

**AN EVALUATIVE FRAMEWORK FOR DEFECTS  
IN NEW RESIDENTIAL BUILDINGS:  
THE NEW ZEALAND CASE**

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## **Attestation of Authorship**

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Author's Signature

Date

## **Dedication**

With love to my husband

James Olabode Rotimi  
whose criticisms were impeccable

and

my daughters and son

Lola Rotimi  
Dammy Rotimi  
Shegun Rotimi  
for their tremendous encouragement

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## **Abstract**

The achievement of quality performance is an important component in the handover stage of new residential buildings, and plays a key role in homeowners' satisfaction levels. Every new homeowner wants a product that is defect-free and worth the utmost value for their investment. Unfortunately this is not generally the case, since majority of newly built homes have been found to contain significant number of defects. Defects have become a main issue for concern to house developers, approving authorities, end-users and the construction industry as a whole. Therefore the aim of this research is to improve quality achievement levels through the reduction or complete eradication of defects at the handover stage of new residential buildings in New Zealand.

To achieve this aim and its attendant interstitial objectives, the study employed a mixed method research approach involving questionnaire surveys, interviews, and research verification using key industry stakeholders (subject matter experts). The investigations cover five regions in New Zealand: Auckland, Wellington, Waikato, Canterbury and Otago region, so that the entire population of new homeowners is truly represented.

The research generated a list of common defects and provides insight into the extent of defects experienced by new homeowners at handover. This information enhances the understanding of quality performance in the residential and wider construction industry. Major causes of defects were found to be poor workmanship and material quality. These are attributable to lack of training, poor apprenticeship schemes, skills of imported trades, and poor monitoring of imported building products. It is made apparent from the current research that standard operating procedures (SOP) for quality achievement would need to be maintained across all house developer organisations in New Zealand. The research also found that the use of independent building inspectors for new homes is at a low level. It is therefore suggested that independent building inspection be made part of pre-purchase agreements and would make developers liable for defect rectification within a reasonable time frame. In the same light, the research suggests that financial institutions make

the release of mortgages, conditional upon the provision of independent building inspectors' reports for all categories of buildings. The current research shows that creating awareness and establishing a national warranty scheme will address the lack of uniformity and inconsistencies in new home warranties in the residential sector. This research has added new data to existing literature and provided a good wealth of information with respect to current quality performance in the house building sector in New Zealand.

## List of Publications

### Conferences (peer-reviewed)

1. **Rotimi, F.E.**, Tookey, J.E. and Rotimi J.O.B. (2012). The UK snagging process: A benchmark for residential construction. *In proceedings of the ASEA-SEC-1 Conference on Research, Development, and Practice in Structural Engineering and Construction*, Perth, Australia. 28 Nov - 2 Dec. Pp. 1015-1020.
2. **Rotimi F.E.** and Tookey J. (2012). Identifying common defects in new residential buildings: A New Zealand study. *In proceedings of the 2012 RICS COBRA Research Conference*. Las Vegas, Nevada. USA. 11-13 September. Pp. 1015-1020
3. **Rotimi, F.E.**, Tookey, J.E. (2012). Stage building inspection: A possible solution to building failures in Nigeria. *In Proceedings of the West African Built Environment Research (WABER) conference*. Abuja-Nigeria. 24-26 July. Pp. 1295-1306
4. **Rotimi, F.E.**, Tookey, J., Rotimi J.O. and Craig, N. (2011). Improved snag reporting in new residential buildings in New Zealand. *In proceedings of the RICS/COBRA Research Conference*. University of Salford, UK. 12-13 September. Pp. 1469-1478.
5. **Rotimi, F.E.**, Tookey, J., Craig, N. and Rotimi J.O.B. (2011). Opportunities for snag reporting in new residential buildings: A case for New Zealand. *In proceedings of the 27th Annual ARCOM Conference and Annual General Meeting*. University of the West of England, Bristol, UK. 5-7 September. Pp. 643-652.
6. **Rotimi, F.E.**, Tookey, J.E. and Rotimi, J.O.B. (2011). Level of customer satisfaction to quality achievement in new residential buildings in New Zealand - An exploratory study. *In proceedings of the 15th Pacific Association of Quantity Surveyors Congress on Cost Management in a World Emerging from Adversity*. Colombo, Sri Lanka. 22-27 July. Pp. 297-305.

### Article

1. Rotimi, F.E. (2011). Evaluating snags in New Zealand. Article in the Build Magazine, Produced by BRANZ. April Issue. P. 36.

## **Glossary**

|       |                                                           |
|-------|-----------------------------------------------------------|
| BA    | Building Act                                              |
| BCSPP | Building and Construction Sector Productivity Partnership |
| CBANZ | Certified Builders Association of New Zealand             |
| LBP   | Licensed Building Practitioner                            |
| MBF   | Master Builders Federation                                |
| QFD   | Quality Function Deployment                               |
| SME   | Subject Matter Experts                                    |
| TQM   | Total Quality Management                                  |

# CHAPTER ONE

## INTRODUCTION

### 1.1: Background

Enhancing the capability of the construction industry to deliver high quality products continue to generate interest in the building sector and the wider construction industry. This is because the building and construction sector is crucial for economic performance and prosperity. The housing sector is one of the most important sectors in the national development agenda of every country (Mohd & Buang, 2010). In New Zealand, the construction sector contributes 5% of Gross Domestic Product (2009). The residential property sector alone has a total market value of between NZ\$450 and NZ\$500 billion, making it the largest asset class in New Zealand (DTZ New Zealand, 2004). Because of the importance of the residential sector and how it supports the economy, the current study shares the view that improving quality achievement levels in new residential buildings will impact positively on the performance of the overall construction sector (Sommerville, Craig, & Ambler, 2006), and improve productivity.

According to the Building and Construction Sector Productivity Taskforce (2009), productivity within the construction sector is comparatively lower than other sectors of the New Zealand economy. The study shows that improvement is needed across a wide range of issues such as the minimisation of wastes and the reduction of production costs. It is apparent that productivity problems are not peculiar to the New Zealand construction industry alone, because studies in other countries have also suggested improvements to their own production performance. Mohammed (1996) for example suggests the application of benchmarking concepts (internal, project and external benchmarking) as a way of improving construction performance and productivity. Rounds and Chi (1985) on the other hand, suggests that for productivity to increase, a proper quality management system will need to be implemented which will lead to savings in costs and fulfilment of quality requirements. Page (2010) agrees that proper quality management systems within construction organisations and their productivity are positively related, and believes that improvement is needed

in skills training to reduce the incidence of defects resulting in poor quality performance.

Fundamental in the context of the Building and Construction Sector Productivity Taskforce Report (2009) is the potential impact that improving quality and reducing defects will have in driving up productivity within the whole construction industry. Thus it can be seen that the result of developing improved capability and understanding of quality management for defect elimination can substantially increase performance and productivity in construction projects (Love & Edwards, 2004a). This realisation is the starting point for this research project, and indeed its principal desired outcomes. At present insufficient data exists regarding current New Zealand quality performance in order to reduce the occurrence of defects at handover stage. The current study seeks to provide essential data for future industry improvement initiatives in reducing new residential building defects and consequently improving industry performance.

Quality improvement has been identified as one of a number of initiatives to assist in the drive for major improvements in the construction industry. The Latham Report (1994) and the Egan Report (1998) were two major studies suggesting performance improvement in the UK construction industry. The Latham report for example outlined improvements which emphasised early customer involvement so that customer requirements were established from the project's outset. The Egan report on the other hand identified the need for a consistent reduction in the level of defects by proposing an annual reduction of 20% in the levels of defects discovered in construction projects in the UK. Though the Egan report has been criticised in several studies as being short of factual evidence, and with little evidence of benchmark figures for current defect levels that the industry could work towards reducing, the authors believe that the Egan report provide a broad base on which subsequent studies could build on. Further, though there is no substantial evidence to show how figures were generated, the authors believed that there could be shared benefits from improved performance if clear measurable targets and specific milestones were set towards productivity improvement.

Poor quality practices and non-conformance to quality standards result in unnecessary costs associated with defects and reworks that are damaging to the

construction industry. For the past two decades, researchers have tried to give estimated costs required to carry out work that was not correctly done the first time. For example, Hammarlund and Josephson (1991) found that the cost of repairing quality failure items is approximately 6% of total production costs. Burati, Farrington and Ledbetter (1992) identifies that the cost of defect rectification varies between 0.4 and 26.0% of total project costs resulting in an average cost at 12.4%. Comparatively, studies by Josephson and Hammarlund (1999) show that the costs of defects vary between 2.3% and 9.4% of total construction costs, and only includes the direct costs of defects. Around the same period, Abdul-Rahman (1997) estimated costs of non-conformance on constructions sites to be 6% of total project costs. A study conducted by Love and Li (2000) on Australian construction projects gives an estimate of rework costs to be between 2.4% and 3.2% of a project's contract value. Similarly, the study by Barber, Graves, Hall, Sheath, and Tomkins (2000) on the costs of quality failures in two major road projects shows that the costs of quality failure were respectively 3.6 and 6.6% of total project costs. These and other studies demonstrate the need to understand how and when defects occur and the possible remedial measures needed to prevent reworks in construction. Additionally the studies establish the need for effective and efficient quality management systems combined with continuous improvement strategies as a way of reducing rework costs (Fayek, Dissanayake, & Campero, 2004). Thus quality must be fundamental to every design process, and defects need to be 'designed out' before works commence on sites (Egan, 1998). If Egan's suggestion of an annual 20% reduction in defects at handover with an ultimate goal of zero defects is implemented, then completed residential projects would have a high likelihood of being defect-free at handover.

According to Georgiou, Love and Smith (1999) a defect is a situation where one or more elements of a building do not perform their intended function. Similarly a defect refers to a failure or shortcoming in the function, performance, statutory or user requirements of a building that manifest itself within the structure, fabric services and other facilities of the building (Ilozor, Okoroh, & Egbu, 2004). So long as the expected final product does not meet the required quality, then a building is said to be defective (Kim, Oh, Cho, & Seo, 2007). The term defects can be used interchangeably with other construction terminology such as faults, repairs, quality failures, deviations, non-conformance, rework, snags and snagging (Abdul-Rahman,

1995; Georgiou, Josephson & Hammarlund, 1999; Love and Edwards, 2004a; Love & Smith, 1999).

‘Snags’ and ‘snagging’ are gradually becoming terms used in construction environments outside the UK construction industry which was the origin of this terminology. Snagging items are quality failure items that are identified near the completion stage of a construction project by what could be termed as ‘the snag identifier’. On the other hand, the process of identifying and rectifying these quality failures is known as snagging (Sommerville, Craig, & Bowden, 2004). Snagging describes the process of checking for faults or defects in a property and correcting them before the property is handed over to a new owner. ‘Snagging’ problems in this context are items of work that still require some degree of attention after the main body of work has been completed (Craig, 2008). Throughout this research the term defect will be used to refer to non-quality achievement because this is the common terminology used in New Zealand.

Defects have an enormous impact on construction projects. For example, non-conformance to quality requirements and procedures could cause project performance parameters like cost, time and quality to be adversely affected (Egan, 2000). Defects may cause discomfort to the primary user (home owner) while the reputation of the constructor and the industry is also damaged in the process. A number of reasons could account for the occurrence of defects. For example, Griffith (1990) suggests that defective work could be attributed to design, detailing, specification, legislation, co-ordination, communication, supervision and constructability issues. Commenting on design as a primary cause for the occurrence of defects, Love and Li (2000) explain that design changes made by the client and end-user, as well as errors and omissions in design concepts are important attributing factors. Josephson and Hammarlund (1999) hold alternative views, believing that defects are linked to the activities of project participants and only the coordinated action of these participants can reduce the incidence of defects on projects. Collaboration and integration between project participants will invariably minimise defects (Abdul-Rahman, 1995). Beattie (2011) identified poor inspection processes, unskilled workers, and poor workmanship as factors increasing the incidence of defects.

The current study provides an insight into the quality achievement of new residential buildings in New Zealand with a view to suggesting means by which the problem can be minimised or completely eliminated. The study should provide data that could be compared to trends in related construction industries such as in the UK and Australia. The study believes that advanced knowledge on defect identification and rectification held by the UK residential sector could become a benchmark for quality improvements in New Zealand. A database search of snags shows that 'snag assessment' is now being offered as a specialist service in the UK. Similar improvements in the New Zealand housing construction sector is encouraged and may well be a solution to the leaky building problems that pervade the local construction industry.

The key to quality in the built environment is to demand good planning and management of projects (CIC, 2004). Integrating best practices within the New Zealand residential construction should therefore improve the quality of projects being delivered. From the literature reviewed it is clear that there is a current and indeed pressing need to examine quality performance of new residential buildings at handover in New Zealand. The building production process requires a creative and sustainable solution that will transform quality performance within the residential sector. If new buildings are to stand the test of time, it is important that the production process does it once and does it right.

## **1.2: Rationale and significance of the study**

The residential housing sector is one of three distinct sub-systems in the New Zealand construction industry. In a typical year, residential housing construction accounts for approximately 24,000 new builds and 32,000 renovations to existing homes (Building and Construction Sector Productivity Taskforce, 2009). However, a current estimate for residential housing construction is at 17,000 units with the present economic downturn. The design and construction of new housing today is becoming more complex partly due to project owners' increasing demands and expectations. Consequently building products and systems are becoming more innovative (e.g. complicated elevations, cladding types, parapets and balustrades, and innovative resource inputs) to meet the demands of owners. Additionally, newer and innovative procurement processes bring about challenges which constructors

need to manage effectively while delivering value to the project owner. Despite these complexities and variability, the time taken to build an average house has decreased. This may mean that quality achievement could be compromised on construction projects. However these rapid developments and changes in a typical house building production have heightened the need for the residential sector to examine the quality achievement of their end product.

The residential sector is under pressure to meet an ever-increasing customer expectation of quality improvement and innovation on every development project. Innovative quality management approaches are therefore a necessity for homebuilders, and one such approach is to develop quality management processes that will identify defects in constructed items before a new building is handed over to the end user (Sommerville Craig & Ambler, 2006). Once these defects are identified, rectification work can then be carried out to the end-users' satisfaction.

The impetus to investigate the quality of new residential buildings originated from the findings of research carried out by Craig in the UK into the prevailing trend of defects in new homes (Craig, 2008). These findings revealed an industry average of 53 defects per new home inspected. Such research contrasts with New Zealand, where there is little data on defects in new residential buildings with which to benchmark industry performance. It is important to note that the legal position in relation to consumer protection in this area is clouded somewhat by the fact that it is not clear where legal responsibility lies for some of the defects that may arise at hand over of new residential buildings. Thus seeking redress and identifying accountability is difficult when quality problems arise (Cossar, 2003).

Other studies in the UK confirm that defects are common features in most new residential buildings. Sommerville and McCosh (2006) studied defects in about 1700 new homes in the UK and found that the scale of defects peaked at 389 for a single property. Another study conducted by Sommerville, Craig, and Ambler (2005) on 2202 new buildings in the UK over a period of four years had observed similar quality failures. The initial analysis of 55,000 out of 130,000 defective items captured in Sommerville et al.'s (2006) study estimated that 68% of the defects were attributable to poor workmanship and 14% due to omission.

Likewise the severity of non-quality achievement was illustrated in similar studies in Australia. An unpublished Master's thesis by Georgiou (2000) analysed 1772 houses constructed between 1988-1996, of which 1002 were dwellings built by their owners and 770 by registered builders. Georgiou's data was used to determine the severity of defect occurrences and the location of the defects within each house type. The results reveal that a mean of 2.74 defects per house was recorded in houses built by owners, while a mean of 2.3 defects per house was recorded for those executed using registered builders. Georgiou's research shows that houses that were less than one year old were found to have a significant proportion of defects. Further, there was no significant difference in the quality of homes built by the two types of builders. Ilozor, Okoroh, and Egbu (2004) conclude that framing and roofing are major defects that complicate other quality problems in new residential buildings, and which could be mitigated by focussing on them. More recently Mills et al., (2009) reveal that one out of eight residential buildings have defects in Australia, and that the estimated cost to rectify them was 4% of the construction contract value. These poor quality performances continue to bring disrepute to the construction industry, particularly its residential building sector.

The most commonly known quality failure in the New Zealand housing sector is the weather tightness problem. This problem is mainly confined to buildings constructed with monolithic external cladding installed over untreated timber framing and without a drainage cavity between the cladding and the external wall (PWC, 2009). The water ingress problem has affected 22,000 to 89,000 dwellings, with a consensus forecast of 42,000 PWC (2009). The repair cost for this estimate of 42,000 buildings is projected to be NZ\$11.3 billion (in 2008 dollars). The research to date has tended to focus on just the issue of the weathertightness rather than other defects occurring in new homes. Though weather tightness is not the focus of the current study, it is a useful reference point for quality problems in buildings in New Zealand. New residential buildings are particularly vulnerable, with homeowners having to bear the burden of defects. Page (2011b) in a recent survey, found that 72% of new homeowners have had to call their developers back for defect rectification in New Zealand. This is the most recent evidence that new homeowners are still faced with defects in their new homes. With these numerous quality problems in residential construction, the current study shares the view that high quality builds cannot always

be achieved by relying on the performance of construction parties (Craig, 2008). Thus a firm process for defect identification and rectification should put home owners' minds at ease about the final quality of their investments.

The search for quality improvement in the residential sector is driven by a long list of industry wide problems, such as poor inspection processes, unskilled workers, poor workmanship and a lack of reliable defect documentation (Beattie, 2011). As no data-base of records on defects at handover of new residential buildings in New Zealand existed before this research began, one obvious benefit to this study is the establishment of a database comprising whatever data can be gathered from existing sources. Once a database is established the current and future incidence of defects can be compared with studies in other countries. This in turn will provide a benchmark for future performance improvement in New Zealand.

It would therefore seem apparent that quality failures are significant in new residential buildings. Examining the situation in New Zealand is therefore relevant. Particular emphasis is given to the magnitude of defects that are recorded at handover of new residential buildings to their owners. The occurrence of defects in new residential buildings shows that quality achievement levels are low and consequential effects on customer satisfaction can be expected. Therefore more aggressive and proactive measures are required to address the issues of defects in new residential buildings. Governments and approving authorities have a huge responsibility to ensure that the quality of building construction is at a level that is acceptable by all stakeholders, and most importantly, homeowners.

### **1.3: The problems being addressed by this research includes:**

- Lack of an established understanding of common defects and their extent in new residential buildings at hand over.
- Lack of information on the satisfaction levels of new homeowners regarding the quality of residential buildings.
- Lack of understanding of the use of defect reporting as a means of minimising defects in new homes at handover, and

- A lack of understanding of current house developers' quality practices and warranties available for new homeowners.

Therefore the principal focus of this research is to improve quality achievement levels in new residential building projects through a reduction or complete elimination of defects that occur at handover of new residential buildings in New Zealand. It is intended that the study complements other BRANZ initiatives around quality improvement and productivity in the construction industry. Specific objectives to be pursued by the research include the following:

#### **1.4: Research Objectives**

- To determine common defects occurring at handover of new residential buildings.
- To capture the extent of defects in new residential buildings in New Zealand
- To identify key causes of defects in new residential buildings in New Zealand
- To determine new homeowners' satisfaction levels with the overall quality of their new homes
- To determine the level of use of independent building inspectors at hand over of new residential buildings
- To determine whether there are uniform warranties available for new homeowners
- To determine the current quality performance of house developers

The research objectives listed have been developed based on the understanding of the problems around the subject area. These objectives were formulated in order to address the main research questions and sub questions which are outlined in the next paragraphs. The two main research questions have seven sub-questions with corresponding research objectives. Therefore the specific questions this study is designed to investigate and answer in order to improve quality achievement levels in new residential buildings are listed below.

## **1.5: Research Questions**

### **1.5.1: Main Research Questions**

1. How can defects be minimised so that the quality of new residential buildings is enhanced in New Zealand?
2. What is the satisfaction level of new homeowners to quality achievement in new residential buildings?

### **1.5.2: Research Sub-questions**

- What are common defects occurring at hand over of new residential buildings?
- What is the extent of defects in new residential buildings in New Zealand?
- What are the key causes of defects in new residential buildings?
- What is the level of satisfaction new homeowners with the quality of their new homes?
- What is the level of use of independent building inspection at hand over of new residential buildings?
- Are there uniform warranties available for new homeowners?
- What is the current quality performance of house developers?

## **1.6: Methodology**

The research focus and methodology have been progressively developed in line with the research questions. Given the nature of the research problem and the different research methods available, it is appropriate to employ a “mixed method” approach. Mixed method research was chosen for the study because the research objectives and questions will benefit from a combination of different approaches for the purposes of triangulation, complementarity, development, initiation and expansion. Methods to be used include: surveys and interviews to establish the current quality performance in the residential building sector and to suggest improvements that will benefit every stakeholder in the house building sector in New Zealand. The chosen

methods will utilise the strength of both qualitative and quantitative research techniques. According to Amaratunga, Baldry, Sarshar, and Newton (2002) the combination of the strengths and weaknesses of both the qualitative and quantitative research approaches can be used to mutually strengthen the results and findings developed.

To achieve the research objectives, new homeowners and house developers were the populations considered for the survey. The first set of data was collected from new homeowners through the administration of a semi-structured questionnaire. The participants for the questionnaire survey were selected using a random sampling method in order to provide an unbiased subset of the population (Collis & Hussey, 2009). The objective of this questionnaire was to determine the extent of defects, homeowner satisfaction levels and the use of defect reporting in new homes.

The second data set was collected from house developers through personal face-to-face interviews. The objective of the second investigation was to understand how quality in new residential was being monitored and the available warranties for new homeowners. The participants were purposively sampled based on their experience in residential building. The study envisaged that the data collection methods would cover a large portion of New Zealand communities so that the population size would be truly representative. Since the research required the canvassing of opinions from live subjects, prior to commencing the investigation, ethics approval was sought from the AUT Ethics Committee (AUTEC) to ensure the privacy and confidentiality of all research participants

The analysis of the data took place via coded entry into SPSS and Excel as appropriate, and thereafter with its manipulation utilising correlation testing. The analysis aimed to determine the significance of defects differences and correlates of information amongst research participants. Simple interpretive and descriptive methods of presentation were also adopted so that the findings could be communicated effectively and be understandable to readers. McQueen and Knussen, (2002) explain that descriptive statistics can be used to describe, illustrate and summarise information in three ways, viz: forming numbers into tables, generating charts and diagrams from the numbers, and then calculating general statistics.

### **1.7: Scope of the study**

The study covers new residential buildings within five main regions in New Zealand, including Auckland, Waikato, Wellington, Canterbury and Otago. A total of 34 local territorial authorities out of 67 were addressed, implying about 51% coverage of New Zealand. These areas were selected so that a good coverage of the main population centres in New Zealand could be achieved as far as possible. The purpose of the research is to capture the extent of defects in new residential buildings in New Zealand, with the intention of ultimately developing systems which will be operable beyond the completion of the PhD programme, and to provide an ongoing benchmark for future development in the New Zealand construction industry. The research project closely aligns with the following BRANZ objectives:

1. To analyse data from reports relating to specific houses provided by construction or defect reporting companies.
2. To analyse the relative significant of snagging defects.
3. To analyse data as to who is most likely to commission defect reporting organisations if available in the market place.
4. To analyse data as to why and in what circumstances individual homebuyers would be likely to commission defect reporting organisations.
5. To analyse data on the outcomes of snagging reports.
6. To analyse any available data on the total number of defects in new homes.

### **1.8: Organisation of Thesis**

**Chapter one** is a general introduction to the research project, and gives background information on the research problem. The chapter further justifies the need for the study with a brief explanation of previous studies around the subject area. The research questions are presented, helping to identify the research aim and objectives.

**Chapter two** gives the definition of quality by various authors, and quality in the context of construction is explained. The chapter also describes quality failure as a

problem experienced within the construction industry, and discusses the importance of quality management system, and quality management standards as a way of ensuring that minimum standards of quality are met on construction sites. It also identifies the main standards that are relevant to the construction industry. The chapter further presents the nature of the construction industry compared with the manufacturing industry and the various methods, techniques and philosophy that have been adopted from the manufacturing industry to improve quality within the construction industry. In the final section, the chapter reviews and evaluates quality initiatives that have been proposed in previous publications/studies for overall performance and productivity improvement within the construction industry. This chapter concludes by providing a conceptual foundation to the study approach.

**Chapter three** begins with the definition of customer satisfaction within the context of the residential building sector. A general review of literature on what new homeowners perceive as quality is discussed. It reviews relevant concepts and previous empirical findings on levels of homeowner satisfaction to quality of new residential buildings. Finally, the chapter reviews warranties and guarantees that cover new homeowners when defects arise.

**Chapter four** begins with a general review of the different terminologies that relate to defects within the construction industry. For example snags, non-conformance, quality failure, reworks and faults. The chapter also includes a review of the current building inspection process and the ways new houses are purchased in New Zealand. It also presents the work of various authors on the extent and categories of defects in residential buildings. The chapter demonstrates that the incidence of defects in new homes and the cost of repairs are significant to construction project performance. The causes of defects in new homes are explained. The chapter concludes by stating the need to examine the current building inspection process.

**Chapter five** describes the research methodology used. It explains the development process of the research from beginning to completion. Further it presents the research design and the underlying epistemological and ontological paradigms and perspectives from which this research is conducted. The chapter gives the description of the methods adopted for data collection and provides an overview of the main data sources. This is followed by information on the reliability, validity, and

ethical issues of the study. Finally the chapter presents a discussion of the data analysis strategy used for the research.

**Chapter six** presents the results of data collected from new homeowners through a questionnaire survey. The Chapter presents the result of analysis performed on the demographic information of the participants, the extent of defects, homeowners' satisfaction levels and the use of independent building inspectors for new residential buildings. As a further analysis, cross tabulation of some of the results have been undertaken to show the important relationships between some of the responses.

**Chapter seven** begins by presenting the analysis and result of interviews with house developers using qualitative analytical methods. The data from this second stage of field investigations are collated from transcripts produced after face-to-face interviews. The interviews with house developers provide more in-depth understanding of issues around defects in new residential buildings in New Zealand. Finally, the chapter presents the findings from the interviews of some subject matter experts that were contacted to validate and extend knowledge on the general research outputs.

**Chapter eight** discusses the overall findings from the analysis of the data. It synthesises all significant findings to answer the research questions and objectives that are presented in the final chapter of the thesis. The chapter presents key themes that emerged from the analysis in Chapters 6 and 7. Each theme recapitulates the critical findings of the questionnaire survey, combined with interviews with house developers and subject matter experts. This is further addressed in relation to current literature around the subject area of this study.

**Chapter nine** presents summaries of possible solutions to the research questions posed at the onset of the study. It outlines recommendations that could facilitate improved quality performance in the house building sub-sector. The chapter also presents the contributions to knowledge made by this study to the house building sector and the wider construction industry. The chapter concludes with suggestions of further research areas that could extend this current study.

## **CHAPTER TWO**

### **QUALITY IN THE CONSTRUCTION INDUSTRY**

#### **2.1: Introduction**

This chapter begins with the definition of quality by various authors in the context of the construction industry. A definition of quality which is appropriate to the current study is evolved and consequently reinforced throughout the study. The chapter then presents some characteristics of the construction industry that set it apart from other production environments. Some basic concepts connected to quality management and other aspects which relate with the current study are discussed also.

The chapter shows that quality failure is a common problem within the construction industry and which needs to be addressed in order to improve its overall image. Thus quality management systems and quality management standards are presented as a way of ensuring minimum standards of quality on construction production activities. This chapter goes further to identify the main standards that are relevant to the construction industry. These standards are both local and international that could encourage organisations to improve their quality performance. In the final section, the chapter reviews and evaluates quality initiatives that have been proposed in previous literature to enhance performance and productivity improvement within the construction industry.

#### **2.2: Quality Defined**

It is important to begin with an understanding of how quality has been variously defined by many authors. These definitions will give a clear view of what quality is and how it can be managed especially within the construction industry. Quality has been defined as 'fitness for use/purpose'. This means that for a product to be of a required quality, it does what it is supposed to do (Wilkinson & Scofield, 2010). Alternatively it could be regarded as conformance to certain performance requirements (Burati, et al., 1992; Crosby, 1979) and meeting legal, aesthetic and functional requirements of a project (Arditi & Gunaydin, 1997).

Quality is also defined as that which shows that a product meets its customers' (i.e. end-user) satisfaction (Deming, 1986; Torbica & Stroh, 1999) for which satisfaction could be both the present and future needs and expectations of the customer. Present and future needs may be determined from statutory conformance requirements and/or the needs that are expressed by customers. Conformance requirements in construction could be as those presented in project documents (drawings, specifications, method statements, etc.) and building standards, while customers' quality requirements could relate to the needs that they have for investing in a facility. Arditi and Gunaydin (1997) refer to customer requirements, as perceptions while conformance needs are facts. Beckford (2010) explains that quality is fully achieved when both factual and perceived expectations and requirements have been met. Thus embedded in all these quality definitions is the desire to achieve some performance expectations which might be for products or services.

A more universally accepted definition is the one provided by the International Standard Organisation (ISO8042, 1996). Quality is defined by the ISO as 'the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs'. Rotimi (2000) provides a similar definition of quality but from a construction perspective, he suggests that the quality of a construction product is the totality of characteristics that a constructed facility has, and the process involved in its construction that it should have; that enables the facility to meet or exceed customers' needs, requirements and other performance criteria. While a variety of definitions of the term quality have been suggested, this paper will use the definition suggested by Rotimi (2000), as this relates more to the residential building sector. Thus a quality residential building would for example, satisfy primarily the needs and desires of homeowners, some of which are implied, but generally are stated in design documentation and their compliance monitored by certifying bodies (independent and council inspectors). Though homeowners may not be knowledgeable in building performance assessments, nonetheless they have quality expectations which are important to the house building process.

Looking at these perspective views of quality, one could conclude that there is no single definition of quality that supersedes the other. Nonetheless it is important to

note that quality awareness, development and implementation as well as its continuous achievement is non-negotiable in any production activity. Dale (2003) concludes that quality is that which differentiates organisations, events, products, services, processes, persons, results, actions or communications from one another. Quality achievement is even more important with global competitive pressures, as it should keep organisations in a better competitive position (Dreyfus, Ashire, & Maling, 2004). Thus the need for a focus on quality by industries and indeed the construction industry as a whole cannot be overemphasised. The next section further discusses quality as it relates to the construction industry.

### **2.3: The characteristics of the construction industry**

The construction industry has many characteristics that set it apart from other production environments (Dubois & Gadde, 2002; Hillebrandt, 1985). Within the context of the current study, some of these characteristics impact on its ability to meet quality objectives that are desired by project owners, users and compliance authorities, and very often make successful project outcomes ambiguous (Chan & Chan, 2004). Generally the characteristics that combine to make construction a complex undertaking include: its fragmented nature, uniqueness, dynamism, lack of standardisation, communication difficulties and lack of customer focus (Davis, 2007; Egan, 1998; Gidado, 1996; Kanji & Wong, 1998; Love, 2002). These underlying circumstances shape the industry's way of operation and its overall performance. These key characteristics are described briefly under the following sub-headings showing how they could impact on the performance of construction projects.

#### **2.3.1: Fragmentation**

Fragmentation in the built environment means that the ownership and control of separate tasks and their related processes in a construction project lifecycle resides in the hands of distinct organisations with their own individual cultures and working practices (Orange, Burke, & Boam, 2000). Alan, Yin, and Scheepbouwer (2008) describe the construction industry as a fragmented one made up of many different bodies, all with different objectives. Traditionally the set up within the house building sector is no different to those that appear within major construction environments. Projects are if anything shorter than the major projects in duration. Teams are

formed in house building with the tendency to use sub-contracted labour that is spread across a number of sites that create even more fragmented contractual relationships (Sommerville, et al., 2005). According to Craig (2008) this fragmented nature of the construction industry means that many aspects of construction work do not lend themselves to quantification and measurement. Alashwal, Rahman and Beksin (2011) argue further that fragmentation leads to difficulties in quality assurance and low levels of productivity, poor integration of information across the fragmented parts, elimination of learning and innovative solutions, and difficulties in capturing and sharing knowledge among construction project participants.

Fundamentally, the fragmented nature of the industry relates to the poor performance that is commonly associated with building projects. Latham (1994) and Egan (1998) also emphasise that fragmentation is a major contributing factor to poor communication between all stakeholders working on a construction project. Thus a more serious quality plan is needed to cope with the plethora of stakeholders involved on construction projects (Dikmen, Birgonul, & Semiha, 2005). The production of the quality plan must recognise that only the positive performance of people can make it effective. According to Ashford (1992), no matter how carefully planned and comprehensive any quality system may be, only people can put it into effect. Therefore all project stakeholders including the project owner, consultants, contractors and suppliers, have a role to play in delivering a quality project. Failure of any of these stakeholders will seriously affect the quality of the final project (Kanji & Wong, 1998).

### **2.3.2: Uniqueness**

Another characteristic that sets the construction industry apart from other industries is the uniqueness of the processes and the final product of the industry. The production process is unique in the sense that there could be varying clients, design team and specialist subcontractors and suppliers, coupled with thousands of components and materials that need to be brought together at the right time and in the right order (McIntyre, 2009). These unique processes mean that no universal standards or specifications can be applied to construction products. Individual projects can be viewed as a project structure which is predominantly short lived when compared to the structure of established industries such as manufacturing.

Thus scope and design changes are typical and may occur throughout construction processes. Changing circumstances suggest that construction projects are at risk during their design and construction, therefore increasing the likelihood of quality defects (Dawood, Akinsola, & Hobbs, 2002; Dubois & Gadde, 2002; Hoonakkar, Carayon, & Loushine, 2010). The unique nature of the construction industry requires the understanding of customers' needs and expectations for each project so that organisations can deliver projects to their satisfaction. This is the rational objective in any production activity whether it is in the construction or any other industry.

### **2.3.3: Complexity**

In reference to the first two characteristics of the construction industry, it is not difficult to understand why construction activities are complex. Winch (1987) suggests that construction projects are amongst the most complex of all activities. A similar view is shared by Gidado (1996) who believes that complexity of construction projects is continuously increasing.

Palaneeswaran (2006) explains that the construction industry is project based, involving a lot of complexities associated with diverse stakeholders (each with their own objectives, goals and value systems) and scope fluctuations. These large numbers of project participants with differing quality objectives are expected to work together towards a common goal of project success. From another perspective, complexity in construction can result from the resources employed, the environment in which construction takes place, the level of scientific knowledge required, and the number and interaction of different workflows (Gidado, 1996). This complexity in the construction industry makes it difficult for house builders and subcontractors to achieve a common goal of improved quality. Complexity with respect to set objectives seems to favour the house builder rather than the homeowner, who is the most important party in the house building process (Sommerville, et al., 2006). Complexity also comes from the complicated nature of construction operations resulting in numerous problems (Hagan, Bower, & Smith, 2011; Kanji & Wong, 1998). For example Tyler and Frost (1993) explain that construction work activities are labour intensive and place heavy demands on people in terms of working conditions and the environment in which they function.

#### **2.3.4: Dynamism**

Dynamism stems from the constancy of changes in the design, construction, and general procurement process in the construction industry (Hunn, 2002). Love, Holt, Shen and Irani, (2002) explain that both the internal and the external environment of construction projects are dynamic and relatively unstable. However, Haupt and Whiteman (2004) describe the dynamic and transient nature of the construction projects and their workforce as being very restrictive to the implementation of quality initiatives on construction sites. Thus changes during a project's development will tend to have significant and often unpredictable effects on the final product.

#### **2.3.5: Lack of flow of information**

As explained under previous characteristics of the construction industry, construction projects require a large number of project participants in their processes. The coordination of these project participants during construction becomes an onerous task because participants differ in terms of work activities, training and skill levels and ultimately in quality objectives. At any point in time a number of these specialties will be simultaneously involved with the project and often the work of one cannot proceed until several others have completed a phase of work (Eccles, 1981). Craig, Sommerville, and Auchterlounie (2010) agrees that the coordination of the numerous parties involved in a construction project results in problems particularly within the house building sector where there are large numbers of subcontractors and suppliers. In the same line of argument, Love and Irani (2003) explain that the interfaces that exist in construction have become potential barriers to effective and efficient communication and coordination. As a result there is often a breakdown in communication along the supply chain which manifests as informational flow mishaps and therefore additional quality defects.

#### **2.3.6: Lack of Standardisation**

Rowlinson and Walker (1995) point out that the construction industry is also characterised by its lack of standardisation. Production processes are to some extent different from one another. Hence there are no universal standards or specifications that can be applied to construction products. As explained earlier, this uniqueness and one-off nature of construction projects leads to difficulties in quality assurance.

Along a similar line, McHugh, Merli, and Wheeler (1995) explain that a new set of project participants, structures and environment are created for every new project that is constructed. This transient nature of the industry diminishes the value of learning and experience gained on previous developments of a similar nature under a different team (McHugh, et al., 1995). Another issue that contributes to a lack of standardisation, as discussed previously, is excessive changes to design and construction details throughout the construction process (Kanji & Wong, 1998). It is not difficult to see why construction quality is often at risk because of excessive changes.

In summary, the characteristics of the construction industry highlighted in Sections 2.3.1 to 2.3.6 show that construction activities involve the assembling of materials from widely scattered sources, which undergo different kinds and degrees of processing in different numbers of places. The processes involve many types of handling over periods that vary greatly in length, and using the services of a multitude of people that are organised into many different sorts of business entities. These characteristics constitute challenges to quality performance, and coupled with the shifting demands of project owners, make it difficult to achieve quality performance.

The survival of the construction industry requires a proper understanding of how it is currently performing and how it needs to perform in the future (Love & Holt, 2000). There needs to be a change in construction processes that will circumvent industry characteristics in order to improve quality performance (Love & Heng, 2000; Mohamood, Mohammed, Misnan, Yusof, & Bakri, 2006). In the words of Egan (1998), the industry needs significant re-engineering of its processes and sub processes. In New Zealand significant process improvement should align with current initiative of the Building and Construction sector productivity, which seek to raise sector productivity by 20% by the year 2020.

## **2.4: Construction industry quality performance**

Over the last decade, the house building sector has witnessed an increasing need from both customers and government to improve the quality of its finished products (Sommerville, et al., 2005). This need is apparent in the construction industry as

more evidence of poor quality performance emerges, particularly from the residential sector. Various reports and articles have shown that quality performance within the general construction industry is an issue particularly amongst the less well established and less well organised building firms (Craig, 2008). Further several high profile instances have shown that poor quality performance has enormous impacts on the industry's final products and on the end user. For example the impact could be poor end user satisfaction, loss of confidence in building developers, reduced profit margins for building developers and ultimately a bad image for the wider construction industry. Mohamood, Mohammed, Misnan, Yusof, and Bakri (2006) explain that the impact is not only limited to industry's final products, but the processes, peoples and material inputs are subject to criticisms, which in turn cause tremendous pressure for the overall improvement of quality in the construction industry.

The construction industry has been perceived as one with poor quality emphasis when compared to other sectors like the manufacturing industry (David & Aspinwall, 2010; Mohamood, et al., 2006). The ability of the industry to become quality-focused has been one of the most difficult to achieve (Love, Mandal, & Li, 1999). Yet the need to attain quality in the construction industry is no less important than in manufacturing or any other industry. Bates and Kane (2009) identified a lack of understanding of the fundamentals of good building practices occurring at every stage of the design and build process and including designers, builders, and inspectors, as a significant factor affecting quality performance in the industry. These inadequate skills were considered highly noteworthy in the New Zealand construction industry (Beattie, 2011; Page, 2010). Therefore, attention to quality and understanding the fundamentals of good building practice is one means of improving quality and technical performance.

Thus the development and implementation of appropriate quality programmes or plans is necessary in order to achieve stated levels of quality in construction projects. According to Juran (1989) "quality does not happen by accident it has to be planned". Quality plans that clearly define how quality is to be achieved are needed at the beginning of projects, and this has to be kept in mind by a construction organisation throughout a project's duration. Feigenbaum (1986) notes that quality

considerations should begin at the initiation stage of any project and continues through to final delivery of the project. Where there are deviations from planned achievements, good quality plans should indicate how the deviations can be rectified and what corrective measures should be taken (Abdul-Rahman, 1993).

Several studies have suggested areas for improving traditional construction practices which might improve quality achievement. Mohammed (1996) for example suggests the application of benchmarking concepts (internal, project and external benchmarking) as a way of improving construction performance and productivity in any industry. Caldwell (2007) suggests using key performance indicators, which could assist organisations to set realistic performance targets and focus efforts where they are most needed. Along similar lines, Rounds and Chi (1985) suggests the implementation of appropriate quality management systems that could lead to savings in costs while fulfilling quality requirements. Indeed having a proper quality management system within a construction organisation and productivity are positively related (Page, 2010). Page (2010) also believes that by improving skills through training and re-training of the workforce, it might be possible to reduce reworks and waiting times in construction activities.

The need to improve quality standards in the construction industry in New Zealand construction sector has been identified by various bodies. The Centre for Advanced Engineering New Zealand (CAENZ) based in Canterbury University developed a series of performance indicators for the NZ construction industry. A steering group, comprising key industry players, chose to align these measures with a suite of indicators developed in the UK to enable international benchmarking. However there has been insufficient follow up on the study so that trends in quality performance could be identified. In spite of a desire to emulate examples of performance improvement and best practice from the UK or Australia, little has been achieved. There is a belief that the scale of construction activities in New Zealand will not accommodate the level of investment required for significant performance improvements. Whilst it is true that the scale is different, it is not true that the ideas for improvement cannot be translated (Constructing excellence New Zealand, 2009).

The chairman of New Zealand Construction Industry Council at the time John Pfahlert, in a media release in 2002 identified some of the issues that need

addressing to raise quality standards across the board within the New Zealand construction industry. One of the suggestions was for more on-site inspections during critical stages in the construction of homes and project development. Pfahlert suggested that customers could have available to them a check-list of procedures and requirements with which they could ensure their architects, designers and builders comply with. He conclude that there is a need to establish an independent audit of industry compliance with quality systems (Pfahlert, 2002).

Changing prevailing practices to that which supports continuous improvement will promote quality and improve customer satisfaction. However, Torbica and Stroh (1999) explained that two fundamental questions have to be answered in order to improve and maintain quality in construction. These are: who sets the quality standards and what is high quality in construction? These key questions will be addressed in the course of the current research study (especially as it relates to new residential buildings). Further related questions which this study hopes to address include how quality is to be achieved and what improvements can be made to house building practice in order to sustain quality performance.

## **2.5: Quality management systems**

Quality management systems have become the central point in businesses and within the wider construction industry. A quality management system according to the ISO 8402 (1994) is defined as “all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance, and quality implementation within the quality system”. A Quality Management System provides a framework of requirements for setting up a quality management system as a process model. It describes the need for quality manuals, quality control documents and how quality records can be controlled. Similarly, quality management systems provide the framework for quality assurance and the basis for quality improvement (Rhodes & Smallwood, 2002). It also ensures that the quality of construction activities are monitored to prevent quality deviations and to give early warning of poor quality, from the design of the product to its delivery and use by the customer (Kelada, 1996).

Quality management starts with the recognition of the complexity of needs and expectations surrounding the constructed facility. Every stakeholder in the construction process will have their quality objectives on a project. Quality management systems are internal operational systems that ensure that all the product/service performance requirements and needs of the stakeholders are met. The purpose of the system is 'to establish a framework of reference points to ensure that every time a process is performed, the same information, methods, skills and controls are used and applied in a consistent manner' (Dale, 2003; McCabe, 1998). Good quality management systems start with the development of a vision or mission statement. Minks and Jonhston (2004) gives an example of a typical mission statement below:

*"Our company strives to be a leader in providing the highest level of construction services to our clients. Our mission in providing these services is to satisfy our customers' needs and demands at all levels of the organisation".*

Such a vision and mission statement could then be translated into a feasible quality plan which may be both general (i.e. an overall company quality plan) and specific (i.e. a project quality plan) to particular projects. Wilkinson and Scofield (2010) explains that both the overall and project quality plans should document the organisation's quality mission statement and quality objectives. The plan should also include quality structure and quality management systems, which gives a hierarchical structure of responsibilities to quality achievement within the organisation, quality documentation procedures (inspection, testing, checking procedures) and other management systems.

An alternative approach to quality management system development suggested by Sjiholt and Berg (2003) includes a five step model. The model assists in the implementation of quality management in construction processes, and is based on customers' needs. The steps suggested include:

Step 1: Working out a quality plan.

Step 2: Initiating improvements

Step 3: Analysing current procedures

Step 4: Developing a quality system

Step 5: Integrating and supervising the quality system.

Implementing quality management systems provide various benefits to the construction industry and to construction firms in particular. Essentially a quality management system standardises an organisation's processes, helps to, enhance the image and reputation of the organisation, improves performance and customer's satisfaction, minimises waste and reworks, and creates opportunities for a greater market share (Hoonakkar, et al., 2010; Odusami, Bello, & Williams, 2010).

Recent quality focus and improvements have moved production practices closer to systems obtainable in the manufacturing and service industries (Aoieong, Tang, & Ahmed, 2002). Quality management systems provide the environment that either fosters or stifles the achievement of quality within organisations. The quality management system is the criteria by which organisations' quality performance are measured and for which quality management standards have been developed. The construction industry sees quality management as an initiative to solve its quality problems and to meet the needs of its customers (Kanji & Wong, 1998). Auchterlounie's (2004) study proposed a conceptual model of Total Quality Management (TQM) for new house building projects based on a system that establishes the project owners' requirements at the inception of projects and the implementation of a robust quality management system that delivers the project owners requirements. The developed conceptual model would include feedback elements that could capture project owners' feedback to improve work performance. A similar quality management system has been developed and is being used by a house builder (developer) in NZ to keep track of project owners' quality issues to assist with future project delivery. This quality management system will be discussed in a later section.

Lee and Arditi (2006) explain that a project owner will come closest to their desired quality by selecting house builders based on the totality of their quality performance. House builders are responsible for resource acquisition and utilisation, technology and sequence of building activities and all processes that could ensure the achievement of project objectives. The level of achievement of project requirements

defines the nature and level of quality in construction processes and the final products. Two criteria explain quality achievement in constructed buildings: conformance to requirements and customer satisfaction (Torbica & Stroh, 1999). These two criteria are indicative of the obligation of house builders to deliver quality outputs. It has also been contended that house builders need to have the right attitude and inner motivation to improve construction quality culture (Ashford, 1989). These attitudes and motivations can be inculcated only by a long-term programme of company-wide quality improvement that is initiated and supported by overt personal involvement of an organisation's leadership (Craig, 2008).

Construction organisations are required to meet and exceed their customers' requirements. However they are only able to achieve this objective if they have an efficient management system as a starting point (Dikmen, et al., 2005). This reference points is in the form of a set of known and adhered to quality standards. Quality management standards go further to provide clear guidelines that if followed should guarantee quality achievement. Quality standards are therefore the focus of the next section.

## **2.6: Construction quality standards**

Quality management standards are an audit of quality management systems to determine how well processes produce what customers want (Wilkinson & Scofield, 2010). Quality management standards could be regarded as a compliance audit that ensures that minimum standards of quality are met. The standards thus provide a certification process for quality achievement. Standards can also be a comparative measure of quality delivery between prospective construction organisations for example. Organisations have to demonstrate that their internal process will guarantee a completed product of the required quality. The following subheadings outline quality management standards that are relevant to the construction industry.

### **2.6.1: The International Organisation for Standardisation (ISO)**

The International Organisation for Standardisation (ISO) was founded in 1946 in Geneva, Switzerland. It was established to provide world-wide standards for manufacturing, communication and trade organisation (Lin & Wu, 2005). Their initial sets of standards have been progressively developed to be relevant to other

industries including construction. A typical example would be the ISO 9000 series of standards that refers to a set of three Quality Management System (QMS) documents: ISO 9000, ISO 9001, and ISO 9004. For example the ISO 9000 contains the definitions and terminology used by the ISO 9001 standard, as it establishes the starting point for understanding the standards and defines the fundamental terms and definitions used in the ISO 9001 (Wilkinson & Scofield, 2010). The ISO 9001 on the other hand contains the actual QMS requirements used for certification or registration audits. ISO 9001 is the certification standard in the series that sets the minimum standard for a quality management system and the achievement of agreed goals between a client and contractor (using construction projects as an example) and the conformance of requirements. It is the standard that is used to assess the ability of an organisation to meet customers' needs and applicable regulatory requirements and thereby address customer satisfaction (Tummala & Tang, 1996). ISO 9004 gives a set of guidelines that can be used to develop quality management systems.

All requirements of this International Standard are generic and are intended to be applicable to all organisations, regardless of type, size and product provided. These sets of standards have become invaluable to the construction industry. Although, the three documents make up the ISO 9000 set, the main document that organisations are concerned with is the ISO 9001 standard. It sets up an assurance regime that provides confidence that an organisation has a quality process installed and that such an organisation could provide consistent quality products throughout all stages of the product's quality cycle (Love & Li, 2000). About every seven years a new ISO 9000 set is released. The current release used for ISO registration is the ISO 9001:2008.

The implementation of ISO 9000 deserves special focus by construction professionals, government and its compliance agencies. This standard enables forward planning of quality issues before their actual performance. In the wider construction industry, some countries have stressed the need for organisations to be ISO 9000 certified before contracts are awarded. For example the Housing Authority in Hong Kong emphasises that all construction contractors must be ISO 9000 certified otherwise they would be deprived of the right to tender for housing projects

(Chan & Tam, 2000; Dissanayaka, Kumaraswamy, Karim, & Marosszeky, 2001). Similarly in Australia, certification has become mandatory for all organizations wishing to do business with government agencies and major private companies (Love & Li 2000). However within the house building sector, there are suggestions that the implementation of the ISO 9000 series could be difficult, because it relies heavily upon the structure of management and its relationship with the various other parties of a contract, such as small to medium scale contractors. Craig's (2008) study of house builders in the UK identified three reasons why there is no incentive to implement the ISO 9000. Firstly house builders in the UK are essentially their own clients, building to their own expectations. Therefore quality levels are set by house builders which may be different from owners' quality expectations. Secondly there seems to be little competitive pressure from other house builders due to the lack of newly built houses coupled with low demand for new homes within the UK. Thirdly, the regulatory environment does not affect house builders as the sector is self-regulating; hence ISO certification is not mandatory. There is little or no pressure from outside bodies such as government or indeed house buyers to become quality certified.

Craig's (2008) argument may be similar to what is obtainable within the house building sector in New Zealand. Smaller and larger house builders are equally not bound to be quality certified. Considering that the construction industry in New Zealand is characterised by a large number of small firms (91% of firms having five or fewer employees) and a very small number of very large firms make certification difficult. Small and medium firms are particularly prevalent in the residential sector, with either sole traders or owner-operators with a very small staff (Skills productivity Partnership, 2011). Even though assurance to such standards provides proof that an optimal level of quality could be obtained, the need for certification remains inconclusive. Similarly it has been noted that most homeowners choose their house builders based on recommendations from friends and designers rather than any quality certification, since satisfied customers disseminate favourable word of mouth publicly and make referrals (Chee & Peng, 1996; Page, 2011a). Consequently it is not far-fetched to see why the homeowners would think that quality certification by their house builders is unnecessary.

Critics of the implementation of ISO 9000 in construction believe that the process is costly and time-consuming with minimal return on investment (Jaafari, 1996; Landin & Nilsson, 2001). The initial process of training staff to run quality management systems effectively is problematic and costly. To maintain appropriate skill levels at a high standard in an industry noted for substantial rates of staff turnover is doubly costly. The complexity and interaction of processes in the construction environment could be another problem hindering organisations from being ISO certified (Pheng & Teo, 2004). Despite these perceived drawbacks the study concluded that the benefit of ISO 9000 implementation outweighs its negative outcomes (Soltani & Lai, 2007). Moatazed-Keani, Ghanbari-Parsa and Kagaya (1999) support this view that several ISO procedures and requirements have proved to be highly advantageous to the organisations concerned. Benefits are particularly felt from the reviews required for the initial registration, the requirement for regular internal audits during the registered period, and reviews carried out for renewing registration. Overall the procedures allow weaknesses to be highlighted, and the system adapted to gain the best result with regard to the particular situation and culture of each organisation. Low and Yeo (1998) suggested that certification could significantly reduce the cost of rework, warranty costs and an extended market. Thus the implementation of ISO 9000 would mean that preventative measures are in place for organisations to monitor their quality process to ensure that defects free houses are delivered to the customer (Love & Li 2000). This will consequently reduce defect rectification costs later on (Kumaraswamy & Dissanayaka, 2001).

Another quality concept that focuses on customer satisfaction and defines the requirements for having a Quality Management System in place is the Total Quality Management (TQM) philosophy. TQM is a preventative-oriented system as opposed to an inspection-oriented quality system (Pheng & Ke-Wei, 1996). It is a quality management philosophy that enlists the contribution of all persons or parties connected to the construction of any facility. It is designed to ensure that organisations get it right first time, every time. The late 1980s and early 1990s saw a dramatic increase in the uptake of TQM principles in the construction industry (Jido, 1996; Kanji & Wong, 1998; Sommerville, 1994). Lately, there has been a significant dropping off of literature pertaining to TQM within the construction industry and TQM has become very much a mainstream or industry standard approach. The

implementation of TQM by construction organisations has come with benefits such as improved customer satisfaction, better quality products and higher market share. However maintaining such benefits require construction teams' main contractors and subcontractors to commit to established quality processes and sustain a true quality attitude.

Other new techniques and methods that have primarily been introduced from the manufacturing industry to the construction industry include philosophies like lean production/construction, Six Sigma and Quality Function Deployment (QFD). These philosophies, borrowed from the manufacturing environment have been suggested for improving efficiency and quality within the construction industry. The main drivers behind these initiatives are to enable organisations to improve the quality of production processes and end products and to consequently increase customer satisfaction levels.

Central to performance improvement and customer satisfaction is the concept of lean construction. The lean construction concept is focused on the minimisation of waste of time and effort, to generate the most probable amount of value while at the same time considering customer needs (Koskela, 1992). This concept is an adaption of lean manufacturing principles and practices to the end-to-end design and construction process. In contrast to manufacturing, the construction industry is a project based-production process. This unique nature sets it apart from other production environments as already explained in Section 2.3. Recognising that construction projects are complex and unique in nature, especially in the flow of both material and information on and off the construction site, lean construction helps to manage and improve the whole construction process. Whilst the concept of lean construction could be argued to be a new philosophy, Bertelsen and Koskela (2004) believe that the concept is not entirely new. Bertelsen and Koskela (2004) explain that well managed construction projects already have many aspects of lean construction. For example, just-in-time delivery of materials is commonplace to avoid the waste of large inventory stockpiles. Green building projects attempt to re-use or recycle all construction wastes. However, what is new in lean construction is the systematic attention to continuous improvement and zero accidents and defects.

Achieving zero defects within residential buildings (which is the focus of this research) is only possible through the collaboration of all project participants.

Achieving zero defects in construction projects depends a great deal on understanding customer needs and expectations. In addition, this objective can be achieved by having an effective quality monitoring process within any organisation. In the construction industry, organisations are increasingly under pressure to deliver high levels of performance to the satisfaction of the client and other project participants. This means that organisations within the industry need to continuously improve their processes and end products to meet this performance level. Therefore the Six Sigma concept was developed to reduce costs and improve quality through reduction in the occurrence of defects (Landin & Nilsson, 2001). According to a definition provided by Lindermann, Schroeder, Zaheer, and Choo (2003), Six Sigma principles is a statistics-based methodology that relies on scientific methods to make significant reductions in customer-defined defect rates in an effort to eliminate defects from every product, process, and transaction.

Coskun and Altun (2012) posit that Six Sigma is one of the most effective management approaches to quality and performance improvement. Similar to lean construction, the term Six Sigma was derived from terminology associated with manufacturing. This term is specifically linked with statistical modelling of manufacturing processes. Six Sigma originated as a set of practices designed to improve manufacturing processes and eliminate defects, but its application has subsequently been extended to other types of business processes as well. The Six Sigma principle can be represented on a normally distributed product quality distribution curve. When the mean is located at the centre of the normal distribution curve, the lower and upper limits are six times the standard deviation sigma from the centre line. Meaning, the range of the lower or upper limit defect is  $\pm 6$  sigma from the mean. Processes that operate with "Six Sigma quality" over the short term are assumed to produce long-term defect levels below 3.4 defects per million opportunities (DPMO). In other words a Six Sigma process is one in which 99.99966% of the products manufactured are statistically expected to be free of defects (Barney, 2002; Han, Chae, Im, & Dong, 2008). Each six sigma project carried out within an organisation follows a defined sequence of steps and has

quantified financial targets (cost reduction and/or profit increase) (Ray & Das, 2011). Six Sigma has key features that make it different from previous quality improvement initiatives (Han, et al., 2008; Prasad, Subbaiah, & Padmavathi, 2012). This includes:

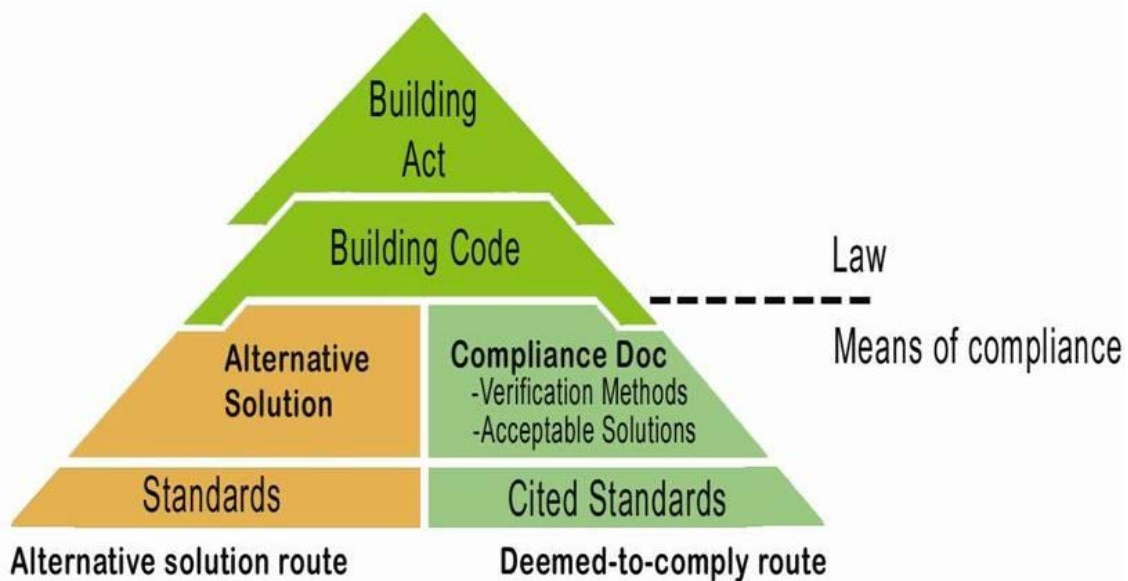
- A strong focus on achieving measurable and quantifiable financial returns
- An increased emphasis on strong management leadership and support.
- A special framework of "Champions", "Master Black Belts", "Black Belts", "Green Belts" that will lead the implementation of the Six Sigma approach.
- A clear commitment to making decisions on the basis of provable data and statistical methods, rather than assumptions.

The various performance improvement initiatives highlighted in this section demonstrate what is needed for the achievement of a high quality product. Therefore within the context of the current study, achieving a high quality product means aiming at zero defects in the end product of a construction project. Focusing on needs and expectation of customers will help identify and eliminate the causes of defects and minimise inconsistency in the house building process. Thus organisations are only able to measure their quality performance when an effective quality management system is established. This view is supported by (Ray & Das, 2011), who write that the ultimate objective of all quality performance improvement concepts is to identify customer needs and then satisfy these needs effectively and efficiently.

### **2.6.2: New Zealand Building Quality Management Standard**

An example of a quality management standard guideline within the house building arena in New Zealand is the Building Act of 2004 which is the primary piece of legislation governing buildings in New Zealand. This Act sets the requirements for the construction, alteration, demolition, use and maintenance of new and existing buildings. The purpose of the Building Act (BA) is to ensure buildings are safe and built right first time. It is administered centrally by the Ministry of Business, Innovation and Employment (MBIE) previously known as the Department of Building and Housing (DBH). The BA is regulated locally by regional, city and district councils and

provided a hierarchy of guidelines and compliance documents. This hierarchy is displayed in Figure 2 below.



**Figure 2.1:** Hierarchy of compliance documents (CIC, 2009)

Under the Building Act (2004) is the New Zealand Building Code that provides functional requirements for buildings and the performance criteria with which buildings must comply with according to their intended use. The code is a performance based document which sets out objectives to be achieved when building work is done. These objectives cover aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities. All new building work must comply with the Building Act (2004).

Some other important guidelines are compliance documents which contain prescriptive design solutions to assist builders to comply with the Building code. It is expected that these standards will serve as guidelines for building designers, building developers and trade people, to assist in quality achievement on construction sites. Although these standards and guidelines do not guarantee with absolute certainty the production of quality products, they do make this more likely. Aside from these building standards, there are other international quality awards established to encourage improved quality performance on construction sites.

### **2.6.3: National and international quality awards**

#### **2.6.3.1: Malcolm Baldrige National Quality Programme Criteria**

The Baldrige National Quality Programme Criteria is an award for performance excellence that recognises companies in the USA that have excelled in quality management and quality achievement (Oakland & Marosszeky, 2006). The award is reputed for its excellent framework for TQM and organisational self-assessments (Hoonakkar, et al., 2010).

Oakland and Marosszeky (2006) explain that the award criteria are built upon a set of interrelated core values and concepts. These are visionary leadership; customer-driven excellence; organisational and personal learning; valuing employees and partners; agility; focus on the future; managing for innovation; management by fact; public responsibility and citizenship; focus on results and creating value; and systems developments.

The aims of the award include the following:

- a) To help improve organisational performance practices, their capabilities and result.
- b) To help facilitate communication and sharing of best practice information.
- c) To serve as a working tool for managing performance.

The overall goal of the award is the delivery of customer satisfaction and market success leading in turn to excellent business result (Oakland & Marosszeky, 2006). This drives companies to manage quality achievement in their processes and final products.

#### **2.6.3.2: European Foundation for Quality Management Business Excellence Model**

This is a similar kind of quality achievement award to the Baldrige Award but based in Europe. It provides the means of implementing Total Quality Management within the construction industry. The aim of the award according to Griffith and Watson (2004) includes:

- a) To stimulate and assist organisations throughout Europe to participate in improvement activities leading ultimately to excellence in customer satisfaction, employee satisfaction, knowledge management, impact on society and business results.
- b) To support the managers of European organisations in accelerating the process of making Total Quality Management a decisive factor for achieving global competitive advantage.

Other local awards within New Zealand that could encourage construction organisations to improve their performance is the Registered Master Builders House of the Year and RMB Commercial Project Awards. This award is arranged in association with PlaceMakers. This competition is New Zealand's premier residential and commercial building awards programme. Though these awards are not quality management standards per se, they encourage organisations to strive towards quality assurance if they desire to be recognised with such a prestigious award. Several quality initiatives which have been suggested to improve quality in the construction industry will be explained in the next section.

## **2.7: Quality initiatives in the UK**

### **2.7.1: Latham Report**

Quality improvement has been identified as one of a number of initiatives to assist in the drive for major improvements in the construction industry. The Latham report was one of the first studies commissioned by the UK government to help project owners and construction participants attain the highest quality on building and infrastructure projects. The study sought the opinions of construction stakeholders on a whole range of issues related to procurement and contractual arrangements within the UK construction industry. Usefully and within the context of the current study, it identified 8 wishes that owners of construction projects want on their projects. These are value for money, pleasing to look at, defect free on completion, delivered on time, fit for purpose, supported by worthwhile guarantees, reasonable running costs, and satisfactory durability. It would seem these varying wishes and requirements need to be met, but very often project owners do not get what they

want, most especially in the house building sector of the construction industry (Sommerville & Craig, 2007).

Where house builders build to their own requirements, the homeowners' wishes and requirement will be difficult to achieve because they vary considerably from those of the house builder (Sommerville & Craig, 2007). However, when the required quality standards of building projects are not met, homeowners desire worthwhile guarantees to protect them in case of poor or under-performance of the completed buildings. The Latham report puts the client more succinctly thus:

*"Defects should not be inevitable in a building or other forms of construction project. The aim should be right first time, every time. Some clients believe that the concept of practical completion should be rejected because the building is not complete so far as the client is concerned until all defects and snagging has been satisfactorily sorted out".[ Section 11.1]*

The Latham report went further to compare buildings or other forms of construction to consumer goods, explaining that unlike consumer goods that could be returned if they do not work, a building project cannot be returned. Therefore building owners will have to put up with the stress of defects and latent defects when they arise (Sommerville & McCosh, 2006). Thus for reliable quality project delivery, construction participants need to be accountable. They should know that every client has the right to expect high quality from projects which they have commissioned. The Latham report suggests that early customer/homeowner involvement might help to establish their requirement from a project's outset. This aspect of the report is significant from a New Zealand perspective. This is because while some house building in New Zealand is speculative as in the UK, there is also allowance for homeowners to be involved during the construction of their homes, through the presence of packages such as the land/house package. This non-speculative nature can arguably reduce the amount of defects at hand-over as homeowners would have had opportunities to view their homes during construction and voice their dissatisfactions at the time of the building construction.

### **2.7.2: Egan Report**

The Egan (1998) report titled 'Rethinking Construction' is an innovative document prepared for the construction industry in the UK. It reviews particular practise

problems and suggests improvements. The improvements that were proposed by the report were mainly drawn from best practises observed in the manufacturing industry. It states that the construction industry is under achieving thus the need for quality improvement and efficiency in order to stay in the competitive market. The report identifies five key drivers and seven key quantified targets that need to be put in place if the construction industry is to improve its performance. The report adopted a holistic approach covering product development; project implementation; partnering the supply chain; and the production of components. These four key areas need to be integrated to achieve the desired improvements. The driving force for the industry-wide improvements suggested in the Egan report find their origin in highly reported changes in the manufacturing sector. The report believes that the construction industry can benchmark giant strides made in the management styles of firms within the manufacturing industry.

The Egan report suggests that quality, as one of the drivers for change must be fundamental in the design process, and that defects must be eliminated before work commences on any particular site. The objective of quality improvement is not only to eliminate waste but to aim at achieving zero defects across the construction industry within five years. The report proposes a consistent reduction in the level of defects with a target annual reduction of 20% in defects discovered in construction projects in the UK, and a 10% increase in production annually which could lead to an overall performance improvement within the industry. According to the report, to achieve this improvement, a radical and successful change is needed to the process through which the construction industry delivers its product. This will yield cost benefits (from higher productivity) to the client and the producer as well as quality project delivered on time, within budget, and defect free. The report also stated that quality means total package therefore it is important to meet a customer's satisfaction through after-sale customer care. This requires a greater focus on clients' project requirements. Even though project participants (i.e. designers, contractors, suppliers) may have their individual objectives, which in most of cases are commercial, they will still have to strive towards meeting the client's objectives of time, cost, and quality of construction.

The second Egan (2000) report, *Accelerating Change* was an extension of the first report. The report was produced to reaffirm the principles set out in *Rethinking Construction* and was meant to accelerate the rate of change initially proposed in the first report. The report identifies three main drivers that could accelerate the change to enable continuous improvement. These include the need for client leadership, an integrated supply chain and improved health and safety. Both reports aim at improvements to current practices in the construction industry. They both believe that there are benefits to be made if the construction industry benchmarks best practices used in the manufacturing industry. As such, these are radical changes to current processes in construction project delivery.

Though the Egan report has been criticised as being short of factual evidence with little by way of benchmark figures of current defect levels that the industry could work towards reducing, this study believes that the Egan report provides a broad base on which subsequent studies can build on. Further, though there is no substantial evidence to show how figures were generated, this researcher believes there could be shared benefits from improved performance if clear measurable targets and specific milestones are set towards productivity improvement. If their suggestion of an annual 20% reduction in defects at handover, with an ultimate goal of zero defects is implemented within the residential sector, then completed residential projects will most probably be defect-free at handover.

Both reports from the UK, the Latham Report (1994) and the Egan Report (1998) are often referred to in relation to overall performance and productivity improvement in the construction industry. However, central to the two reports is the need for performance improvement in the construction industry. Even though Sommerville & McCosh (2006) argue that the two reports largely focused on the commercial sector with little emphasis on the house building sector, the current study believes that both documents were also significant for other countries as they began to look at their own residential and commercial construction industries to seek similar improvements.

## **2.8: Review of reports relating to quality improvement in New Zealand**

### **2.8.1: Hunn Report and Leaky Buildings**

The New Zealand government's intentions to improve the quality of new homes have prompted a number of reports. For example, an overview group was commissioned in 2002 by the Building Industry Authority, to examine the problem of weather tightness with emphasis on houses that are leaking. The overview group met with representatives from different sectors of the building industry and visited a number of affected buildings with the aim of seeking solutions to address systematic failures within the building industry. The group had amongst its terms of reference the following: (a) to determine the nature, extent, and effect of the weather tightness problem, (b) to evaluate the potential contributing causes of regulatory systems and (c) to determine if failures could be attributed to deficiencies in the Building Act (1991).

Weathertightness in new buildings is the most well-known quality failure in New Zealand. "Weathertightness" is synonymous with the now infamous 'leaky building' scandal in the country. This problem is mainly confined to buildings constructed with monolithic external cladding installed over untreated timber framing and without a drainage cavity between the cladding and the external wall (PWC, 2009). The problem results from the inability of monolithic cladding to completely stop water from entering the timber framework where it is thereafter unable to dry. Although buildings in New Zealand had always leaked to some extent because of its coastal climate and capability of extreme climate variations, what was abnormal and new was the significant percentage of increase in cladding systems letting in moisture (Murphy, 2011). In the same line of argument, PWC (2009) explains that in some building design it is expected that water will penetrate the primary cladding, but the design ensures that it will not cause damage. This means that it is possible that any building will leak, however it is the ability to handle those leaks that determines if damage will occur.

The use of monolithic cladding became popular from the mid-1990s when the demand for condominium style living was on the increase. There was a rapid uptake of new cladding materials and the use of traditional weatherboard and brick

construction began to decrease (Murphy 2011). Consumer's preferences changed from traditional styles to flush plaster finishes, a lack of eaves, the use of parapet walls, and with balconies both internal and external to the building's main form. This monolithic cladding was both new and cheaper and allowed for flexibility in design, and as a result there was increased complexity in design and construction of houses. The increase in the use of these cladding materials and design occurred simultaneously with other changes in the house building sector such as an increase in construction of apartment buildings, and a deviation from "old-fashioned" procurement methods. A combination of all these changes and growth in the house building sector resulted in a state of ambiguity as many building workers began to use new systems and materials that their level of training did not adequately prepare them for (Murphy 2011).

The Hunn report (2002) came up with twenty-five recommendations. The recommendations within the report are intended to benefit homeowners by improving the industry's overall performance, although the report had a narrow focus on problems relating to water ingress alone. The report recommended that guidelines should be provided to building inspectors as part of the Code Compliance Certification process to specific reference to the weather tightness issue. Other recommendations suggested by the report are clarity of roles and responsibilities of parties responsible for procuring, designing and constructing a building to ensure quality assurance. This will improve the accountability of all project participants in the house building sector. It will also give consumers some level of confidence and protection in the builder employed for their services. Of note is the mandatory inspection regime for all new buildings at different stages during construction work. The inspection regime varies for different building types but is specified in the development consent that is issued before any building can be constructed. The report further suggested the review of building inspector qualifications by developing a tertiary qualification with continuous professional development so that the practice of good building will be addressed. Though the Hunn report focused on the weathertightness issue, it provided a blueprint for changes across the house building industry as a whole (PWC 2009). The recommendations made by the Hunn report (2002) contributed to the review of the 1991 version of the Building Act.

The report of the overview group (referred to as the Hunn report) concluded that though the extent of the problem is not fully known, urgent, corrective and preventive measures were needed to solve it. Conservative estimates for the annual cost of rectifying the weather tightness problem was put at between NZ\$12-24 million by the Hunn report. The report confirms the result obtained by an earlier study by Porteous (1992) that evaluated and classified building failures in New Zealand. Porteous found that about 1% of 25,000 new houses constructed annually fail within the first few years of their commission and these failures are mostly due to water ingress. The water ingress problem affects 22,000 to 89,000 dwellings, with a consensus forecast of 42,000, PWC (2009). The repair cost for this consensus forecast of 42,000 buildings is estimated to be NZ\$11.3 billion (in 2008 dollars). New residential buildings are particularly vulnerable because homeowners have to bear the burden of defects. While the weather tightness problem is not the focus of the current study, it is nevertheless a useful reference point to quality problems in house building in New Zealand. Despite these recommendations and suggestions the industry has still yet to address its many flaws. Kernohan (2012) states that:

*'To say nothing has happened in the past 10 years would be unfair to many who have strived to make changes and improvements. However, sadly, overall, the systemic failures identified in the Hunn Report in 2002 are still evident - 10 years on'*

## **2.8.2: Changes to the Building Act**

The Building Act 1991 has gone through several changes over the years. These changes were introduced in stages. Some have already taken effect, while others are still in the process of implementation. The Building Act 2004 repealed the Building Act 1991 and introduced a number of changes to the law governing building work. Although the 1991 Act was repealed by the 2004 Act, it remains the legislation that governs the building industry in New Zealand, and it applies to the construction of new buildings as well as the alteration and demolition of existing buildings. Proposed changes to the Building Act and other related pieces of legislation are designed to help New Zealanders build quality, cost effective homes and buildings that they can have confidence in. Beattie (2011) explains that the continuous change in technology and the introduction of new building materials into the market place

requires regular updating of standards and regulations within the construction industry.

The amendment to the 1991 version of the Building Act was an immediate response to recommendations made by the Hunn Report (2002). Hunn's recommendations saw a significant tightening up of procedures and policies surrounding the implementation of building controls. The changes to the Building Act played a large part in addressing weathertightness problems experienced in the country as explained in Section 2.8.1 (DTZ New Zealand, 2004). An earlier change allowed the use of untreated kiln-dried pinus radiata in timber house framing. Though this change was retracted in 2004, it has had significant and long-term consequences in the building industry (Murphy 2011). This view is also supported by (Beattie 2011): that it was the changes within the building regulations that caused severe quality failures in the residential construction sector.

The Building Amendment Act 2012 is the result of a comprehensive review of the Building Act 2004 carried out in 2009/2010 and is aimed at lifting the overall performance of the building and construction sector (MBIE website). One of the amendments is the introduction of the Licensed Building Practitioner that came into force on 1st March 2012. This scheme stipulates disclosure requirements for building contractors regarding their skills, qualifications, licensing status and track record. This change is one of several that were made to the Building Act 2004 to encourage better building design and construction. Details of the scheme will be explained in the next sub section.

Subsequent amendments proposed and still under consideration at the time of writing this thesis include mandatory written contracts for all building work over \$20,000, and rules making principal building contractors fix any defects in their work within 12 months. The intention is to improve the control of, and encourage better practices in, building design and construction. The purpose of the review is also to give clarity on the standards, and guidance on how these standards can be met. It further ensures that people undertaking building design, construction and inspection are competent to carry out the task. There will also be better protection for homeowners through the introduction of mandatory warranties.

Table 2.1 presents a breakdown of some of the key events impacting on the New Zealand Building Standards from 1990 to 2012. The majority of the key events outlined in the table resulted in the amendment of the Building Act 1991. These amendments form a package of changes to lift the performance and productivity of the building industry. The overall aim of the changes to the Building Act is to improve the quality of building work, as evidenced by less defective work, rework and fewer disputes (Williamson, 2010).

**Table 2.1:** Breakdown of some key events impacting the New Zealand Building standards from 1990 to 2012

| Dates               | Events                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1990                | NZS 3602 required radiata pine to be treated if it was exposed to moisture                                                                                                                                                                                                                                                                                                                                                                           |
| 1992 (1 July)       | Building Act 1991 came into force & also new national Building Code (under Building Regulations 1992), under the Code monolithic cladding (without a cavity) could be used as an alternative solution. First edition of B2/AS1 Approved Document provided for NZS 3602:1990 to be an acceptable solution to the Code requirements for timber framing.                                                                                                |
| 1993 (1 January)    | Formal transitional period under Building Act 1991 ended, all new building work required a building consent under the 1991 Act from this date.                                                                                                                                                                                                                                                                                                       |
| 1993 (15 September) | Schedule 1 of Building Act 1991 amended to clarify that any repair or replacement of a component or assembly that has failed the durability provisions of the Code (clause B2) must be done under a building consent.                                                                                                                                                                                                                                |
| 1995                | NZS 3602 revised to allow use of untreated timber in certain circumstances. The use of untreated timber was an alternative solution for Code compliance                                                                                                                                                                                                                                                                                              |
| 1998 (28 February)  | Second edition of B2/AS1 Approved Document provided for NZS 3602:1995 to be an acceptable solution to the Code requirements for timber framing.<br>Second edition of E2/AS1 Approved Document provided for plaster cladding on a rigid backing without a cavity to be an acceptable solution to the Code requirements for external moisture protection. (cf plaster cladding on a non-rigid backing requires a cavity to be an acceptable solution). |
| 2002 (31 August)    | Hunn Report on weathertightness published                                                                                                                                                                                                                                                                                                                                                                                                            |
| 2002 (26 November)  | Weathertight Homes Resolution Services Act 2002 came into force.                                                                                                                                                                                                                                                                                                                                                                                     |
| 2003 (March)        | Government Administration Select Committee report on weathertightness released.                                                                                                                                                                                                                                                                                                                                                                      |
| 2003 (December)     | NZS 3602 revised to no longer allow untreated timber to be used in framing for exterior walls.                                                                                                                                                                                                                                                                                                                                                       |
| 2004 (June)         | Third edition of E2/AS1 Approved Document published but did not come into effect. This edition provided, among other things, for all stucco cladding to be fixed over a cavity in order to be an “acceptable solution” for the Code                                                                                                                                                                                                                  |
| 2005 (31 March)     | Building Act 2004 came into force. Schedule 1 of the Act inadvertently omitted the 1993 provision requiring durability failures to be repaired under a building consent. Approved Documents now called Compliance Documents. B2/AS1 Compliance Document amended to refer to NZS 3602:2003 as the acceptable solution to the Code requirements for timber framing.                                                                                    |
| 2005 (1 July)       | Amended version of third edition of E2/AS1 Compliance Document came into effect requiring, among other things, stucco cladding to only be used over a cavity.                                                                                                                                                                                                                                                                                        |
| 2007 (1 May)        | Weathertight Homes Resolution Services Act 2006 came into force. Key new provisions: future damage and general damages able to be claimed; easier for owners of multi-unit buildings to make claims, Weathertight Homes Tribunal established to adjudicate claims                                                                                                                                                                                    |
| 2008 (14 March)     | Schedule 1 of Building Act 2004 amended to reinstate 1993 provision requiring durability failures to be repaired under a building consent.                                                                                                                                                                                                                                                                                                           |
| 2012 (1 March)      | Licensed Building Practitioner Scheme came into force                                                                                                                                                                                                                                                                                                                                                                                                |

**Source:** PWC. (2009).

### **2.8.3 CIC Report**

The CIC report (2004) was prepared with the aim of creating improvements within the construction industry in New Zealand. This idea was developed based on the UK achieving Excellence. It has a comparatively narrow focus on the procurement processes within the industry. Underpinning the improvements suggested for change is the need for the industry to apply customer-driven approaches evident in controlled production environments (manufacturing). The CIC report aims to assist client organisations to integrate best practice activities into their procurement practices in order to achieve their goal of best value and to encourage them to act as a role model that will set standards for other firms to follow.

The CIC report identified six key driving forces which need to be in place in order to secure significant improvement in overall construction performance. The driving forces are the following:

- There is a focus on short term and not whole of life costs.
- There is a focus on costs over value.
- The lowest-bid approach compromises health and safety, quality, training, environment and education, all of which constrains innovation.
- The lowest bid approach encourages unsustainable markets.
- Inappropriate risk allocation is occurring.
- Accountability needs to be improved.

All these driving forces are aimed at meeting client expectations of quality and improving industry best practice which is one of the focuses of this research. Thus the importance of quality of service received /product delivered should be paramount to all project stakeholders. One aspect of the report (p.25) talks about quality assurance and suggests that project participants have to recognise quality assurance systems as standards that will help achieve best practice and best value for money. This aligns with the current study's key focus, which is to seek improvements to the house building process so that

quality assurance becomes a standard process that will help achieve best practice in newly - built houses.

The CIC report (2004) further believes that project participants and suppliers in particular need to be able to operate in an industry that is sustainable with an adequate return on whatever capital that is invested. Such an industry recognises the value added-on by the project participants and where their respective contributors work in a non-adversarial relationship. Project participants would consequently be more competent and organized. Ultimately, the CIC report was able to come up with useful and important ways in developing and improving the construction industry, and ensuring that customers are offered the best value for their investments. To achieve these, the government, industry and clients will have to go through radical changes to improve efficiency and quality of services delivered. All of the changes proposed, if fully implemented will improve the construction industry and place it advantageously to deliver as productively as the manufacturing sector.

#### **2.8.4: House Condition Surveys**

As part of the BRANZ initiatives to improve quality within residential buildings in New Zealand, house condition surveys are conducted every five years to assess the state of New Zealand's housing stock and to raise occupants' awareness to maintenance shortcomings and building defects in their buildings. Previous surveys conducted were in 1994, 1999, 2005 and 2010. The surveys considered owner-occupied houses located in Auckland, Wellington and Christchurch. The most recent survey in 2010 built on robust information gathered previously to include rental properties and new buildings. The 2010 survey also expanded the sample size to include houses located all over New Zealand and weighted this over the population, to ensure an even distribution of data for the analysis.

The house condition survey analyses information on the condition of buildings cost of defects and other household characteristics. A summary of the survey conducted in 2010 shows that there has been no appreciable change in house conditions nationally from those recorded in 1999. Although there were reported improvements between 1999 and 2010 (in the previous survey reports), the

2010 survey mentioned that there were more new houses included in those previous surveys, which could have accounted for the improved level of house conditions. Similarly common defects were as those observed in previous surveys and notably many houses typically had at least one component in poor or serious condition.

The house condition surveys do not provide information on defects that are attributable to the performance of house builders. There is no indication within the survey reports that defects noticed are due to the house builder, occupants or any other parties. To determine defects that result from poor quality performance of house builders would require surveys at handover before or shortly after occupation. Further, cost data provided in the house condition surveys covers maintenance related costs which is outside the scope of the current study.

#### **2.8.5: Building and construction sector productivity partnership**

As a result of the perceived low productivity hovering around the image of the New Zealand construction industry, government and industry came together to form a partnership known as the Building and Construction Sector Productivity Partnership (BCSPP). It was established in 2010 through the Department of Building and Housing (now called the Ministry of Business, Innovation and Employment (MBIE), to address low productivity in the construction industry. The aim of the Partnership is to raise sector productivity by 20% by the year 2020 (Skills productivity Partnership, 2011). The Partnership is made up of Governance Group, which sets its direction, with four work streams which are working towards a deeper understanding of what makes for a productive sector. The four work streams include: skills, evidence, and procurement and construction systems. It would seem apparent that the skills work stream has most relevance to the current research.

It is anticipated that the skills work stream will work with the construction industry to map out future skills needs and ensure access to highly skilled people. It is widely recognised that investing in skills development results in improved productivity (Building and Construction Sector Productivity Taskforce, 2009). For an industry going through a revolution, as the building industry is, it

is essential to know which skills are needed for the future and to ensure that the right workforce with the right training are in place to meet both present and future needs. The skills workstream through consultation with industry stakeholders identified four key priority areas that could improve performance within the built environment/construction industry.

The four key areas for action that were identified by the productivity partnership in conjunction with industry stakeholders include: short term skill challenges, culture (such as attitudes, beliefs, values of people within firms), firms (characterised by size) and education and training. In each of these action areas, smaller topics with a range of responses were identified based on the inputs of the industry stakeholders. The key area that deserves focus and which aligns with the research described in this thesis is the culture change that is required of the built environment as a whole. Culture was further subdivided into four viz: fragmentation, attraction and retention, quality, and engagement with education and training. Consequently quality is particularly relevant because an improvement in quality performance of the residential sub-sector would require a culture shift along the lines of the objectives of the BCSP. Table 2.2 outlines the different responses/focus areas and the key groups that could assist in addressing the issues around quality improvement. The groups highlighted in bold are the leaders of each key groups. The productivity partnership expects the achievement of these response initiatives could ultimately cause productivity growth in the entire built environment. Closer observation of the focus areas in the table, show that quality improvement, customer satisfaction and awareness of quality standards are central to achieving productivity improvement within the construction industry.

Table 2.2 also suggests that celebrating and rewarding quality projects could help construction organisations to improve the quality of their products. This is in line with the conclusions reached in section 2.6.4, that recognising and rewarding organisations for quality projects through international and local awards will encourage them to strive towards quality assurance.

**Table 2.2:** Focus areas and key groups that address quality improvement

| <b>Responses/focus areas</b>                                                                                                                                                                                                                    | <b>Key groups involved</b>                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Raise awareness at all levels of the costs of rework and the ripple effect flowing from products that do not meet quality standards                                                                                                             | <b>Industry Association and Institutes</b> , tertiary providers, ITOs  |
| Introduce at all levels an understanding that customer satisfaction is a core industry driver                                                                                                                                                   | <b>Industry Association and Institutes</b>                             |
| Introduce aspect of quality control into training at all levels                                                                                                                                                                                 | <b>Industry Association and Institutes</b> , secondary providers, ITOs |
| Celebrate good examples of quality projects as often as possible                                                                                                                                                                                | <b>Industry Association and Institutes</b> , DBH                       |
| Train more procurement professionals to ensure procurement process include risks and whole-life value approach                                                                                                                                  | <b>Tertiary providers</b> , ITOs, TEC, DBH                             |
| Make code, compliance documents, standards and research more accessible, both in terms of cost and readability, in recognition of their critical importance for the industry in providing a level of certainty and consistency to practitioners | <b>Industry Association and Institutes</b> , DBH, Standards NZ, BRANZ  |
| Set up a feedback website to allow customers to record their experience including a simple rating system on a few key indicators                                                                                                                | <b>Industry Association and Institutes</b> , DBH                       |

**Source:** Skills Productivity Partnership (2011)

Another significant point in Table 2.2 is the need for customer feedback. Customer satisfaction through feedbacks is an area that needs attention especially in residential building projects. According to Karna, Sorvala and Junnonen (2009) construction organisations seem not to bother about customer feedback as they expect to receive honest and sincere input. However, as is emphasised throughout the current study, the only way to improve quality in new house building is by first finding out what the customer thinks is important, and their experiences when they purchased their new homes (Auchterlounie & Hinks, 2001). Understanding their customers' experiences will enable construction organisations to identify priority areas for improvement. Feedback is a form of benchmarking that could allow performance to be measured and analysed, consequently enabling continuous quality improvement to be developed and implemented. Way (2005) also expressed a similar view that feedback enables construction organisations to improve both their performance and customer satisfactions. Customer satisfaction should be paramount to any organisation because there is a close relationship between it and quality achievement levels (Auchterlounie, 2009). The survival of any construction

organisation depends on the ability to meet increased customer expectations and to keep the cost of operations and product failure as low as possible (Abdul-Rahman, 1993).

The responses/focus areas presented in Table 2.2 mirror quality issues inherent in the residential construction sector. The author believes that a focus on culture within the construction industry will yield the behavioural changes needed to consistently and continuously improve quality performance. Therefore the achievement of the skill work stream objectives should feed into other work streams, as all work streams are interrelated and geared towards improved construction productivity.

Levey (2002) further emphasises the significance of the skill stream in the wider construction industry, explains that one of the major challenges facing the construction industry is the growing shortage of skilled workers which ultimately jeopardises the quality performance of construction projects. A similar view to Levey (2002) is held by the Building and Construction Taskforce report (2009) that states improved skill levels in the construction industry will have a positive impact on its overall performance of the industry. The right skill for the right job could reduce building defects and consequently improve the quality of construction projects.

#### **2.8.6: Licensed Building Practitioners**

The Licence Building Practitioner Scheme (LBP) was first established in November 2007 under the Building Act 2004 by the Department of Building and Housing. The LBP scheme came into effect on 1<sup>st</sup> March 2012. It places an emphasis on higher standards by those working in the industry, giving added protection to home buyers and home owners. The LBP scheme, introduced in 2004 with the new Act and modified in 2010, is to encourage better building design and construction at the critical building consent and inspection stages of the building process. This scheme was introduced to put right the respective deficiency identified in the Hunn Report (2002) explained in section 2.8.1 of this research. The scheme is competency based but from 2015 it is intended to be qualification based with applicants needing the appropriate trade to qualify (Murphy, 2011). The LBP scheme aims to ensure that people in the building

industry who are responsible for building work are skilled and accountable, so that homes and buildings are designed and built right the first time. The intent of the scheme is also to bring about better consistency in regulatory building controls across New Zealand, as well as generally improving performance in the building control system.

There are seven different types of licence class under the LBP scheme which includes; designers, carpenters, roofers, external plasterers, brick and block layers, foundation specialists and site workers. Each licence class has a number of competencies, skills and knowledge required. Professional Engineers, Architects, Plumbers and Gasfitters are also deemed to be Licensed (Department of Building and Housing, 2010b). Persons not licensed cannot undertake or sign off on responsibility for restricted building work. Restricted works are works that are critical to the integrity of a building. Under the scheme, work that is related to the structural integrity or weathertightness of residential buildings would have to be designed and carried out or supervised by an LBP. A lot of work that requires a Building Consent is restricted building work but not all, and this is applicable to most residential building or renovation work.

There are three building categories to identify how applicants should be assessed and to provide definitions for the various licence classes (Department of Building and Housing, 2010a). The new building categories are complexity based, ranging from simple low risk dwellings in category 1 to complex multi-storey structure in category 3. The categories are presented in Table 2.3.

**Table 2.3:** New Building categories

| Category                    | Definition                                                                                                                | Description                                                                                                           |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Category 1 buildings</b> | SH use<br>Risk score of 12 or less for any external elevation.                                                            | Single household dwellings with low- or medium-risk envelope design.                                                  |
| <b>Category 2 buildings</b> | SH use<br>Risk score greater than 12 for any external elevation.<br>OR<br>Not SH use, and building height less than 10 m. | Single household dwellings with high-risk envelope design, or other buildings with a building height* less than 10 m. |
| <b>Category 3 buildings</b> | Not SH use, and building height greater than 10m.                                                                         | All buildings 10 m or greater in building height*, except single household dwellings.                                 |

Source: <http://www.dbh.govt.nz/ibp> \*SH Single Household

The inclusion of restricted building work in the LBP scheme may help reduce the amount of defects experienced during and after construction as building work will be performed or monitored by qualified and experienced individuals. Beattie (2011) believes that the public registration of an LBP, and a procedure for complaints, categories of licence obtained, and restricted building work to be carried out will ensure stricter inspection, thereby reducing defects within the building industry. Similarly, Henderson (2010) contends that the LBP scheme has features that will raise the level of competency in all areas of house building.

The Skills Productivity Partnership (2011) predicts that the Canterbury earthquakes coupled with the long-standing problem of weathertightness will generate a significant upswing in building and construction activities over the next five years. Therefore the LBP scheme could be an immediate solution to help cope with issues of quality for the rebuild of the earthquake affected areas. LBPs are required to continuously update their record of training and activities through reading of industry publication and attending seminars to stay current in their trades. Implementation of the LBP would raise standards in the sector while doing away with unnecessary red tape (Department of Building and Housing sector capability deputy chief executive Alison Geddes). However it is too early to conclusively state that the implementation of the LBP scheme has significant benefits because it is still very new and the building industry is still coming to terms with it. Only time will tell the full effects of the LBP scheme on the house building sector. However what is clear from the introduction of the scheme is that prospective house buyers and new home owners will have to carefully select their house builders to make sure they are registered.

## **2.9: Summary**

Despite the subjectivity of the definition of quality, this research takes the premise that quality is that which meets or exceeds customers' needs, requirements and other performance criteria. Central to determining performance expectations is the customers' end-users' requirements. However the characteristics of the construction industry constitute challenges in achieving the needs and expectations of present and future construction project owners. The construction industry has been perceived as an industry that lacks

customer and quality focus, therefore the building processes, peoples, materials and final products have been subjected to a lot of criticism. Overcoming these challenges requires efficient and effective quality management systems that will monitor activities and mechanisms on construction sites. This will enable early detection of quality deviations and necessary remedial measures, so that the end product will be free of defects.

Several initiatives both within and outside New Zealand have been promulgated to improve the performance of the construction industry. While some construction organisations in New Zealand are actively pursuing quality attainment initiatives, others have still yet to adopt the idea. The researcher believes that the adoption of these quality initiatives will allow construction organisations to compare and benchmark their performance with other organisation thereby achieving the goal of best practice.

## **CHAPTER THREE**

### **CUSTOMER REQUIREMENTS IN RESIDENTIAL BUILDINGS**

#### **3.1: Introduction**

Having presented some fundamental concepts surrounding quality and various initiatives suggested for performance improvement in the construction industry, this chapter focuses on issues pertaining to customer satisfaction with quality achievements in new residential buildings. The chapter presents literature on different perceptions of quality held by homeowners when they purchase their new homes. It also reviews relevant concepts and previous empirical findings on levels of homeowner satisfaction in new residential buildings. The chapter addresses research objective 4 outlined in section 1.5, which seeks to explore and determine new homeowner satisfaction levels with regard to defects observed when they take possession of their properties. Finally, the chapter reviews warranties and guarantees that cover new homeowners when problems of quality performance arise. This is necessary in order to establish the gaps that exist with regards to new homeowner protection and its implications.

#### **3.2: What is customer satisfaction?**

Several descriptions of customer satisfaction exist, but there seems to be an absence of a generally acceptable operational definition and measure of customer satisfaction in the construction industry (Torbica & Stroh, 1999). However there appears to be some agreement that a good measure of customer satisfaction could be:

- The extent to which a physical facility and a construction process meet and/or exceed customer's expectations (Karna, 2009; Yang & Peng, 2008)
- Satisfaction with the constructed facility, the contracting facility and contracting service received (Yasamis, Arditi, & Mohammadi, 2002).
- The product should be suitable for the intended purpose and the product should be right the first time (Juran, 1988)

These measures of customer satisfaction have been developed and shaped by the early writings of Crosby, Juran and Deming. Karna (2009) explains that customer satisfaction means that the customer is satisfied with the quality of the product or service and they meet or exceed their expectations. Despite the subjectivity in the definition of customer satisfaction, Karna (2009) opines that customers are not satisfied when the quality of a product or a service is under their performance expectations. From this perspective, an important attribute of customer satisfaction that could serve as a measure of performance in construction is the reference to the customer as a key determinant of quality. Therefore, every quality performance needs to be directed towards ensuring that products fulfil the requirements and specifications assigned by the customer (Kim, Oh et al. 2007). Building on earlier studies and taking into account several definitions that currently exist of customer satisfaction, this research takes the premise that within the residential building sector, customer satisfaction means achieving all quality expectations of new homeowners and providing defect free houses. Accordingly house developers need to understand home owners' expectations and preferences to ensure that they provide a complete value package (Stephenson & Carrick, 2006). The value package must meet both stated and implied expectations, as will be presented in the following section.

### **3.3: Customer satisfaction to quality of new buildings**

Customer satisfaction as a fundamental issue in the house buying process has appeared in many academic journals, technical reports, and magazines and has also caught media attention (Auchterlounie & Hinks, 2001; Barlow & Ozaki, 2003; Craig, et al., 2010; Curtis, 2011; Torbica & Stroh, 1999). The current level of customer satisfaction within the New Zealand residential sector is difficult to estimate as very little by way of customer surveys have been done in this area. However anecdotal evidence suggests that new homeowners are not satisfied with the quality of their new homes in New Zealand. Some of the poor satisfaction of home owners may be attributable to the history of problems of weathertightness since the early 1990's (see Section 2.8.1). Changes to code provisions that were allowed in the 1991 version of the Building Act accounted for this phenomenon (Hunn, 2002). The Building Act 2004 introduced amendments which re-instigated the timber treatment requirement that was

removed in 1996 as was explained in section 2.8.2. (Murphy, 2011). The key changes made in the Building Act (2004) may have accounted for an increase in building quality and homeowner satisfaction levels and consequently reduced complaints about the reputation of the residential building sector. Equally as likely though, is that higher satisfaction was the resultant of increased confidence that properties built to the new building code were less inherently likely to have future problems. Therefore “defect free” and “less likely to leak” became synonymous in the minds of homeowners. More recently Curtis (2011) alluded to generally high satisfaction levels amongst new homeowners in New Zealand. Curtis’s (2011) report also mentioned that, though new homeowners were satisfied with the overall quality of their new homes, there were still concerns around the services provided by house developers when they moved into their homes. This suggests that there was room for improving customer satisfaction levels in house building generally. Karna (2009) makes it clear that customers' requirements are not static. Rather, the requirements have become more demanding in terms of what they expect from their house developers regarding products and services.

Conversely, Craig, Sommerville and Auchterlounie (2010) present results different from that of New Zealand home owners. Craig et al., (2010) gave an overview of three customer satisfaction surveys carried out in 2000, 2001 and 2003 by the Housing Forum (UK), and customer satisfaction surveys from 2006 to 2009 by the Home Building Federation also in the UK. Analyses of the surveys indicate an increase in the number of new home purchasers that are unhappy with the finished quality of their homes. Further the surveys show an increase in the number of new home owners reporting defects at handover, rising by 14% (from year 2000 to 2010) to a staggering 95% (Craig et al., 2008). Unsurprisingly from 2000 to 2006, overall levels of quality, finish, and conditions of new homes display downward trends, but ‘levelled off’ from 2006.

Every customer wants a quality product that meets their needs and is worth the money committed to the building product (Chan & Tam, 2000). Thus there is a tendency to be satisfied when quality product and service are delivered to them. Barlow and Ozaki (2003) assert that to meet low customer satisfaction experienced in the construction industry, there has to be an improvement in the quality provided. Even though Barlow and Ozaki’s study focused on the

construction industry in the UK, their conclusions find relevance in New Zealand. The reason is that the study emphasises pro-active customer relationships and the importance of learning from them so that customer-focused services can be provided. Barlow and Ozaki further explain that the ability to give customers what they want and when they want it are two aspects that can build long term relationship and increase customer satisfaction. From another perspective, Sower, Savoie and Renick (1999) suggest that cordiality in house building relationships could be achieved through the integration of customers into the supply chain. Importantly, clarity of information on the customers' needs and expectations, when established, would allow house developers to take these into consideration throughout the building process.

Within any industry (including construction) achieving customer satisfaction by providing a good quality service to customers should be considered the main aim of all parties. Torbica and Stroh (2001) found that service emerged as the most important determinant of home buyers' overall satisfaction. Their study produced a model of home-buyer satisfaction based on the assumption that a home-buyer is affected by three distinct dimensions, namely house design, house quality, and service offered by home builders. The provision of quality service and after-care service indicates a good relationship. In contrast to other areas of production, in which the relationship between client and supplier is frequently long term, the relationship in building construction is periodic and often depends on the duration of the project. Long term relationships are more difficult in the residential sector in New Zealand because an average build period for a typical new residential building is 14 weeks (Tookey, 2012).

Barlow and Ozaki (2003) argued that in the past some house developers have viewed customer care and satisfaction as a reactive matter that is restricted to the remediation of defects. However, good after care service and customers that are kept up to date in a polite manner are likely to enjoy longer service relationships. Roy and Cochrane (1998) indicate that customers will usually buy a number of houses in their lifetime, thus poor overall customer service could impact on future commissions.

Customer satisfaction could also be driven by other considerations. Specific to the New Zealand context, is the fact that its residential sector consists of mostly

'spec builders' that construct normally between ten and a hundred buildings every year. In this situation the potential house buyer could specify fixtures and fittings, but no structural modifications to the original design produced by the builders may be allowed (Tookey, 2012). Thus because of house buyers' involvement in the construction process there is a tendency to expect more in terms of functional quality (which is what they have greater control over) than technical quality. However achieving customers' varying expectations is significant, as overall satisfaction is based on all encounters and experiences that customers have in relation to the organisations they deal with (Karna, 2009).

Curtis (2011) explains that new homeowners are mostly satisfied with houses built from one-off designs produced by architects/designers, especially when these homeowners have major inputs in the design. In situations where homeowners' have greater involvement, their input is more required to be able to meet their needs and expectations. Adequate achievement of their needs should translate into longer term relationships.

Finally, it is reasonable to say that the concept of customer satisfaction is not new. It has formed the most basic of marketing practices for many years. Professionals and other service providers concentrate on varying aspects of customer satisfaction and attribute differing levels of importance to them (O'Reilly & Proverbs, 2008). Latham (1994) and Egan (1998) documented the need to achieve customer satisfaction in the construction industry. The position in the current study is that central to the determination of construction performance expectations, is the meeting of customers'/end-users' requirements. It is often the case that new homeowners' requirements and quality expectations are mismatched with those held by house developers (Sommerville, et al., 2006). The next section will provide some basic understanding of two quality measures before reviewing literature on what new homeowners perceive to be quality. It will focus on technical and functional quality as it relates to new home buyers.

### **3.4: Technical and Functional quality**

As mentioned earlier, this section provides a review of two quality dimensions (technical and functional) and relates them to customer requirements and expectations of new houses. Gronroos (2001) suggests that technical and functional qualities are two dimensions of quality expectation for homeowners that are very different in nature. According to Gronroos (2001) technical quality is 'what the customer gets' while functional quality refers to how the process itself functions. Technical quality could be equated to quality specifications e.g. structural, mechanical and electrical services (Ferguson, Paulin, Pigeassou, & Gauduchon, 1999). "Function" on the other hand relates more to aesthetics and performance in use. Kang (2006) explains that functional quality depends on how customers perceive and respond to the final product and overall consumption of the service. According to Kang (2006) these would include cleanliness of the product, style and presentation, and look and feel. Whilst both technical and functional qualities are important in the residential building sector, Kang (2006) suggests that the functional aspect of quality is more significant to new house buyers.

There is little practical evidence to suggest that functional is more significant than technical quality (Leishman, Aspinall, Munro, & Warren, 2004). Leishman et al. (2004) conclude that the purchase of newer homes over second hand homes were to do with practical reasons with little evidence to suggest that new home buyers are attracted primarily by the quality, or 'newness', of the building product. However Craig et al. (2010) have gone further to explain that more often than not the main driver behind the purchase of new homes is to remove the stress of having to embark on remedial work that is usually associated with second hand homes.

In chapter four, the importance of functional quality is reviewed further by showing how problems associated with functional quality are much larger than technical quality problems in line with Sommerville et al. (2006). Both are important, considering the premium that customers are prepared to pay for products that are high in design quality, construction and any after care delivered by the house developer Stephenson and Carrick (2006), but functional quality seems more significant.

### **3.5: Customers perceived quality in new residential buildings**

Several studies have shown that new homeowners find the aesthetic (functional quality) and finishes part of their buildings to be more important than technical (Auchterlounie & Hinks, 2001; Craig, et al., 2010). This is confirmed by Auchterlounie's (2009) study of 300 new homeowners in the UK. The study found that customer satisfaction rarely correlates with technical defects and performance issues. This would suggest that aesthetics and the finishing aspects of buildings are of greater importance to homeowners. Craig (2008) believes that because of the technical inexperience of most homeowners, they are more likely to have a strong emotional attachment with the quality of the product itself and the softer issues of quality such as aesthetics. Also homeowners seem to place more emphasis on aesthetics because they very often consider that all quality standards and expectations have been met by the house developer (Craig et al., 2010).

Similarly, Sommerville, Craig, and Ambler (2006) believe that homeowners (referring to the UK) view the technical aspects as a 'given' since they are covered under various protective regulations and building standards. This may account for a narrower focus on technical quality by house developers. Thus quality conformance is higher for building elements (e.g. foundations, roofing) and for structural integrity, while functional aspects that relate to aesthetics do not gain much attention by house developers. Page (2011) found that most defects in new houses in New Zealand relate to finishes, doors, plumbing and hardware, which conveniently fall into the aesthetics category. Sommerville & Craig (2005) conclude that there is a gap between a buyer's expectation and what the industry delivers in the way of functional quality (aesthetics). Therefore the current study places more emphasis on aesthetic defects as a way of improving satisfaction levels of homeowners with the quality of new builds.

Quality in construction not only depends on the content of the original design and specifications, but also on the level of workmanship and conformity to the design requirements. Overall, quality needs to meet the perceived expectations of customers (in this case, homeowners). Customers' needs and expectations are paramount as these define the quality characteristics of any product and/or service (Dikmen, et al., 2005). Kim et al. (2007) identifies two categories of

defects as a final product that does not appropriately function and the second category as a final product that functions but does not give a satisfied result. These two categories of defects can be perceived not only by building inspectors or project managers but also by the user of the end product (customers). Chan and Chan (2004) opine that because end users are actually the ones that live and spend time in the constructed facility, it is important that the completed facility meets their expectations and satisfaction. Barrett (2000) is of the opinion that the ultimate measure of construction quality should be customer satisfaction. Thus the ability to achieve quality with a customer focus is an issue for consideration by the construction industry (Love, Mandal, et al., 1999).

Sommerville et al. (2006) suggest that in order to focus on customers' needs the residential sector requires a change in working attitudes, working practices and more importantly a shift in attitude towards the homebuyer. It is crucial for all project participants to understand the customer's needs and requirements so that any stated level of quality can be met. This could enable organisations to implement quality practices and imbibe cultures which could monitor customer satisfaction. A strong commitment to quality practice and continuous company-wide quality improvement will lead to reduced defects and increased profit margin. This suggestion could ultimately improve productivity within the construction industry.

The tolerance level of defects and the way customers (homeowners) perceive quality is unique to each individual. Thus it may seem difficult to match their perceptions with those of individual house developers (Georgiou, et al., 1999; Porteous, 1992). New residential buildings are usually susceptible to quality defects, leaving homeowners unhappy with their purchases (Sommerville et al., 2006). While some have questioned the quality of the end product, the wider notion is that builders are not up to providing defect free homes (Gamble & Corbett, 2001).

Continuous quality improvement is central in a highly competitive construction market as this would contribute to the survival of construction organisations (Hui & Zheng, 2010). Hart (1994) suggests that a competitive edge is with those who are able to provide a quality product on time and within budget. Surviving the

competitive market also requires innovativeness and high quality products and services that are economical (Beaujean, Kristes, & Schmitt, 2008). Thus improving performance in the construction industry requires a change in current culture towards one that supports continuous improvement and promotes quality (Sommerville, Stocks, & Robertson, 1999).

Craig, et al. (2010) argue to the contrary, believing that house buyers are responsible for lower than anticipated quality standards because they accept finished products as they are and should therefore bear some of the blame. However there is the question: how aware are home buyers of their roles and responsibilities in any house procurement process? Again one may ask: how can homeowners ensure the delivery of their quality expectations and what recourse have homeowners when these expectations are not met? Some of these questions are addressed by the current study (see objective 6 and 7).

### **3.6: Customer satisfaction as a performance measurement**

Performance measurements and criteria used for determining project achievement have relied upon the traditional factors of time, quality, cost and safety (Karna, 2009; Pinto & Rouhiainen, 2002). These factors are very often translated into measures of customer satisfaction. However, Toor and Ogunlana (2010) deem these parameters insufficient.

More recently, subjective measures that determine the level of customer satisfaction have been included as criterion for measuring performance (Auchterlounie & Hinks, 2001; Chan & Chan, 2004). Similarly Ashford (1992) believes that the perception of the end user (homeowner) represents a good measure of construction quality. Auchterlounie and Hinks, (2001) suggest that customer satisfaction is basically linked with quality, while Karna et al. (2009) view it as a goal or measurement tool in the development of construction products. Homeowners want a product that is defect free and worth the utmost value for their investment. Their opinion is relevant even though there is a tendency (as explained previously) for these opinions to lean more towards functional rather than technical performance measures. The importance of homeowners is borne out of the fact that they bear the highest risks and their

needs and requirements are the basis of every effort, process and activity concerned with the execution of projects (Alinaitwe, 2008).

Customer satisfaction has been argued by Masrom and Skitmore (2010), as being influenced by individual perceptions, orientations/experiences and expectations. Thus satisfaction levels could differ for different individual customers. Auchterlounie and Hinks (2001) point out that whilst the measurement of physical processes (i.e. quantitative) is easier, the difficulty with measuring subjective (i.e. qualitative) areas of service is not due to a lack of measurement practices. Nevertheless measure of satisfaction remains an indication of the success of delivery and/or the ability to execute and complete a project within expectations (Rao, 2009).

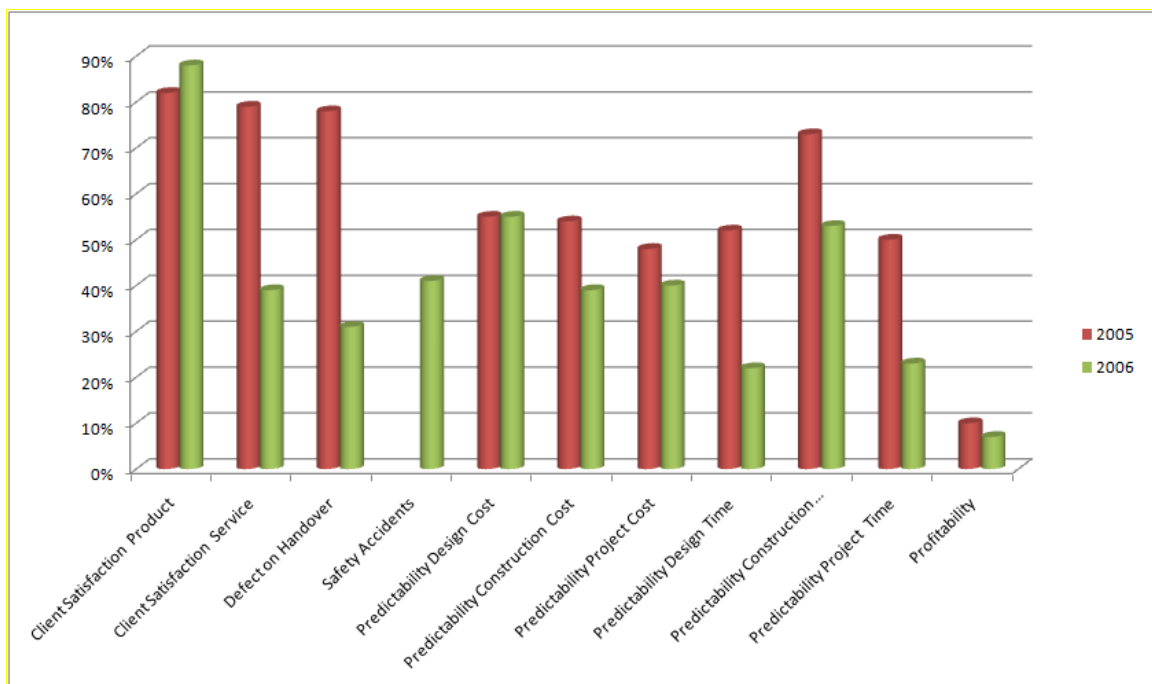
Determining and achieving customer requirements and expectations require performance measurement systems that will capture both current and future needs. One can only manage what can be measured. In the words of Ragothaman and Korte (1999), quality does not improve unless it is first measured. It is necessary for quality-driven house developers to make conscious attempts at measuring their quality achievement levels. Ragothaman and Korte (1999) explains that by so doing, such organisations are able to achieve the following: customer satisfaction, achievable business objectives, provide standards for business comparisons, enable individuals to monitor their own performance, enable identification of quality problems and those requiring priority attention, give indications of the costs of poor quality, justify the use of resources, and provide feedback for driving all improvement efforts.

Notably, some construction organisations in New Zealand (e.g. Naylor Love) have taken proactive approaches to performance measurement towards achieving their organisation's best practice. Naylor Love's approach is to carry out customer satisfaction surveys at the end of every project and to publish the results. Naylor Love believes that by so doing, it is able to make a positive impact on customers' satisfaction. In their opinion, rectifying defects on time and efficiently, retains and reinforces a positive relationship with their customers. Similarly Rao (2009) believes that a customer satisfaction survey is an important tool in measuring customer satisfaction. If the organisations want to know how satisfied their customers feel, the questions asked in the survey

should cover the customers' main requirements (Rao, 2009). In another view, Torbica and Stroh, (2001) suggest that the provision of better-quality service delivery appears to be the best overall strategy for house developers to improve overall levels of customer satisfaction. In addition, the current study takes the position that getting new buildings checked, and corrected for defects as soon as they are identified is one way of ensuring customer satisfaction and consequently ensure industry best quality practice.

A survey was conducted by the Centre for Advanced Engineering NZ in 2005 and 2006 on key performance indicators (KPI) in the construction industry. Figure 3.1 presents the summary of the different factors considered. It was revealed that there was an increase in customer satisfaction with building products from 2005 to 2006. However there was a decrease in customer satisfaction with the service received from their builders. The figure further shows a decline in the level of defects at handover from about 80% in 2005 to 30% in 2006. Even though there was a decrease in defects observed at handover, 30% in 2006 is still significant. Similarly the level of predictability of project objectives of time, cost and quality were on the decrease as well.

**Figure 3.1:** Key Performance Measurement in the construction industry



Source: Constructing Excellence NZ, 2008

Underlying this data is the lack of certainty of the root cause of the problem. Information on the figure is presented on an industry wide basis with no

indication of particular information for the residential industry. Therefore any change to minimise defects both within the residential sector and the construction industry generally will have a positive impact on the industry. New Zealand currently has no data to show the satisfaction levels of building owners, especially for residential buildings.

Customer satisfaction as a measure of quality performance is an increasingly important area of study in the construction industry (Torbica & Stroh, 1999; Barlow & Ozaki, 2003; Cheng, Proverbs, & Oduoza, 2006), though few studies have covered the residential building sector. These few studies were conducted in countries like the UK, US, Malaysia (Roy & Cochrane, 1998; Auchterlounie & Hinks, 2001; Craig, et al., 2010). The lack of detailed research in the area of defects and customer satisfaction within new homes in New Zealand leaves a knowledge gap which the current study hopes to address. In line with Craig and Roy's (2004) conclusions, one way in which organisations could focus on customers is to measure customer satisfaction, although to be of value this must recognise priority areas for improvement.

### **3.7: Available warranties and guarantees**

According to Porteous (1992), like most developed countries, the building industry in New Zealand has been governed by various Acts and regulations. New Zealand Acts and regulations are imposed by central government, its codes imposed by government departments, and bylaws imposed by local authorities. The New Zealand building industry is also regulated by its own internal networks of professional and trade organisations, teaching, training and research institutions and systems. This level of governance is still in existence and it is expected that with such a large number of industry stakeholders, appropriate protection in the form of warranties and guarantees will be in place for new homeowners when quality problems arise after building occupation.

The Building Act 2004 is the primary piece of legislation governing buildings in New Zealand (Section 2.8). The Act provides for the issuance of a Code Compliance Certificate (CCC) after the achievement of all building standards and practical completion is attained. This CCC is a formal statement issued to indicate that building work was carried out and complies with the conditions in

issued building consents. However, Alexander (2008) believes that the CCC takes on the role that is greater than its statutory purpose. This is because the public perceive the CCC to be a warranty or a kind of statement about quality of work.

There are initiatives in the Building Act 2004 to support homeowners' quality expectations through the provision of statutory warranties that are implied in all building contracts for household units, whether specified in the construction contract or not (Section 396-399). The Act expects that building work will be done competently using suitable materials, completed within a reasonable time, and that the household unit will be suitable for occupation. The Act considers it illegal for a house developer to complete the sale, or allow a purchaser to take possession, of a household unit before a CCC has been issued. In effect it is the house developer's responsibility to fix any defect before sale. These warranties cover technical items that could affect the structural integrity of buildings. However the warranties are only useful where the house developer is responsible and is prepared to make good any breaches and/or rectify the building work to the quality levels originally anticipated (Kaye, 2011).

Apart from the Building Act 2004, there are a number of other pieces of legislation that serve to protect customers when house purchases are made in New Zealand. For example, the Consumer Guarantee Act 1993 (CGA) covers goods and services ordinarily purchased for personal, domestic or household use. The word 'goods' includes most things in and around the home, from appliances to vehicles, furniture to food, while 'services' are activities carried out by trades people (like plumbers and painters). The CGA does not cover the purchase of houses, although it does cover house repairs. For example the CGA does not apply to a contract for the sale of a whole building attached to land which is designated for residential purposes.

Similarly, the Sale of Goods Act 1908 and the Companies Act 1993 provide some form of protection to new homeowners. However these Acts have limited application in the house building sector. The Sale of Goods Act is also limited to consumers who had a particular contractual agreement with builders and subcontractors (Laxon, 2002). The Fair Trading Act 1986 on the other hand protects consumers against being misled or treated unfairly by traders or shops.

In general, the difference between the Fair Trading Act (Oppenheim) and the Consumer Guarantees Act (CGA) is that the FTA covers claims about products and services prior to sale, but the CGA covers the quality of those products and services after they have been bought.

As part of government commitments to ensure new homeowners are protected when purchases are made, especially in the residential building sector, amendments have been suggested to the Building Act. The proposed amendments are to incorporate a compulsory builders' warranty to ensure that house developers fix any faults quickly and efficiently with no questions asked. It has been suggested that homeowners commissioning building work of NZ\$20,000 or more are to have a written contract with their house developers, which will specify performance expectations, warranties, and remedial measures. Builders would be expected to rectify any defect reported by the homeowners within 12 months of commission on top of existing obligations to put things right for up to 10 years (Williamson, 2010). However plans to incorporate a compulsory builders' guarantee appear to have been excluded according to Thompson (2011). In Thompson's (2011) words, "once again they have been hijacked by the industry". Thus it is likely that homeowners will continue to bear the burden of failed buildings (Thompson, 2011). Other significant amendments to the Building Act have been discussed in Section 2.8 of this research. Nevertheless, with the introduction of the LBP Scheme discussed in Section 2.8.3, there could be an increase in the level of confidence that homeowners will have with their house developers. This is particularly the case considering that key project participants will have to sign off on the quality of individual aspects of the building works they perform. Therefore accountability is clear. Also, it can be reasonably contended that homeowner satisfaction will increase when the LBP scheme commences in earnest.

The proposed amendments will help homeowners to be able to hold their builders to account and get defects to be rectified more quickly and cheaply during defect warranty periods. House developers that are members of a professional body (e.g. Master Builders Federation and Certified Builders Association) provide better protection under current regulatory environments, because their professional organisation could rectify quality problems on their behalf (Ong, 1997). The fundamental issue around warranties and guarantees

is being able to recall builders back to rectify defects and for the buildings to have been checked by qualified building inspectors at handover, so that any rectification can occur within these guarantee periods. Although the proposed revisions to legislation and policy documents could encourage quality achievement in house building production, engaging the service of independent building inspectors to identify defects could further ensure that owners' expectations are met. Sommerville and McCosh (2006) explain that within the house building sector in the UK, house buyers often misconceive their rights and privileges within purchase contracts. A key expectation of these house buyers is that these buildings will be built (as of right) to quality standards, but this is rarely the case. Therefore it is important that appropriate warranties and guarantees are written and made clear to the house buyer within purchase contracts.

### **3.7.1: Master Builders Federations**

As previously mentioned, within the residential building sector in New Zealand, the Master Builders Federation (MBF) is one of two prominent bodies that provide some form of cover for new homeowners when things go wrong. This warranty is only available for new homeowners who used a house developer that is registered with the MBF. The Federation represents New Zealand's premier building and construction companies. Its purpose is to protect customers against loss of deposit, non-completion, defective workmanship, rot and structural defects or if house builders are unable or unwilling to put things right. To be a beneficiary of the different warranty schemes offered by the MBF, customers have to complete an application form provided by the Registered Master Builder. The application form is required to be detached from the guarantee agreement and completed and signed by the customer and the builder before commencement of building work. The builder must then send the form to Master Build Services for approval. Once the application is approved, an acceptance letter is sent to the homeowner. At the completion of all building work, it is required that both the homeowner and the MBF house developer will sign a completion form to be forwarded to Master Build Services. The completion form ensures that on-going cover is provided once the building project is finished. If a customer notices a problem with the building work, the MBF requires that no further payment be made to the house developer.

**Table 3.1:** Summary of warranty provided by the MBF

| The 10 Year Premium Guarantee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The 10 Year Classic Guarantee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The 10 Year Standard Guarantee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Loss of Deposit<br/>Up to 5% of the Contract Price to a maximum of \$25,000, if the permanent work hasn't started.</p> <p><b>OR</b></p> <p>Non-completion<br/>Up to 10% of the Contract Price to a maximum of \$40,000 if the house or work isn't finished</p> <p><b>Plus:</b> Defect in Materials* and Workmanship and Structural Defect<br/>Protection against any defects in workmanship and materials*, or structural elements, for two years after completion of the building.</p>                                                                                                                                                                                                                                                                                         | <p><b>N/A</b></p> <p>Defect in Materials* and Workmanship and Structural Defect<br/>Protection against any defects in workmanship and materials*, or structural elements, for two years after completion of the building.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Loss of Deposit <b>(Optional)</b><br/>Up to 5% of the Contract Price to a maximum of \$15,000 if the building hasn't started</p> <p><b>OR</b></p> <p>Non-completion (Optional)<br/>Up to 10% of the Contract Price to a maximum of \$30,000 if the house or work is not finished</p> <p><b>Plus:</b> Materials, Workmanship and Structural.<br/>You will be protected against any defects in workmanship and materials*, or structural elements, for 2 years after completion of the building underwritten by Master Build Services.</p>                                                                                                                              |
| <p><b>Plus:</b> Structural Cover<br/>Cover for defects in specific structural elements of the building work, after expiry of the Materials, Workmanship and Structural cover, for a total cover of ten years from acceptance of the Guarantee.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Plus:</b> Structural Cover<br/>Cover for defects in specific structural elements of the building work, after expiry of the Materials, Workmanship and Structural cover, for a total cover of ten years from acceptance of the Guarantee.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Plus:</b> Cover for defects in specific structural elements of the building work, after expiry of the Materials, Workmanship and Structural cover, for a total cover of ten years from acceptance of the Guarantee.<br/>The Maximum total aggregate payment for all cover is \$100,000 including GST<br/>Note: The Standard Guarantee contains an option for opting out of the cover for Loss of Deposit and Non-completion.<br/>Materials which have a current certificate of accreditation or product certificate issued under the Building Act, or which, in Master Build Services' opinion, comply with an appropriate Australian or New Zealand standard.</p> |
| <p><b>Including:</b> Rot and Fungal Decay<br/>Cover for properties where the design, materials and construction achieve a score of 12 or less based on the E2/AS1 Risk Matrix**.<br/>Maximum total aggregate payout for all cover is \$500,000 including GST.<br/>Materials which have a current certificate of accreditation or product certificate issued under the Building Act, or which, in Master Build Services' opinion, comply with an appropriate Australian or New Zealand standard.<br/>The E2AS1 is the Department of Building and Housing's Acceptable Solution for Building Code clause E2 External Moisture. It incorporates a Risk Matrix which is a design tool that allows designers to analyse the weather tightness risk of a particular building design.</p> | <p><b>Including:</b> Rot and Fungal Decay<br/>Cover for properties where the design, materials and construction achieve a score of 12 or less based on the E2/AS1 Risk Matrix**.<br/>Materials which have a current certificate of accreditation or product certificate issued under the Building Act, or which, in Master Build Services' opinion, comply with an appropriate Australian or New Zealand standard.<br/>The E2AS1 is the Department of Building and Housing's Acceptable Solution for Building Code clause E2 External Moisture. It incorporates a Risk Matrix which is a design tool that allows designers to analyse the weather tightness risk of a particular building design.<br/>Maximum total aggregate payout for all cover is \$500,000 including GST.</p> | <p><b>N/A</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

Adapted from MBF (n.d.)

This is because no cover will be provided for any significant defect or incomplete work that is known to the customer at the time of final payment or possession of the dwelling.

To be a Registered Master Builder, house developers must show that they have sufficient building experience, trade or professional qualifications and practical management experience. Workmanship is inspected and previous customer contacted, to ensure the house developer's work is of a high standard and has satisfied customers' expectations. In addition, house developers must provide evidence of financial responsibility with written references from their banks, public accountants and building material suppliers. Re-certification of members occurs regularly, with checks on financial viability and more importantly their workmanship. Table 3.1 presents the summary of the three types of cover provided by the MBF.

Table 3.1 shows that only the 10 years classic guarantee will not cover for loss of deposit and non-completion of work. The 10 years standard guarantee on the other hand will not provide cover for issues around weathertightness. These three types of warranties are available for customers whether building a new home or renovating. The warranty covers residential building work with a contract price of \$25,000 and over and covers full-contract, labour-only and managed labour-only work. Work by subcontractors, as well as materials and rot are covered, although this is conditional.

### **3.7.2: Certified Builders Association of New Zealand**

The Certified Builders Association of New Zealand (CBANZ) is the second well known professional body that ensures that new homeowners have some form of cover for their house purchase. The organisation was established about 15 years ago with the intention of recognising and promoting qualified builders. CBANZ began operation with a group of builders who were concerned with the direction in which the building industry was heading. They were worried that their trade was being undermined by those who had entered the building industry without qualifications and were subsequently giving the industry a bad name. According to information on the CBANZ website, about 70% of all builders in New Zealand who make a living from the trade are unqualified, or do not meet the criteria, or choose not to belong to a trade association. There was an urgent need to establish an association where trade qualification would be a requirement. The CBANZ believes that the formation of an association and the advent of licensing will lead to the decline of non-trade qualified builders

operating within the industry. Therefore the primary purpose of the CBANZ was to establish a clearly identifiable level of competence, consistency and excellence within the house building industry.

It became mandatory that a CBANZ member is to hold a recognised trade qualification equivalent to or better than National Trade Certificate in Carpentry Level 4. Other criteria of membership includes: reasonable history of stability and success, continued solvency, absence of complaints by customers and suppliers, a good untarnished reputation and brand, and consistently high standards (CBANZ, n.d.).

Members of the CBANZ must make their customers aware that they can apply to Bultin New Zealand Ltd for a ten-year written guarantee when they are building a new home, and to assist them if they choose to do so. For alterations and additions the house developer can choose to raise the possibility of a guarantee with his customer, at his discretion. Bultin New Zealand is a specialist provider of guarantees and liability insurance to the construction sector in New Zealand. The guarantee provided by Bultin New Zealand is known as the Homefirst Builders Guarantee. It provides support and administrative services for the Homefirst Builders Guarantee to Certified Builders and their customers. The guarantee itself is underwritten by CBL Insurance Ltd, New Zealand's largest and longest-established specialist bonding, financial risk and Surety Company (CBANZ, n.d.).

Similar to the MBF application process, the Certified Builder is required to help the customer lodge an application for a guarantee with Bultin New Zealand Ltd at the time the building contract is signed, and before construction work begins. If the application is approved by Bultin New Zealand, the homeowner will be sent a Construction Period Certificate and written confirmation that the guarantee is accepted. At the practical completion stage of the project when owners have discharged their obligations, a 10-Year Guarantee Certificate will be issued. The warranty provided by CBANZ also covers remediation work for weathertightness problems. Bultin New Zealand developed a watertight warranty that will cover weathertightness remediation work undertaken by approved builders.

The Homefirst Builders Guarantee provides four different types of cover for homeowners depending on the construction project. These include:

1. Full Contract – where a house developer manages the whole project for the homeowner.
2. Carpentry Labour Only – where a homeowner decides to act as project manager and organises all the materials and sub-contractors directly, so the guarantee applies only to the builder's work.
3. Alterations & Additions – where work is being done on an existing building.
4. Kitset Loss of Deposit – covers a homeowner when a deposit has been made but something untoward happens, such as the death, disappearance, legal incapacity, or insolvency of the house developer or the kitset provider, and materials paid for are not received. The features of the Homefirst Builders Guarantee in summary include (CBANZ, n.d.):

- Loss of deposit
- Build completion
- Non-structural defects (up to 2yrs)
- Structural defects (up to 10yrs)
- Accommodation, removal & storage allowance
- Underwritten by a Standard & Poors-rated, independent specialist insurer

There are a number of obligations or conditions under the guarantee including payment of the guarantee fee, frank and honest disclosure, prompt notification of claims, preservation of the owner's rights against the builder, compliance with the building contract and the building code, acknowledgment of practical completion, using only approved builders, maintenance of the dwelling or works, and mitigation of any damage or loss, as approved by Built-in New Zealand Ltd. Full details and obligations of the builder and owner are set out in the written guarantee document.

It is worth mentioning that these guaranties only take effect when the proper documentation is completed. The guarantees are not automatic upon hiring a house developer that is registered with a professional body or trade organisation. In addition, it must be recognised that warranty providers are only responsible for items specifically covered by their warranties. It is expected that these legislation and policy documents will encourage building designers, house developers and trades people, to assist in quality achievement in house production. This is not often the case. Ong (1997) also agrees that there is an increasing concern from homeowners over building defects that arises after new residential property developments are taken over. Ong (1997) suggested an extended warranty for new homeowners to deal with defects which are observed after possession.

Recognising that while these warranties can work reasonably well for homeowners using house developers that are registered with professional bodies or trade organisations, this may not be effective for homeowners commissioning private house developers. In light of the available warranty discussed in Sections 3.7.1 and 3.7.2 the search for a solution to issues of redress when quality problems arise was given a sharper focus in the need to find uniform and consistent warranty cover for new homeowners. Therefore within the house building sector in New Zealand, the effectiveness of warranties could be improved by establishing a common body that will serve as a watchdog for house developers. However significant progress has been made by government with the recently introduced LBP scheme to ensure that home owners are protected. This is achieved by ensuring that house developers stand by their work.

The fundamental purpose of any warranty scheme in a house building project is to provide cover for house buyers when problems of either structural, non-structural, workmanship or material defects arise after project completion. However Craig (2008) elucidates that the various warranties and guarantees offered to new home buyers offer little protection and the various pieces of legislation in place do not cover one of the largest purchases most people ever make; namely, a new home. Holder (2002) observes that government standards do not guarantee that the final building product will suit what the buyers

(homeowners) actually want. If the quality and expectations of the owners are not met, then the customer will obviously not be satisfied.

### **3.7.3: Weathertightness Resolution in New Zealand**

As has been previously noted, the principal quality defect of note in New Zealand was the so called “leaky building” problem of the 1990s/2000s. The government response was to provide both a mediation service, and to assume liability for a percentage of leaky building repair costs (Palmer, 2012). This approach was needed to build confidence in the building industry. Mediation services are provided by the Weathertight Homes Resolution Service. This resolution service provides support for homeowners that suffer from the weather tightness problem. However support is only provided to homeowners whose dwellings were built in the 10 years immediately before lodging a claim and whose houses have signs of leaks. The conditions for lodging a claim are in themselves problematic since leaky problems may not be obvious until after the 10 years limit stipulated.

Before the establishment of the Weathertight Homes Resolution Service, there had been widespread dissatisfaction with the way leaky building issues were resolved. The Hunn (2002) report had mentioned that homeowners were angry because they are faced with large and unexpected bills when seeking redress on their leaky homes through the New Zealand legal system. More recently Gibson (2010) indicated that the general opinion was that the state system is restrictive, bureaucratic, flawed and under-resourced, while the New Zealand court system is too expensive and mainly benefited lawyers. Consequently homeowners have little money left after legal proceedings to embark on meaningful repairs to their leaky buildings.

The Weathertight Homes Resolution Service has been criticised for handling far too few claims, given the scale of the leaky building disaster. The service issued figures showing 3312 claims had been closed, 1598 claims were active and 1986 claims had been resolved. Thousands of victims who have not been able to pay for litigation, have not gone to the resolution service, leaving a huge stock of rotting homes with no prospect of being fixed (Gibson, 2012).

The review of leaky buildings by PWC (2009) suggests that only a minority of leaky homes have been repaired since the year 2006 when the Weathertight Homes Service was fully established. Further, a Financial Assistance Package (FAP) was introduced by the New Zealand government to enable quick repairs of leaky buildings. The FAP will ensure more time and money is spent on repairing leaky homes instead of disputing the problem. A Financial Aid Package (FAP) scheme was started in 2011 to help people to avoid having to sue and to enable them to get their houses fixed. The scheme is a joint government and local council plan which requires government and the councils to each pay a quarter of the cost, while the homeowner pays the other half of repair costs. The FAP scheme is limited because affected houses must be less than 10 years old, and owners must agree not to sue before they can qualify for the assistance package. Gibson (2012) has scored the FAP scheme low because of its conditional requirements and he concludes that a significant number of homeowners may not qualify for the FAP scheme.

The leaky building saga has damaged the reputation of the house building sector, leading to wide scale frustration for building owners, and mistrust of the government's ability to effectively tackle the problem. For example only 12 victims of the \$11 billion leaky homes catastrophe have received final payments from a \$1 billion government and local council scheme under the Weathertight Homes Service. This poor level of settlement has raised the anger of construction experts that are trying to help homeowners. Further the President of the Home Owners and Buyers Association questioned the much-trumpeted leaky home rescue package that was announced in 2011 (Gibson, 2012). He mentioned that victims were enduring long delays as they tried to qualify for the Financial Assistance Package (FAP) to repair their homes. Details of FAP payouts, provided by the Ministry of Business, Innovation and Employment show that there were 1,232 victims that had lodged expressions of interest by the end of September 2012. Out of the total of 1,232 claimants only 186 homeowner agreements had been finalised by the claimants and the ministry. Thirty five claims were proceeding, of which 31 had received one or more contribution payments. Only 12 had received their final payments (Gibson, 2012). Roger Levie, chief executive of the Home Owners and Buyers Association of NZ also believes that if the problem of leaky buildings is to be addressed, there must be

an in-depth inquiry and a sharing of understanding between all those affected and involved, so that all parties could work out the right questions and come up with effective responses. This is evidence that more proactive measures are required to address the issue of weathertightness in New Zealand.

#### **3.7.4: Review of warranty schemes overseas**

In light of the review of the various warranties, it is clear that the government intervention policies have fully not achieved their desired objectives to combat quality problems associated with house building in New Zealand. The reviews show that the reputation of the construction industry has suffered greatly and continues to suffer with the current levels of satisfaction with quality performance. The nature of other warranty schemes is reviewed here with the hope that they could provide benchmark practices to warranty schemes in New Zealand. Emphasis is placed on UK schemes within the current review with information drawn largely from the seminal work produced by Sommerville in 2008. Sommerville (2008) undertook a comparative review of different new home warranties for several countries including Australia, Canada, and the UK. Table 3.2 gives a summary of the nature of warranties for six countries. The nature of some of the schemes is described in subsequent paragraphs. However it is useful to note that the essential differences between the various warranty schemes as outlined by Sommerville (2008) are:

- a. House developer's registration and their indemnity insurances.
- b. Warranty cover (value, scope of work, period).
- c. Dispute resolution

There are five main players in the new home market that provide warranties in the UK (Sommerville, 2008). These are the National House Building Council (NHBC) Buildmark, Zurich Building Guarantee, Building Life Plans (BLP) Secure, Local Authority Building Control (LABC) New Home Warranty, and the Premier Guarantee. The extent of building control service offered varies significantly between the providers, and Sommerville (2008) explains that only three are directly linked to a building control service. The two schemes most

frequently referred to in literature are provided by the NHBC and Zurich Building Guarantee. The two are briefly described in the next paragraphs.

**Table 3.2:** Comparison of warranty in six different countries

| Country   | Warranty period      | Homebuilder/warranty provider<br>Approval/registration required | Premium calculator | 3 <sup>rd</sup> party dispute resolution facility | Warranty able to be passed to next homebuyer |
|-----------|----------------------|-----------------------------------------------------------------|--------------------|---------------------------------------------------|----------------------------------------------|
| Australia | 2 to 6 years*        | Home builder and warranty provider                              | N/A                | Yes                                               | Yes                                          |
| Canada    | 1, 2, 5 to 10 years* | Home builder and warranty provider                              | Ready reckoner     | Yes                                               | Yes                                          |
| France    | 2 to 10 years        | Home builder                                                    | Central body       | Yes                                               | Yes                                          |
| Japan     | 2 to 10 years        | Home builder                                                    | N/A                | Yes                                               | No                                           |
| UK        | 2 to 10 years        | N/A                                                             | N/A                | N/A                                               | Yes                                          |
| USA       | 1, 2 to 10 years**   | Home builder and warranty provider*                             | N/A                | Yes*                                              | Yes                                          |

\* Varies from region to region. \*\* Time period varies with the items being covered.

Adapted from Sommerville (2008)

The warranty provided by the NHBC is known as Buildmark. It is regarded as the UK's leading warranty and insurance scheme for new and newly renovated homes. The NHBC that administers the scheme was established in 1936 with the primary purpose of helping raise standards in the house building industry and to provide consumer protection for new homeowners. The NHBC produces its own standards that (in many cases) are more stringent than minimum legal requirements. It operates an inspection scheme providing both statutory building control and its own standard compliance inspections. Cover is provided by the NHBC for around 80% of new homes that are built in the UK, with a register of around 18,000 builders (Goodier & Pan, 2010). The NHBC also keeps records of warranty claims as part of its risk assessment for determining house builders' premiums to register each plot. Buildmark has a holistic industry involvement that helps to ensure best practice in all areas, and ultimately minimising the risk to buyers of new homes by providing quality control during preparation and construction, and a post-purchase safety net (NHBC, 2011).

Zurich Building Guarantees is another scheme in the UK that provides homeowners with 10 year warranty policies. Zurich provides a comparable service to that of the NHBC as they provide a set of standards which new house developers have to comply with (Craig, 2008). Zurich Building Guarantees protects new home buyers from the costs of repairing certain elements of the new home that may have suffered damage due to failed workmanship at the time of construction. According to Auchterlounie (2004) Zurich Building Guarantees have also produced regulations and specifications that are in addition to statutory building regulations. For the purpose of this study, focus is made on the NHBC warranty as it covers a significant number of newly built homes within the UK.

The Buildmark cover provided by the NHBC is explained under five sections (NHBC Buildmark, 2012). The cover is divided into numbered sections each of which applies to different stages and situations. Table 3.3 provides the sections and different categories of cover explained in the recent NHBC Buildmark (2012). The overview of the Buildmark cover is explained in the next paragraphs as it relates to the current study.

**Table 3.3:** Categories of cover in the NHBC Buildmark (Buildmark 2012)

| Sections  | Categories                                                                                                                           |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------|
| Section 1 | NHBC cover before completion                                                                                                         |
| Section 2 | The builder's obligations after completion, NHBC's cover if the builder fails to meet obligations, and the resolution service.       |
| Section 3 | NHBC's obligations regarding damage to certain parts of building and defects to flues or chimney (after period covered by section 2) |
| Section 4 | NHBC's obligations regarding non-compliance with building regulations (after period covered by section 2)                            |
| Section 5 | NHBC's obligations regarding contaminated land (after period covered by section 2)                                                   |

#### **3.7.4.1: Pre-completion insolvency cover**

The NHBC Buildmark (2012) specifies that the house developer is responsible for the completion of new homes to NHBC Standards. After exchange of contracts, if, because of insolvency or fraud, the house developer does not start or complete the building, the NHBC reimburses the deposit initially made, or arranges for the building to be completed in line with NHBC Standards. The NHBC will reimburse up to a maximum of 10% of the purchase price or £100,000, whichever is less.

#### **3.7.4.2: Cover for the first 2 years after completion**

According to the NHBC Buildmark (2012), the onus is on the house developer to put right any defects or damage caused by their failure to build to NHBC Standards. This is explicitly explained in Section 2 of the Buildmark policy. The section outlines what builders are responsible for in the first two years when defects arise. It is mandatory that house developers put right, within a reasonable time and at their own expense, any defect or damage caused to the building which is notified to them during the relevant notification period (NHBC Buildmark, 2012).

If the homeowner has to move out of their home so that work can be done, the house developer will make prior arrangements to meet any reasonable costs incurred for removal, storage and appropriate alternative accommodation. There is no excess or minimum claim value for this part of the policy. If there is a dispute between the homeowner and the house developer about work to be done, then the NHBC may be able to offer their Resolution Service to assist in resolving disputes about defects or damage relating to NHBC Standards.

If house developers cannot meet their obligations to rectify defects because they are insolvent or non-compliant with an NHBC resolution report, or if they do not pay an arbitration award or court judgement against them relating to their obligations under Buildmark, the NHBC will provide cover for their obligations.

### **3.7.4.3: Cover for damage caused by a defect in certain parts of the home in years 3 to 10**

The NHBC also provides insurance to cover the cost of putting right any damage caused by defects in specified parts of the building, usually the structural and weatherproofing parts. This will start two years after the date on the Buildmark insurance certificate. Areas to be covered include: foundations, load-bearing walls, non-load-bearing partition walls, wet-applied wall plaster, external render and external vertical tile hanging, load-bearing parts of the roof, roof coverings, ceilings, load-bearing parts of the floors, staircases and internal floor decking and screeds, retaining walls, double-glazing or triple-glazing panes and below-ground drainage

The minimum claim value is the amount specified in Section 3 of the Buildmark policy indexed, i.e. increased each year to allow for the effects of inflation. For Buildmark policies where the amount specified in section 3 is £500 indexed, the current minimum claim value is £880. Also where the amount specified in Section 3 is £1,000 indexed; the current minimum claim value is £1,324. In order for a claim to be valid under most parts of Section 3 of the Buildmark policy, the cost of claim must exceed the minimum claim value. Unlike most insurers, NHBC operates a minimum claim value rather than a policy excess. This means that if the cost of claim exceeds the minimum claim value the NHBC will pay it in full, rather than a policy excess being applied for the homeowner to pay. The NHBC will generally cover pre-existing contamination on the land on which a new building is constructed. In addition the NHBC will provide protection for certain breaches of building regulations if, their subsidiary or another NHBC registered Approved Inspector is appointed for building control. However, exclusions and limitations of the Buildmark policy are explained in Buildmark 2012.

To address the problems of redress when defects occur at handover of new residential buildings, some questions that readily come to mind are:

- What other forms of warranty can be employed?
- Are there other benchmarks that can be applied to New Zealand?

- Do new homeowners understand how warranties operate and their coverage?
- Does the available warranty cover for cosmetics and finishing quality of new homes?
- Does the available warranty reinforce the drive for quality within the residential building sector?

The widespread adoption of the initiative of the NHBC in giving homeowners assurance and redress on occasions when things go wrong has established the need for the house residential sector in New Zealand to emulate such initiatives. The NHBC model is a provable success, copied around the world in countries such as China, South Africa, Holland, Australia, Canada and the USA (<http://www.nhbc.co.uk/>). Sommerville (2008) explains that features within the NHBC and the other warranty providers offer homebuyers with a fairly robust new home warranty system.

Four main conclusions can be drawn from the NHBC as warranty provider for a benchmark within the New Zealand residential house building sector. Firstly the NHBC enables a consistent and uniform application of warranty cover for new homeowners. Secondly it enables a system of evaluating homeowners' satisfaction levels to the quality of their new homes. In terms of ensuring homeowner satisfaction, the NHBC has worked with the industry to develop what is known as the 'Consumer Code for Home Builders'. This Code gives protection and rights to purchasers of new homes, ensuring that all new home buyers are treated fairly and are fully informed about their purchase before and after they sign the contract. The NHBC has also surveyed over 100,000 new home owners in their first year of ownership, to provide house developers with information on how well they treat their customers. Thirdly it has set its own standards that are more than the minimum provided by the legal requirement and also carry out building inspections. Lastly, it also provides home warranty and risk management services for the house building industry.

### **3.8: Summary**

This chapter has defined customer satisfaction within the context of the residential building sector. It has generated insights into the issues surrounding customer satisfaction such as the measures and the different perspectives from which previous studies have viewed things. The chapter points out that functional quality (aesthetic) is of utmost importance to new house buyers as they believe that the technical aspects would have been catered for through the various regulations provided in building control documents. It became obvious from the literature reviewed that the occurrence of defects and poor after-care services decrease customer satisfaction significantly. The reviews within the chapter also show the importance of warranties to new homeowners when issues of defects arise. Understanding of various warranties and their potential implications/limitations to the most important member of construction parties (the home owner) would enable improvements to be made to enhance their overall satisfaction. Such understanding could also help to provide a foundation on which to build new practices that will protect new homeowners. The chapter argues that achievement of customer satisfaction is a matter for concern which cannot be regulated simply by building control systems or currently available warranties. Thus a review of a warranty available overseas is provided with a view to benchmarking this initiative. Whether homeowner protection and quality assurance processes similar to the NHBC could be adopted in New Zealand will be the subject of further investigation in the current study. The directions in which the current research progresses are based on the reviews covered in this chapter. The next chapter then focuses on providing an understanding of defects as a phenomenon that significantly affects customer satisfaction especially in residential house building.

## **CHAPTER FOUR**

### **DEFECTS AND RESIDENTIAL BUILDINGS**

#### **4.1: Introduction**

A preliminary literature survey showed that the bulk of literature pertinent to defects in new residential buildings originates from a limited number of countries. This presents a significant challenge to the research in terms of adequately conceptualising the work within the New Zealand context. However, a closer examination of the residential sector in New Zealand shows that similar quality problems exist. Therefore this chapter begins with a general review of different terminologies that relate to defects within the construction industry. For example snags, non-conformance, quality failure, defect, reworks, and faults. The definitions of defects and the defect reporting process (building inspection) are reinforced throughout the study within the context of the current study. Existing research and work on the incidence of defects in new residential buildings is also presented. Chapter four also describe the stages of occurrence of defects and the different categories of defects. This will allow timely decisions to be made and proper actions to be taken when defect issues occur. It further explains the cost of rework, causes of rework and its impact on construction projects. The current defects reporting process in the construction of new residential buildings is also presented. Chapter four concludes with the establishment of the knowledge gap.

#### **4.2: Definition of defects and different terminologies used in the construction environment**

It is necessary here to clarify exactly what is meant by defects and the different terminologies which exist in the construction management literature. 'Defects' could be used interchangeably with construction fault, repairs, quality failures, quality deviations, non-conformance, rework and snags (Abdul-Rahman, 1995; Burati, et al., 1992; Georgiou, et al., 1999; Josephson & Hammarlund, 1999; Love & Edwards, 2004b).

'Snags' and 'snagging' are gradually becoming terms used in construction environments outside the UK construction industry which was the origin of this

terminology. Snags are quality failure items that are identified near the completion stage of a construction project by an individual who could be termed as 'the snag identifier', while the process of identifying and rectifying these snags is known as snagging or defect reporting (Sommerville, et al., 2004). Snagging describes the process of checking for faults or defects in a property and correcting them before the property is handed over to the new owner. 'Snagging' problems in this context are items of work that still require some degree of attention after the main body of work has been completed (Sommerville, et al., 2005). The common terminology for 'snags' is 'defects' while a 'snag identifier' will mostly likely be referred to as a 'building inspector' in New Zealand.

Another term that is commonly used is rework. Rework may be defined as the process by which an item is made to conform to the original requirement by completion or correction (Ashford, 1992). Alternatively, rework is doing something at least one extra time due to non-conformance to requirements (Construction Industry Development Agency, 1995). A broader definition of rework is unnecessary effort of redoing a process or activity that was incorrectly done the first time (Love & Edwards, 2004b). All these definitions share a common theme which is to redo work due to non-conformance with requirements or the occurrence of a defect (Hwang, Thomas, Haas, & Caldas, 2009).

However for the purpose of the current study the words 'defects' and 'defect reporting' will be used. Table 4.1 outline the definition of defect within the context of the house building environment and the wider construction industry. It can be observed from the table that Illozor et al. (2004), Georgiou (2010) NHBC (2007) and Kim et al. (2007) specifically define defect in the context of the house building environment. Whilst researchers have made some inroads into describing and understanding the phenomenon of defects and rework, available literature has tended to concentrate on the major project environment and the wider construction industry (Sommerville & Craig, 2007). However, Table 4.1 shows that there has been a recent increase in research on defect issues in the house building sector. On the other hand there is a limited literature that has examined defects in new residential building particularly in New Zealand. In this

research the term defect will be used in its broadest sense to refer to final products that fail to meet the required quality (Kim et al., 2007).

**Table 4.1:** Various definitions of defect

| Context of definition          | Definition                                                                                                                                                                                     | Literature Sources              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Wider construction environment | Shortfall in performance occurring at any time in the life of the product, element or dwelling in which it occurs                                                                              | BRE (1990)                      |
| Wider construction environment | Non-fulfilment of intended usage requirements                                                                                                                                                  | Josephson and Hammarlund (1999) |
| House building environment     | A component has a shortcoming and no longer fulfils its intended function.                                                                                                                     | Georgiou (2010)                 |
| House building environment     | Failing or shortcoming in function, performance, statutory or user requirements of a building that manifests itself within the structure, fabric services and other facilities of the building | Ilozor, et al.(2004)            |
| Wider construction environment | Part of work which is not in accordance with the work's information                                                                                                                            | NEC (2005)                      |
| House building environment     | Breach of any mandatory requirement by builder or anyone employed by or acting for the builder                                                                                                 | NHBC (2011)                     |
| House building environment     | A final product that does not meet the required quality                                                                                                                                        | Kim, et al (2007)               |
| House building environment     | Something that is unfinished, or an imperfection that is inadequate or causes failure                                                                                                          | Beattie (2011)                  |

### 4.3: Defects in residential buildings

Defects are common features of most construction industries with significant detrimental effects on construction project stakeholders especially end users. Defects reduce satisfaction levels, and create conflicts and disputes between project stakeholders (Almusharraf & Whyte, 2012). The end users (homeowners) of constructed facilities will expect that when new homes are purchased, the building will be problem-free until such time that normal wear and tear begins to occur. Unfortunately this is not generally the case, since most newly built homes have been found to have a significant number of defects (Craig, 2008; Isa, Mat, Isnin, & Sapeciay, 2011; Rhodes & Smallwood, 2002; Sommerville & McCosh, 2006). Sommerville et al. (2005) states that

defects have almost become part of the house building cultural paradigm and the wider construction industry. New residential buildings are particularly susceptible to quality defects, often leaving home owners unhappy with their purchase (Craig, 2008). The vulnerability of new residential buildings means that home owners have to bear the burden of defects sometimes without any recourse to the house building developer's warranties. Thus when buildings fail to fulfil the function for which they were built, numerous benefits which could have accrued to the nation and society become elusive (Windapo, 2006). New residential buildings in New Zealand are not an exception with its history of weather tightness problems. The extent and the estimated cost to remedy this problem have been explained in Chapter 2.8.1.

The overall aim in any house building project is to design and construct to meet the specific requirements of a client or homeowner at optimal quality. However, the design and construction of new housing is today becoming more complex, partly due to project owners' increasing demands and expectations. Building products and systems are becoming more innovative (e.g. complicated elevations, cladding types, parapets and balustrades, and innovative resource inputs) to meet the demands of owners. Newer and innovative procurement processes bring about challenges which house building developers have to manage effectively while delivering value to the project owner. Attempts to meet the pressing needs of housing development, has reduced the time to build an average house. Quicker building times with little attention to details coupled with the increasing complexities of the design and construction of new housing combine to make quality performance challenging. These result in quality achievement being compromised on construction projects, hence the occurrence of defects in new residential buildings.

A recent report on building industry performance measures in New Zealand confirms that 72% of new homeowners needed to call back their house builders/developers for at least one form of defect rectification (Page, 2011a). Page's report further explained that this significant number of call backs is a measure of quality performance in new buildings and is another indicator that needs to be monitored. This and other studies are indicative of a current and pressing need to focus on defects in the New Zealand residential building sector

in order to achieve the ultimate goal of zero defects (Egan 1998), and a 20% increase in productivity by the year 2020.

The UK residential sector is also continually experiencing low quality performance with a significant record of defects in its new residential buildings (Sommerville & Craig, 2007). This is evident from several studies that have been conducted around the UK. For example earlier research by Sommerville et al. (2004) on 600 new residential buildings in the UK, found that a typical five bedroom house with an entrance hall, dining room, living room, downstairs WC, kitchen, utility room, study, single garage, communal bathroom and two en suites recorded a staggering 406 defects. A similar study conducted by Sommerville and McCosh (2006) over a period of 40 months on approximately 1700 new homes in the UK, found a significant number of defects across all buildings inspected. The worst case recorded found 389 defects in a single property.

Still within the UK, Sommerville and Craig (2007) analysed more data over a period of four years. A total of 2202 new buildings were analysed from a data set provided by the UK's leading independent home snagging company. An approximate figure of 130,000 defective items was recorded. The initial analysis of 55,000 out of 130,000 defective items captured in Sommerville and Craig's study estimated that 68% of the defects were attributable to poor workmanship and 14% due to omission. Similarly, a doctoral research by Craig (2008) presented a longitudinal survey in 2002-2006 on 3696 new residential buildings in the UK. A total number of 200,000 defective items were analysed from a comprehensive defect report generated for each of 3696 buildings over a period of 5 years. The maximum recorded was 452 defects in a new six-bedroom house, while the minimum number of defective items identified was one, identified on three separate occasions in two one-bedroom flats, and one, two-bedroom flat. Craig's study further showed an overall industry average of 53 defects per new home inspected. This study was the first step towards providing a benchmark figure for the house building sector in the UK.

Defects in new residential buildings in Australia are not any different from what have been found in the UK. For example, an earlier study by Georgiou (2000) analysed 1772 houses between 1988-1996, of which 1002 were houses built by

their owners and 770 by registered builders. A total of 2740 defects were found of which 1.8% (50) were classified as major. Defect numbers found within each property ranged from 0 to 21 and many houses had numerous incomplete items despite an occupancy certificate being issued. Georgiou's data was used to decide the severity of occurrence and location of defects within each house type. The result revealed that a mean of 2.74 defects per house was recorded in houses built by owners while a mean of 2.3 defects per house was recorded for those executed using registered builders. The research shows that houses that were less than one year old were found to have a significant proportion of defects using both types of builders. Over 60% of the defects were technical items such as cracking, damp and structural inadequacy, with 38% of the items being attributed to workmanship. The study concludes that there is no significant difference in the quality of homes built by the two types of builders and that housing quality can be improved through the rectification of defects.

About four years later, Ilozor et al. (2004) also investigated nine major types of defects (faults) in 42,753 homes in Australia. The results showed that the most common types of defects were rising damp, framing, cracking, roofing and illegal building. Framing and roofing problems were found to be major defects that could complicate other problems. The research concluded that attention should be given to these types of defects to avoid further defects arising. More recently a study conducted by Mills et al. (2009) on the cost of defects in new houses in the state of Victoria from 1982 to 1997 used a subset of approximately 32,000 records. The results of the analysis revealed that one out of eight buildings was reported to have defects and the estimated cost to rectify these defects was 4% of the construction contract value. Mills et al. (2009) identified leaking roofs as the most frequent defects.

The severity of non-quality achievement was illustrated in similar studies in Spain. Forcada, Macarulla, and Love (2012) examined residential defects at post-handover of new residential buildings. A total of 2351 post-handover defects were derived from four Spanish builders in seven residential developments. The research reveals that the most common defects identified at handover by customers were incomplete tile grouting and incorrect fixtures and fittings in toilets. In addition, failure to apply second coats of paint to walls was deemed problematic. Typical surface/appearance defects were found to include

floor or wall unevenness, stains, messes, small cracks and marks mainly caused by lack of protection. In areas where fixtures and fittings and finishes were of a similar nature, such as the kitchen and bathroom, defect types also arose.

In Malaysia, Fauzi, Yusof, and Abidin (2011b) evaluated housing defects on recently implemented Build-Then-Sell (BTS) houses. A questionnaire was administered to the house occupiers in six BTS residential areas. Fourteen building elements were identified from previous studies and were included in the questionnaire. The study revealed that the practice of the BTS housing delivery system has been proven to record low defects in houses. However, though most of the houses recorded low defects, there were cases where the workmanship and the materials used by certain BTS developers were unsatisfactory.

The general review of defects in this section has consistently shown that newly built properties which are assumed to be completed can be found to have a significant number of defects (Sommerville and McCosh, 2006). Though the extent of defects varies between countries, a significant number was recorded in the UK housing sector. This is in agreement with Craig (2008) that new homes within the UK are being repeatedly handed over to new homeowners with very high levels of defects which cause those owners to be dissatisfied with the overall quality. This is significant in that it supports the views held by Sommerville and McCosh (2006) that despite all the quality initiatives implemented in the industry, new homes still have a number of defects that cause homeowners to be repeatedly dissatisfied.

In terms of the nature of defects experienced in studies conducted in Australia, Ilozor et al. (2004) and Georgiou (2000) studies indicate particular defects that relate to the technical aspects of quality such as non-compliance and contravention of the building regulations. These results are not unlikely as the data used for these studies were obtained from the ArchCentre database. The data were mostly from inspection reports for all types of property available for sale and were mainly existing buildings. In contrast, Sommerville et al. (2004), Sommerville and McCosh (2006), and Craig (2008) captured overall industry quality standards in the UK rather than just a reflection of worst properties. The

data for the study was extracted from inspection reports obtained from leading building inspectors in the UK. The building inspectors were commissioned to carry out inspections on new residential buildings after the properties had been checked and verified by the appropriate warranty provider and passed over by the house building developer to the new home owners. The majority of the defects recorded were mostly aesthetics-related defects as opposed to the study conducted in Australia.

Although these studies used data from different sources such as independent building inspection reports, questionnaires to homeowners and archival records, what is common is that defects were apparent. These defects were found after the properties had been checked, verified and passed over by the house building developer to the new home owners. Sommerville et al. (2004) explains that homeowners of the properties surveyed had identified between 20-30 defects on their own before independent building inspections were carried out. It is therefore evident that quality problems are not limited to a particular country. However the volume of research related to defects in new house building (particularly in New Zealand) is remarkably scant considering the size of the residential sector (Sommerville & McCosh, 2006). There is little meaningful published literature on defects at the handover stage of new residential buildings in New Zealand. Thus this study believes that understanding common defects and the extent of defects occurring at handover could act as a preventative rather than a corrective measure to quality issues experienced in the residential sector. Examining the situation in New Zealand is therefore relevant. With these numerous quality problems in residential construction, the current study shares the view that high quality builds cannot always be achieved by relying on the performance of construction parties (Craig, 2008). The occurrence of defects is an indication that the desired quality of a completed building has not been achieved and this result in rework.

#### **4.4: Cost of rework**

As discussed earlier, rework is the common term used for non-achievement of quality standards within the construction industry. Rework as defined by Love and Li (2000) in Section 4.2 is the unnecessary effort of re-doing a process or activity that was incorrectly implemented the first time. The impact of rework on

construction organisation is significant. It can adversely affect an individual's, organisation's and project's performance and productivity (Love, 2002). Abdul-Rahman (1995) agrees that an organisation's reputation and its profit margin can be affected because the cost of redoing a project that is not up to standard is high. The need to reduce costs and at the same time improve quality standards is mutually supportive for any project. If the building process must achieve the principle of doing things right the first time and every time, it should be appreciated that the occurrence of defects has a price (cost increase). Similarly, the end products that have to be repaired invariably lead to a perception of low standards from the point of view of the customer. Love et al. (1999) mentioned that rework is a non-value adding item that could be completely avoided or eliminated. Thus complete elimination of rework would mean that the objective of zero defects could be achieved. This is only possible if the right quality management system is established to manage construction projects. The next paragraphs the present estimated costs of rework on construction projects from different countries. However, rework costs between each country should not be considered to be authoritative, but merely indicative, as levels and interpretations of quality will differ between each country. Local practices, industry culture, and contract arrangements may also have a significant influence on the incidence and cost of rework in any situation and locality.

For the past two decades, researchers have tried to estimate the cost of construction work that was not correctly done the first time. Countries currently involved in such extensive rework studies include Australia, Canada, Sweden, UK, USA, South Africa and Hong Kong. The extent and the intensity of worldwide research efforts towards the problem of rework indicate the occurrence of defect on construction projects. For example in the UK, Egan (2008) reported that up to 30% of construction work is related to rework while in the USA the annual loss due to rework could be as high as US\$15 billion for industrial construction. The study by Burati et al. (1992) in the UK revealed that the cost of defect rectification varies between 0.4% and 26.0 % of total project costs resulting in an average cost of 12.4 %. Similarly, the study by Barber et al. (2000) on the costs of quality failures in two major road projects show that they were respectively 3.6% and 6.6% of the total project costs. Hammalund et al.

(1990) found that the cost of repairing quality failure items was 6% of the total production costs and the time taken to rectify these errors were estimated to be 11% of the total working hours allocated for the project.

From 1990 to 1996 a number of studies were conducted in Sweden to examine the causes and associated costs of defects on several building projects (Josephson 1990; 1994; Josephson and Hammarlund, 1996). Results from the findings indicate the cost of defects to be between 2.3% and 9.4% of the contract value. Josephson and Hammarlund (2002), extending previous studies on the investigation of causes of construction rework among some projects in the Swedish construction industry, showed that the cost of rework for the case study projects were 4.4% of construction value and the time needed to rectify the defect was 7.1% of the total work time. Around the same period, Abdul-Rahman (Abdul-Rahman, 1997) estimated costs of non-conformance on construction sites to be 6% of total project costs. In a similar vein, Rhodes and Smallwood (2003) estimated the cost of rework in a construction project in South Africa to be 13% of the value of the completed construction. The same article reported that research conducted by the Associated General Contractors of America found an average rework cost was 12.4% of the project cost. The following findings were derived as a cost contribution summary from the 108 field rework cost incidence in a Canada-based study: Engineering and reviews 61.65%; Human resource capability 20.49%; Material and equipment supply 14.81%; construction planning and scheduling 2.61%; Leadership and communication 0.45%. Research conducted in New South Wales found the average cost of rework to be 5.5% of the total contract value and this included direct and indirect costs (Morasszeky, 2006). Palaneeswaran (2006) found the cost of rework in a private building project in Hong Kong to be 3.5% to 16.1% of the contract value.

Table 4.2 shows a chronological compilation of work carried out by Prof. Peter Love and his cohorts, who have worked extensively on the determination of costs of rework in the construction industry. From database searches, Love and his colleague's studies seem to have begun in 1999 and since then they have produced several articles around the subject area of rework costs on construction projects. Their studies generally identified causes, magnitude and costs of rework across a range of construction projects. Their studies are

highlighted in this current research because of their consistent and statistically significant findings that show the extent of rework costs on construction projects. It can be observed from the table over a 14 year period (1999 to 2012), the value of the costs of rework averaged between 3.15% and 12%.

Table 4.2 shows that the work of Love and his colleagues has been published in nine different journal articles. Eight of the articles used a case study approach considering one or two case studies, while the other six used questionnaire survey of participants ranging from 115 to 276. In spite of criticisms by Craig (2008), of the sample sizes, methodology, and validity of their findings citations of their study could suggest their ground breaking efforts in this research domain. It can be seen from the table that some of the work of Love and his colleagues were poorly cited. The low citations of the articles could be an indication of either of two factors. Firstly, it could be due to a lack of recognition of his work. Secondly, Love's area of interest, rework costs seems a relatively new and developing research area which is yet to gain full ground, therefore little by way of follow-on study has been carried out in this area. Citations of Love's articles are indicated in the Fifth column on Table 4.2.

These and other studies demonstrate the need to understand how and when defects occur and the possible remedial measures needed to prevent reworks in construction projects. Additionally, a common conclusion from all of the study investigations is the need for effective and efficient quality management systems, combined with continuous improvement strategies which Fayek, Dissanayake and Campero (2004) have also suggested will reduce rework costs. While most of these estimates are considered within the wider construction industry, the impetus has led to a continuous search to eliminate defects resulting in rework from the house building sector.

Studies on rework costs have heightened the need to reduce or completely eliminate defects occurring at handover of new residential buildings. Quality must be fundamental to every design process and defects need to be 'designed out' before work commences on construction sites (Egan 1998). If Egan's suggestion in 1998, of an annual 20% reduction in defects at handover (with an ultimate goal of zero defects) were implemented, then completed residential projects would most probably now be defect free. However organisations will

only appreciate the full economic benefits of achieving quality on construction sites when they begin to measure the cost of rework.

**Table 4.2:** Chronological evaluation of research work conducted by Love and colleagues (Adapted from Craig 2008)

| Supporting authors       | Year published | Journals                                                     | Title                                                                                                   | Cited by | Methodology used                    | No of projects used | Mean results | Standard deviations |
|--------------------------|----------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------|-------------------------------------|---------------------|--------------|---------------------|
| Smith and Li             | 1999           | International Journal of Quality and Reliability Management  | The propagation of rework benchmark matrix for construction                                             | 42       | Case study                          | 2                   | 3.15%        | 2.4%                |
| Mandal and Li            | 1999           | Construction Management and Economics (CME)                  | Determining the causal structure of rework influences in construction                                   | 82       | Case study                          | 2                   | 3.15%        | 2.4%                |
| Li and Mandal            | 1999           | European Journal of Purchasing and Supply Management         | Rework a symptom of dysfunctional supply chain                                                          | 91       | Case study                          | 1                   | 3.15%        |                     |
| Li                       | 2000           | Construction Management and Economics (CME)                  | Quantifying the causes and costs of rework in construction                                              | 117      | Case study                          | 2                   | 3.15%        | 2.4%                |
| –                        | 2002           | Managerial Auditing Journal                                  | Auditing the indirect consequences of rework in construction: a case based approach                     | 32       | Case study                          | 1                   | 3.15%        |                     |
| Holt, Shen, Li and Irani | 2002           | International Journal of Project Management                  | Using system dynamics to better understand change and rework in construction project management systems | 76       | Case study                          | 1                   | 3.15%        |                     |
| –                        | 2002           | ASCE Journal of Construction Engineering and Management      | Influence of project type and procurement method on rework costs in building construction projects      | 91       | Yellow pages                        | 116                 | 12%          | 13.56%              |
| Edwards,                 | 2004           | Engineering Construction and Architectural Management (ECAM) | Determinant of rework in building construction projects                                                 | 17       | Yellow pages                        | 116                 | 12%          | 13.56%              |
| Irani and Edwards        | 2004           | IEEE Transactions on Engineering Management                  | A rework reduction model for construction projects                                                      | 40       | Yellow pages                        | 116                 | 12%          | 13.56%              |
| Sohal                    | 2003           | Managerial Auditing Journal                                  | Capturing rework cost in projects                                                                       | 18       | Case study                          | 2                   | 3.15%        | 2.4%                |
| Edwards                  | 2004           | Civil Engineering and Environmental Systems                  | Forensic project management: the underlying causes of rework in construction projects                   | 15       | Case study                          | 2                   | 3.15%        | 2.4%                |
| Edwards                  | 2004           | Civil Engineering and Environmental Systems                  | Calculating total rework costs in Australian construction projects                                      | 9        | Yellow pages                        | 116                 | 12%          | 13.56%              |
| Edwards, Watson, Davies  | 2010           | Construction Engineering and Management                      | Rework in Civil Infrastructure Projects: Determination of Cost Predictors                               | 11       | Questionnaire survey (Yellow pages) | 115                 | 10%          |                     |
| Sing                     | 2013           | Structure and Infrastructure Engineering                     | Determining the probability distribution of rework costs in construction and engineering projects       | -        | Questionnaire survey (Yellow pages) | 276                 | 11.30%       |                     |

\*Citations noted at date of collection 28/08/2012 changes may have occurred since this date

#### **4.5: Cause of defects/rework**

The causes of defects resulting in rework have been the subject of extensive research and publication within the built environment (Fayek, Dissanayake, & Campero, 2003; Georgiou, et al., 1999; Love & Edwards, 2004a; Palaneeswaran, 2006). Previous research has identified that the improvement of quality performance on construction projects is reliant on the understanding of the root causes of defects and the basic reasons for its existence, or the sets of conditions that stimulates its occurrence in a process (Love, Mandal, et al., 1999). Defects lead to rework and a reduced overall performance of the end product, thus continuing the decline in customer satisfaction.

The initiation of any house building project involves two fundamental aspects: task, to be executed, and people, who carry out the tasks (Sommerville, Craig & Ambler 2006). Defects occur when these tasks are not properly performed to standards or specifications. However, Atkinson (1999) attributed the cause of defects on construction sites to a single entity, which is the human working on construction activities. According to Pringle (2009) construction activities are carried out by four primary participants in any construction project. These include the instigator (owner or developer), visualisers (designers/architects), examiners (Building Consent Authority) and finally the assemblers (house developers). An earlier study by Josephson and Hammarlund (1999) supports this view that defects are linked to the activities of project participants and only the coordinated action of these participants can reduce the incidence of defects which result in rework on construction projects.

Often on building projects there are several causes of the same erroneous action. These may be either combined causes, or a chain of causes. Whichever is the case, defects are proven reasons for the existence of non-quality achievement (Sommerville & Craig, 2007). Prior to the occurrence of a defect, there must be an originator or a cause (materials, design) (Craig, 2008). The originators of defects or causes may act either in isolation or interact simultaneously with each other, ensuring that the process of locating the finite source of the defect item is extremely difficult. Ilozor et al. (2004), argues that if a new building experiences defects, then someone has blundered. Atkinson (1999) further reinforces the view that the problem of error relates to the people

that carry out construction in the widest sense. This is also in line with Kaplan (1992) that building defects result from procedural inadequacies and consequently are caused by human error. Drawing on the key contributors of defects resulting in rework, many studies have shown that the occurrence of defects on construction projects is a significant predictor that project participation needs to do more for quality performance to improve. Taking a broader view, Love, Edwards, Irani, and Walker (2009) explain that the underlying contributors of defects are strategic decisions taken by top management or key decision-makers who stimulate the conditions for the adoption of inappropriate structures, processes, practices and technologies for construction projects.

Examples of causes of defects which are commonly identified to support the argument in the previous paragraph are listed in Table 4.3. The table presents the causes of defects and the number of times these causes have been identified by various authors. In general twenty-two causes of defects have been compiled from sixteen previous articles. From the table it can be observed that poor workmanship was the most identified cause that contributes significantly to defect occurrence in building projects. This cause has been identified by ten different researchers from 1999 to 2011. This is in agreement with Sommerville and Craig,s (2006) study that a significant percentage of defects (68%) was attributable to poor workmanship. Table 4.3 further shows that build error, material fault and failure were also significant causes of defects.

Although several researchers have directed efforts towards identifying the causes of defects, the game is not over yet as the industry is continuously pushed to aim for higher quality performance achievements. This is especially so with efforts placed on the ultimate goal of zero defects on construction projects suggested by Egan in 1998 and the 20% increase in productivity by the year 2020 initiatives in New Zealand (Skills productivity Partnership, 2011). In order to reduce defects on construction projects particularly in residential buildings, it is necessary to identify their origins and causes and a further understanding of how these origins and causes are interrelated. Thus collaboration and integration between project participants will invariably minimise defects in building construction (Abdul-Rahman, 1995).

**Table 4.3: Causes of defects**

| Authors<br>Causes of defects | Atkinson, 1999 | Chung, 1999 | Josephson and Hammarlund, 1999 | Love <i>et al.</i> , 1999 | Rogge <i>et al.</i> , 2001 | Rogge <i>et al.</i> , 2002 | Yates and Lockley, 2002 | Love <i>et al.</i> , 2002 | Stephenson <i>et al.</i> , 2002 | Fayek <i>et al.</i> , 2003 | Rhodes and Smallwood, 2003 | Love and Edwards, 2004 | Ogden <i>et al.</i> , 2004 | Sommerville <i>et al.</i> , 2006 | Palaneeswaran, 2006 | Beattie, 2011 | No of times causes identified |
|------------------------------|----------------|-------------|--------------------------------|---------------------------|----------------------------|----------------------------|-------------------------|---------------------------|---------------------------------|----------------------------|----------------------------|------------------------|----------------------------|----------------------------------|---------------------|---------------|-------------------------------|
| Safety issues                |                |             |                                |                           |                            |                            |                         |                           |                                 | x                          |                            |                        |                            |                                  |                     |               | 1                             |
| General changes              |                |             |                                |                           |                            | x                          |                         |                           |                                 |                            |                            |                        |                            |                                  |                     |               | 1                             |
| Maintenance                  |                |             |                                |                           |                            |                            | x                       |                           |                                 |                            |                            |                        |                            |                                  |                     |               | 1                             |
| Personal motivation          |                |             |                                |                           |                            |                            |                         | x                         |                                 |                            |                            |                        |                            |                                  |                     |               | 1                             |
| Ignorance of standards       |                |             |                                |                           |                            |                            |                         |                           |                                 |                            |                            | x                      | x                          |                                  |                     |               | 2                             |
| Conflict delays              |                |             |                                |                           |                            |                            |                         | x                         |                                 |                            |                            |                        | x                          |                                  |                     |               | 2                             |
| Poor communication           | x              | x           |                                |                           |                            |                            |                         |                           |                                 |                            |                            |                        |                            |                                  |                     |               | 2                             |
| Design error                 |                |             |                                | x                         | x                          |                            |                         |                           |                                 |                            |                            |                        |                            |                                  |                     |               | 2                             |
| Inadequate plans/planning    |                |             | x                              |                           |                            |                            |                         |                           |                                 | x                          |                            |                        |                            |                                  |                     |               | 2                             |
| Lack of quality mngt         |                | x           |                                |                           |                            |                            |                         |                           |                                 |                            |                            | x                      |                            |                                  |                     |               | 2                             |
| Misinterpret drawing         |                | x           |                                |                           |                            |                            |                         |                           |                                 |                            | x                          |                        |                            |                                  |                     |               | 2                             |
| Omissions                    |                |             |                                |                           | x                          |                            |                         |                           |                                 |                            | x                          |                        |                            | x                                |                     |               | 3                             |
| Time and cost                | x              |             | x                              |                           |                            |                            |                         |                           |                                 |                            |                            | x                      |                            |                                  |                     |               | 3                             |
| Poor practice/lack of skills |                |             | x                              |                           |                            |                            |                         |                           |                                 | x                          |                            |                        | x                          |                                  |                     | x             | 4                             |
| Poor supervision             |                | x           | x                              |                           |                            |                            |                         |                           |                                 |                            |                            | x                      |                            |                                  |                     |               | 3                             |
| Lack of inspection           | x              |             |                                |                           |                            |                            |                         |                           |                                 | x                          |                            | x                      |                            |                                  |                     | x             | 4                             |
| Procedural errors            |                |             |                                | x                         |                            |                            | x                       |                           | x                               | x                          |                            | x                      |                            |                                  |                     | x             | 5                             |
| Design                       |                |             |                                |                           | x                          |                            | x                       |                           | x                               | x                          |                            |                        |                            | x                                |                     |               | 5                             |
| Co-ordination                |                | x           | x                              | x                         |                            |                            |                         | x                         |                                 | x                          |                            |                        |                            |                                  |                     |               | 5                             |
| Material faults and failures |                | x           | x                              |                           |                            |                            | x                       |                           | x                               | x                          |                            |                        |                            | x                                |                     |               | 6                             |
| Build error                  |                |             |                                | x                         | x                          |                            | x                       | x                         |                                 |                            | x                          |                        |                            | x                                |                     |               | 6                             |
| Workmanship                  | x              |             | x                              | x                         |                            |                            |                         | x                         | x                               | x                          |                            | x                      | x                          | x                                |                     | x             | 10                            |

In this light, Atkinson (2002) suggests that developing a management system to address the problem of poor formal communication (transfer and use of information) between project parties could lead considerably to improved performance (Atkinson, 2002). The current study takes the basis that understanding defects and establishing appropriate quality management systems to monitor and track them down as and when they occur will improve quality performance in building projects.

#### **4.6: Impact of defect/rework on construction projects**

It is tempting to assume that understanding defects occurring at handover of new residential buildings matters little in New Zealand given that the house building sector is small by international standards. Doing so is to disregard economic data which shows that the residential building sector forms an essential part of the New Zealand economy. The sector alone has a total market value of between NZ\$450 and NZ\$500 billion making it the largest asset class in New Zealand (DTZ New Zealand, 2004). More recently (in March 2012) there are indications that the value of residential buildings has picked up since the recession, with the value of residential building consents rising by 30% compared with March 2011. This current spike is the highest value of residential building consents recorded since September 2008 (Bascand, 2012). This increase in the number of residential buildings will mean that more proactive measures are required to monitor the quality of the final product in a way that meets project owners' needs. Recognising also that home ownership means so much to New Zealanders and settlers, good quality homes will mean high satisfaction levels with the performance of house building developers. The fact that most of the country's wealth is tied up in buildings means that any unnecessary quality non-achievement will impact on the general economy. Therefore an understanding of the nature of defects will create awareness that could help to enhance building performance levels. This is emphasised by Building Research Levy in New Zealand having identified the residential building sector as one of the key areas requiring performance improvement.

Apparently, the impact of rework on construction projects has been huge and common around the globe. Rework contributes significantly to increased project costs, inadequate schedule performance and poor quality (Hwang, et al., 2009;

Love & Edwards, 2004a). At the organisational level, rework has been identified to reduce profit, diminish professional image, resulting in inter-organisational conflict, loss of future work, and poor morale amongst operational staff (Palaneeswaran, 2006). In some cases this could cause a ripple effect on different work aspects such as stress, motivation, relationships and reputation. At the project level, rework causes time waiting, idle time and travelling time and end-user dissatisfaction in activities (Rhodes & Smallwood, 2002). Within the context of the house building sector, Sommerville et al. (2004) agrees that remedial work results in significant expenses to house building developer businesses and as a result they are reluctant to highlight and sometimes rectify defects in their completed projects.

Fundamental in the context of the Building and Construction Sector Productivity Taskforce Report (2009) is the potential impact that improving quality and reducing defects will have in driving up productivity. If one looks at the Single Factor Productivity of Labour ((SFP)\_L) method of representing productivity (in this case, slightly modified for the purpose of this research) it can be seen that in order to force productivity in the construction sector up, one or both of two things need to happen. Firstly the value of the built product, in this instance house price on completion of build, needs to increase. Alternatively the value of the labour input into the construction process needs to be reduced. In an ideal world for construction productivity, both of these phenomena need to occur. However in the current 'flat', post-recession housing market conditions, the value of finished housing is unlikely to see significant change in the short to medium term. Arguably, in standard quality management theory, customers pay a premium for a product that has fewer defects. However, practically that is unlikely to occur in housing since a new house's value is largely commensurate with existing housing stock values for a particular area. However, the second contention of reducing labour input offers a substantial opportunity to positively affect productivity. Labour input into housing construction consists of two principle components, one being the labour to initially construct the building (Labour to build, LB) the other being the labour required to rectify errors (Labour to rework, LR).

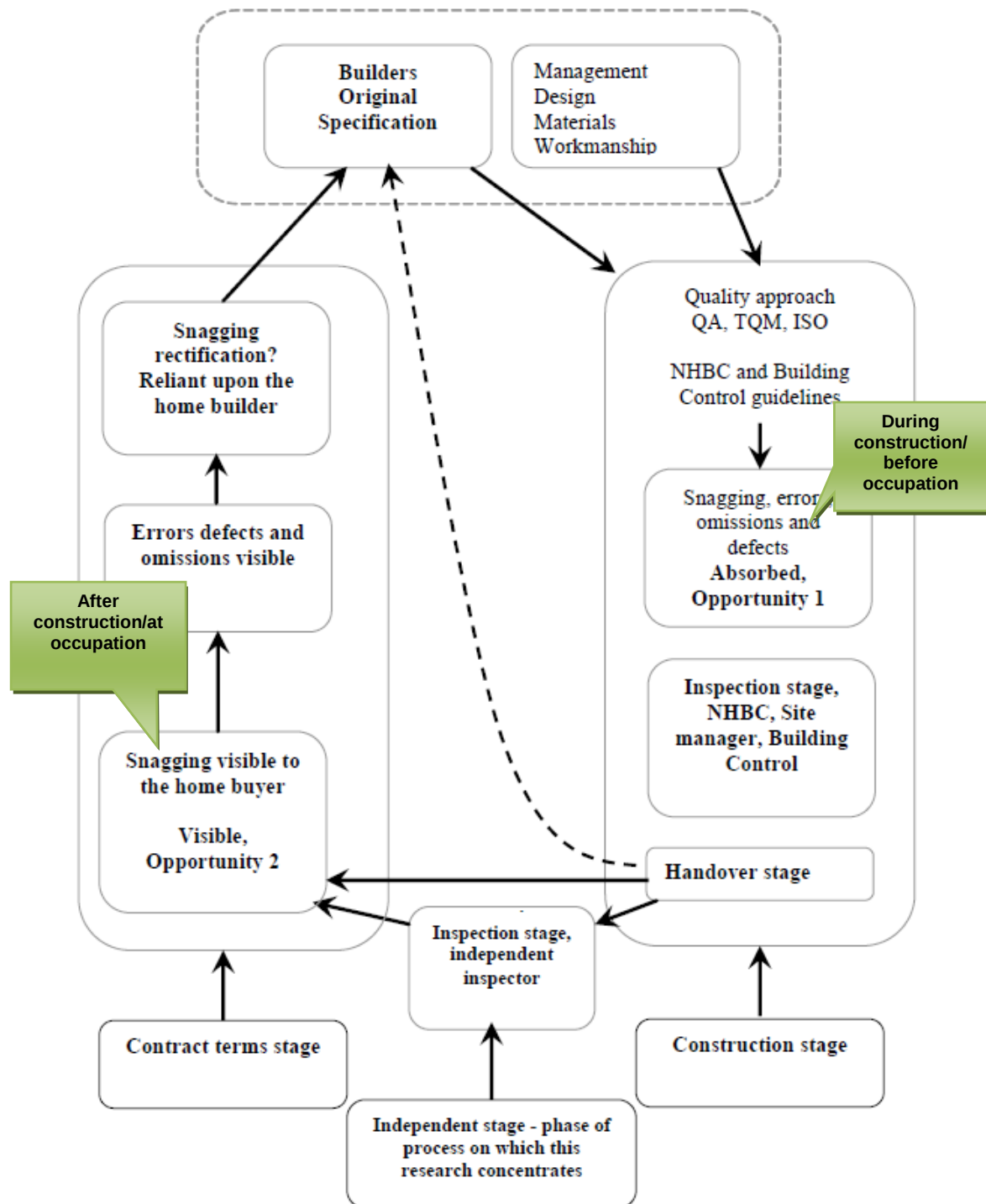
Consequently it can be seen that reducing the number of defects will immediately reduce the total value of labour (i.e. the LR component will tend towards zero) in the construction process. Reducing the LR component by reduced rework due to defects offers the possibility to significantly increase value added during construction work. Thus it can be seen that the result of developing improved capability and understanding of quality management and defect elimination can substantially improve quality performance and therefore increase productivity. It is quite clear that the cost of rework resulting from defective items is significant in terms of project costs. This realisation is the starting point for this research project, and indeed its principal desired outcome. At present insufficient data exists regarding current New Zealand performance in order to take forward the reduction of non-conformance and defect rectification costs. Thus this study will provide essential data for future industry improvement initiatives in reducing house building quality defects and improving industry performance generally.

#### **4.7: Stages of defect occurrence**

There are two types of defects, the absorbed and visible (Craig, 2008). Absorbed defects are the defective items that are mostly noticed by either the house building developer or council building inspector during their regular building inspections. These defects occur during the actual building construction process. Visible defects are those which are usually detected by homeowners or building occupants after the built facility has been purchased and occupied. These visible defects normally become obvious after the issuance of the Code Compliance Certificate (CCC). It is possible for the absorbed defects to be corrected during construction before practical completion, while visible defects which are noticed by the homeowner might not be corrected once the developer has gone, due in part to a lack of legislation which covers the homebuyer (Craig, 2008). Visible defects are the category of defects that become burdens to a new homeowner. Sommerville et al. (2006) explain that the purchaser of a new home that is defective cannot just “give it back” and they are unable to request a refund in most cases. In most situations, the homeowner would have to put up with the stress and inconvenience of living in a poorly built property.

Sommerville and McCosh (2006) identify two stages of occurrence of defects as two useful opportunity points where building inspection processes could be enhanced to improve the overall quality of new homes. The first opportunity point is during building construction when 'absorbed defects' are picked up by the builder or during council inspections. Craig (2008) explains that the range of inspections conducted by the project manager and council inspectors will only view the technical aspects of quality. However, Beattie (2011) believes that having higher skilled council building inspectors could enable the identification of defects earlier during building construction and beyond current practice. With proper attention to performance details, it is possible for 'absorbed defects' to be corrected during construction before the practical completion of buildings. Therefore, the key concept will be to increase the probability of the product being 'right first time'.

The second opportunity point is at hand-over of newly constructed buildings to new owners. Sommerville et al. (2005) explain that these opportunity points present potentials for cost savings and process improvement in residential construction. For example, house building developers have to absorb rectification costs which reduce their potential profit during construction, while at hand-over, visible defects deplete profit further and are burdensome to homeowners.



**Figure 4.1:** New house quality setting pathway. Adapted from Sommerville and McCosh (2006)

This study focuses on visible defects which arise after code compliance certificates (CCC) have been issued after the final inspection of a completed building project in New Zealand. Sommerville et al. (2006) believe that these defects that occur after practical completion have been regarded as causes that

bring conflict and distress to the parties involved in the house buying process. Homeowners also perceive these defects as the most important as previously discussed in Section 3.4 and 3.5.

Figure 4.1 presents both opportunity points for defect reporting in the house building sector in the UK adapted from Sommerville et al. (2005) and Sommerville and McCosh (2006)

#### 4.8: Defects categorisation

Georgiou (2000) has shown in his study that defects could be viewed from three different aspects: technical, functional and aesthetics. The technical defects are contraventions to building regulations and relate to workmanship, materials or design of an element of a building. The functional aspect relates to omitted parts or features, and the aesthetic aspects relate to the appearance of the completed building. A more detailed explanation of these aspects which could act as indicators/moderators of defects is provided by Sommerville et al. (2006).

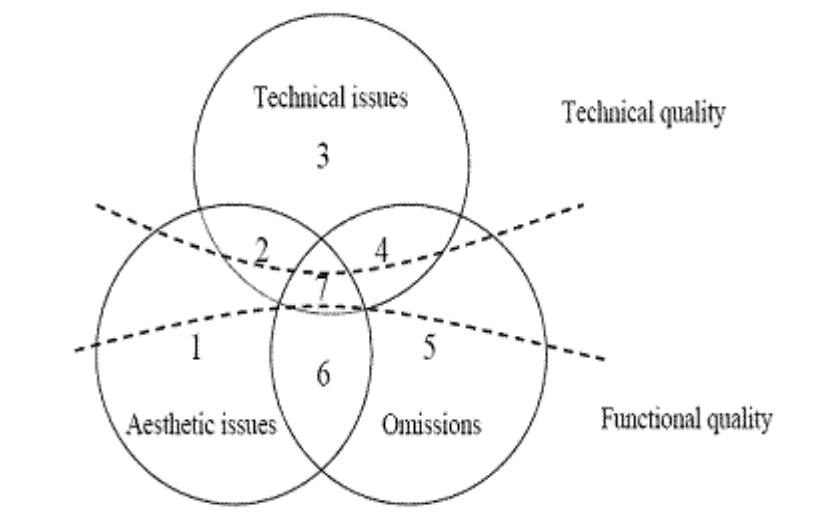
Sommerville et al. (2006) present seven complex combinations of aspects of defects that occur in a house building project. These combinations of defects are listed in Table 4.4. However, figure 4.2 represents the different categories on a Venn diagram.

**Table 4.4:** Different combinations of aspect of defect

| Categories | Different combinations       |
|------------|------------------------------|
| 1          | Aesthetic                    |
| 2          | Aesthetics/Technical         |
| 3          | Technical                    |
| 4          | Technical/Omission           |
| 5          | Omission                     |
| 6          | Omission/Aesthetics          |
| 7          | Aesthetic/technical/omission |

It can be observed from the figure that the different combinations of defects fall into two distinct dimensions of quality functional and technical defects (as

explained in section 3.4). Defect combinations 2, 3 and 4 are mostly technical in nature while 1, 5 and 6 relate to functional quality (mostly aesthetics). It was highlighted in section 3.5 that functional defect categories are the most significant to new homeowners and determines their satisfaction level (Auchterlounie, 2009; Craig, 2008; Page, 2011).



**Figure 4.2:** Categories of defects (Sommerville et al., 2006)

A good illustration of these categories of defects in the context of new residential building was given by Sommerville, et al. (2006). Using air brackets as examples, Sommerville et al. (2006) explain that:

1. 'Aesthetic' defect could mean that the air brick is missing, thus leaving the building unsightly.
2. 'Aesthetic/technical' defect could mean that the missing air brick makes the building to be unsightly therefore the issue is technical as it does not comply with building regulations.
3. 'Technical' defect could mean the defect does not comply with building regulations.
4. 'Technical/omission' defect means the issue is technical because it does not comply with building regulations and is an omission because the brick is "not there".
5. 'Omission' defect could mean that the brick is "not there".

6. 'Omission/aesthetic' defect meaning is an omission because the brick is "not there" and because the brick is missing the building is unsightly.
7. 'Aesthetic/technical/omission' defect could mean a combination of all three aspects.

These distinctions of defects are important because they provide an understanding of the customers' needs and focus that are required to be met. Craig (2008) believes that the allocation of specific defective items could allow timely decisions to be made and appropriate actions to be taken to rectify defects. The residential building sector in New Zealand relies heavily on specialist subcontractors. As a result of these different speciality tasks, the quality of the final product, which is the house, could fall short of the required expectations. A great deal of the nature of defects in house building involves understanding the causes and the stages of their occurrence. However, solutions cannot be suggested unless the problem is fully analysed, and this involves a thorough understanding of the causes and the nature of defects occurring at the various stages of construction, particularly at handover.

It is clear from these aspects and combinations suggested by Sommerville et al. (2006) that defects occur either during the building process or after the building has been completed. Georgiou (1999) explains that if the desired quality level of a product is not achieved, it could be perceived that a defect has occurred. Identifying and rectifying these defects would allow house developers to track improvements that will provide quality products and services for the end user. Therefore, with emphasis to the residential sector which is the focus of the current study, Auchterlounie (2009) explains that one of the main quality indicators used by the industry has traditionally been the number of defects or claims made against the warranty as an indicator of the quality of a new house.

#### **4.9: The house buying process in New Zealand**

The house buying process in New Zealand such as in any other country has a number of stakeholders. These include: house buyers, house developers, council inspectors, independent building inspector and financiers. When considering the house buying process, it is important to remember that these stakeholders have differing roles and priorities regarding quality expectations

and performances. House buyers are very often more concerned with aesthetics and functioning of their building properties. House developers on the other hand, perform to meet set standards (such as those contained in building regulations, drawings and specifications). Council inspectors focus more on technical quality aspects of buildings and would aim to monitor developers' performance so that they meet codes and regulatory requirements. Council inspectors in New Zealand carry out a range of inspections depending on the stage inspection contained in consent documents. Independent building inspectors' complement council inspectors by acting on behalf of home buyers to ensure that their concerns are addressed during the house buying process. Finally, the financiers, as stakeholders provide necessary funds to carry out building works, either to the house developers or homeowners.

Buying a new home requires monetary support from financial institutions in the form of mortgages (Sommerville, 2008). The majority of homebuyers in New Zealand need a mortgage when buying a new house. In order to secure this mortgage, lenders often require some form of warranty that could cover the home against some set of risks for a specified period of time. Such warranties are generally provided to the homebuyer by house developers when the homebuyer takes possession of the new homes. For house developers registered with MBF or CBANZ, warranties apply, though not automatically as was explained in Sections 3.7.1 and 3.7.2.

There are three common ways by which new houses can be purchased in New Zealand. The first is to buy a completed building that has been built by a house building developer who may or may not be professionally registered. The process begins with the customer visiting the new home on a particular site. This is the only indication to a customer of the quality and standard that they may expect to receive. Similar to the UK house buying process, the situation is speculative, since decisions on purchase of land, building design and building production are made without any reference to the homeowner who often is found only after the building has been built (Auchterlounie & Hinks, 2001; Roy & Cochrane, 1998). Speculative house builders in the UK buy and trade in land, they then build and sell completed houses and they are what UK house buyers purchase. It is difficult but not impossible for house buyers to order the house they want; they can have modifications to the standard, but usually only minor

ones (Meikle, 2008). In this process the home quality requirements rest on the house builder. This method of procuring a house is also similar to what is obtainable in Australia. The new house is purchased from a speculative house builder from one of the home designs displayed (Georgiou et al., 1999).

Another way by which new houses are purchased is by negotiating and buying a house that is under construction. In this case, the purchaser enters into an agreement to purchase the house upon completion. In this process, the potential homeowner could make changes to the building, depending on the stage of the construction. Defects or quality failures could be identified during construction by the homeowner during visits to the site. These defects could be rectified at the insistence of the potential owner. Certainly the identification of defects will depend on the level of knowledge of the owner about building construction.

Finally, the house buying process may be made by purchasing what is referred to as a complete land package from a house building developer. The designs may be bespoke, using the owners' own designers or from prototypes offered by the house building developer. Management of the construction could be by the designer (on behalf of the owner) or by the house building developer. Alternatively, clients provide the land and house builders provide the construction and often the design service. This type of house procurement takes significant risks away from the house building developer (Tookey, 2012). This non speculative house buying process means that homeowners are more involved in the building construction. Therefore the early involvement of the new homeowner in this process may allow for quality performance and satisfaction to be achieved.

Georgiou et al. (1999) believe that the perceived level of expected product quality varies with the different house procurement approaches. However this study advocates that whichever the process through which a home is purchased or built, it is important that the quality needs of the owners are met. Ong (1997) encourages potential home buyers to buy a home that is not yet built because this makes a lot of difference compared to buying an existing new home. This will prevent house building developers from taking short cuts or making mistakes. The more the checks on building performance, the more

probable the final build will meet the required quality standards. Holder (2002) suggests that homeowners have a responsibility to ensure that their needs are met. Holder advocates quality audits (snagging) that will enable the identification of defects that may not be visually detectable and for which ordinary reports or inspections may not highlight. Getting a building checked out before the decision to buy a dream home is important (Cossar, 2003). Similarly Landin (1995) believes that inspection is the most common way of achieving quality, even though it occurs downstream.

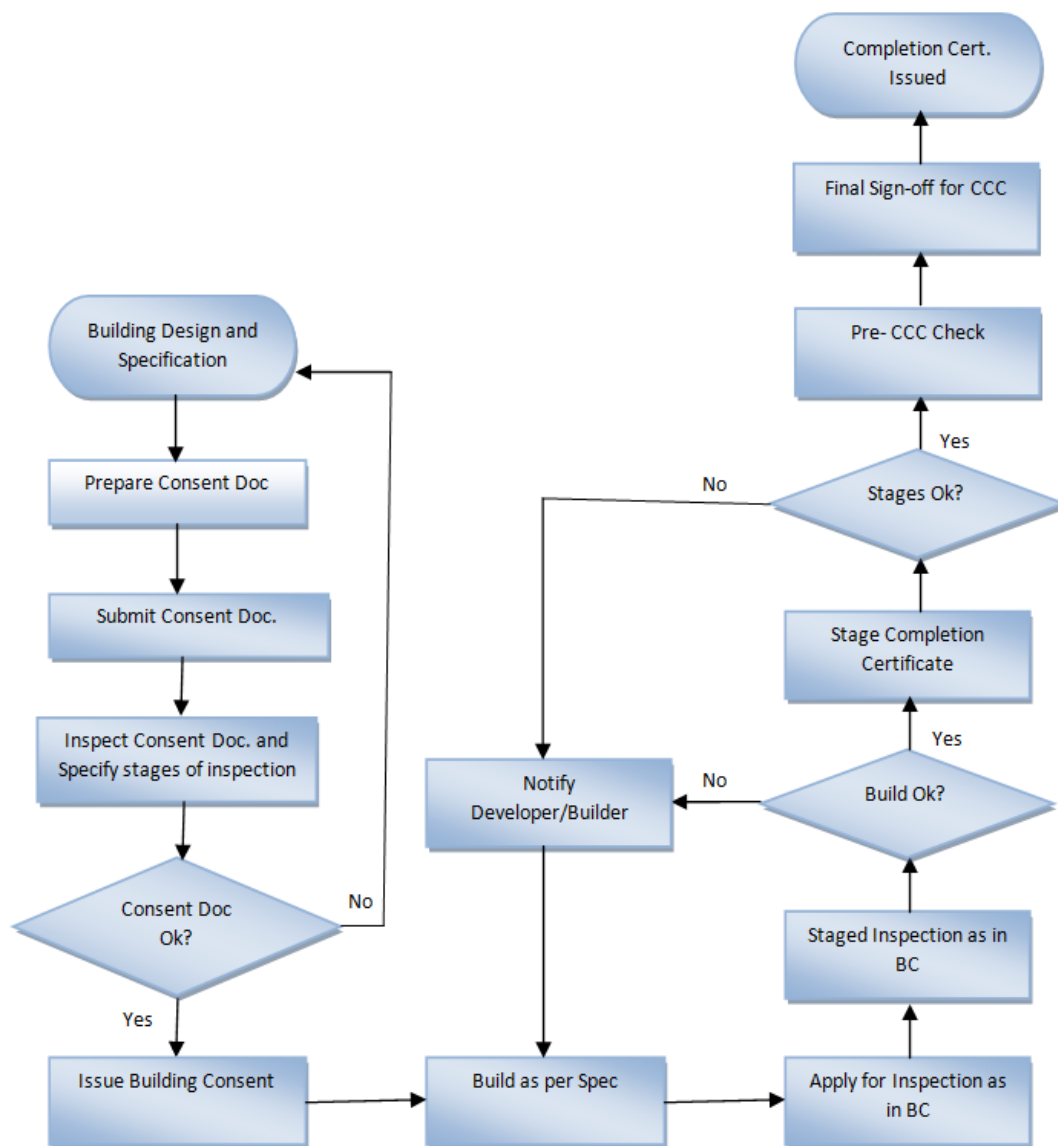
#### **4.10: The current building Inspection process**

In New Zealand it is a requirement that a building consent is granted by an approving authority (Building Consent Authority) before the commencement of construction work. The role of the Building Consent Authority is to review and inspect processes to ensure that the proposed building and completed building complies with the performance requirements of the Building Code and protects current and future owners (Bates & Kane, 2009; Pringle, 2009). The building codes and regulations are supported by a self-regulated inspection reporting system, all of which are routinely checked by the council building inspector (Mills et al., 2009).

Building consents contain compliance requirements which are necessary for the proposed building work. The consent also specifies the inspection requirements for the building project, based on the submitted plans and specification. Building inspection is usually carried out at specific stages corresponding to building progress. Typically the inspections will cover: foundations, framing and insulation, plumbing, drainage, cladding and flashings, and the finished building. Work cannot proceed until the inspection for each stage is completed; this is to ensure that all building work complies with consent documentation. If the council inspector finds work that does not comply with the building consent during the inspection regime, a notice will be issued to rectify all defects. However, the council inspector is not a clerk of works and does not provide full inspection or quality control services (Pringle, 2009). The inspection regime concludes with a final inspection of the completed build after which a CCC is issued. The CCC confirms that the work has been done in accordance to the plans and specifications approved in the building consent as discussed in

section 3.7. House sales and purchase contracts are often conditional on the issuance of a CCC (Gibson, 2010). This wrongfully assumes that staged council inspections during construction would have identified defective work, and which would have been rectified before the issuance of a CCC. This is because new homeowners would normally assume that most defects have been taken care of through the building inspection processes which are outlined in the building consent process. The overall quality of the finish product can often be overlooked during the buying process, but once a buyer has moved in, perceived problems can grow out of all proportion to affect the overall performance of the new home.

Figure 4.3 presents the current building inspection process from when the building design document is submitted for building consent application, right through to the point where a CCC is issued. Of note is that any of the typical stages mentioned above, inspections may occur more than once depending on the nature of the work. For example when there is slab plumbing this should occur before slab building and similarly when there is pre-line plumbing this should occur before the pre-line building. It is also possible for some inspections to occur at the same time.



**Figure 4.3:** Typical building inspection processes

#### 4.11 Establishing the knowledge gap

This section brings together all of the knowledge gained from existing literature on defect in residential building construction. The intent is to establish the extent of the knowledge gap and appropriately determine how the current research fits with improvements that are needed in residential building construction in New Zealand.

Firstly, a relevant literature search has shown that there is an absence of New Zealand related research on common defects that occur at handover of new residential buildings. There are no records to show the extent and magnitude of defects or any other significant details which might provide insight into ways and

means of reducing the incidence of defects, thus improving the quality of new homes. The inevitable result of such an incomplete record of defects makes benchmarking of local New Zealand residential building quality performance difficult. Therefore performance measurement may also be difficult. Auchterlounie (2009) supports this view by explaining that there are no standards for new house buyers to compare their new homes when they are looking to buy. The availability of such industry wide standards could encourage construction organisations to share best practices, processes, systems, and initiatives, and learn from the experience of others (Fayek, et al., 2003).

Secondly, very little or no research has been undertaken to determine the level of customer satisfaction with the quality of their new homes. Though the review of industry practice shows that some organisations have a system to determine customer satisfaction, there appear to be variations in these systems with no apparent industry-wide standard. The need to establish customer satisfaction is important to all parties in building construction. A gauge of customer satisfaction would enable measures and processes to be put in place that could encourage not only best practice but identify opportunities where improvements could be made to house building processes. Therefore customer satisfaction is one of the key reasons for embarking on the current study.

Finally, defect reporting as a building production process has not been as widely adopted within the new residential house building sector in New Zealand. In contrast, a literature evaluation shows that there is a lot of research on defect reporting in the UK. In recent developments in the study of defects in new homes in the UK, Craig (2008) developed an industry benchmark figure on the extent of defects at hand over. These studies show the importance of defect reporting as a viable solution to reducing their incidence. In the same light these UK studies heighten the need for countries like New Zealand to examine how they could improve their building production processes through defect reporting. Checking for defects in residential building construction would help identify areas where performance improvements could be achieved. A particular benefit of adopting a defect reporting process in residential building construction would be to reduce the frequency of inappropriate and defective items and components being included in the house building process. This in turn would allow a more rapid handover as well as reducing the defect lists that could be

generated. This current study believes that there are benefits to defect reporting for new buildings which the New Zealand building production process should embrace for best practice. Defect reporting before or after handover would enable house building developers to rectify potential defects before they became burdens to homeowners. Ultimately this will increase the confidence that new homeowners can have in their house building developers and the quality of their new home.

The areas where defects reporting could be performed during the house buying process are shown in Figure 4.4 in line with Sommerville et al. (2006). Two opportunity points identified by Sommerville et al. (2006) are explained in Section 4.7. These opportunity points could be incorporated into the house procurement process to suit the ways in which houses are procured in New Zealand. In this light, Figure 4.4 shows the points at which defect reporting by independent building inspectors could be useful.

The figure shows the different participants in the house buying process and their involvement throughout this process. The shaded portion in Figure 4.4 corresponds to the focus area of this current study. Thus irrespective of the stages at which a homebuyer becomes involved in the house buying process, the greatest opportunity point for the homeowner is at the initial occupation stage.

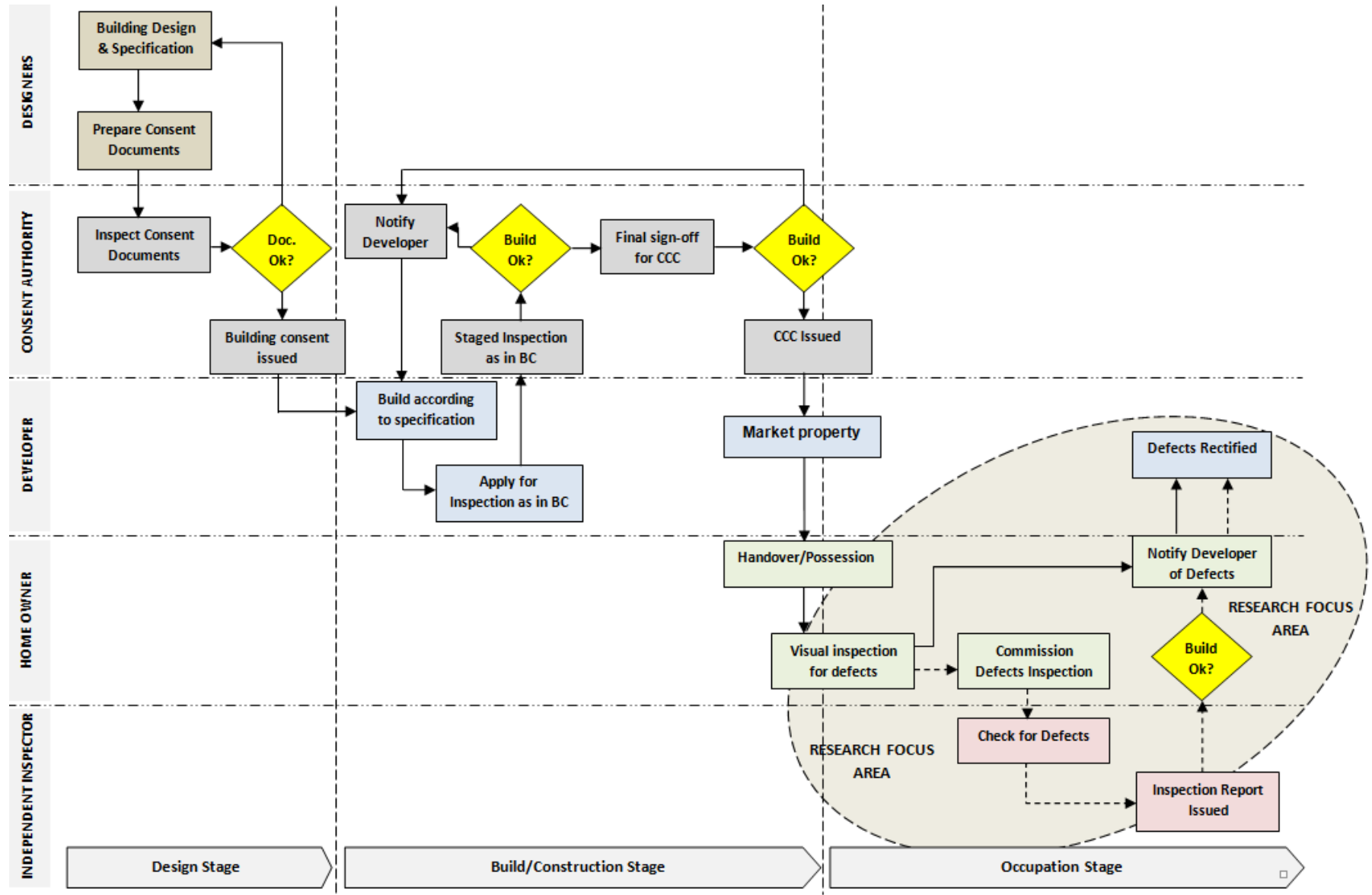


Figure 4.4: Building purchase process showing the research gap

Defect reporting process (snagging) outlined in Sommerville et al. (2006) explains how heavily the house buying process is geared towards house building developers, though within the New Zealand residential building the house procurement process is mostly non-speculative. Sommerville et al. (2004) explain that invariably the representatives that are responsible for controlling the staged building inspection process belong to the same bodies with the project manager who also acts as the controller of the overall quality process. Therefore detection of quality failures may be compromised.

A significant number of new house construction is being undertaken by house developers who may not belong to a trade organisation. In which case, seeking redress and accountability is difficult when issues of defect arise (Cossar 2003). Sommerville et al. (2006) believe that visible defects at handover stages are completely avoidable. They believe that changes in the working attitudes of construction operatives, management of the defect reporting process, and the overall building management process could reduce or mitigate defects in new residential buildings. The current study intends to create awareness that defect reporting is important in the house buying process particularly for residential buildings, and that a focus on customer satisfaction could assist house building developers to improve their performance levels.

This study believes that New Zealand could learn valuable lessons from UK practice. According to Brennan (2004) defect reporting at handover provides an opportunity for problem areas to be remedied when a home buyer still has the builder under obligation. We therefore conclude that there are opportunities for the use of independent building inspections for defect identification at the hand-over stage of new residential buildings in New Zealand. The more checks and inspection of building performance, the more probable the final build will meet required quality standards. It is important to rectify a defect once it is identified, as a prolonged period of incubation could be more damaging to the quality performance of a construction project (Burati, et al., 1992; Love & Edwards, 2012). In view of this, the current study sets out to improve the quality of new residential buildings and also increase the level of customer satisfaction in the quality of their new homes.

In order to understand the extent and common defects observed at handover stage of new residential buildings and the satisfaction levels of new homeowners, it is essential to conduct basic research to establish the dynamics of the problem. This paper seeks to address the following questions as outlined in chapter one.

*How can defects be minimised so that the quality of new residential buildings is enhanced in New Zealand?*

*What is the satisfaction level of new homeowners to quality achievement in new residential buildings?*

It is hoped that this research will serve as a base for future studies and also make several contributions to the current body of literature.

#### **4.12: Summary**

This chapter presents the need for defect reporting by independent building inspectors for new residential buildings. This was done by first establishing that the incidence of defects in new homes and the cost of repairs are significant to construction project performance (in terms of schedule, cost and quality). Therefore identifying the causes of defects and their origin, which results in rework, could reduce the magnitude of defects on construction projects. The chapter has thus far provided a concrete and conceptual framework for the research. The purpose was to place and examine in detail the research problems which were highlighted in chapter one, from a residential building construction perspective. While other researches have focused on the issue of weathertightness, the current research examines the types of defects experienced by new residential homeowners at handover stage. Thus, the knowledge gaps which the current study desires to fill have been made evident. The next chapter provides the methodological framework and research techniques employed in this research.

## **CHAPTER FIVE**

### **RESEARCH METHODOLOGY**

#### **5.1: Introduction**

From the review of literature presented in Chapter 2, Chapter 3 and Chapter 4, it is evident that little research has been done to capture the magnitude of defects in new residential buildings in New Zealand. Also very little research has been conducted to determine the satisfaction levels of new homeowners on the quality of their new homes. Therefore a knowledge gap exists in the current research. For that reason, this research seeks to capture the extent and common defects and satisfaction levels of new homeowners with the aim of improving quality achievement levels in new residential buildings in New Zealand.

Chapter 5 explains the development process of the research from start to completion. It further presents the research design and the underlying epistemological and ontological paradigms and perspectives from which this research is conducted. This chapter also provides an overview of the main data sources, followed by information on the reliability and validity and ethical issues of the study. Finally, the chapter presents a discussion of the data analysis strategy used for this research. Further details on the research process will be presented in the following sections to show how the study developed from the initial research directions to its current form.

#### **5.2: What is research?**

Research can be defined as simply the process of thoroughly studying and analysing situational factors surrounding a problem in order to search for solutions (Cavana, Delahaye, & Sekeran, 2001). While a variety of definitions of the term research have been suggested, the current study will use the definition suggested by Polit and Beck (2006) as a diligent and systematic investigation that may refine existing knowledge or indeed generate new knowledge or expand a base of knowledge. More specifically, in relation to the focus of the current study, this aims to improve quality achievement levels in new residential buildings. Amaratunga et al. (2002) identifies three abilities that might be

subsumed under the term research: (a) research is a process of enquiry and investigation (b) it is systematic and methodical and (c) research increases knowledge. Therefore knowledge could be grouped into two categories (Higgs, Horsfall, & Grace, 2009):

Propositional knowledge: that which is derived from research and scholarships with an attempt to generalise findings.

Non-propositional knowledge: derived primarily through practice without an attempt to generalise findings.

Since the purpose of conducting research is to generate, test and expand knowledge, it is therefore necessary for a researcher to answer some questions when designing a research project (Burns & Grove, 2001; Higgs, et al., 2009)

- What questions are being addressed?
- What is the nature of knowledge being looked for?
- Why is the question being researched?
- What needs to be achieved by the research?
- Are there contextual factors which influence the questions and answers that are being explored?

To address these questions, it is important to identify the possible research methods and paradigm that is appropriate for the subject area and the nature of the specific problem. Therefore the following sections will describe the entire process of the current research, beginning with the research methodology.

### **5.3: Research methodology**

The research methodology section is an important part of a research project because it stresses the nature and rationale for the selected methodology. Research has been defined in section 5.2 as a diligent and systematic investigation that may refine existing knowledge or indeed generate new knowledge or expand a base of knowledge. Methodology according to Collis and Hussey (2009) is an approach to the process of research that

encompasses a body of methods. Therefore the combination of these two definitions will go in line with Easterby-Smith, Thorpe, Jackson, and Lowe's (2008) definition of research methodology. Easterby-Smith et al. (2008) define research methodology as the combination of established scientific techniques used to enquire about a particular problem in a specific situation. A more generic description of research methodology is given by Collis and Hussey (2009) as an "entire process of the research study". Which means: what data needs to be collected, where the data is to be collected, when is the data to be collected, how would the data be collected and analysed (Parahoo, 2006)? The choice of research methodology should consider a number of issues such as research objectives, epistemological concerns, norms of practice, resource availability, and historical, political, ethical and personal factors (Buchanan & Bryman, 2009). The choice of research methodology should be influenced by whether the research is inclined towards a positivist, interpretive (i.e. phenomenology) or other perspective. Choosing a research methodology requires a good understanding of the research problem so that the research questions can be formulated. Therefore, the next section describes the research problem and research questions developed for this study, so that the appropriate methodology and paradigm that envelop the research can be determined.

*"The general principle is that the research strategy or strategies, and the methods or techniques employed, must be appropriate for the question you want to answer" (Robson, 1993).*

#### **5.4: Analysis of the research problem**

The problems being addressed by this research include:

- Lack of an established understanding of common defects and their extent in new residential buildings at handover.
- Lack of information on the satisfaction levels of new homeowners regarding the quality of residential buildings.
- Lack of understanding of the use of defect reporting as a means of minimising defects in new homes at handover, and

- A lack of understanding of the current house developers' quality practices and warranties available for new homeowners.

The research questions were carefully formulated as this is the most important step to be taken in a research study (Yin, 1994). Research questions are crucial because they provide means for finding solutions to a particular research problem. It further helps to link the researcher's knowledge of the domain to the kinds of data that will be collected to address the research problem (Bryman & Bell, 2003). Given the research problem, two main research questions were formulated. According to Werner and Schoepfle (1987) the main research questions are referred to as 'grand tour' questions. Collis and Hussey (2009) mentioned that by having a grand tour question, a researcher is exposed to other potential lines of enquiry. It will also help the researcher to focus on a particular direction and on certain phenomenon. Sub-research questions are also formulated to answer the main research question. Creswell (2009) suggests not more than seven subsidiary questions for one or two grand tour research questions. The current research has formulated two main research questions and seven sub-research question in line with (Collis & Hussey, 2009; Creswell, 2009). These research questions will enable the objectives of the three main focus areas to be achieved. Firstly, capturing the magnitude of common defects in new residential buildings and determining new homeowners' satisfaction levels in the quality of their new homes. Secondly, create awareness in the use of defect reporting in New Zealand. Finally, it will enable the understanding of house developers' current quality practices and the warranties available for new homeowners when defects occur at handover. Therefore the specific questions this study is designed to investigate, and answer, to improve quality achievement levels in new residential buildings, are listed in Table 5.1.

With the research questions listed in Table 5.1, it becomes easier to find solutions to the current research problems by linking the knowledge of the problem to the kinds of data that will be collected, as explained by Bryman and Bell (2003). Given the variety of issues to be explored, this research takes the premise that the approach to be used by a particular study should be driven by the nature of the research questions. Therefore the overall aim of this research is to improve quality achievement levels in new residential building through the

minimisation of defects that occur before or after handover of projects in New Zealand.

**Table 5.1:** Research questions and objectives

| Research Questions                                                                                        | Research Objectives                                                                                         |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| How can defects be minimised so that the quality of new residential buildings is enhanced in New Zealand? |                                                                                                             |
| What is the satisfaction level of new homeowners to quality achievement in new residential buildings?     |                                                                                                             |
| What are common defects occurring at hand over of new residential buildings?                              | To determine common defects occurring at handover of new residential buildings                              |
| What is the extent of defects in new residential buildings in New Zealand?                                | To capture the extent of defects in new residential buildings in New Zealand                                |
| What are the key causes of defects in new residential buildings?                                          | To identify key causes of defects in new residential buildings in New Zealand                               |
| What is the satisfaction level of new homeowners with the quality of their new homes?                     | To determine new homeowners' satisfaction levels with the overall quality of their new homes                |
| What is the level of use of independent building inspection at hand over of new residential buildings?    | To determine the level of use of independent building inspections at hand over of new residential buildings |
| Are there uniform warranties available for new homeowners?                                                | To determine whether there are uniform warranties available for new homeowners                              |
| What is the current quality performance of house developers?                                              | To determine the current quality performance of house developers                                            |

#### 5.4.1: Generalisability

Collis and Hussey (2009) explain generalisability as the application of research results to cases or situations beyond those examined in the research. According to Gummesson (1991), the use of statistics is just one type of generalisability. Norman (1970) argues that generalisability is possible from a very few cases or even a single case provided the analysis captured the interactions and characteristics of the phenomena studied. In similar vein, Yin (1994) explained that generalisability is concerned with the researcher's analysis and interpretation of contexts in order to be able to predicate a theoretical understanding of the examined situation and field. Sekaran and Bougie (2010)

mentioned that for wider generalisability, the sampling design has to be logically developed and details and data collection methods should be followed carefully.

The problem of defects at handover in new residential buildings is both specific and generalisable. The problem is specific in that it has not been addressed in the house building sector. This was established during the literature survey. However, the solution of the problem should be as generalisable as possible to new homeowners and residential buildings within the residential building sector. Consequently, the methodological approach, as well as methods selected, must be able to deliver a broadly generalisable result.

#### **5.4.2: Nature of the research**

According to Collis and Hussey (2009), research can be classified into four types, according to the purpose of the research: exploratory, descriptive, analytical and predictive. Collis and Hussey's (2009) classification describes research sophistication as graduating from exploratory to descriptive, to analytical and predictive research. In descriptive research the questions posed would include words such as 'what' or 'how' because the aim is to describe a phenomenon. Collis and Hussey go further to explain that descriptive research describes phenomena as they exist, and identifies and obtains information on the nature of problems or issues. Similarly, Sekaran and Bougie (2010) pointed out that the goal of descriptive research is to offer researchers a profile to describe important aspects of the phenomenon of interest from an individual, organisational, industry oriented, or other perspectives. In the current study the main research questions are:

- *Q1. How can defects be minimised so that the quality of new residential buildings is enhanced in New Zealand?*
- *Q2. What is the satisfaction level of new homeowners to the quality achievement of new residential building?*

This suggests that the current research falls under the descriptive research classification, because answering the research question will require rich contextual description of data. This is different from exploratory research which includes the word 'why' in the research questions to look for patterns, ideas or

hypotheses in a given problem or issue. Therefore the logic of enquiry for this research includes the use of inductive reasoning for generating data, establishing patterns, consistencies and meanings in order to understand quality achievement levels in house construction and the satisfaction of homeowners.

### **5.5: Philosophical background**

In conducting research of this size, it is necessary to understand the philosophical position that underpins it. This will allow the researcher to clarify alternative research designs and methods for a particular research project (Easterby-Smith, et al., 2008). In order to establish the philosophical position of this research, its epistemological and ontological background will be examined. Sections 5.5.1 and 5.5.2 discuss these issues. Subsequently it is imperative to situate the research background in the relevant research paradigm. The choice of a research paradigm has effects on both methodology and research methods. For this reason, before beginning a research project, the philosophical positions need to be discussed (Amaratunga, et al., 2002).

#### **5.5.1: Ontological background**

In simple terms ontology is a philosophical assumption about the nature of reality (Bailey, Ford, & Raelin, 2009). According to Bryman and Bell (2003, pp. 19-20) objective ontology views social phenomena and their meanings as existing independently of social actions, while constructivist ontology infers that social phenomena are shaped through social interaction in a constant state of revision.

#### **5.5.2: Epistemological background**

Epistemology provides a philosophical background for deciding what kinds of knowledge are legitimate and adequate. Therefore, epistemological attempts to reflect on the methods and principles through which reliable and verifiable knowledge is produced (Knight & Turnbull, 2008). Similarly Collis and Hussey (2009) describe epistemological assumptions as what constitutes valid knowledge in the context of the relationship between the researcher and that being researched (Guba & Lincoln, 1994). That is how we come to know 'the

world' about us and the different levels of proof we aspire to (Greene, 2006; Krauss, 2005).

### **5.5.3: Ontological and epistemological position of the research**

Love, Holt and Li (2002) argue that robust methodological approaches that are based on both ontological and epistemological viewpoints are needed in construction management research. In this way construction management research could effectively resolve problems and issues that impact on organisational and project performance levels. In the current research, to understand quality achievement levels in new residential buildings, the ontological and epistemological position taken is as follows: that there is a social reality regarding quality achievement levels in the residential building sector and its impact on the level of satisfaction of homeowners. The research investigates whether or not this reality can be observed and understood from the perspectives of new residential homeowners and house developers in New Zealand.

### **5.6: Research paradigms**

Paradigms describe the model in which a community of scholars or scientists generate knowledge (Smith, 1998). Alternatively paradigms refer to a set or clusters of commonly held beliefs or values about a field of study. However in broader terms and within the context of the current study Collis and Hussey (2009) describe paradigms as a framework that guides how research should be conducted based on people's beliefs and assumptions about the world and the nature of knowledge. Sekaran and Bougie (2010) explain that this belief shapes and dictates how researchers should proceed with carrying out their research – what the focus should be the method to use and the way the results will be interpreted. Researchers need to understand methodological paradigms to be able to underpin, support and justify a chosen research approach. To this end, the following sections consider the characteristics of positivism and phenomenology within the context of the current research problem.

### **5.6.1: Positivist paradigm**

The positivist paradigm attempts to discover and justify knowledge on the basis of empirical processes (Krauss, 2005). Such a paradigm is based on careful observation and measurement of objective reality in the world. Research focuses on testing or refining existing laws or theories. The positivism paradigm uses a quantitative research method that operates on a strict set of rules of logic and research activity directed at understanding the underlying causes of natural phenomena (Amaratunga, et al., 2002; Burns & Grove, 2001; Polit & Beck, 2006). Neuman (2003, p. 71) simplifies the empirical process as stated below:

*“A positivist approach implies that a researcher begins with a cause-effect relationship that he or she logically derives from a possible causal law in general theory. He or she logically links the abstract ideas of the relationship to precise measurement of the social world. The researcher remains detached, neutral and objective as he or she measures aspects of social life examines evidence and replicates the research of others”.*

The positivist approach has an ontological assumption that social reality is objective and external to the researcher. The epistemological position of a positivist is that only phenomenon that is observable and measurable can be validly regarded as knowledge (Collis & Hussey, 2009).

### **5.6.2: Phenomenological/interpretive paradigm**

The phenomenological paradigm like any other methodology is said to have its root in the interpretative or naturalistic paradigm (Amaratunga, et al., 2002; Smith, 1998). Phenomenology is the study of “lived human phenomena within the everyday social context in which the phenomena occur from the perspectives of those who experience them” (Titchen & Hobson, 2005, p. 121). The individual and the world are not constituted independently of one another. Hence what is investigated cannot be unaffected by the research process (Collis & Hussey, 2009). Therefore phenomenology attempts to understand the world as it is known (Cormack, 2000). Phenomenology looks at the whole and takes account of the context of the situation, timings, subjective meanings and intentions within partial situations. Understanding ‘lived experiences’ marks phenomenology as a research philosophy as well as a research method (Creswell, 2009). As a research philosophy, phenomenology focuses on the

subjective experience of the individual studied. The interpretivist has an ontological belief that social reality is subjective because it is socially constructed. There is an attempt to minimise the distance between the researcher and that which is researched (Bailey, 2007; Collis & Hussey, 2009). Thus the epistemological position of the interpretive paradigm is that what is learned in research does not exist independently of the researcher. The methodological approach of interpretivism is qualitative (Bailey, 2007). The main features of the positivist and phenomenological paradigm are given in Table 4.4 by Easterby-Smith, Thorpe, and Lowe (1991). Weber (2004) believes that the distinction between these two schools of thought (positivism and interpretivism) is not perfectly clear and that the two are not entirely opposed.

**Table 5.2:** Features of positivist and phenomenological paradigm Easterby-Smith et al., 1991)

|                                  | <b>Positivist paradigm</b>                                                                                                                                     | <b>Phenomenological paradigm</b>                                                                                                                               |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic Beliefs</b>             | <p>The world is external and objective</p> <p>Observer is independent</p> <p>Science is value-free</p>                                                         | <p>The world is socially constructed and subjective</p> <p>Observer is part of what is observed</p> <p>Science is driven by human interests</p>                |
| <b>Researcher should</b>         | <p>Focus on facts</p> <p>Look for causality and fundamental laws</p> <p>Reduce phenomena to simplest events</p> <p>Formulate hypotheses and then test them</p> | <p>Focus on meanings</p> <p>Try to understand what is happening</p> <p>Look at totality of each situation</p> <p>Develop ideas through induction from data</p> |
| <b>Preferred methods include</b> | <p>Operationalising concepts so that they can be measured</p> <p>Taking large samples</p>                                                                      | <p>Using multiple methods to establish different views of phenomena</p> <p>Small samples investigated in-depth or over time</p>                                |

### 5.6.3: Mixed method research

Mixed method research is the application of or combination of several approaches to the study of the same phenomenon (Tashakkori & Teddlie, 2003). Johnson, Onwuegbuzie and Turner (2007) describe mixed methods research as a situation where a single investigator collects and analyses data,

integrates the findings, and draws inferences, using a combination of qualitative and quantitative approaches. Other names by which mixed method research is known include mixed methods research (Johnson, et al. 2007), multi-methods (Brannen 2005), multi-strategy (Bryman, 2006), mixed methods (Creswell, 2009; Tashakkori & Teddlie, 2003), mixed methodology (Tashakkori & Teddlie, 1998) complementary research (Flick, 2006), and triangulation (Webb, Campbell, Schwartz, & Sechrest, 1966). In other words, when a research project explores mixed research questions with interconnected qualitative and quantitative components or aspects (e.g. questions including “what and how” or “what and why”), the end result of the study would be derived from both qualitative and quantitative approaches (Plano Clark & Creswell, 2008).

In the current research, the research questions used are in the form of ‘what’ and ‘how’ questions, and therefore point the study towards a methodological position that incorporates both qualitative and quantitative approaches. This is in line with Clark, Creswell, Green and Shope (2008) above. Both qualitative (subjective) and quantitative (objective) approaches are considered appropriate for the study, thus the relationship between the research questions and study objectives have been interlinked to allow for the use of both research approaches.

Mixed methods research has been recognised as the third major research approach or research paradigm in addition to qualitative and quantitative research (Teddlie & Tashakkori, 2003; Johnson, et al., 2007; Denscombe, 2008). The primary philosophy behind this research method is that of introducing pragmatism to the research process (Feilzer, 2010; Johnson, et al., 2007). Pragmatism offers an immediate and useful middle position of philosophy and methodology which benefits research (Onwuegbuzie & Leech, 2005). Thus a mixed methods research follows practical and outcome-oriented methods of inquiry (that is action based) and leads iteratively to further action which consequently eliminates doubts. Johnson and Onwuegbuzie (2004) also suggest that the approach offers a method for selecting methodological mixes that could help researchers to better answer many research questions. Thus knowledge could be approached from a variety of viewpoints, perspectives and standpoints (Johnson, et al., 2007).

Further, Sandelowski (2004) explains that knowledge obtained from such a variety of approaches is not pedestrian but rather particular. Mixed methods benefits research by improving confidence in the material that has been gathered from a variety of sources. Hewson (2006) explains that confidence is achieved through convergence and cross-validation of the findings; and wherever there are differences in the findings, these can be easily identified for further research. Greene, Caracelli and Graham (1989) give reasons for employing mixed methodological approaches and how these could benefit research (Bryman, 2006). These reasons are outlined briefly below.

- a) Triangulation: seeking convergence and substantiation of results from different methods when studying the same phenomenon;
- b) Complementarity: which means seeking to elaborate, enhance, illustrate, or clarify the results from one research method with results from other research method;
- c) Development: involves using the results from one method to help inform another method;
- d) Initiation: discovering paradoxes and contradictions that may lead to the review of original research question(s); and
- e) Expansion: seeking to expand the breadth and range of an inquiry through the use of different methods for different inquiry components.

These key reasons outlined by Greene, Caracelli and Graham (1989) are of paramount importance when considering the use of mixed method research. The recent history of mixed method research can be traced back to the concept of triangulation. According to Denzin (1978) triangulation is the combination of methodologies in the study of the same phenomenon. Four distinguishable forms of mixed methods research or triangulation have been outlined by Denzin (1978). These include:

1. Data - a situation where data is gathered using several sampling strategies. This may involve collecting data at different times, different social situations, or from a variety of people.

2. Investigator - refers to the use of more than one researcher (multiple informants) in the field to gather and interpret data with a view to balance out the subjective influences of single individuals.
3. Theoretical - refers to the use of more than one theoretical position in interpreting research data.
4. Methodological triangulation - refers to the use of more than one method for gathering data. The two variants of methodical triangulation are 'within-method' which employs varieties of the same method to investigate a research issue; and 'between-method', that involves contrasting research methods such as questionnaires and observations (Denzin & Lincoln, 2005).

Methodical triangulation is dominant in the use of the four forms of triangulation (Denscombe, 2008; Johnson, et al., 2007). The intention is to maximise the validity of a research project by playing the chosen methods off against one another (Jupp, 2006).

#### **5.6.4: Qualitative research**

Qualitative research attempts to focus on questions concerned with developing an understanding of the meaning and experience dimensions of humans' lives and social worlds (Fossey, Harvey, McDermott, & Davidson, 2002). Similarly, Burns and Grove (2001) describe qualitative research as a systematic, subjective approach used to describe life experiences and give them meaning. It is a research approach that explores attitudes, behaviours and experiences using interviews, observations or focus groups (Parahoo, 2006; Denzin, 2010). The focus in qualitative research is to gather mainly non-numeric data rather than measurements (Borrego, Douglas, & Amelink, 2009). This gathered information is then analysed in an interpretative manner, and may be subjective, impressionistic or even diagnostic.

According to Creswell (2003), qualitative research is an inductive process which begins by collecting detailed information from participants and forms this information into categories or themes. This inductive process enables a full and rounded humanistic understanding of a situation rather than an entirely objective scientific quantification of a current situation. These themes or

categories can then be developed into broad patterns, theories, or generalisations which will subsequently be compared with personal experience or with existing literature on the subject matter.

Qualitative research provides rich data, thick description and a greater depth of analysis to give a fuller understanding of the phenomena under investigation. Bryan (1984) explains that the validity of data in qualitative research does not depend on the numbers but rather the logical integration of data from different sources and different methods of analysis, into a single consistent interpretation. Terms like thematic analysis have been seen as a foundational method for qualitative analysis because they provide skills that are useful for conducting many other forms of qualitative analysis rather than a standalone methodology (Boyatzis, 1998; Braun & Clarke, 2006; Ryan & Bernard, 2000).

#### **5.6.5: Quantitative research**

Quantitative Research on the other hand focuses more in counting and classifying features and constructing statistical models and figures to explain what is observed. Quantitative research generates statistics through the use of large-scale survey research, using methods such as questionnaires or structured interviews. Thus a quantitative research approach involves collecting and analysing numerical data and applying statistical tests (Amaratunga, et al., 2002). Similarly Craig (2008) explains that quantitative researchers tend to use a multitude of quantitative terms such as frequencies, numbers, amounts, trends, patterns and relationships for data analysis. It was considered that quantitative measures would usefully supplement and extend qualitative analysis. Amaratunga et al. (2002) explain that one of the weaknesses of the quantitative method in the built environment is in its tendency to measure 'snapshots' of a situation. The current study believes that by using both quantitative and qualitative approaches, this weakness identified by Amaratunga et al. (2002) will be balanced by the use of both approaches.

#### **5.6.6: Qualitative versus quantitative research**

Yin (1994) explains that there is strong and essential common ground between qualitative or quantitative research approaches. Both seem complementary in most research. For example Amaratunga et al. (2002) explain that quantitative

research could assist the qualitative side of a study during design, by finding a representative sample and locating deviant samples. On the other hand qualitative data could help the quantitative side of a study during design by aiding with conceptual development and instrumentation. In the same line of interpretation Sandelowski (2004) mentioned that the data derived from both qualitative and quantitative research methods can be linked together, so that numbers and words in each data set can be preserved. Otherwise a data set can be converted with qualitative data into becoming quantitative data and vice versa. Cant (1998) suggests that the difference between the two approaches is in the ways by which the findings are described. A comprehensive distinction between both approaches is presented in tabular form on Table 5.3. The table was produced in line with Creswell (1994, p. 5) and Neuman (2000).

**Table 5.3:** Differences between quantitative and qualitative research approach (Creswell, 1994; Neuman, 2000)

| Quantitative research                                                                                             | Qualitative research                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Reality is objective and singular, and apart from the researcher                                                  | Reality is subjective and multiple, as seen by participants in a study                                                      |
| Researcher is independent of that being researched                                                                | Researcher interacts with that being researched                                                                             |
| Researcher is assumed to be value free and unbiased                                                               | Researcher is value-laden and biased, with values generally made explicit                                                   |
| Theory is largely causal and deductive                                                                            | Theory can be causal or non- causal, and is often inductive                                                                 |
| Hypothesis that the researcher begins with is tested                                                              | Meaning is captured and discovered once the researcher becomes immersed in the data                                         |
| Concepts are in the form of distinct variables                                                                    | Concepts are in the form of themes, motifs, generalisations and taxonomies                                                  |
| Measures are systematically created before data collection and are standardised                                   | Measures are created in an ad hoc manner and are often specific to the individual setting or research                       |
| Data are in the form of numbers from precise measurement                                                          | Data are in the form of words from document, observations and transcript                                                    |
| There are generally many cases or subjects                                                                        | There are generally few cases or subjects                                                                                   |
| Procedures are standard and replication is assumed                                                                | Research procedures are particular, and replication is rare                                                                 |
| Analysis proceeds by using statistics, tables and charts, and discussing how what they show relates to hypothesis | Analysis proceeds by extracting themes or generalisations from evidence and organising data to present a consistent picture |

### 5.6.7: Selection of research method

Chapters 1 to 4 within this research thesis show that defects are a problem within residential buildings. The use of defect reporting organisations by new home owners to inspect and report defects is not widely understood within the construction industry or indeed by home owners themselves. Lack of customer satisfaction to the quality of their new homes was also identified as a problem. Therefore it is important to select a research method that will help achieve the research objectives and address the research question.

Creswell and Tashakkori (2008) gave three criteria for selecting a research method as the research problem, the personal experience of the researcher and the audience. Similarly, Yin (1994) identifies three conditions for choosing a research approach, the type of question inquired; the control over actual behavioural elements, and the degree of focus on historical or contemporary events. Therefore Table 5.4 depicts the outcome of the intersection between the research strategy and the three conditions mentioned above.

**Table 5.4:** Research strategies and characteristics (Yin, 1994)

| Strategy          | Form of research question            | Requires control over behavioural events | Focuses on contemporary events | Application in this research |
|-------------------|--------------------------------------|------------------------------------------|--------------------------------|------------------------------|
| Experiment        | How, Why                             | Yes                                      | Yes                            | No                           |
| Survey            | Who, What, Where, How many, How      | No                                       | Yes                            | Yes                          |
| Archival analysis | Who, What, Where, How many, How much | No                                       | Yes/No                         | No                           |
| History           | How, Why                             | No                                       | No                             | No                           |
| Case study        | How, Why                             | No                                       | Yes                            | No                           |

In this particular research where the research questions are in the form of “What” and “How”, survey strategies (questionnaires and interviews) are deemed appropriate where the researcher does not require control over behavioural events and the study may focus on contemporary events (Yin, 1994). To address the research questions analysed in Section 5.4 around these three focus areas, the methods used to collect data include a questionnaire

survey and interviews. As a result of this lack of understanding of the extent of defects, defect reporting and customer satisfaction levels in the house building sector, it would seem illogical to use single survey techniques. The techniques chosen will help to explore in depth the phenomena of defects in new residential buildings, as well as new home owner satisfaction levels, to identify ways in which improvement can be made to the house building process. According to Gray (2009) the choice of data gathering methods is influenced by the research methodology, which in turn is influenced by the theoretical perspectives adopted and the epistemological stance.

The research paradigm is determined by the nature of the research problem being examined (Easterby-Smith, et al., 2008). This research is underpinned by the belief that knowledge could be approached from a variety of viewpoints, perspectives and standpoints (Johnson, et al., 2007). Thus, this research belongs to the pragmatic paradigm that seeks to understand phenomena systematically and coherently. In the context of the current study and based on the research questions, it seeks to understand the extent and common defects in new residential buildings and the satisfaction levels of new homeowners. It further seeks to understand house building developers' current quality practices. The answers to the two main research questions listed in Section 5.4 of this research will be inferred from the views of research participants through questionnaire surveys and interviews.

Given the nature of the current research problem and the different research methods available, it is appropriate to employ a mixed methods approach. This research uses a mixed methods research approach that involves a first phase of quantitative data collection, followed by a qualitative phase. This arrangement is necessary so that the quality performance levels of new residential buildings can be adequately investigated. The rationale for this arrangement is based on the nature of the research problem and research questions as indicated in Section 5.3 and 5.4 of this study. As explained by Johnson and Onwuegbuzie (2004), high-quality mixed research requires high degrees of integration at different stages of the study. This could be achieved while forming research questions, during sampling, data collection and analysis, while making interpretations, and drawing conclusions. A mixed research method is chosen for the study because the research objectives and questions

will benefit from a combination of different approaches for the purposes of triangulation, complementarity, development, initiation and expansion. Methods used include surveys and interviews to establish the current quality performance in the residential building sector and to suggest improvements that will benefit every stakeholder in the residential building sector in New Zealand. Therefore, the two major data collection techniques used in this research (questionnaires and interviews) will establish patterns, consistencies and meanings from the data collected from new homeowners and house building developers. These two techniques will also allow an in-depth understanding in quality performance of the residential building sector. The techniques are explained in detail in proceeding sections. The chosen methods will utilise the strengths of both the qualitative and quantitative research method. According to Amaratunga et al. (2002) the combination of the strengths and weaknesses of both the qualitative and quantitative research approaches can focus on their relevant strengths (Onwuegbuzie & Leech, 2005). The study envisages that the final output gives more credence to the mixed methods research approach employed in this research, consequently enhancing the validity of the current research findings.

### **5.7: Research design**

Yin (1994) describes research design as the logical sequence that links the data to the initial research question and finally to its conclusion. Decisions on research design are fundamental to both the philosophical background underpinning the research and the contribution that the research is likely to make (Dainty, 2008). Tan (2002) describes research design as the strategies, plans and steps needed to answer a research question. It involves two major aspects as follows: specifying precisely what is to be researched and determining the best way to do it (Babbie, 1992). Research design includes the overall approach to be taken and detailed information on how the research will be carried out and with whom and where (Maykut & Morehouse, 1994; O'Sullivan, Rassel, & Berner, 1989). It was considered that a survey would best allow the determination of the extent and common defects at handover, new homeowners satisfaction levels, the current quality practice of house building developers, available warranties for new homeowners' and the use of a defect reporting organisation for new homes. According to Babbie (2008) surveys are

appropriate for research studies that involve the use of individuals as units of analysis, such as these addressed in this current study.

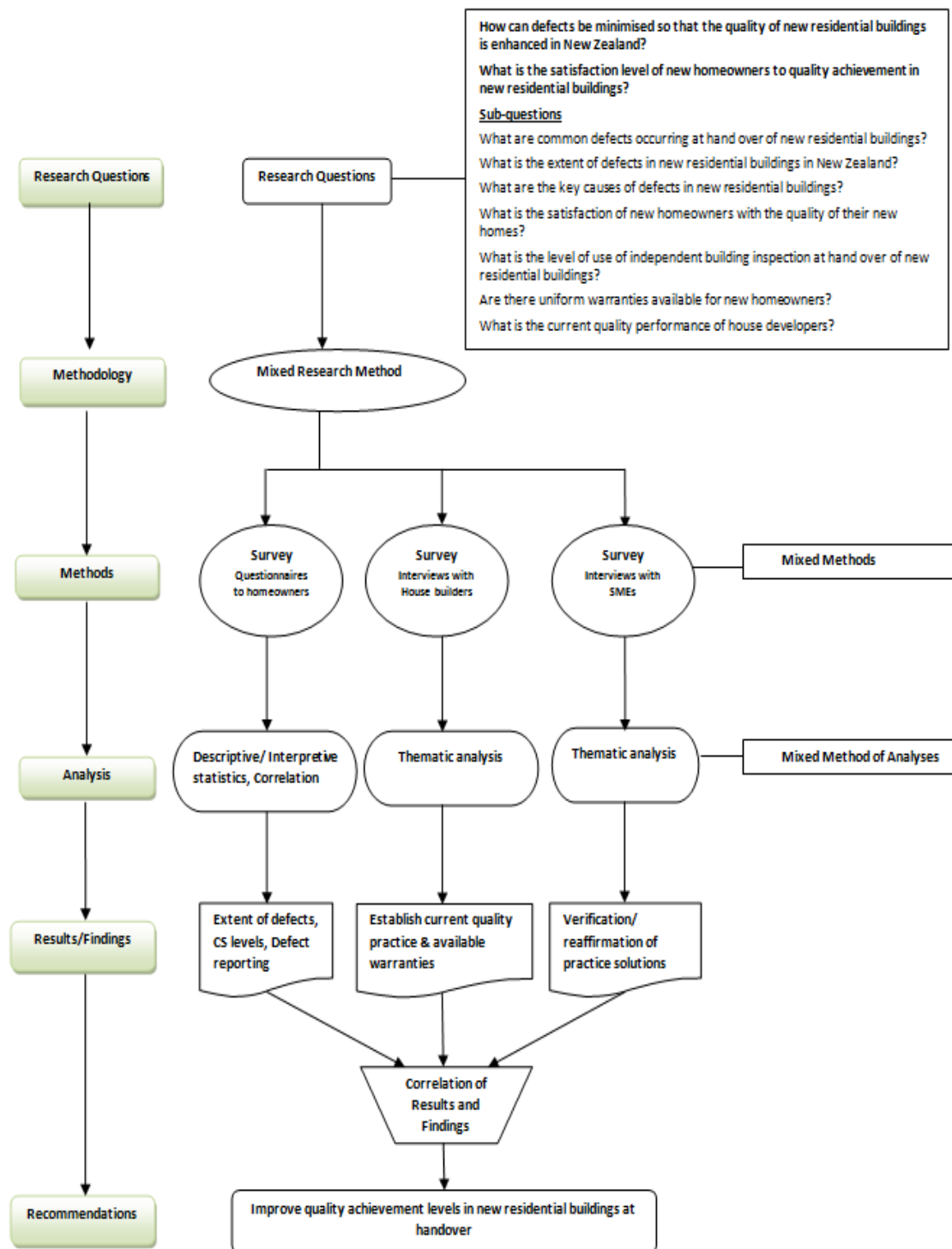
#### **5.7.1 Typologies of mixed methods research for the current study**

Figure 5.1 presents the typologies of the current research. The figure shows the sequential and multi-stranded integration of quantitative and qualitative methods adopted for the study. Though both research methods were equally as effective, the quantitative method was more dominant. The mixed-method nature of this research was assumed mainly during the data collection and analysis stages as indicated in Figure 5.1. This layout is in line with Bryman (2006) where five key aspects of mixed methods research were outlined.

#### **5.8: Pilot study**

Two pilot studies were performed for this research in two phases. Firstly telephone calls were made to 5 building companies for their records of defects or call backs from new homeowners/customers. These developers were unable to provide this information and claimed that such data was not available as they do not keep record of call backs. They further indicated that since defects observed by new homeowners are mostly minor and aesthetic in nature, these defects get rectified immediately without having to keep a record. It was apparent that there is a lack of performance monitoring of their building products, hence the poor record keeping.

Secondly a semi-structured questionnaire was also administered to new home owners within two suburban areas in Auckland. This was to test the efficiency of the questionnaire. A total of 42 questionnaires were sent out and 35 were returned corresponding to a 70% response rate. According to Parfitt (2005), to determine a questionnaire's usefulness and suitability, it is important to conduct a pilot test with at least twenty participants. Thus 35 responses from 42 participants are in line with Parfitt's (2005) suggestion. The initial questionnaire was later modified in line with the response received from this pilot survey. A large proportion of the changes made to the initial questionnaire dealt with rewording/rephrasing of the questions.



**Figure 5.1:** Typologies of mixed methods research for the current study

Other changes as a result of the pilot survey relate to the structure of the questionnaire. For example some questionnaires with Likert scales had to be written to include both positively and negatively-worded questions to prevent participants from answering questions at one end of the scale.

As part of the modification done on the questionnaire to new homeowners, a standard list of defects extracted from previous literature (Craig 2008) had to be included in the questionnaire survey. This was to enable objective two of this current study to be achieved (capturing common defects). In this way the inability to obtain a record of defects (call backs) from house developers could be addressed. The list of defects that were extracted from previous literature was further confirmed with the list of items that make up the checklist of typical building inspectors (Consumer Build, n.d.).

The list of defects was condensed into 43 defects for the purpose of the survey. For example, a defect that relates to damaged door and window handles regardless of the type and location of the window and door in the house is categorised as door/window handles. The research participants were not restricted to the list of defects given in the questionnaire. They had opportunity to include any other defects that they found to the list. The list of defects is presented in Table 5.5.

**Table 5.5:** Standard list provided for participants

|                      |                      |                    |
|----------------------|----------------------|--------------------|
| Poor finish          | Brackets             | Bath panel         |
| Uneven painting      | Sinks/WHB            | Piping work        |
| Nail pops            | Window sills         | Drainage           |
| Ceiling joint        | Seals/Rubber linings | Leaks              |
| Kitchen units        | Toilet/WC            | Handrails          |
| Flooring             | Glazing              | Walls              |
| Wall tiling          | Roof flashing        | Garage door        |
| Door/Window          | Cracks               | Wardrobes/Shelves  |
| Worktops             | Staircase            | Plasterboard       |
| Door stopper         | Locks                | Trickling vent     |
| Extractor            | Roofing/Tiles        | Spouting           |
| Hob and Oven         | Roof gutter          | Creaking/Squeaking |
| Socket/Switches      | Insulation/Lagging   | Labels             |
| Skirting/Architraves | Concreting           | Stains             |
|                      |                      | others             |

## **5.9: Research issues**

### **5.9.1: Ethical issues**

Ethical consideration is fundamental in any research project. Therefore prior to commencing this research project ethical clearance was sought from the AUTECH committee. The current study considered ethical issues at all stages of the research design and execution process. An application was made to the AUTECH Ethics Committee on 14 June 2011. Ethics approval was granted by the Human Ethics Committee on 03 August 2011 (AUTECH Reference Number 11/165 in Appendix A1). An ethics application was made on the University's approved form EA1 and other supporting documents such as the questionnaires to new homeowners, participant information sheet (included in Appendix B1 and A2); and participant consent form (included in Appendix A3) were attached. All University ethics guidelines and principles were adhered to in the formulation and administration of the questionnaire and interviews.

The objectives of the research were explained to all participants by attaching a participant information sheet along with the questionnaire, so as to enable every participant to understand the aim of the research. Participants were also informed that the information provided would be used for the completion of a PhD Degree and that their participation was voluntary. It was necessary to inform the participants that there was no cost involved in participating in the survey, other than their time and sharing of views and experiences. They were told their rights to accept or decline their participation at any time during the study (including withdrawal of information they had provided). All participants were informed that the completion of the questionnaire would be considered as their consent to participate in the research.

In terms of privacy and confidentiality, all participants were assured of their rights to privacy, confidentiality and anonymity by assigning participants with a numerical code to protect their identity. No participant was directly identified within this research. The information gathered was kept confidential and was not disclosed to anyone except the researcher and project supervisors. Moreover, any information related to organisations or participants was not

shared or discussed with any other participants. The confidentiality of each participant was protected throughout the research.

Every step was taken to provide participants with the true nature of the research and of the use of any information they provided. Participants were informed that all information provided would be used solely for this research. There were no foreseeable risks on the part of the participants and the researcher in this study considered that all other ethics principles were upheld. However potential discomfort and risk associated with this research were limited to privacy and confidentiality. All responses were treated in strict confidence.

Another ethical issue for consideration was the cultural concern of participants. There were no matters of cultural concern raised; nonetheless cognisance was given to the three principles of the Treaty of Waitangi throughout the study. The research did not strictly focus on any ethnic groups but a mixed group of people. This research study also considered the three main principles of the Treaty of Waitangi which provides equal rights of partnership, participation and protection of all ethnic groups.

The participant information sheet also included contact details for the research supervisor and AUTECH to answer any concerns that the participants may have had about the research. All the documents relating to the research participants such as completed questionnaires were stored in a secure environment with access limited to the researcher. The Information sheet is attached in Appendix A2.

### **5.9.2: Research Scope**

The data used for this study was collected from new residential homeowners within five regions in New Zealand. These were Auckland, Canterbury, Otago, Wellington, and Waikato. A total of 34 local territorial authorities out of the 67, in all of the regions were covered, which meant about 51% of the areas were included (see Section 1.7). The local territorial authorities are presented in Table 5.6. The initial plan was to cover all the local territorial authorities (67). However, upon closer examination major building activities fell within 34 territorial authorities, thus the building works outside of these locations were not considered. Also the study selection criteria explained in Section 5.11.3 had

provided a good filter of information which was only available in the 34 territorial authorities.

**Table 5.6:** Data coverage area

| <b>Auckland Region</b> | <b>Canterbury Region</b> | <b>Otago Region</b> | <b>Wellington Region</b> | <b>Waikato Region</b> |
|------------------------|--------------------------|---------------------|--------------------------|-----------------------|
| Auckland               | Christchurch             | Central Otago       | Wellington               | South Waikato         |
| North Shore            | Timaru                   | Dunedin             | Porirua                  | Hamilton              |
| Papakura               | Ashburton                | Waitaki             | Kapiti                   | Thames Coromandel     |
| Franklin               | Hurunui                  | Clutha              | Upper Hutt               | Hauraki               |
| Waitakere              | Mackenzie                | Queenstown Lakes    | Masterton                | Waikato               |
| Rodney                 | Selwyn                   |                     | Carterton                | Matamata Piako        |
| Manukau                | Waimakariri              |                     | Hutt City                | Waipa                 |
|                        | Waimate                  |                     |                          | Otorohanga            |

### **5.9.3: Research Limitation**

This study is one of the first undertakings to capture the extent and common defects at hand over of new residential buildings and customer satisfaction levels in New Zealand. One of the data collection methods used in this study was a postal survey. A postal survey was considered as a method for obtaining information from new homeowners located across the breadth of New Zealand, because it could help to cover a large sample size (1296). It was considered above other data collection methods such as like telephone calls or an online survey despite some of its limitations. For example, postal surveys are time consuming and are usually not appropriate for research with a limited time frame. There is also the risk that the response rates may be low compared to methods where more direct contact with the research participants could generate more responses (Fellows & Liu, 2009). However in the current study, incentives were offered to the research participants, so that the response rate could be improved. Participants of the first survey (a questionnaire) were entered into a prize draw where 10 participants were randomly selected once all the questionnaires were received. Incentives significantly increase response rates in mail surveys and have been used in a great number of studies (James

& Bolstein, 1992; Jobber, Saunders, & Mitchell, 2004; Singer, Van Hoewyk, & Maher, 1998). An incentive is an important part of a postal survey method as it helps to encourage participants to complete the questionnaire (Fink, 2003). The kind of incentive offered in this research study was a material incentive which was appropriate to the research study and was purely to assure respondents that the researcher appreciated and acknowledged their time and effort (Fink, 2003).

There were high returns in the first few days of the survey, but these decreased significantly in the second week and remained low until the end of the survey period. A significant number of the questionnaires were returned because addresses could not be located, particularly around the Canterbury region where rebuilding work after the 2011 earthquake is underway. Furthermore, many respondents provided invalid answers, and therefore their questionnaires were incomplete. Future mail surveys could consider a generous timeframe for data collection. Also it may be useful to send out an initial mail to notify participants of their potential participation in the research, as a way of improving the survey response rate. However, this could be more expensive considering the sample size.

A total number of 216 usable questionnaires were collected representing an overall response rate of about 21%. Although the response rate was lower than expected, the total number of responses is significant for any statistical analysis, as this satisfies Central Limit Theorem (sample size > 30). Subsequent interviews with house developers and subject matter experts complimented this low response rate. Therefore the triangulation desired of the research methods was achieved.

For the second survey, established house developers having technical expertise and franchises, were selected and with sufficient experience required to provide the information needed to address the research problem.

#### **5.9.4 Reliability**

Reliability means the absence of differences in results if research were to be repeated (Collis & Hussey, 2009). Alternatively Yin (1994) believes that the goal of reliability is to minimise errors and biases in a research. Therefore reliability

is the ability of a measurement instrument to generate the same answer in the same situation time after time. Data reliability relates to data source and the identification of the position held by the research participant in completing the questionnaire (Oppenheim, 2000). Therefore, it was critically important that only new residential homeowners completed the questionnaire. Also, it was imperative that only selected house building developers who had sufficient knowledge and experience about new house construction were interviewed. The intention of this research is to limit the range and scope of the study such that the findings would be robust and repeatable within the context of the new residential buildings that make up the results of the survey. However the low response rate does in some ways limit the reliability of the research, though the total number of responses was statistically significant. Nevertheless, it was anticipated that the combination of the first survey (a questionnaire) in conjunction with the second survey (interviews) would limit any threat to the reliability of the study. According to Komu (2008) it is not the sample size in research that determines scientific rigour, rather it is the consistency, systematic nature and fitness for purpose that matters.

#### **5.9.5: Validity**

Validity is the ability to generalise findings outside a study, the quality of measurement, and the proper use of procedures (Neuman, 2003). Creswell (2003 p.196) identifies eight strategies to check the accuracy of findings in a research. They include:

- Triangulating different data sources of information
- Using member checking to determine the accuracy of the qualitative result
- Using rich thick description to convey the findings
- Clarifying the bias the researcher brings to the study
- Presenting negatives or discrepant information that runs counter to the themes
- Spending prolonged time in the field

- Using peer debriefing to enhance the accuracy of the accounts
- Using eternal auditors to review the entire project

It can also be assumed that the researcher has followed the procedural perspectives listed above to ensure that the findings accurately measures what it is supposed to measure. The result of the analysis has been validated using interview techniques with subject matter experts as indicated in the research framework. The result of the validation is presented in Section 7.9. Thus this research can be deemed to be valid because it has been designed to measure what it was proposed to measure within the research objectives.

## **5.10: Sampling frame**

### **5.10.1: Unit of analysis**

In this study, building developers and new homeowners in New Zealand have been selected as the main sample frame. The reason is that house developers are central when considering the issues of defects in new residential buildings. New homeowners are also crucial when considering the level of customer satisfaction (Craig, 2008). A sample of new homeowners in New Zealand was randomly selected from the data obtained from 'What's on', a private company that provides 'on demand' construction intelligence for the residential, commercial, and civil building industry sectors across New Zealand and the South Pacific ([www.whatson.co.nz](http://www.whatson.co.nz)). 'What's on' is considered to have sufficient resources, experience and technical expertise in gathering information on new buildings in New Zealand. The data obtained comprised details of newly consented residential developments, locations and building developers. House building developers on the other hand were selected from the Yellow Pages based on their year of operations and the number of franchisees.

### **5.10.2: Sampling method**

Sampling is one of the crucial parts of a research process. Sample survey research is probably the best method available to social sciences related studies. This research method requires the collection of original data for describing a population too large to observe directly (Babbie, 2008). The nature of the research method employed, and the population under consideration,

largely dictate the sampling method used. In addition, the purpose of the study has a significant impact on the nature of the sample selected (Neuman, 2003; Babbie, 2008). To achieve the research objectives stated in Section 5.4, new homeowners and house developers were the populations to be considered for the survey. New homeowners were selected using a random sampling method in order to provide an unbiased subset of the population (Collis and Hussey, 2009). The random sampling method was adopted so that the population of new homeowners would be truly represented in New Zealand. This is in line with Creswell's (2003) and Neuman's (2003) definition of random sampling: that random samples are samples which represent the population because every member had an equal probability of being selected. The random numbers for the research participants was generated using Microsoft Excel from the database obtained from 'What's on'. The population size for the survey of new homeowners was determined from building consent lists published by Building Consent Authorities. The total population size of participants for the survey of new homeowners was 5,700 (obtained from an average of residential building consents issued from 2008 – 2011)

The minimum sample size for the questionnaire survey was obtained from the table for determining minimum return sample sizes for a given population size developed by Barlett, Kotrlik and Higgins (2001). The conditions used for the sample size choice are: t-value = 1.96; alpha value level = 0.50; margin of error = 0.05; and population = 6000. Thus sample size = 362.

The sampling method adopted for the second investigation was Purposive Sampling (Neuman, 2006; Babbie, 2008; Easterby-Smith et al., 2008). According to Teddlie and Yu (2007) purposive sampling techniques have also been referred to as non-probability sampling or qualitative sampling. It is a non-probabilistic method because it selects informative participants as representative of the wider phenomenon under investigation. In the same vein Babbie (2008) explains that purposive sampling is useful when there are no possibilities of specifying the whole population under study. This sampling method provides a group of participants whose characteristics reflect those of the larger population. Therefore it was imperative to use purposive sampling in the current study because house developers have the knowledge and the expertise when considering the issue of defects in new residential buildings.

### **5.11: Data collection strategy**

The data collection aspect of this research is founded in both quantitative and qualitative research, because this study sought to gather data from participants so that a rich detailed description of the phenomenon under investigation could be constructed. There are various methods of data collection for a study. The method to use depends on the nature of the information required and other prevailing circumstance relating to the research area. There is no one method that is perfect, rather any approach that will provide the required information is appropriate. The information obtained for this research was not easy to collect and tended to be sensitive. Due to the sensitivity of the nature of the information and to protect the research participants, some details of the data were deliberately excluded so that individual identity could be kept anonymous. Thus a survey method of data collection was adopted for this current study. According to Babbie (2008) surveys are an excellent vehicle for measuring attitudes and orientations in a large population. Neuman (2003) comment that, the strength of survey research design lies in its suitability for research questions about self-reported beliefs, attitudes and past behaviour patterns. Other advantages of survey research include: economy, speed, possibility of anonymity, and privacy to encourage more candid responses on sensitive subjects such as the ones addressed in this research. However the weakness of a survey generally lies in its vulnerability to systematic bias, non-response rates, and social interest responses in which participants tend to give socially desirable responses that make them look good or which are in line with what the researcher is looking for (Babbie, 2008). Nevertheless the current study was able to overcome this weakness as explained in Section 5.9.3.

Therefore, the major data collecting methods used in this research were mail questionnaire and interviews surveys. A questionnaire was used as a survey instrument for the first field investigation because it is considered to be the most ideal research instrument for a survey approach (Altinay & Paraskevas, 2008). Of note is that the best way to reach the research participants for this current study is through postal questionnaires. For the second field investigation an unstructured interview technique was adopted. Interviews were used because they are the most widely used qualitative method in the built environment sector (Amaratunga, et al., 2002). According to Silverman (2005), this technique is

very beneficial in obtaining the views and opinions of various groups of people at different levels of society on any matter or phenomenon. These two data collection techniques have been used by several researchers to collect and obtain views from homeowners and housing building developers (Curtis, 2011; Fauzi, Yusof, & Abidin, 2011a; Forcada, Macarulla, Gangoells, et al., 2012; Page, 2011b). A mailed questionnaire to new homeowners and interviews with house developers were used in order to get statistically significant results from a range of different property types, values, building technologies, and regions that would allow the study to be truly representative of the New Zealand residential building industry. An interview was further conducted with subject matter experts to validate the results from the two analyses. These two techniques will be explained in detail in the next sub-sections.

#### **5.11.1: Questionnaire survey**

The primary data was collected by administering questionnaires to new homeowners. As already mentioned the contacts of individual new homeowners were obtained from 'What's On', a private company that provides 'on demand' construction intelligence for the commercial, residential and civil building industry sectors across New Zealand and the South Pacific (<http://www.whatson.co.nz>). The initial arrangement was to collect the contact details of new homeowners from councils, but this was not possible as there were no records of newly built homes which could be readily obtained from the councils, and in addition the researcher would have had to approach 86 councils separately. The data for building consents and the value of work put in place are the most representative indicators of the number of new dwellings within a period of time. However there are no substantive records on the number of newly built residential buildings. The 'Whats On' research team manages and compiles data obtained from councils into a single common format allowing a filter of data by value, region, district or building type (<http://www.whatson.co.nz/>). It was anticipated that the survey of new homeowners using a questionnaire would provide information that could improve the, level of homeowner satisfaction, and create awareness for the use of defect reporting organisations so that the quality of finished new residential buildings in New Zealand would be enhanced. The purpose of the study had a significant impact on the nature of the sample selected.

The questionnaires, information sheets and addressed envelopes were printed over a period of two days (15<sup>th</sup> November – 16<sup>th</sup> November 2011). The collected address list of participants (from 'Whats On') was then used to post the final copy of the questionnaires along with a participant information sheet as a cover letter, together with a pre-paid return envelope. All entire research participants were identified by a code number assigned to each questionnaire to maintain their privacy and confidentiality. In total, 1032 postal questionnaires were sent to new homeowners within the research coverage area as presented in Table 5.4. The total time period provided to the research participants to complete and return the questionnaires was four weeks. The overall process of distribution and collection of questionnaires took two months from November, 2010 to January, 2011. The entire process also took into consideration all ethical issues as explained in Section 5.9.1, to avoid any discomfort to the target participants.

### **5.11.2 Interviews**

#### **5.11.2.1: House developers**

Apart from the questionnaire survey of new homeowners, the survey research also required interviews to be conducted in a very detailed manner. The participants for the interview were purposively sampled as discussed in section 5.10.2. Purposive sampling techniques are largely used in qualitative studies and could be defined as selecting units (e.g., individuals, groups of individuals, institutions) based on the specific purposes associated with answering research questions. The data obtained from the interview was not easy to gather because of the sensitive nature of the information. Due to this sensitivity and to safeguard the participating organisations' interests, many details of the organisations were deliberately excluded and their identity kept anonymous. As Craig (2008) mentioned, conducting research requires input from external parties, thus it is important to approach potential contributors with care and courtesy. The stakeholders were contacted by phone and emails and the potential benefits of the research to the industry and particularly the housing sector were discussed.

The interview was performed with 10 house developers with franchisees in the research coverage area. The interview technique applied in the current

research was a face to face interview with the use of semi-structured questions. This allowed an in-depth understanding of the research topic and its relevance to the stakeholders. The semi-structured interview also facilitates cross-questioning in the process, thereby allowing the researcher to probe answers deeply by asking further questions, or by asking for clarification of an answer (Johnson & Turner, 2003). In addition, the researcher was also able to prompt and probe for better responses, which is generally not the case when an interviewer is operating from an objective epistemological perspective. This was the main reason for choosing the semi-structured interview over other survey instruments. Even though the interview topics were pre-specified, the interview questions were open-ended, and could be reworded and covered by the researcher in any sequence or order. House developers were selected on the basis of how likely their interview would contribute to the research objectives. In their diverse and various capacities, all of the research participants have knowledge and experience in house building. This ensures that they are well aware of issues around defects, and their opinions lend credibility to the research findings.

The interview was conducted at the end of the first field investigation (questionnaire survey) to determine the current quality practice of house building developers and the available warranties for new homeowners. The sample size which consisted of 10 house developers was sufficient for qualitative analysis which is in line with Gay and Airasian (2000). Gay and Airasian (2000) explain that a small number of analysis samples consisting of individuals or selected groups for qualitative approach is sufficient.

#### **5.11.2.2: Subject matter experts**

Finally a validation exercise was conducted through interviews with 3 key industry players (i.e. subject matter experts or SMEs) to validate the findings from the current research. Subject matter experts (SMEs) are individuals who are experts in their field of activity. They were engaged in the current study to complete triangulation in the research process. The research was conscious of the need to provide feasible solutions to issues around quality improvement in new residential buildings, and for this reason SMEs were engaged to verify the research outputs and to confirm whether suggested solutions could be applied

in practice. The three key SMEs to be recruited for the validation exercise include a representative from the Home Owners & Buyers Association of New Zealand (HOBANZ), Auckland City Council (ACC) and the Master Builder Federation (MBF). The participants for the validation exercise were selected because of their experience, expertise and in-depth knowledge of the residential building sector. These research participants have achieved a measure of success in their field, holding senior positions within organisations or managing successful businesses. It was important that participants asked to be interviewed for the validation exercise were experts that had keen insights in the subject area and were in a position to influence decisions, strategies and operations within their sphere.

A face-to-face interview was conducted with three the SMEs similar to the process of interviews with house developers. The questionnaires to the SMEs are included in Appendix B3. The questionnaires contained the outlines of key issues that emerged from the questionnaire survey and interviews with house developers and other issues of relevance to the residential building sector in New Zealand. The three SMEs selected for the current study included:

1. A representative from the Homeowners and Buyers Association of New Zealand. This participant has good experience and a sound understanding of the importance of standards and the need for a robust regulatory system. The objective for approaching this SME was to enable verification of the research outputs, in terms of the effectiveness of the warranties available for new homeowners and the feasibility in practice of this study's suggested improvements.
2. A representative from the Master Builder Federation (member of the Technical Advisory Committee). This participant has over 27 years' experience in the construction industry, holding senior management positions in one of NZ's major building and civil engineering companies. The participant is also a Committee Member involved in the development of the NZS 3910:2003: NZS 3915:2005: NZIA Conditions of Contract SCC1:1996. This participant was selected as an SME to address issues pertaining to developers' performance, defective work and warranties on offer to new homes.

3. Team leader Building Control, in one of New Zealand's Local Councils. The participant has very good knowledge of the building inspection process and legislative documents used in the building industry. This participant was selected as the SME to give valued opinions on issues around building inspections and defects in new homes.

The information obtained from this verification exercise enable a re-classification of practicable solutions beyond those generated from the secondary data collection and analyses. The actual results of the verification are presented Chapter 7 in line with the key themes that emerged from the research. The verification exercise enhanced the research triangulation that pulls together all information into a meaningful conclusion in Chapters 8 and 9.

### **5.11.3: Data management**

The detail of new homeowners within the 67 territorial authorities provided at the outset of this research was vast. The initial data search yielded 34,000 new dwellings within the 67 territorial authorities from the period of 2008 to 2011. This data was then reduced to site addresses that were post coded and with only a single dwelling consent. The post coded site address was necessary to enable the delivery of the questionnaires as NZPost only identifies single explicit delivery points. A complete set of data files was later generated for the period and the 34 local territorial authorities under consideration as discussed in Section 5.9.2. The sample size of 362 for the year 2008, 2009, 2010 and of 210 for year 2011 (7 months) calculated in section 5.10.2 were randomly sampled proportionately according to the local authorities. A total number of 1296 addresses were obtained for the questionnaire survey on a spreadsheet. The details on the spreadsheet include: Reference number, Local authority, Consent number, Issue date, Sector, Type, Description, Dwellings, Floor area, Site address 1, Site address 2, Site number, Site street, Site suburb, Site post code, Builder's name. However, after careful observation of the information collected from 'Whats On', it was realised that about 20% (256) of the information related to projects that could be considered minor works and alterations. For example, construction of new garages, construction of sleep outs and storage unit. Therefore the total sample size had to be reduced by about 20%, giving a total of 1032. The sample size for each year came down to 301, 293, 282 and 156

for years 2008 to 2011 respectively. This information was re-entered into Microsoft Excel to keep record of only the details necessary for postage. Each address was assigned a code for efficient data management and to protect the identity of the research participants. This data was later transferred to Microsoft Access to enable mail merging of the addresses during printing. Microsoft Excel and Access were adopted for the current research because they are user friendly and compatible. This explanation is in line with Blismas and Dainty (2003) who emphasise the need for researchers to justify the purpose of adopting a particular software programme for a research project.

Further coding of data was also performed after completed questionnaires had been received from the research participants. This coding was used to allocate numbers to each answer to facilitate the transfer of data from the completed questionnaire to SPSS version 18 (Malhotra, Agarwal, & Peterson, 1996). Coding can be done before the questionnaire is answered (pre-coding) or after the questionnaires have been received (DeVaus, 1995). In this thesis, coding was done after the questionnaires had been answered. The coding procedure was conducted by establishing a data file in SPSS, and all measurement items were all assigned with a number (see survey questionnaire in Appendix B1). The remaining missing data was assigned a numerical code of nine. The data set had no further errors during this check. The coded data was subsequently entered into SPSS via Microsoft Excel to check for further data entry accuracy. Codification was important for the current research because it allowed the researcher to reduce huge volumes of data into meaningful themes in order that comparison and analysis could be undertaken (Blismas & Dainty, 2003).

The data for the interview with house developers and subject matter expert began with the transcription of the recorded interviews. The transcripts provided a complete record of the interviews, which facilitated the analysis of the data. Notes and transcripts were reviewed for readability and consistency with audiotape versions. A thematic analysis was performed on the information obtained from the interviews of house developers and subject matter experts. The purpose of the analysis was to identify themes within the interviews and to provide explanation regarding such patterns.

The actual source and location of the information from interview transcriptions followed coded format. Coding was necessary to ensure privacy and confidentiality of the research participants. For example, excerpts from interview transcripts of house developer HD1, who was the first interviewee, are presented as (HD1) and for the second interviewee as HD2 and so on. To differentiate between themes and sub themes where applicable, the thematic names are presented theme 1, theme 2 and so on. Similarly the details of the SMEs were also coded for privacy reasons. Auckland Council staff is referred to as SME1, the representative from the MBF as SME2, and lastly a representative from HOBANZ as SME3.

#### **5.11.4: Data clean up exercise**

The purpose of this exercise was to review the data collected from the new homeowners to remove obvious errors and produce some fundamental descriptive statistics from the data. Out of 1290 questionnaires issued to new residential homeowners within the regions, a total of 480 questionnaires were returned. A total of 228 were completed by the research participants and 252 were returned because the delivery point could not be located by the postal agency. The questionnaire survey in total generated 228 responses. After carefully checking the responses for completeness, 216 responses were retained for analysis and 12 responses removed. This means 95% were usable and 5% were un-usable. Eliminating 5% responses in this way may seem extreme. However, each of these participants had completed only one section of the questionnaire. Data clean-up also included assigning a special code to missing data as described in Section 5.11.3. These are data that the research participant may not have wished to answer or did not know the answer or did not have an opinion on it. In the process of analysis, questions that were not answered by the majority of participants were excluded from the analysis and were treated as missing data as described above. According to Altinay and Paraskevas (2008) data clean-up helps to correct inconsistencies in data to avoid any errors that may affect the results dramatically.

### **5.12: Data analysis strategy**

Quantitative and qualitative data follow a distinct approach with regard to data analysis. In analysing and evaluating the data for this research, qualitative and quantitative approaches were adopted in order to achieve the set research outcomes. The two methods of analysis for this study included descriptive analysis and thematic analysis. Descriptive statistics were used for the analysis of the mail questionnaires while thematic analyses were performed on the open ended questions from questionnaires and interviews. Amaratunga et al. (2002) describe descriptive analysis as a common type of research setting that could be classified under quantitative research and is concerned with information generally obtained by interviews and mailed questionnaires. According to Leary (2004), statistical analysis could be descriptive (to summarize the data), or inferential (to draw conclusions that extend beyond the immediate data).

In the current research, simple interpretive and descriptive statistical analysis aims to provide a general idea of the extent of defects and the satisfaction levels of new homeowners in terms of frequency counts, means, ranges, standard deviations, etc. The reason for using descriptive statistical analysis was to explore the data and present it in tables, charts and graphs to show the data distribution patterns that emerged after applying various statistical tests (Blaxter et al, 2001). The other added advantage that such analysis gives to this research was the preliminary technique which is independent and can be applied to data as a part or even as a full analysis on its own (Hussey & Hussey, 1997). Furthermore, a cross tabulation was performed to identify strong correlations among the measured parameters. The stronger the interdependence between the parameters, the more powerful conclusions can be drawn regarding the understanding of the current quality performance situation in the residential building sector. The Statistical Package for Social Science (SPSS for Windows) was used for the analysis of data for this research.

The questionnaire also included one open-ended question which provided qualitative data to the questionnaire survey. This aspect of the questionnaire was analysed using thematic analysis. The open-ended question provided qualitative information which was categorised into different groups depending

on the themes that emerged from the responses. It can be observed in the following chapters that the qualitative information provided was used to support the research results and added extra supportive meaning to the discussion of them.

Thematic analysis can be described as a qualitative methodology which identifies analyses and reports patterns (themes) within data. Berg (1995) views thematic analysis as a systematic process of categorising the content of texts and identifying relationships among the different categories within the texts. According to Boyatzis (1998) two types of thematic analysis exist, and are manifest-thematic analysis and latent thematic analysis. Boyatzis (1998) describes manifest thematic analysis as an approach involving the reporting of data on the surface, i.e. reporting only from what data is visible to the researcher. Latent thematic analysis, on the other hand, involves deeper analysis of the underlying information presented by the data and comparing it to any surface information. Latent thematic analysis is used in the current study to provide deeper insight into information obtained from open-ended questions (within the questionnaire survey) and interviews. This approach provides more understanding to the underlying and surface themes/issues around quality within the residential building sector.

Braun and Clarke (2006) point out that thematic analysis is the first qualitative method of analysis that should be learnt by researchers, because thematic analysis provides the core skills useful for conducting other forms of qualitative analysis. For example thematic coding is a process that cuts across 'major' analytic traditions (e.g. grounded theory) (Ryan & Bernard, 2000). Accordingly, thematic analysis can be considered a tool rather than a specific qualitative method of analysis (Boyatzis, 1998).

Analysing themes help to capture pertinent issues about a dataset in relation to research questions, which could represent some level of patterned response or meaning within a dataset. Thematic analysis could be approached inductively or 'bottom up' way, or in a theoretical or deductive or 'top down' way (Boyatzis, 1998; Braun & Clarke, 2006). An inductive approach means the themes identified within a dataset are strongly linked to the data themselves (Patton, 1990). Inductive thematic analysis is similar to grounded theory. The inductive

approach used to interpret the data requires total immersion in order to become familiar with the “depth and breadth of the content” (Braun & Clarke, 2006). In this study, the themes or patterns were identified from the raw data (interview transcripts and field notes). This study used an inductive approach in an attempt to understand and “unpack” the meanings of participants’ experience (homeowners, house developers, and SMEs) gathered from the data.

### **5.13: Chapter summary**

This chapter described the research methodology and the philosophical position that underpinned the current research. The research paradigms of positivism, phenomenology and mixed method research have been discussed in detail with specific emphasis and discussion taking place regarding quantitative and qualitative approaches. A survey research approach was adopted for this study because of the nature and sensitivity of the information required. The survey used for this research involved the collection of information from new homeowners through mailed questionnaires and personal interviews with house developers. The responses to the mail questionnaires were analysed using descriptive statistics and thematic analysis for the open-ended questions. In addition the interviews were analysed using thematic analysis. This aspect of the research is covered in chapters six and seven.

This study was based on the philosophy of pragmatism which offers an immediate and useful middle position of philosophy and methodology that could benefit research. One of the key advantages of the mixed research method is that it improves confidence from the variety of data that has been gathered from different sources. Other issues that were highlighted include: ethical considerations, reliability, validity, generalisability and the limitations of the research. It has been determined that this research is reliable and valid within the contexts of the current research and the residential house building sector. The next chapter (Chapter 6) discusses data analysis and the results of this study.

## **CHAPTER SIX**

### **ANALYSIS AND PRESENTATION OF RESULTS**

#### **6.1: Introduction**

One of the methods of data collection explained in the previous chapter was the questionnaire survey to residential homeowners. The current chapter covers the analysis of the responses received through this questionnaire. It begins by summarising the responses according to each local territorial authority. The chapter then presents demographic information of the research participants. Research participants are referred to as homeowners and these terms will be used interchangeably within this chapter. Following the demographic information, is the presentation of results on the extent of common defects identified by homeowners, the analysis of homeowners' satisfaction levels and the use of independent building inspectors (defect reporting) for new residential buildings. Besides presenting a descriptive analyses of the responses, further analyses involving cross tabulation and correlation of some of the results is undertaken to draw out important relationships that answer some of the questions posed within this study (see Section 1.5). The word house developer was used consistently within this research to refer to actual building construction companies. Chapter six closes with the presentation of responses to the opened ended questions within the questionnaire.

#### **6.2: Characteristics of the sample**

The data used for this study was collected from new residential homeowners within five regions in New Zealand as discussed in Section 5.9.2. Out of 1032 questionnaires administered to new residential homeowners within these regions, 228 were returned of which 95% were usable. The total number of usable questionnaires after the data clean-up exercise (described in Section 5.9.2) was 216 representing an overall response rate of about 21%. Although the response rate was lower than hoped, the total number of responses is statistically significant as it satisfies Central Limit Theorem (sample size > 30). A total number of 252 questionnaires were returned because the delivery point could not be located by the postal agency. Table 6.1 provides a breakdown of the number of questionnaires administered, received and undelivered. It shows

that the highest number of questionnaires was received from residential homes built in the year 2009 with 2011 recording the lowest number of responses. The low number of questionnaires collected for year 2011 was not unusual considering that the survey was conducted in the last quarter of the same year so that data covered only January to July 2011.

**Table 6.1:** Analysis of surveys/questionnaires distributed

| Years         | Questionnaires Administered | Questionnaires Received | Usable Response | No Delivery points |
|---------------|-----------------------------|-------------------------|-----------------|--------------------|
| 2008          | 301                         | 56                      | 51              | 38                 |
| 2009          | 293                         | 81                      | 78              | 47                 |
| 2010          | 282                         | 56                      | 55              | 79                 |
| 2011          | 156                         | 35                      | 32              | 88                 |
| <b>Totals</b> | <b>1032</b>                 | <b>228</b>              | <b>216</b>      | <b>252</b>         |

A further analysis of the returned questionnaires was conducted in order to establish the effects of the Canterbury earthquake on the responses. This is presented in Table 6.2.

**Table 6.2:** Analysis of surveys/questionnaires returned

| Auckland Region |           | Canterbury Region |           | Otago Region     |           | Wellington Region |           | Waikato Region    |           |
|-----------------|-----------|-------------------|-----------|------------------|-----------|-------------------|-----------|-------------------|-----------|
| Auckland        | 20        | Christchurch      | 46        | Central Otago    | 4         | Wellington        | 12        | South Waikato     | 0         |
| North Shore     | 14        | Timaru            | 8         | Dunedin          | 8         | Porirua           | 0         | Hamilton          | 22        |
| Papakura        | 2         | Ashburton         | 4         | Waitaki          | 2         | Kapiti            | 4         | Thames Coromandel | 8         |
| Franklin        | 4         | Hurunui           | 0         | Clutha           | 2         | Upper Hutt        | 2         | Hauraki           | 2         |
| Waitakere       | 2         | Mackenzie         | 4         | Queenstown Lakes | 16        | Masterton         | 0         | Waikato           | 8         |
| Rodney          | 8         | Selwyn            | 6         |                  |           | Carterton         | 4         | Matamata Piako    | 0         |
| Manukau         | 12        | Waimakariri       | 12        |                  |           | Hutt City         | 4         | Waipa             | 8         |
|                 |           | Waimate           | 0         |                  |           |                   | 8         | Otorohanga        | 0         |
| <b>Totals</b>   | <b>62</b> |                   | <b>80</b> |                  | <b>32</b> |                   | <b>30</b> |                   | <b>48</b> |

Table 6.2 shows that out of the 252 questionnaires returned due to the absence of delivery points, 32% were from the Canterbury region. 58% of the undelivered points to the Canterbury region were from Christchurch alone (see Table 6.2). It is reasonable to assume that these buildings may well have experienced damages due to 2010 and 2011 earthquakes, thus contributing to the non-delivery point.

### **6.3: Summary of responses to the survey**

This section gives a summary of the main categories of participants that were involved in the survey. The participants were randomly selected from a list of new homes that were constructed between 2008 and 2011 as was discussed in Section 5.11.1 and 5.11.3. The intent of the study was to target recent homeowners so that their comments on quality issues are taken as a reflection of visible defects as opposed to absorbed and/or maintenance-related defects in residential buildings. The semi-structured questionnaire designed for this purpose (the result which is presented in this chapter) comprises four key sections (A to D): demographic information, issues on defects, homeowner satisfaction levels and an aspect on the use of independent building inspectors (defect reporting). A sub-aspect of section D covered open-ended question which are analysed thematically. The four key sections of the questionnaire survey are presented in sections 6.4 to 6.7. The questions were predominantly based on a seven point Likert scale, ranging from 1 (very satisfied) to 7 (very dissatisfied). Others include five-point Likert scaled questions ranging from 1 (very high) to 5 (very low), and Yes/No type questions. Finally the questionnaire contained open-ended questions, which allowed the participants to comment on the nature and other general issues relating to defects within the residential building sector of New Zealand. This aspect of the questionnaire is presented in Section 6.8.

### **6.4: Demographic information of research participants (Section A)**

This section of the questionnaire was designed to capture demographic information of the research participants. The section is labelled, Section A - Property Details within the questionnaire and comprised six related questions (see Appendix B1). The questions covered: type of ownership, period of

ownership, house type, number of bedrooms, number of occupants, and information on the house developer involved in the house construction. These 6 questions are displayed in the first column in Table 6.3 which summarises the responses obtained from the research participants. The objective of the questions here is to understand the background of the research participants, which will allow further understanding of the nature of their responses to upcoming sections of the questionnaire.

The response to the first question shows that majority of the research participants own their homes (98.6%) with only (1.4%) under a rental agreement. As the target population for this study are homeowners, this result is in line with the objective of this research.

In response to the question on how long the homeowners have owned their homes, the result shows that 44.2% of the participants have owned their homes for about two years, followed by participants who indicated that they have owned their home for over two years (27%). 14.4% of the participants had ownership of their homes for less than a year. The results further show that 11.6% of participants owned their homes for about six months and 2.8% for less than a month. The desire of the study was to target recent homeowners so that their opinions on defects will not be biased by their observed maintenance-related defects. Though there is the need to reduce the effects of such biases, it is also important to include responses from the last two years, at least, in order to increase the statistical credibility of the results as it allows for accumulation of sufficient sample size. In addition, including these participants could mean that that time-related bias, for instance effects of factors such as the Canterbury Earthquake, change in governance or economic conditions, can be accounted for.

The third question in the section requires participants to indicate their house type. This question provides an understanding of house-type-related disparities in nature and number of defects. The results shows that majority of the participants (94%) fell into the house category (single lease), meaning the buildings were single family dwellings. 5% of the participants owned town houses (shared lease) while 0.5% of participants owned units and retirement villages respectively. Since a large proportion of the house types were single

family dwellings, the assessment of house-type-related disparities in nature and number of defects is no longer necessary.

**Table 6.3:** Demographic information in frequency and percentage (Section A)

| Profile of Participants    |                          | Frequency | Percentage |
|----------------------------|--------------------------|-----------|------------|
| <b>Type of Ownership</b>   | Homeowner                | 213       | 98.6       |
|                            | Renting                  | 3         | 1.4        |
| <b>Period of Ownership</b> | Less than 1 month        | 6         | 2.8        |
|                            | 1 - 6 months             | 25        | 11.6       |
|                            | 6 months - 1 year        | 31        | 14.4       |
|                            | 1 – 2 years              | 95        | 44.2       |
|                            | Over 2 years             | 58        | 27.0       |
| <b>Type of House</b>       | House                    | 204       | 94.4       |
|                            | Townhouse                | 10        | 4.7        |
|                            | Unit                     | 1         | 0.5        |
|                            | Retirement village       | 1         | 0.5        |
| <b>No of Bedroom</b>       | One                      | 1         | 0.5        |
|                            | Two                      | 12        | 5.6        |
|                            | Three                    | 72        | 33.5       |
|                            | Four                     | 115       | 53.0       |
|                            | Five                     | 16        | 7.4        |
| <b>No of Occupants</b>     | One                      | 16        | 7.4        |
|                            | Two                      | 90        | 41.9       |
|                            | Three                    | 28        | 13.0       |
|                            | Four                     | 53        | 24.7       |
|                            | Five or more             | 28        | 13.0       |
| <b>Who built the home?</b> | Building Company (MBF)   | 135       | 62.8       |
|                            | Building company (CBANZ) | 31        | 14.4       |
|                            | Yourself                 | 17        | 7.9        |
|                            | Developer (Private)      | 24        | 11.2       |
|                            | Don't know               | 8         | 3.7        |

Further, participants were required to indicate the number of bedrooms in their homes. The purpose of this question is to match the number of defects indicated by the participants to number of bedrooms. The results (presented in Table 6.3) show that majority of the participants own four bedroom houses (53%), while 33.5% own three bedroom homes. 7.4% own five or more bedroom homes, while 5.6% of the participants own two and one bedroom properties reflecting the lowest (0.5%) category.

Participants were further asked to indicate the number of occupants in their homes. The results show that 41.9% of participants had two individuals, 24.7% had four individuals and 13% of participants had three individuals, same percentage as participants that had 5 or more individuals occupying their

homes. Finally, 7.4% participants indicated that they were the only occupants in their homes.

Comparing these two questions on number of bedrooms and building occupants, it is reasonable to conclude that the buildings were moderately occupied (with moderate density) as more than 50% of the residential buildings have between one and two occupants. This is supported by the finding that while the highest percentage of participants had four bedrooms in their homes, the highest percentage for individuals occupying these homes is two. Such finding is important as studies have shown that the higher the number of occupants, the higher the maintenance-related defects that are recorded (Page, 2011b). Therefore, the fact that the average number of occupants is low could imply that maintenance-related defects may contribute minimal bias in this study.

The last question in the section required participants to indicate the type of house developers that built their homes. This is to show the quality performance of different types of house builders and their responses to rectifying defects. Summary of the responses to the question is given in Table 6.3. 62.8% of the participants indicated that their houses were built by registered Master builders and 14.4% by certified builders. 11% of participants had their houses built by private house developers while 8% of the participants built their own homes. Only 4% of the participants indicated that they do not know who and how their houses were built, most likely indicating that they were not involved in the building process.

The demographic information summarised on Table 6.3 suggests that the survey covered the population targeted for the research. The results appear to show that the buildings selected for this study are reliable for the study of defects and homeowners satisfaction levels in new residential buildings. Findings from this section have largely been in line with the objective of the research. In addition, the various questions asked have provided a foundation on which successive sections can be built and understood. Consequently, the responses provided in sections B to D of the questionnaire can be compared based on the demographics described in this section to allow a more thorough analysis of the data.

## **6.5: Defects (Section B)**

Section B covers defects which new homeowners observed when they took possession of their homes. The participants were also required to indicate any warranty either for structural components or minor defects provided on their homes. The intent of this section is to capture common defects and extent of defects at handover of new residential buildings. This section will also show how quickly house developers respond to defect rectification. It is hoped that the extent to which homeowners understand warranty provided on their homes will be determined. By understanding these points, further analyses can be carried out to establish relationships between number and extents of defects and the satisfaction levels of new homeowners. This will lay the foundation for the analysis of quality performance of their house developers. Finally, a comparison of section B to the demographic findings in section A will give a more holistic view of the factors influencing homeowner satisfaction levels and quality performance levels.

The first two questions in this section address issues of warranty for new homes. A summary of questions 1 to 3 in Section B of the questionnaire and the corresponding responses is presented as frequencies and percentages in Table 6.4. Results of the remaining analysis in this section are presented in bar chart format in later sections.

### **6.5.1: Warranties provided for new homeowners for structural defects**

The first question in this section requires research participants to indicate the number of years that was provided for warranty on structural components for their homes. The objective of the question is to know whether homeowners actually have knowledge of the implied warranty set out in Section 397 - 399 of the Building Act 2004, despite any provision to the contrary in any agreement. This *de facto* warranty is automatic and intended to provide a greater level of consumer protection. Based on the results, 37.7% of participants indicated that the warranty provided for the structural component on their home is between seven to ten years. Another 20.5% indicated five to seven years while 11.6% between two and five years. 7.5% of the participants indicated that they do not know the provisions for structural components on their homes. Interestingly,

only 86% of participants completed the question, the remaining 14% did not attempt the question. It can be argued that the lack of response from 14% of participants is due to a lack of knowledge of the warranty available for new homes. If this 14% of participants are added to the 7.5% of participants that indicated that they do not know, it is possible that 21.5% of participants are completely unaware of the warranty regulations for their homes. This lack of awareness was shown by approximately 1 in 5 participants. Consequently it could be argued that, the protection offered by the Section 397 – 399 of the Building Act 2004 regulation can be rendered ineffective as homeowners are unable to defend their rights without the help of a person aware of these law and regulations.

#### **6.5.2: Warranties provided for new homeowners on minor defects**

The second question requires research participants to indicate the number of years that was provided for warranty on minor defects on their homes. This is presented in Table 6.4. Similar to the response in Section 6.5.1, only 86% of participants completed this question; the remaining 14% did not attempt the question. As in Section 6.5.1 above, it can be supposed that the 14% who did not attempt the question were not knowledgeable in this issue. It is interesting to know that the same percentage of participants that did not complete the previous question did not complete this question. Therefore, it is logical to assume that the 14% that did not answer the question are generally unaware of warranty provisions regardless of the nature of defects that these warranties protect against and also there is a gap in the homeowners' knowledge of home warranty. This finding is in line with Sommerville (2008).

The result shows that 32.1% of participants were given between nine and twelve months warranties by their house developers for minor repairs. Another 22.8% indicated a period of over two years. 12.1% of the participants responded that their warranty for minor defect repairs cover between three to six months, while 16.7% indicated between one to three months. Only 2.3% of the research participants indicated six to nine months. The variability seen in the results obtained appears to indicate a lack of standard warranty time frame for defect rectification that new homeowners observed after handover.

**Table 6.4:** Percentage distribution of warranty provided

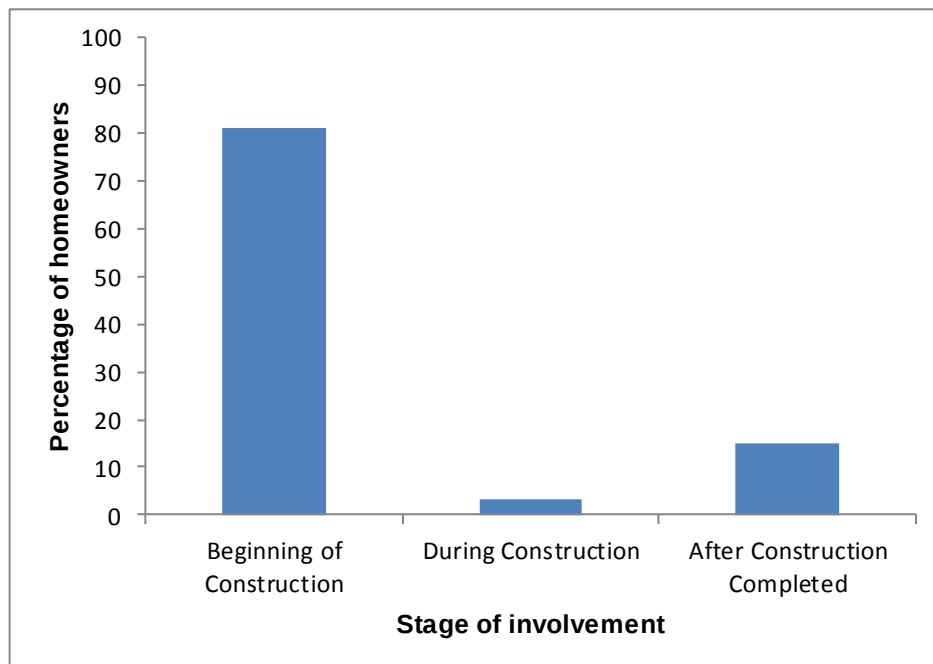
| Questions Asked                           | Response Option     | Frequency | Percentages |
|-------------------------------------------|---------------------|-----------|-------------|
| <b>Warranty for Structural components</b> | 1 – 2yrs            | 15        | 7.0         |
|                                           | 2 - 5 yrs           | 25        | 11.6        |
|                                           | 5 - 7 yrs           | 44        | 20.5        |
|                                           | 7 - 10 yrs          | 81        | 37.7        |
|                                           | More than 10yrs     | 20        | 9.3         |
| <b>Warranty for minor defects</b>         | 1 - 3 month         | 36        | 16.7        |
|                                           | 3 - 6 months        | 26        | 12.1        |
|                                           | 6 months – 9 months | 5         | 2.3         |
|                                           | 9 months – 12months | 69        | 32.1        |
|                                           | More than 2 months  | 49        | 22.8        |

In conclusion, the findings of Sections 6.5.1 and 6.5.2 appear to point towards a possible flaw in the communication of the warranty regulations to homeowners. While a larger percentage of participants were able to answer the question on the number of years that they were covered for structural defects, less than 40% were able to provide a value approximate to that within stipulated by the Building code (10years). Several literature have highlighted the importance of emphasis on new home warranties, though some of these have placed the onus on the homeowners to inquire into this for their own protection (Craig, 2008; Ong, 1997; Sommerville, 2008). However, such enquiry can only be made when there is prior knowledge of the need for warranty information. Improvements are therefore needed in the area of homeowner awareness of warranties on residential buildings.

### **6.5.3: Stage at which participants become involved in construction**

The third aspect of this section requires participants to indicate when they became involved in the buying process of their homes. The aim of the question was to determine whether there is any relationship between the time homeowners became involved in the house construction and the extent and number of defects observed in their homes. Figure 6.1 clearly show that a significant number (80.9%) of the participants were involved right from the beginning of construction, followed by 14.9% when the buildings had been

completed. The least percentage (3.3%) were participants that became involved during the construction stage.



**Figure 6.1:** Percentage distribution of when homeowners became involved

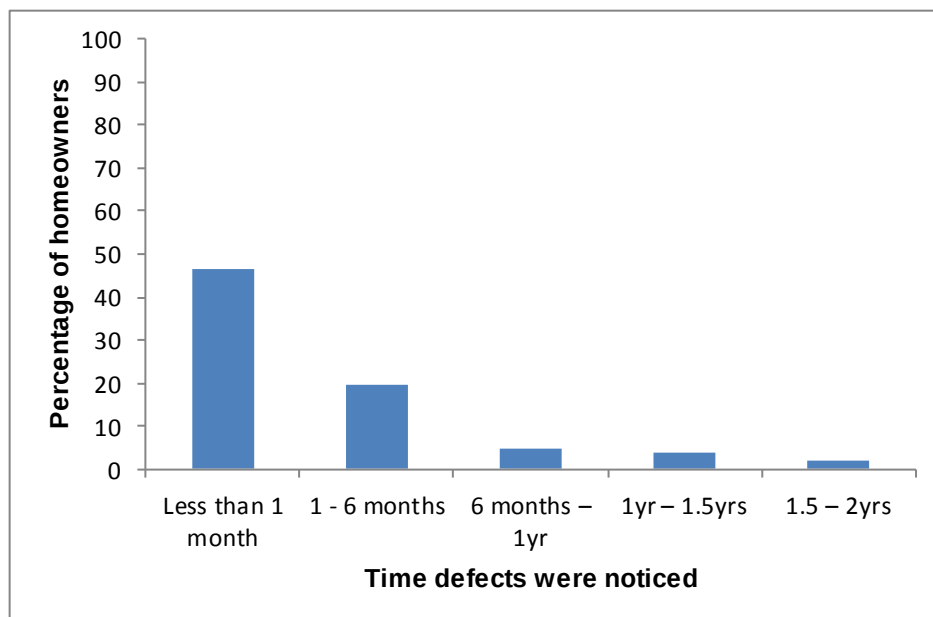
The fact that over 80% of participants have been involved since the beginning of construction raises the expectation that these homeowners should have the potential to influence the developers' quality performance levels. This expectation is logical as it is likely that some of the homeowners would have noticed defects during their visits to site and such complaints would have been made known to the house developers. For the few who became involved after completion, their influence on the house developers' performance levels can be assumed to be comparatively minimal.

#### **6.5.4: When defects were noticed**

This section required participants to indicate when they began to notice defect after they took possession of their new homes. Only 76.3% of participants completed this question, the remaining 23.7% did not attempt the question. As this is the first question addressing defects directly, the lack of answers to the question could mean that the participants had no defect to report. Figure 6.2 show a downward trend of the time homeowners' began to notice defects in their homes. The majority of the participants (46.5%) began to notice defects right from initial possession of their homes while 19.5% of the participants

indicated between one to six months before detection. 4.7% of participants began to notice defects between six months to one year, and 3.7% indicated between one year and one and a half years. The least (1.9%) were participants that noticed defects between one and a half and two years after possession.

It is apparent from the result that 66% of homeowners noticed one form of defects within the first six months that they occupied their new homes. This finding further reinforces the objective of this study that the survey covered the population targeted for the research.

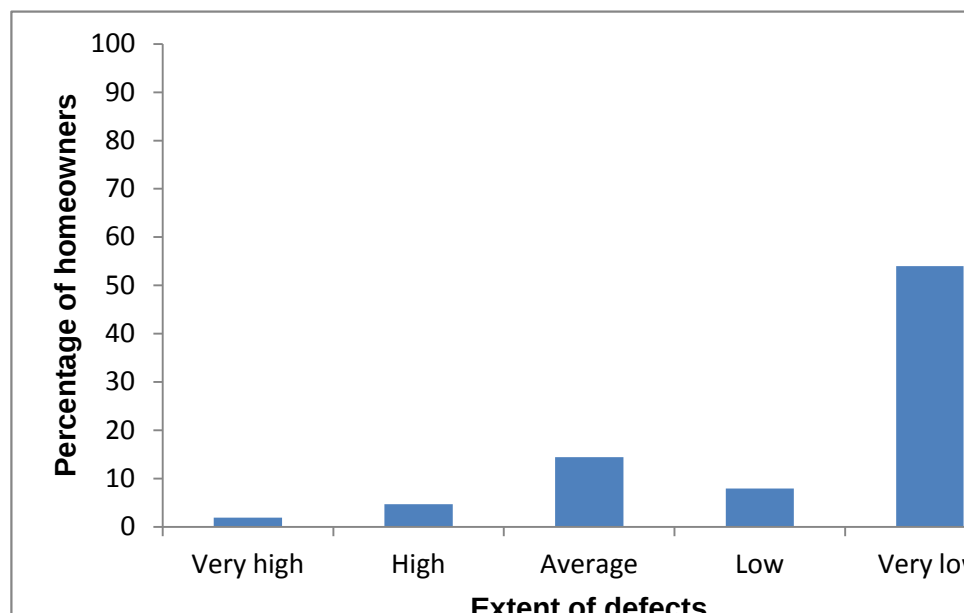


**Figure 6.2:** Percentage distribution of time homeowners noticed defects

#### 6.5.5: Extent of defects

The research participants were asked to indicate on a five point likert scale, with 1 being very high and 5 very low, the extent of defects they observed when they took possession of their new homes. 82.8% of the participants responded to this question with the remaining 17.2% of participants that did not respond most likely being the participants that had no defects in their homes. Figure 6.3 shows the extent of defects that new homeowners observed when they took possession of their homes. From the figure, 61.9% of participants indicated that they observed low levels of defects in their homes after handover. Only 6.6% observed high defects, with 14.4% revealing that they have 'average levels' of defects. Of the 61.9% of participants who indicated that they have low levels of

defects, 87% had very low defects levels. Overall, the result shows that all the 82.8% of the participants that responded to this question had identified some form of defects which needed to be rectified. It is important to note the subjectivity of this question, meaning that the definition of each term used in the likert scale can be defined differently by each participant. It is therefore possible that their perspectives are relatively ignorant as compared to the perspective of a suitably trained building inspector, for instance. Consequently, the successive question in the section asks the participants to define the exact types of defects that they noticed. Though subjective, it is important to ask the question on extent of defects as it appears to correlate to their levels of satisfaction as will be shown in subsequent sections.



**Figure 6.3:** Percentage distribution of extent of defects

#### **6.5.6: Defects observed by participants**

This section presents the results of question six in Section B of the questionnaire. The question requires the research participants to indicate the types of defects that they observed when they took possession of their new homes. A 43 standard term common defects in residential homes checklists extracted from previous literature was provided by the researcher. This is presented in Table 6.5. The participants could also add more to the list if they had observed defects different from the ones provided in the questionnaire. A total of 81% of participants responded to this question. About 19% of the participants responded that their home was defect free at the time of handover,

therefore no defects were reported. This question allows the participants to define objectively, the types of defects in their homes. On the whole the research participants confirmed observing 42 of the defects (see Table 6.5) provided and also identified 13 additional defects. Only defects that fall under the category of rails was not identified. These additional defects identified by the participants are listed in Table 6.6 below. The frequency of the responses on the items they identified as defective is presented in bar chart format in Figure 6.5. It is evident from Figure 6.4 that the ten most common defects in order are: uneven painting surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet/WC, concreting and locks.

**Table 6.5:** Standard list provided for participants

|                      |                      |                    |
|----------------------|----------------------|--------------------|
| Poor finish          | Brackets             | Bath panel         |
| Uneven painting      | Sinks/WHB            | Piping work        |
| Nail pops            | Window sills         | Drainage           |
| Ceiling joint        | Seals/Rubber linings | Leaks              |
| Kitchen units        | Toilet/WC            | Handrails          |
| Flooring             | Glazing              | Walls              |
| Wall tiling          | Roof flashing        | Garage door        |
| Door/Window          | Cracks               | Wardrobes/Shelves  |
| Worktops             | Staircase            | Plaster board      |
| Door stopper         | Locks                | Trickling vent     |
| Extractor            | Roofing/Tiles        | Spouting           |
| Hob and Oven         | Roof gutter          | Creaking/Squeaking |
| Socket/Switches      | Insulation/Lagging   | Labels             |
| Skirting/Architraves | Concreting           | Stains             |
|                      |                      | others             |

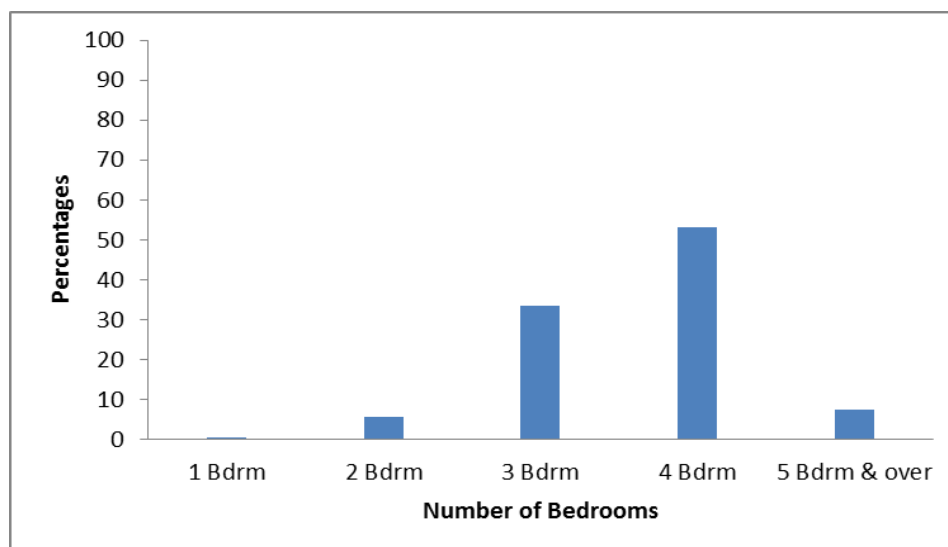
In addition to this, the numbers of defects observed were also compared between individuals. The worst scenario was from a participant who indicated that they had 43 defects in their home. The homeowner enclosed the list of defects with the questionnaire to support the fact that quality performance of their house developer was not satisfactory. This particular homeowner had indicated that another builder was called in to identify the defects after three court cases with the original builder.

**Table 6.6:** Additional defects identified by research participants

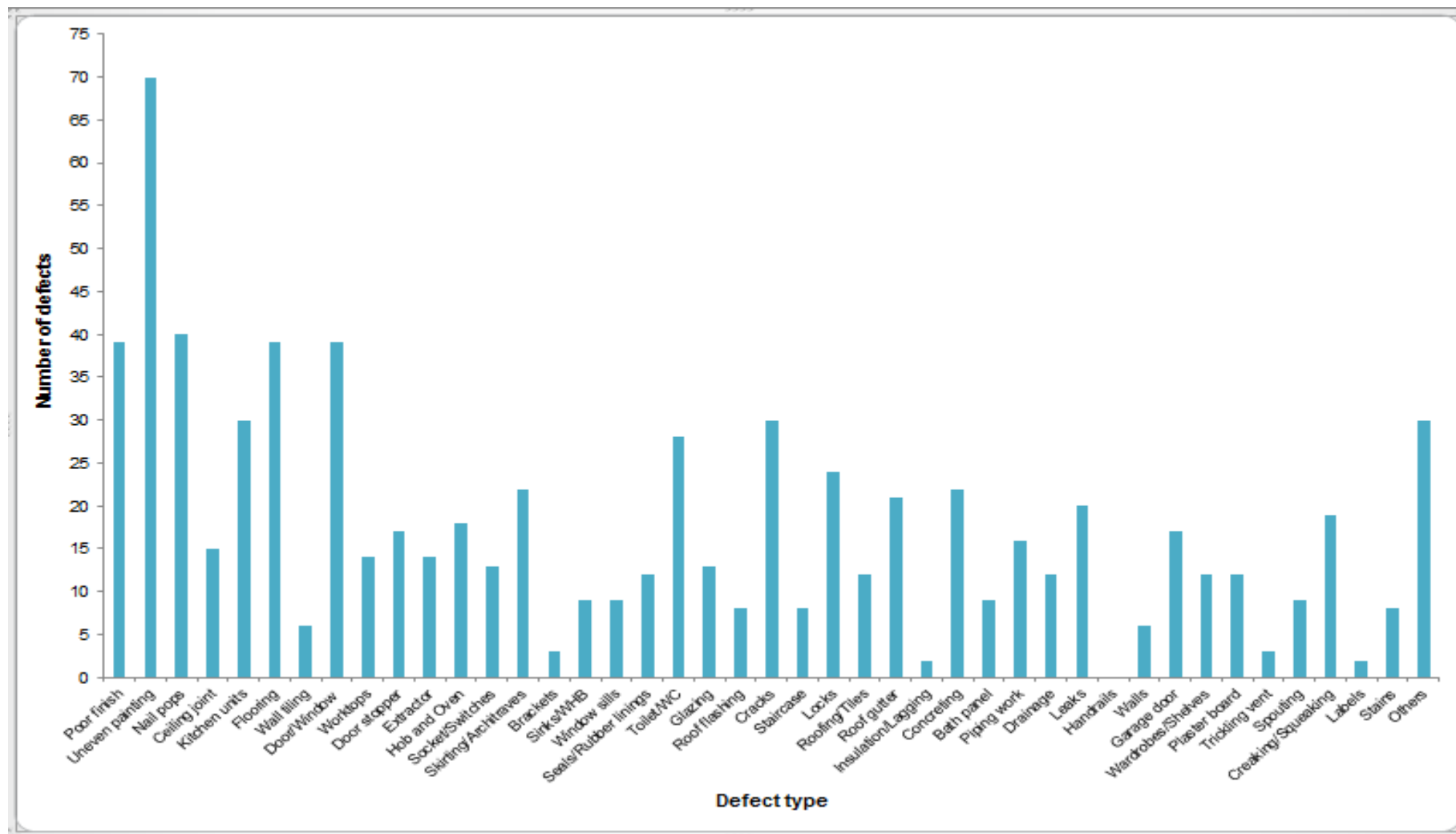
|                        |                  |                              |
|------------------------|------------------|------------------------------|
| Interior doors warping | Lights           | Fittings                     |
| Wall paper             | Landscape/deck 2 | cavity slider doors - warped |
| leaked water heater    | Fuse board,      | Roof noise                   |
| Solar panel            | Master board     | Air conditioner cod          |
| Plastering             | Sagging beam     |                              |

#### 6.5.6.1: Distribution of defects across 216 buildings

Table 6.8 shows the distribution of defects identified by the participants across 216 buildings examined. The defects were grouped into 4 categories: 0 - 5, 6 - 10, 11 - 15, and 16 - 20. The purpose of this section is to determine the total number of defects in each property type. A total number of 752 defects were identified across all the buildings surveyed from 2008 to 2011. Figure 6.4 shows that the number of defects is directly proportional to the number of bedrooms in the house. That is, as the number of bedrooms in the house increases, there is an increase in total number of defects. This excludes the 5 bedroom and over houses where the total number of defects is relatively small. Although it might have been expected and indeed logical to expect an increase in quality achievement as the number of defects decreases, the full extent of this increase was not expected. This finding supports Craig's (2008) study that there is a strong positive correlation between defects and numbers of bedrooms.



**Figure 6.4:** Distribution of defects per number of bedrooms



**Figure 6.5:** Distribution of common defects in new residential buildings

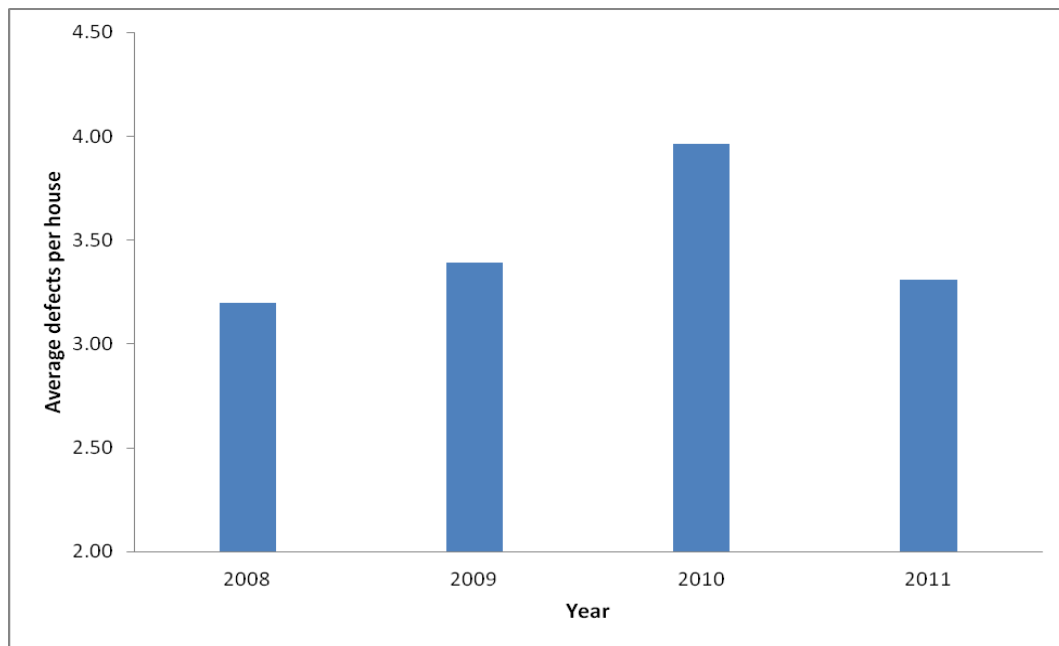
From the analysis of the data on Table 6.7, it became clear that majority of the total number of houses surveyed (166) recorded between 0 – 5 defects followed by houses with 6 – 10 defects (41). Meaning that about 77% of houses recorded between 0 – 5 defects. This indicates that out of four buildings three of the buildings will record 0 – 5 defects. Therefore average of about 5 defects was recorded with the maximum of 19 defects in a four bedroom house and minimum of 0 defects.

**Table 6.7:** Distribution of defects across 216 buildings

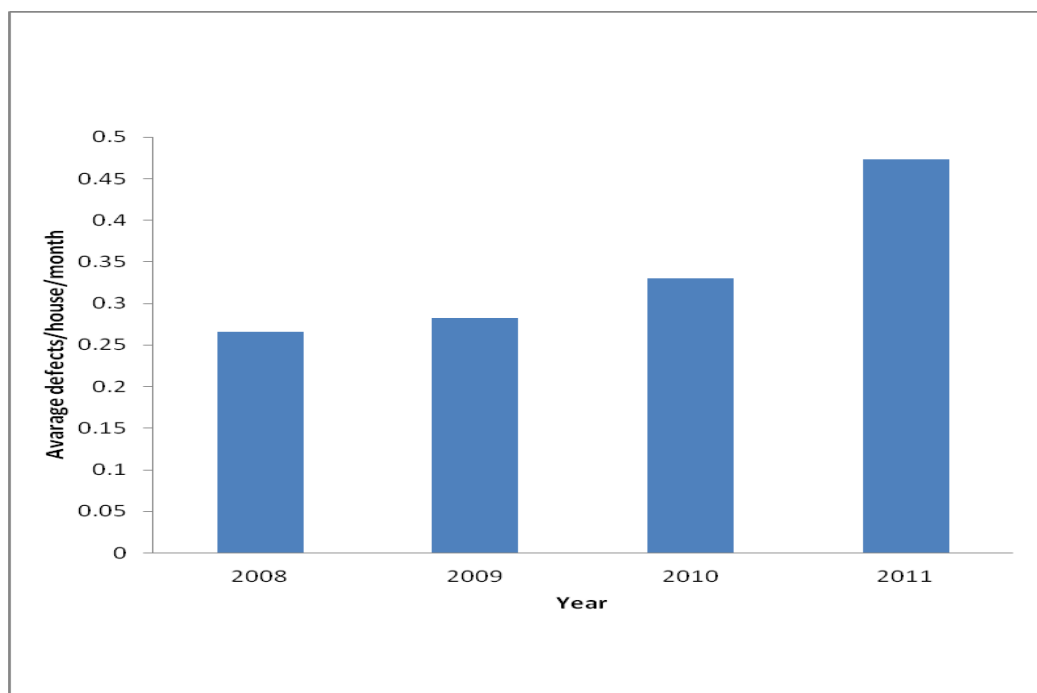
| No of defects | Total No of house | 1 Bdrm   | 2 Bdrm    | 3 Bdrm    | 4 Bdrm     | 5 Bdrm & over |
|---------------|-------------------|----------|-----------|-----------|------------|---------------|
| 0 - 5         | 166               | 1        | 10        | 59        | 86         | 11            |
| 6 - 10        | 41                | 0        | 2         | 9         | 25         | 4             |
| 11 - 15       | 6                 | 0        | 0         | 1         | 4          | 1             |
| 16 - 20       | 3                 | 0        | 0         | 3         | 0          | 0             |
| Over 20       | 0                 | 0        | 0         | 0         | 0          | 0             |
| <b>Totals</b> | <b>216</b>        | <b>1</b> | <b>12</b> | <b>72</b> | <b>115</b> | <b>16</b>     |

#### 6.5.6.2 Average defects per new home

Figure 6.6 presents the yearly estimates of average defects per house identified by new homeowners over a period of four years using descriptive statistics. From the results, there appears to have been increasing defects per house from 2008 to 2010. However, the average defects per house in 2011 were significantly lower. This unexpected decrease can be explained by the fact that estimates for 2011 were collected over a period of only 7 months as the data collection was done in September 2011. However, as proportions have been used and the sample size was over 30, it can be assumed that this is representative of the whole population. Thus, Figure 6.7 was produced showing the estimate of average defects per house per month. It can be observed from the figure, that there is a general increase in defects per house per month with increase in year.



**Figure 6.6:** Yearly estimates of average defects per new residential buildings

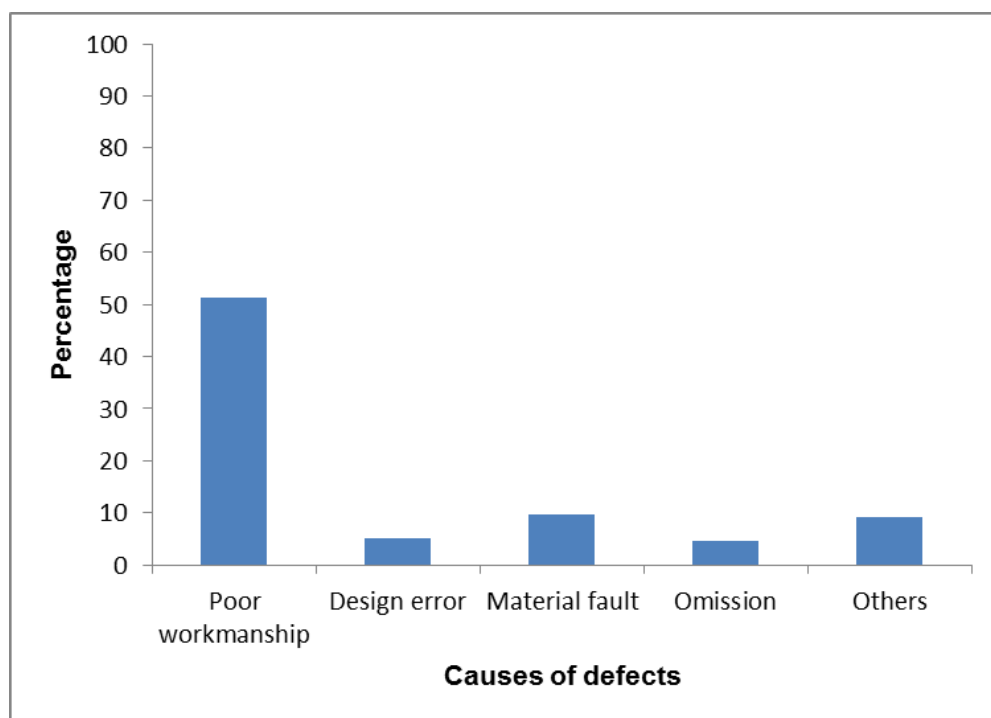


**Figure 6.7:** Yearly estimates of average defects per months of new residential buildings

#### 6.5.7: Causes of defect

Further, question seven in Section B of the questionnaire requires the participants to indicate what they thought was the major cause of defects they have experienced. This question was a follow-up to question six of Section B that required participants to indicate from a list of 43 defects given in the

questionnaire. The purpose of question seven was to determine the participants' view of where the responsibility for the occurrence of defects lies. In the case where either 'poor workmanship' or 'omission' is selected, it can be said that this indicates an indirect error from the house developer as it is a likely fault with their tradesmen. If the participants place the guilt on 'design error' or 'material faults', then the house developer could still be directly responsible for such defects, if the buildings were designed and built by them. This question is therefore important as it will enable the residential sector to know where exactly quality improvement is needed. The result of this analysis is presented on a bar chart format as Figure 6.8.



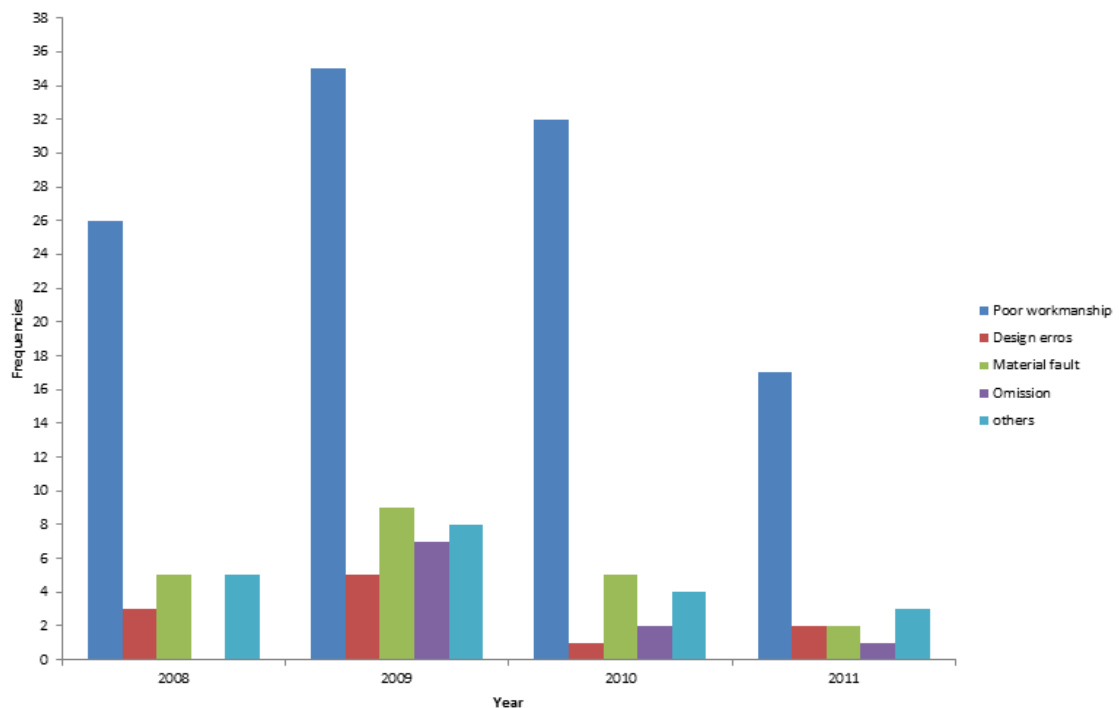
**Figure 6.8:** Percentage distribution of causes of defects

Leading on from this, the figure shows that about 15% (9.8% and 5.1%) of the participants indicated that the defects in their homes are caused by the developers (material fault and design) directly, with 66% of these participants blaming the errors in their homes to design errors and the rest to material faults. However a majority of participants, on the other hand, placed the liability on tradesmen with 51.2% of the research participants in total stating that poor workmanship was the main cause of defects in their homes. This result is suggestive of the need of the industry to focus on its standard/quality of workmanship. Participants were also given the opportunity to state any other

cause apart from the ones the researcher provided. 9.3% of the participants selected this option with 25% of these participants also selecting material fault and omission and 10% selected design error. Based on these results, it appears that the bulk of the responsibility for defective work can be ascribed to developers. Regardless of which factor is selected by the participants as the cause of defects in new homes, it is obligatory that developers proactively do all that is necessary to deliver to the satisfaction of homeowners.

#### 6.5.7.1: Causes of defects identified from 2008 – 2011

As a further analysis to question seven, the yearly estimates of the causes of defects for the four year period are presented in Figure 6.9. From the figure, it is evident that poor workmanship recorded the highest from 2008 to 2011 compared to other causes of defects. The results further shows that the highest causes of defects (poor workmanship) appear to have been recorded in 2009 followed by 2010. Since 2009, there seems to be a downward trend in poor workmanship from Figure 6.8. The year 2009 generally recorded the highest in all causes of defects (poor workmanship, design errors, material fault and omissions) indicated by the participants.



**Figure 6.9:** Causes of defects identified from 2008 - 2011

Causes of defects as a result of omission recorded the lowest from 2008 to 2011. However, the causes of defects generally in 2011 were significantly lower. This unexpected decrease can be explained by the fact only seven months was considered in 2011 because of the period the questionnaire was distributed.

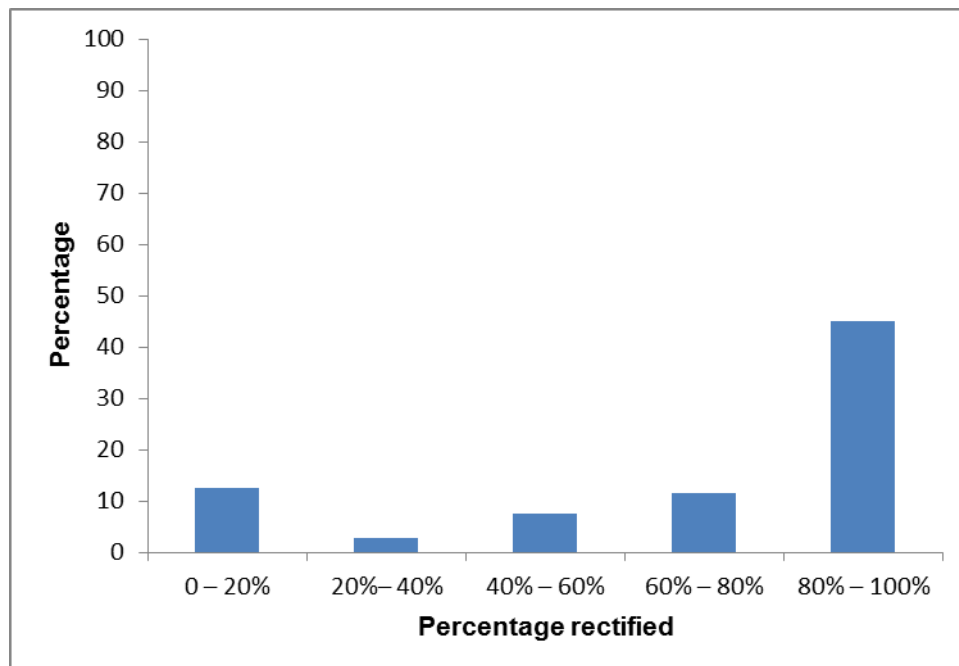
#### **6.5.8 Notification of house developer of defects observed**

In this sub-section, research participants were asked if they informed their house developers when they noticed defects in their homes. This question is to confirm whether developers are aware that there are defects that need to be fixed in the houses they have constructed. 16.3% of the research participants did not attempt this question and out of the 83.7% of the participants that responded, 76.7% indicated that their developers were notified when the defects were observed. Only 6.5% of the participants stated that they did not notify their developers when they noticed defects in their homes. 0.5% was unsure as to whether or not their developers have been notified. Based on the results obtained, it is fair to conclude that significant proportion of house developers were notified and were therefore aware of the defects within the homes they had built. This observation tend to support the research by Page (2011), which shows that a significant number of new homeowners 'call back' their developers to rectify defects in New Zealand. Subsequently, it will be logical to determine how many developers responded to these 'call backs'. This forms the rationale behind the next set of questions in Section B.

#### **6.5.9: Percentage of defects rectified**

Here, participants were required to specify what percentage of the defects they observed in their home was rectified when they notified their developers. 79.5% of the participants answered this question. Figure 6.10 clearly shows that 45.1% of the participants responded that 80 to 100% of the defects were rectified. Another 12.6% of the participants indicated that less than 20% of the defects they observed were rectified, while 11.6% had between 60 to 80% rectified. Only 7.4% of the participants indicated that between 40 to 60% of the defects were rectified and 2.8% between 20 and 40%. In summary, 22.8% of new homeowners had between 0 to 60% of their defects rectified while a larger

percentage of the participants indicated that between 80 to 100% of the defects in their homes were rectified.



**Figure 6.10:** Percentage distribution of defects rectified

#### **6.5.10: Who rectified defects in new homes?**

This question requires participants to indicate whether the defects they observed after they took possession of their new homes were rectified by the house developer or whether participants had to fix the problems themselves. 81.4% of the participants answered this question. Of these, 65.1% of participants indicated that their house developers rectified the defects they observed. 11.6% had to do the rectification themselves while 4.7% participants indicated that the question was not applicable to them. The objective of this question is to determine whether house developers respond to defects rectification when they were notified. Of the 65.1% whose developers responded to their requests, 3.6% had to do some of the rectifications themselves while another 3.6% had their defects not completely rectified and they have had to put up with them. The result obtained suggests that there is not a process in place that compels house developers to rectify defects once the buildings have been handed over.

### 6.5.11: Lawyers involvement before defect rectification

A confirmation of the difficulties being experienced by new homeowners in defect rectification is their response to the question requiring them to indicate if they had to contact their lawyers when they noticed defects in their new homes. 83.3% of the participants answered this question. Out of these 83.3% of respondents, 78.6% said they did not involve their lawyer or contact a third party before defects were rectified. Only 3.7% confirmed that they had to contact their lawyers before they could get their house developers to rectify the defects they observed after possession.

A cross tabulation of the responses to Section 6.5.10 and 6.5.11 was performed to understand the relationship of the responses. This is displayed in Table 6.8.

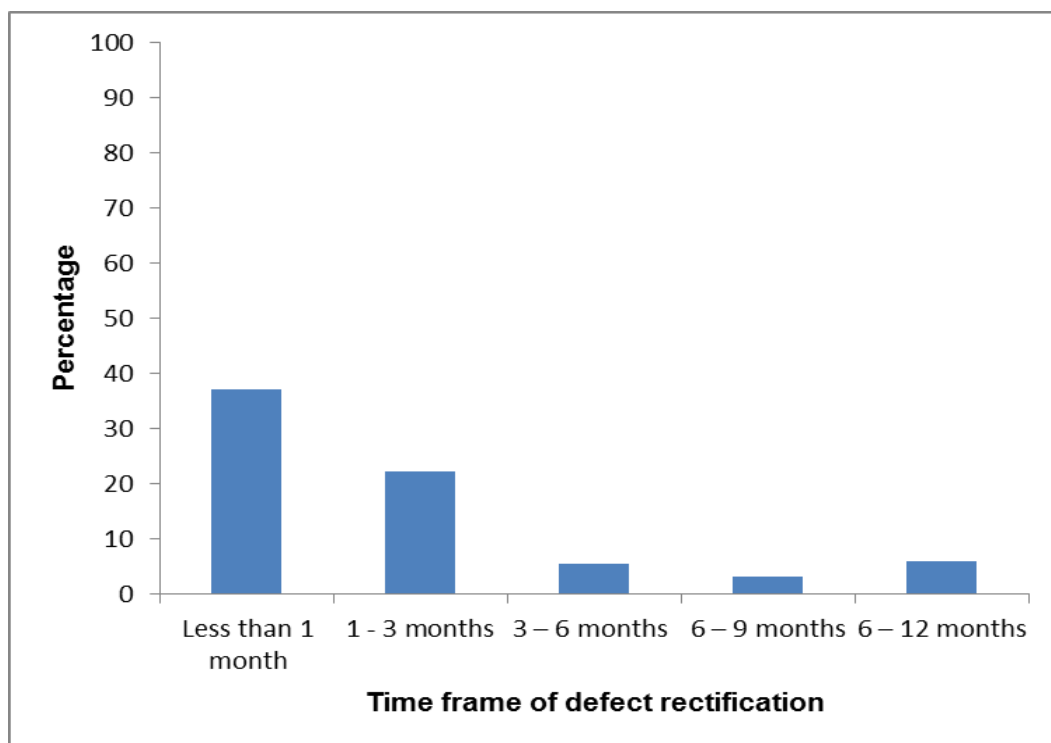
**Table 6.8:** Cross tabulations of who rectified defects and whether lawyer was involved

| Who rectified defects/ Were lawyers involved |           | Yes        | No          | Unsure     | Total        |
|----------------------------------------------|-----------|------------|-------------|------------|--------------|
| <b>Developer</b>                             | Frequency | 2          | 133         | 2          | 137          |
|                                              | %         | <b>1.2</b> | <b>77.8</b> | <b>1.2</b> | <b>80.2%</b> |
| <b>Homeowner</b>                             | Frequency | 6          | 19          | 0          | 25           |
|                                              | %         | <b>3.5</b> | <b>11.1</b> | <b>0</b>   | <b>14.6%</b> |
| <b>Unsure</b>                                | Frequency | 0          | 0           | 0          | 0            |
|                                              | %         | <b>0</b>   | <b>0</b>    | <b>0</b>   | <b>0%</b>    |
| <b>N/A</b>                                   | Frequency | 0          | 9           | 0          | 9            |
|                                              | %         | <b>0</b>   | <b>5.3</b>  | <b>0</b>   | <b>5.3%</b>  |
| <b>Total</b>                                 | Frequency | 8          | 161         | 2          | 171          |
|                                              | %         | <b>4.7</b> | <b>94.2</b> | <b>1.2</b> | <b>100</b>   |

The table shows that 14.6% of homeowners had to rectify the defects they found themselves. Also, out of all the participants who notified their lawyers, more participants (3.5%) still had to fix their defects on their own compared to the participants who got it fixed by the developers (1.2%). The possible implication of this is that lawyers may not be effective in ensuring that developers fix defects in houses. Additionally, a more compelling means may be required to get house developers to fix defects in the houses once they have been brought to their notice.

### 6.5.12: Time frame for defect rectification

The last question in Section B requires participants to indicate how quickly the defects they observed were rectified. This question targets the participants that indicated that they had gotten their developers to rectify the defects. This is to determine how promptly developers respond to new homeowners for defect rectification. The result is displayed in Figure 6.11. From the results, the participants indicated that 37.2% of defects were rectified within one month while 22.3% within three months of them being notified. Another 10.7% of participants indicated that the defects were never rectified while 6.0% said it was rectified between 9 to 12 months. 5.6% of the participants had their defects fixed between 3 to 6 months and another 3.3% between 6 to 9 months.



**Figure 6.11:** Percentage distribution of time defects were rectified

### 6.6: Homeowner satisfaction (Section C)

Table 6.9 present the result of the third section in the questionnaire. The main objective of this section is the determination of the level of satisfaction of the homeowners with the quality of their new homes. Participants were asked to indicate their overall satisfaction with the quality of their new home and the

services provided by the house developers from which they bought their houses.

They were further asked to indicate their overall satisfaction with the workmanship, design and material of their new homes. This is to give indication to what particular area improvements are required for house developers to meet homeowners' needs. A summary of the responses are tabulated in Table 6.9. Four key questions were asked and each will be discussed in the next subheadings.

**Table 6.9:** Homeowner satisfaction

| Questions Asked                                                 | Response Option         | Frequency | Percentages |
|-----------------------------------------------------------------|-------------------------|-----------|-------------|
| <b>Overall satisfaction with new home (n = 213)</b>             | Very satisfied          | 138       | 64.2        |
|                                                                 | Moderately satisfied    | 46        | 21.4        |
|                                                                 | Slightly satisfied      | 5         | 2.3         |
|                                                                 | Neutral                 | 6         | 2.8         |
|                                                                 | Slightly dissatisfied   | 7         | 3.3         |
|                                                                 | Moderately dissatisfied | 4         | 1.9         |
|                                                                 | Very dissatisfied       | 7         | 3.3         |
| <b>Level of satisfaction with developers' service (n = 205)</b> | Very satisfied          | 114       | 53.0        |
|                                                                 | Moderately satisfied    | 54        | 25.1        |
|                                                                 | Slightly satisfied      | 9         | 4.2         |
|                                                                 | Neutral                 | 4         | 1.9         |
|                                                                 | Slightly dissatisfied   | 8         | 3.7         |
|                                                                 | Moderately dissatisfied | 6         | 2.8         |
|                                                                 | Very dissatisfied       | 10        | 4.7         |
| <b>Relationship with developer (n = 202)</b>                    | Exceptional             | 55        | 25.6        |
|                                                                 | Excellent               | 65        | 30.2        |
|                                                                 | Very good               | 35        | 16.3        |
|                                                                 | Good                    | 22        | 10.2        |
|                                                                 | Fair                    | 14        | 6.5         |
|                                                                 | Poor                    | 4         | 1.9         |
|                                                                 | Very poor               | 7         | 3.3         |

#### **6.6.1: Overall satisfaction with quality of new home**

The first question in Section C requires research participants to indicate the level of satisfaction to the overall quality of their new homes. Participants were required to rate their levels of satisfaction on a scale 1 – 7 with 1 being 'Very satisfied' and 5 being 'Very dissatisfied'. Almost all (99.1%) the research participants responded to this question. The result shows that 64.2% of the participants indicated that they were very satisfied with the overall quality of

their new home. 21.4% were moderately satisfied, while 3.3% indicated that the question is not applicable to them. Another 3.3% of the research participants indicated that they were slightly dissatisfied with the quality of their new home. 2.8% indicated that they were neutral meaning that they were either satisfied or dissatisfied with their homes, 2.3% of the participants were slightly dissatisfied and 1.9% moderately dissatisfied.

This range of responses is insightful. It is clear from the result that a higher percentage of homeowners are satisfied with the quality of their home. This is in agreement with the result on the extent of defects, where majority of the homeowners indicated that the level of defects they observed was very low. However when participants were asked to identify particular defects they noticed from a list of defects given by the researcher, some participants recorded significant number of defects. Upon closer observation, it was discovered that only 82% of participants responded to the question on extent of defects (Q5 Section B) while 99.1% answered the question on overall satisfaction. This is an indication that it is either that the homeowners have interpreted quality differently from the developers or builders' own definitions, or that quality performance is achieved in new buildings. Whichever the case may be, there is still room for improvement within the residential sector. One could conclude that the question might be difficult to answer considering that satisfaction level is subjective and may be viewed from conflicting perspectives as discussed in Section 3.2.

#### **6.6.2: Level of satisfaction with the developers' service**

Further, participants were required to indicate how satisfied they were with the service provided by their house developers. This was to reveal some of the reasons behind their response to the first question in the section. The result shows that 53% of the participants indicated they were very satisfied with the services provided by their house developer, while 25.1% are moderately satisfied and 4.2% are slightly satisfies. However 4.7% indicated they were very dissatisfied, while 3.7% expressed that they are moderately dissatisfied and 2.8% are slightly dissatisfied with their developers' service. 1.9% is neither satisfied nor dissatisfied with the service rendered by their developers. The result revealed that the majority of the homeowners indicated that they are very

satisfied with the services they received from their developers. However the total percentage of dissatisfied homeowners is 11.2%, when considering one end of the scale (dissatisfaction) and the neutral value is discounted. Meaning about 1 in every 10 homeowner is dissatisfied with the service provided by their developer.

#### **6.6.3: Relationship between homeowner and developer**

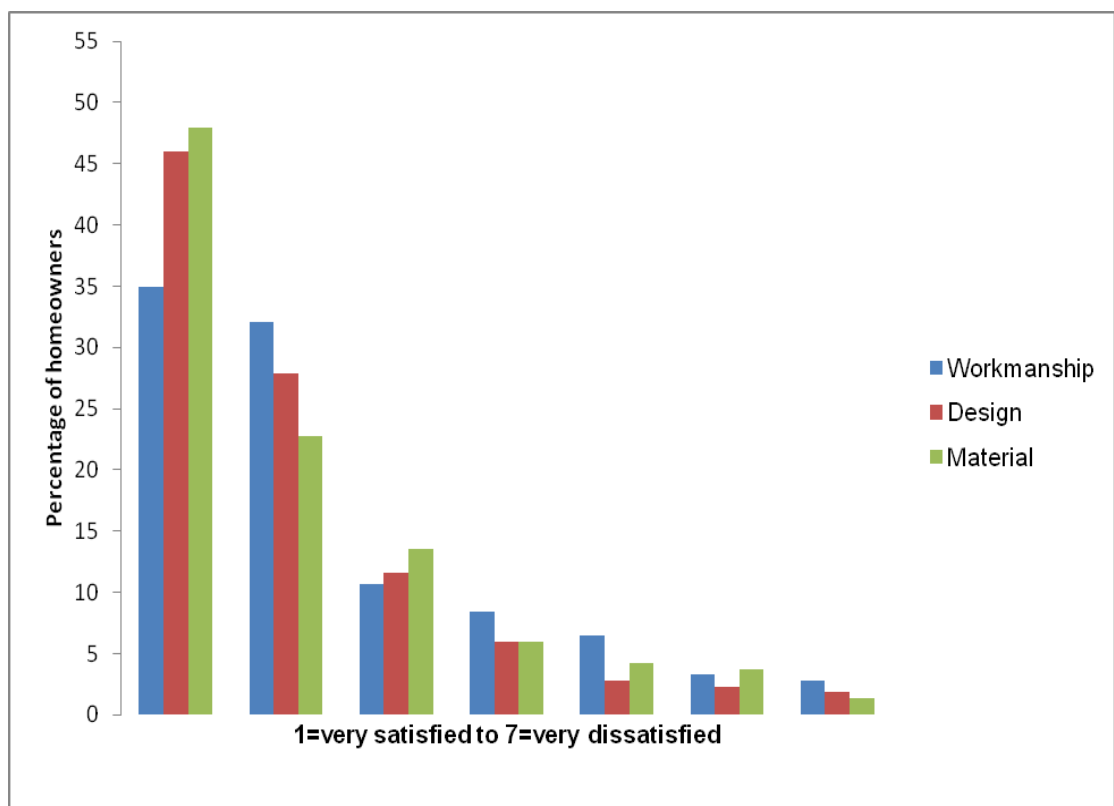
The participants were required to indicate the nature of their relationship with their developers. This could range from being exceptional to very poor on a Likert scale (see Table 6.9). 94% responses were obtained for this question. The participants' responses show that 30.2% had an excellent relationship with their developer while 25.6% had an exceptional relationship, 16.3% and 10.2% had a very good and good relationships respectively. Another 6.5% of the participants had a fair relationship with their developer. However, 3.3% and 1.9% had very poor and poor relationship with their developers respectively. Overall, significant percentage of homeowners has a good relationship with their developers.

#### **6.6.4: Quality of workmanship, design and materials of new home**

As a follow up to the question requiring homeowners to indicate their overall satisfaction to the quality of their new homes and the service provided by their developers, participants were required to qualify their satisfaction levels on a scale of 1 to 7 to workmanship, design and materials used on their new homes. The chosen scale had 1 as being 'very satisfied' and 7 being 'very dissatisfied'. The result obtained after the analysis is presented on a bar chart in Figure 6.12.

The intent of this question to homeowners is for the responses to serve as an indicator to the residential industry on particular areas where quality performance improvement is required. Considering the two ends of the Likert scale (very satisfied and very dissatisfied while discounting the midpoint values), the result confirms that 77.7% of the participants were very satisfied with the quality of workmanship of their home and another 12.6% of participants were very dissatisfied. Along similar tracks, the participants were asked to indicate their overall satisfaction level with the design of their new home. 85.5% were very satisfied while 7% fell at the other end of the scale (very dissatisfied).

Finally participants were required to show their level of satisfaction with the material used for the construction of their home using the same scale as for other factors mentioned above. 84.2% indicated that they were very satisfied and 9.3% very dissatisfied. It can be concluded from these results that a large percentage of participants were generally very satisfied with the workmanship, design and materials of their homes. However this findings show that homeowners are most dissatisfied with the quality of their workmanship (12.6%) compared to design (7%) and building material 9.3%. This result supports the finding in Section 6.5.7. Where homeowners indicate that the most causes of defects in new buildings is poor workmanship.



**Figure 6.12:** Satisfaction level to workmanship, design and building material

### 6.7: Cross tabulations and correlations of responses to section 6.4 to 6.6

As a further analyses, cross tabulation of some of the results in Section 6.4, 6.5 and 6.6 is undertaken to show the relationships between some of the responses. The purpose of this cross tabulation is to provide a basic picture of the interrelations between the two variables, so that the interactions between them can be understood. In addition, to accurately understanding defects in new residential buildings, cross tabulation will help to establish the factors that

were most significant to new homeowners in terms of satisfaction levels and their relationship with their house developers. The researcher considers that cross tabulation would usefully supplement and extend the initial analyses.

In addition, correlations analysis using Pearson correlation was carried out to identify the factor that most satisfies homeowners. This is useful so that it can indicate a predictive relationship that can be exploited in practice. Section 6.7.1 to 6.7.3 presents key determinate of homeowners' relationship with their developers. Three key factors were considered and this include, time of defect rectification, number and extent of defects noticed. Further, Section 6.7.2 describes the key determinant of satisfaction of homeowners to overall quality of their homes. Other determinants under consideration include percentage of defects rectified, timeframe of defect rectification and number of defects.

#### **6.7.1: Determinants of homeowners' relationship with developers**

This section describes the key factors that appear to have direct effects on the nature of the relationship that homeowners have with their house developers. Participants (homeowners) were required to qualify their relationship on a scale of 1 to 7 (see Section 6.6.3). This section grouped the nature of relationships into three: 'Positive relationship' representing homeowners that have good, very good, excellent and exceptional relationships with their developers; 'Fair relationship' for homeowners who have indicated that they have a fair relationship with their developers and 'Negative relationship' for homeowners that have poor and very poor relationships with their developers. All the analysis carried out in this section focused on 'Positive relationships' alone as statistically insignificant results were obtained for the other two categories due to low response numbers (about 5% of the total response). The response rates from the three groups are shown in Table 6.10.

**Table 6.10:** Total number of responses

|                     | Positive | Fair | Negative | TOTAL      |
|---------------------|----------|------|----------|------------|
| Number of responses | 178      | 14   | 11       | <b>203</b> |

#### 6.7.1.1: Satisfaction with service provided by developers

The correlation calculations (using SPSS) for the relationship that the homeowners have with their developers and their satisfaction with the services provided by the developers is given in Table 6.11. From the correlation table, there appears to be a strong, positive, and statistically significant correlation between these two variables ( $R^2 = 0.795$ ). This correlation value obtained suggests that the higher the homeowner's satisfaction with the services provided by the developers, the better the relationship that could exist between them.

**Table 6.11:** Correlation

|                                                    |                     | Relationship<br>with developer | Satisfaction with<br>Service Provided by<br>Developer |
|----------------------------------------------------|---------------------|--------------------------------|-------------------------------------------------------|
| Relationship with developer                        | Pearson Correlation | 1                              | <b>.795**</b>                                         |
|                                                    | Sig. (2-tailed)     |                                | .000                                                  |
|                                                    | N                   | 213                            | 213                                                   |
| Satisfaction with Service<br>Provided by Developer | Pearson Correlation | <b>.795**</b>                  | 1                                                     |
|                                                    | Sig. (2-tailed)     | .000                           |                                                       |
|                                                    | N                   | 213                            | 213                                                   |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

#### 6.7.1.2: Timeframe of defect rectification

This section presents the result of the cross tabulation of the time defects were rectified by house developers and the relationship of homeowners with their developers. The analysis from the cross tabulations of the two variables are presented in Table 6.12. From the result, a bar chart is produced to show the relationship between the timeframe of defect rectification and the percentage of homeowners with positive relationships with their developers (see Figure 6.13). As was previously explained in section 6.7.1 only homeowners responses with positive relationships are considered in the analysis. A best fit curve is produced from the data using the power law function. As observed, there appears to be a strong negative correlation between the two variables so that an increase in the timeframe of defect rectification causes a decrease in the percentage of

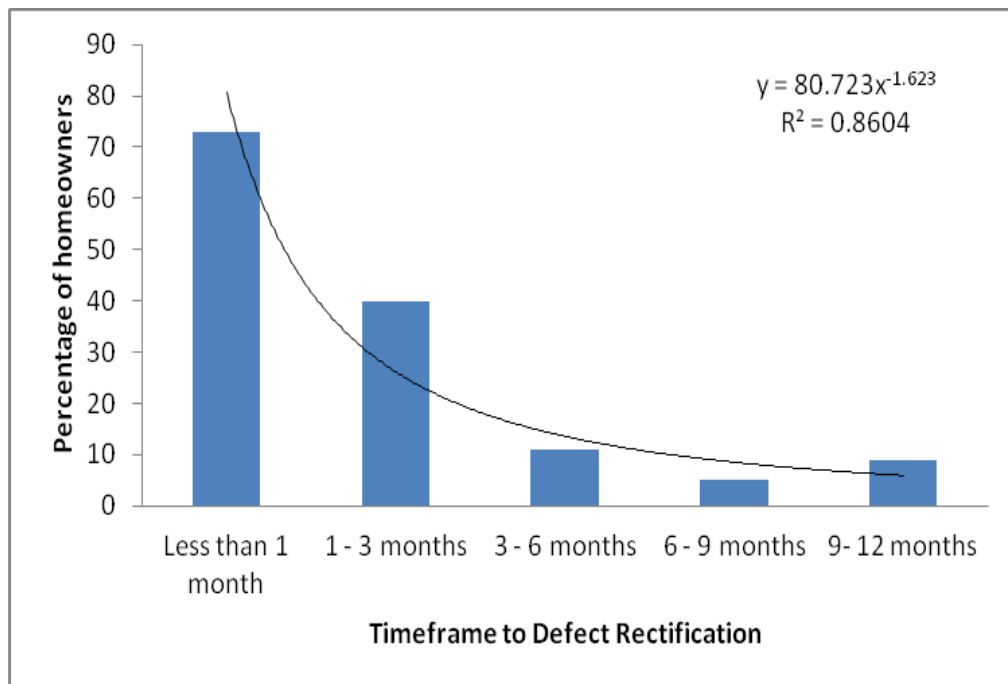
homeowners that have positive relationships with their developers ( $R^2 = 0.8604$ ). In other words, it appears that the quicker the defect is rectified, the higher the proportion of homeowners with positive relationships with their developers. The relationship appears to be fitted by a power curve with the equation:

$$y = 80.723x^{-1.623} \dots\dots\dots \text{Equation 1}$$

Based on equation 1 it is evident that the percentages of homeowners with positive relationships with their developers decrease by a power of 1.623 with increasing timeframe of defect rectification. The longer it takes for developers to rectify defects reported by homeowners, the lesser the cordiality of their relationship.

**Table 6.12:** Time frame of Defect rectification and Relationship with developer Cross-tabulation

|                                    |               | Relationship with developer    |             |           |           |        |        |        |           |        |
|------------------------------------|---------------|--------------------------------|-------------|-----------|-----------|--------|--------|--------|-----------|--------|
|                                    |               |                                | Exceptional | Excellent | Very Good | Good   | Fair   | Poor   | Very poor | Total  |
| Time frame of Defect rectification | > 1 month     | Frequency                      | 24          | 29        | 9         | 11     | 3      | 0      | 0         | 80     |
|                                    |               | % Time of Defect rectification | 30.0        | 36.3      | 11.3      | 13.8   | 3.8    | 0.0    | 0.0       | 100.0% |
|                                    |               | % Relationship with developer  | 63.2        | 48.3      | 25.7      | 61.1   | 23.1   | 0.0    | 0.0       | 43.7%  |
|                                    |               | % of Total                     | 13.1        | 15.8      | 4.9       | 6.0    | 1.6    | 0.0    | 0.0       | 43.7%  |
|                                    | 1 - 3 months  | Frequency                      | 5           | 19        | 13        | 3      | 6      | 0      | 1         | 47     |
|                                    |               | % Time of Defect rectification | 10.6        | 40.4      | 27.7      | 6.4    | 12.8   | 0.0    | 2.1       | 100.0% |
|                                    |               | % Relationship with developer  | 13.2        | 31.7      | 37.1      | 16.7   | 46.2   | 0.0    | 14.3      | 25.7%  |
|                                    |               | % of Total                     | 2.7         | 10.4      | 7.1       | 1.6    | 3.3    | 0.0    | 0.5       | 25.7%  |
|                                    | 3 - 6 months  | Frequency                      | 3           | 3         | 4         | 1      | 1      | 0      | 1         | 13     |
|                                    |               | % Time of Defect rectification | 23.1        | 23.1      | 30.8      | 7.7    | 7.7    | 0.0    | 7.7       | 100.0% |
|                                    |               | % Relationship with developer  | 7.9         | 5.0       | 11.4      | 5.6    | 7.7    | 0.0    | 14.3      | 7.1%   |
|                                    |               | % of Total                     | 1.6         | 1.6       | 2.2       | 0.5    | 0.5    | 0.0    | 0.5       | 7.1%   |
|                                    | 6 - 9 months  | Frequency                      | 2           | 1         | 2         | 0      | 1      | 1      | 0         | 7      |
|                                    |               | % Time of Defect rectification | 28.6        | 14.3      | 28.6      | 0.0    | 14.3   | 14.3   | 0.0       | 100.0% |
|                                    |               | % Relationship with developer  | 5.3         | 1.7       | 5.7       | 0.0    | 7.7    | 25.0   | 0.0       | 3.8%   |
|                                    |               | % of Total                     | 1.1         | 0.5       | 1.1%      | 0.0    | 0.5    | 0.5    | 0.0       | 3.8%   |
|                                    | 9 - 12 months | Frequency                      | 0           | 4         | 4         | 1      | 1      | 2      | 1         | 13     |
|                                    |               | % Time of Defect rectification | 0.0         | 30.8      | 30.8      | 7.7    | 7.7    | 15.4   | 7.7       | 100.0% |
|                                    |               | % Relationship with developer  | 0.0         | 6.7       | 11.4      | 5.6    | 7.7    | 50.0   | 14.3      | 7.1%   |
|                                    |               | % of Total                     | 0.0         | 2.2       | 2.2       | 0.5    | 0.5    | 1.1    | 0.5       | 7.1%   |
|                                    | Total         | Frequency                      | 38          | 60        | 35        | 18     | 13     | 4      | 7         | 183    |
|                                    |               | % Time of Defect rectification | 20.8%       | 32.8%     | 19.1%     | 9.8%   | 7.1%   | 2.2%   | 3.8%      | 100.0% |
|                                    |               | % Relationship with developer  | 100.0%      | 100.0%    | 100.0%    | 100.0% | 100.0% | 100.0% | 100.0%    | 100.0% |
|                                    |               | % of Total                     | 20.8%       | 32.8%     | 19.1%     | 9.8%   | 7.1%   | 2.2%   | 3.8%      | 100.0% |



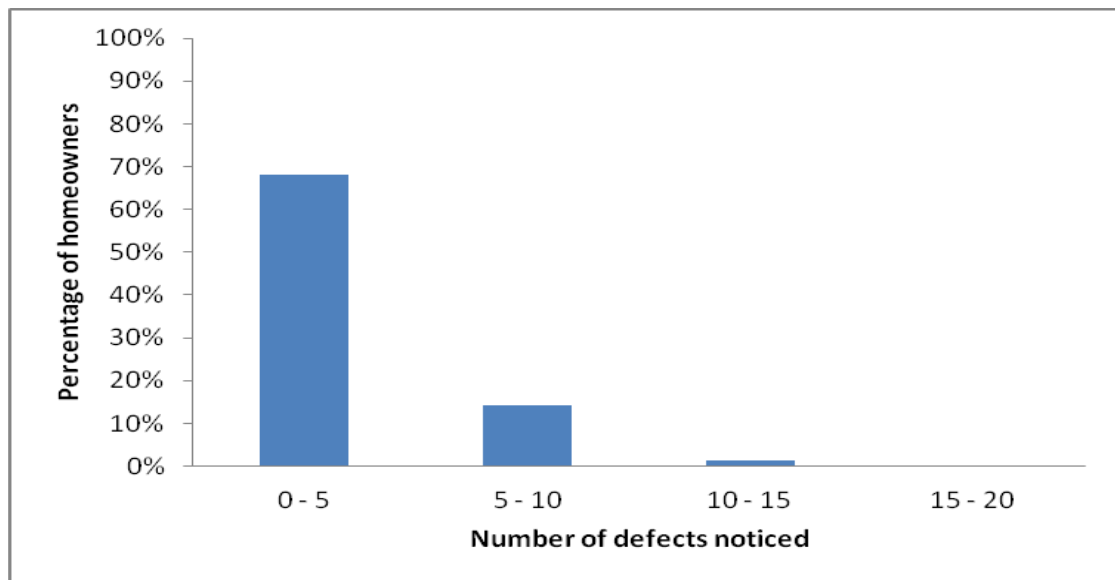
**Figure 6.13:** Percentage of homeowner with positive relationship and the time defects were rectified

#### 6.7.1.3: Number and extent of defects noticed

Number of defects that homeowners observed when they took over their homes was also considered as one of the key determinant of the relationship of homeowners with their house developers. The analysis of the cross tabulation of the two variable is presented in Table 6.13. It is clear from the table that this analysis may be useful in revealing the relationship between the two variables. Similar to Section 6.7.1.2, only the positive category was considered. Figure 6.14 shows the relationship between the number of defects noticed and the percentage of homeowners with positive relationships with their developers. From the results obtained, there appears to be a negative correlation between these two variables, so that an increase in total number of defects noticed is associated with decreasing percentage of homeowners that maintain a positive relationship with their developers. This suggests that, of all homeowners with high numbers of observed defects, lower percentages have positive rapport with their developers. The highest percentage of homeowners with positive relationships with their developers can be observed in the 0 – 5 defects group (68%) while the lowest at the other end of the scale in the 15 – 20 defects group (0%).

**Table 6.13:** Number of Defect rectification and Relationship with developer Cross-tabulation

| Relationship with developer |         |             |           |           |      |      |      |           |       |
|-----------------------------|---------|-------------|-----------|-----------|------|------|------|-----------|-------|
| Number of Defects           |         | Exceptional | Excellent | Very Good | Good | Fair | Poor | Very poor | Total |
|                             | > 5     | 48          | 57        | 27        | 13   | 9    | 1    | 2         | 165   |
|                             | 5 - 10  | 7           | 6         | 9         | 8    | 4    | 2    | 2         | 39    |
|                             | 10 - 15 | 0           | 2         | 0         | 1    | 1    | 1    | 0         | 6     |
|                             | 15 - 20 | 0           | 0         | 0         | 0    | 0    | 0    | 3         | 3     |
|                             | Total   | 55          | 65        | 36        | 22   | 14   | 4    | 7         | 203   |



**Figure 6.14:** Percentage of homeowners with positive relationship and number of defects

Further, another determinant of homeowners' relationship with their house developer is the extent of defects they observed. The cross tabulation of the responses is presented in Table 6.15. Figure 6.14 shows the relationship between the extent of defects noticed and the percentage of homeowners with positive interaction with their developers. The results obtained indicate a strong and negative correlation between the two variables as shown by an  $R^2$  value of 0.8572. Therefore, an increase in the extent of defects is directly related to a decrease in the percentage of homeowners with positive relationships with their

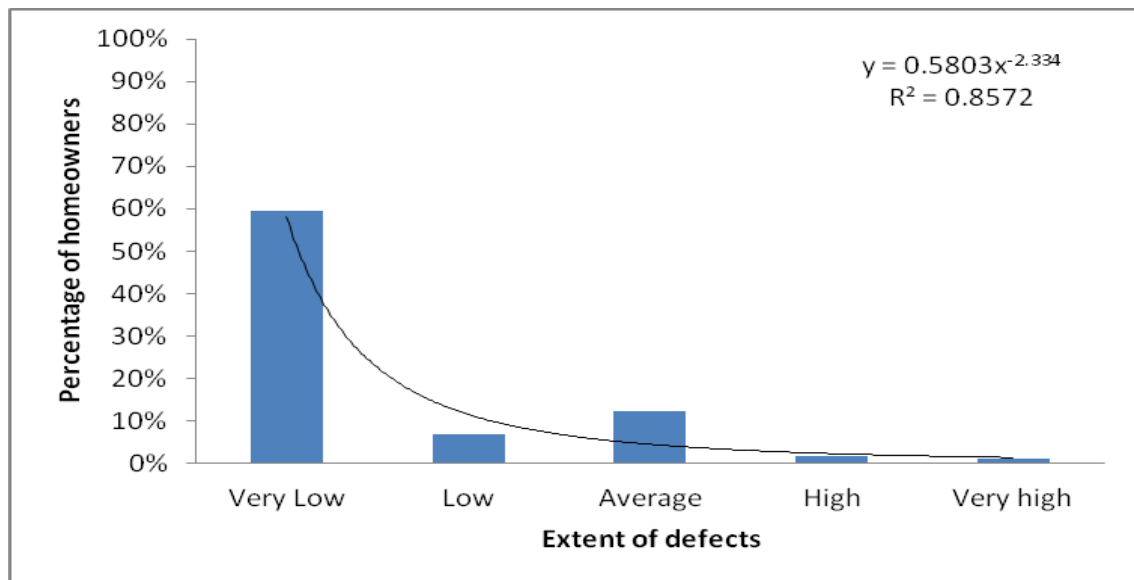
developers. The correlation appears to be fitted by a power curve with the equation:

$$y = 0.5803x^{-2.334} \dots\dots\dots \text{Equation 2}$$

From equation 2, it can be observed that the percentages of homeowners with positive relationships with their developers decrease by a power of 2.334 with increasing extent of defects. In summary, the results from both Figure 6.13 and 6.14 show that the homeowners' relationships with house developers are sensitive to the magnitude (number and extent) of defects in their homes.

**Table 6.14:** Extent of Defect and Relationship with developer Cross-tabulation

| Extent of Defects | Relationship with developer |                     |             |           |           |         |         |         |           |         |
|-------------------|-----------------------------|---------------------|-------------|-----------|-----------|---------|---------|---------|-----------|---------|
|                   |                             |                     | Exceptional | Excellent | Very Good | Good    | Fair    | Poor    | Very poor | Total   |
|                   | Very Low                    | Frequency           | 33          | 44        | 23        | 6       | 2       | 1       | 0         | 117     |
|                   |                             | % Extent of Defects | 28.20%      | 37.60%    | 19.70%    | 5.10%   | 1.70%   | 0.90%   | 0.00%     | 100.00% |
|                   |                             | % Relationship      | 91.70%      | 77.20%    | 67.60%    | 33.30%  | 15.40%  | 25.00%  | 0.00%     | 65.70%  |
|                   |                             | % of Total          | 18.50%      | 24.70%    | 12.90%    | 3.40%   | 1.10%   | 0.60%   | 0.00%     | 65.70%  |
|                   | Low                         | Frequency           | 0           | 5         | 3         | 4       | 4       | 0       | 0         | 17      |
|                   |                             | % Extent of Defects | 0.00%       | 29.40%    | 17.60%    | 23.50%  | 23.50%  | 0.00%   | 0.00%     | 100.00% |
|                   |                             | % Relationship      | 0.00%       | 8.80%     | 8.80%     | 22.20%  | 30.80%  | 0.00%   | 0.00%     | 9.60%   |
|                   |                             | % of Total          | 0.00%       | 2.80%     | 1.70%     | 2.20%   | 2.20%   | 0.00%   | 0.00%     | 9.60%   |
|                   | Average                     | Frequency           | 1           | 7         | 6         | 8       | 4       | 2       | 3         | 31      |
|                   |                             | % Extent of Defects | 3.20%       | 22.60%    | 19.40%    | 25.80%  | 12.90%  | 6.50%   | 9.70%     | 100.00% |
|                   |                             | % Relationship      | 2.80%       | 12.30%    | 17.60%    | 44.40%  | 30.80%  | 50.00%  | 42.90%    | 17.40%  |
|                   |                             | % of Total          | 0.60%       | 3.90%     | 3.40%     | 4.50%   | 2.20%   | 1.10%   | 1.70%     | 17.40%  |
|                   | High                        | Frequency           | 0           | 1         | 2         | 0       | 2       | 1       | 3         | 9       |
|                   |                             | % Extent of Defects | 0.00%       | 11.10%    | 22.20%    | 0.00%   | 22.20%  | 11.10%  | 33.30%    | 100.00% |
|                   |                             | % Relationship      | 0.00%       | 1.80%     | 5.90%     | 0.00%   | 15.40%  | 25.00%  | 42.90%    | 5.10%   |
|                   |                             | % of Total          | 0.00%       | 0.60%     | 1.10%     | 0.00%   | 1.10%   | 0.60%   | 1.70%     | 5.10%   |
|                   | Very high                   | Frequency           | 2           | 0         | 0         | 0       | 1       | 0       | 1         | 4       |
|                   |                             | % Extent of Defects | 50.00%      | 0.00%     | 0.00%     | 0.00%   | 25.00%  | 0.00%   | 25.00%    | 100.00% |
|                   |                             | % Relationship      | 5.60%       | 0.00%     | 0.00%     | 0.00%   | 7.70%   | 0.00%   | 14.30%    | 2.20%   |
|                   |                             | % of Total          | 1.10%       | 0.00%     | 0.00%     | 0.00%   | 0.60%   | 0.00%   | 0.60%     | 2.20%   |
|                   | Total                       | Frequency           | 36          | 57        | 34        | 18      | 13      | 4       | 7         | 178     |
|                   |                             | % Extent of Defects | 20.20%      | 32.00%    | 19.10%    | 10.10%  | 7.30%   | 2.20%   | 3.90%     | 100.00% |
|                   | % Relationship              | 100.00%             | 100.00%     | 100.00%   | 100.00%   | 100.00% | 100.00% | 100.00% | 100.00%   |         |
|                   | % of Total                  | 20.20%              | 32.00%      | 19.10%    | 10.10%    | 7.30%   | 2.20%   | 3.90%   | 100.00%   |         |



**Figure 6.15:** Percentage of homeowner with positive relationship and extent of defects

### 6.7.2: Determinants of overall satisfaction with quality of new homes

In this section the main determinants of homeowners' overall satisfaction with the quality of their new homes is presented. Overall homeowners' satisfaction is grouped into three categories: 'Satisfied homeowners' representing homeowners that have indicated that they are very satisfied, moderately satisfied, and slightly satisfied; 'Neutral homeowners' that have indicated that their satisfaction level is neutral; and the 'Dissatisfied homeowners' that have selected either slightly dissatisfied, moderately dissatisfied or very dissatisfied for this question. A breakdown of the response rates for the three categories is presented in Table 6.15. The analysis carried out in this section focuses on 'satisfied homeowners' alone as statistically insignificant results were obtained for the other two categories due to low response numbers. Three key factors will be considered in this section and they include: developers' service, the time defects were rectified, and percentage of defects rectified.

**Table 6.15:** Total number of responses

|                     | Satisfied | Neutral | Dissatisfied | TOTAL      |
|---------------------|-----------|---------|--------------|------------|
| Number of responses | 189       | 6       | 18           | <b>213</b> |

### 6.7.2.1: Satisfaction with service provided by Developers

From the correlation values presented in Table 6.16, there appears to be a moderate, positive, and statistically significant correlation between the satisfaction level of homeowners to the overall quality of their homes and with the services provided by their house developers ( $R^2 = 0.636$ ). Therefore, the higher the satisfaction of the homeowner with services provided by the developer the more satisfied are homeowner's with the overall quality of their new homes. To further understand the relationship between these two variables, cross tabulation of the responses to overall satisfaction and services provided was performed. From the cross tabulation, a bar chart was produced that relates the satisfaction level of the homeowners with the services provided by their developers to the percentage of homeowners that were satisfied with the overall quality of their new home.

**Table 6.16:** Correlation of overall quality satisfaction and developer's service

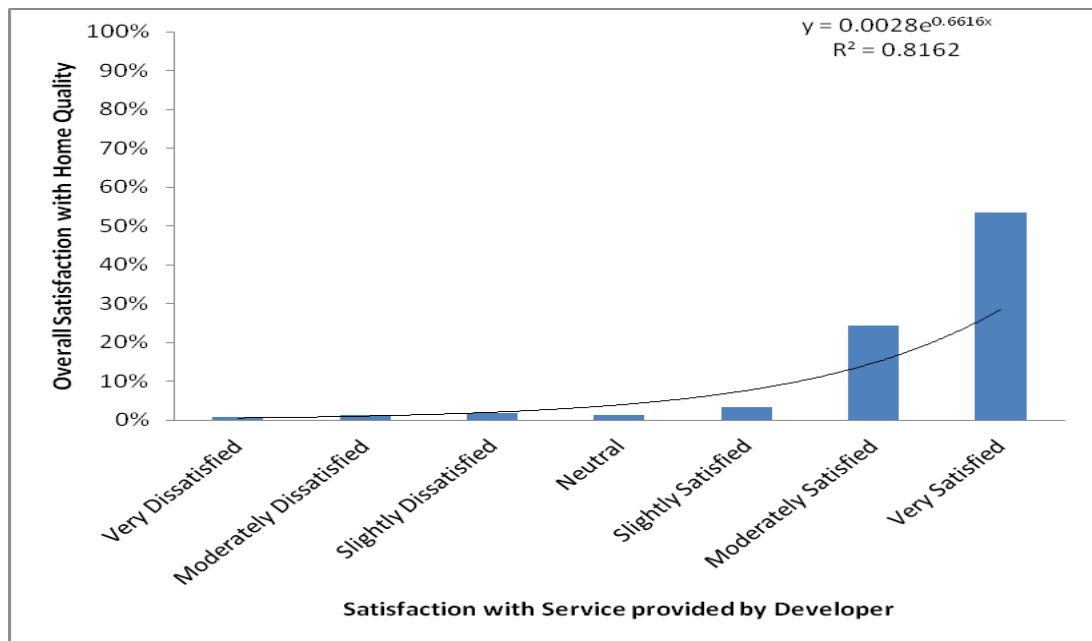
|                                                 |                     | Overall Satisfaction | Satisfaction with Service Provided by Developer |
|-------------------------------------------------|---------------------|----------------------|-------------------------------------------------|
| Overall Satisfaction                            | Pearson Correlation | 1                    | .636**                                          |
|                                                 | Sig. (2-tailed)     |                      | .000                                            |
|                                                 | N                   | 214                  | 213                                             |
| Satisfaction with Service Provided by Developer | Pearson Correlation | .636**               | 1                                               |
|                                                 | Sig. (2-tailed)     | .000                 |                                                 |
|                                                 | N                   | 213                  | 213                                             |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The cross tabulation is presented in a bar chart in Figure 6.16. The result shown in Figure 6.15 reinforces the results presented in Table 6.17. From Figure 6.15, there is an apparent increase in the overall quality satisfaction levels as the satisfaction with developer levels increase. This correlation can be fitted with an exponential curve with an  $R^2$  value of 0.8162. This means that 82% of the time, when homeowners are satisfied with the services they received from their house developers, they will also be satisfied with the overall quality of their homes.

**Table 6.17: Overall Satisfaction and Satisfaction with Service Cross-tabulation**

|                      | Satisfaction with Service Provided by Developer |                    |                      |                    |         |                       |                         |                   |         |         |
|----------------------|-------------------------------------------------|--------------------|----------------------|--------------------|---------|-----------------------|-------------------------|-------------------|---------|---------|
|                      |                                                 | Very Satisfied     | Moderately Satisfied | Slightly Satisfied | Neutral | Slightly Dissatisfied | Moderately Dissatisfied | Very Dissatisfied | Total   |         |
| Overall Satisfaction | Very Satisfied                                  | Frequency          | 105                  | 24                 | 1       | 1                     | 3                       | 0                 | 0       | 139     |
|                      |                                                 | %Overall Sat.      | 75.50%               | 17.30%             | 0.70%   | 0.70%                 | 2.20%                   | 0.00%             | 0.00%   | 100.00% |
|                      |                                                 | % Service Provided | 91.30%               | 44.40%             | 11.10%  | 25.00%                | 37.50%                  | 0.00%             | 0.00%   | 65.30%  |
|                      |                                                 | % of Total         | 49.30%               | 11.30%             | 0.50%   | 0.50%                 | 1.40%                   | 0.00%             | 0.00%   | 65.30%  |
|                      | Moderately Satisfied                            | Frequency          | 9                    | 26                 | 4       | 2                     | 1                       | 2                 | 2       | 46      |
|                      |                                                 | %Overall Sat.      | 19.60%               | 56.50%             | 8.70%   | 4.30%                 | 2.20%                   | 4.30%             | 4.30%   | 100.00% |
|                      |                                                 | % Service Provided | 7.80%                | 48.10%             | 44.40%  | 50.00%                | 12.50%                  | 33.30%            | 20.00%  | 21.60%  |
|                      |                                                 | % of Total         | 4.20%                | 12.20%             | 1.90%   | 0.90%                 | 0.50%                   | 0.90%             | 0.90%   | 21.60%  |
|                      | Slightly Satisfied                              | Frequency          | 0                    | 2                  | 2       | 0                     | 0                       | 1                 | 0       | 5       |
|                      |                                                 | %Overall Sat.      | 0.00%                | 40.00%             | 40.00%  | 0.00%                 | 0.00%                   | 20.00%            | 0.00%   | 100.00% |
|                      |                                                 | % Service Provided | 0.00%                | 3.70%              | 22.20%  | 0.00%                 | 0.00%                   | 16.70%            | 0.00%   | 2.30%   |
|                      |                                                 | % of Total         | 0.00%                | 0.90%              | 0.90%   | 0.00%                 | 0.00%                   | 0.50%             | 0.00%   | 2.30%   |
|                      | Neutral                                         | Frequency          | 0                    | 1                  | 0       | 1                     | 3                       | 0                 | 0       | 5       |
|                      |                                                 | %Overall Sat.      | 0.00%                | 20.00%             | 0.00%   | 20.00%                | 60.00%                  | 0.00%             | 0.00%   | 100.00% |
|                      |                                                 | % Service Provided | 0.00%                | 1.90%              | 0.00%   | 25.00%                | 37.50%                  | 0.00%             | 0.00%   | 2.30%   |
|                      |                                                 | % of Total         | 0.00%                | 0.50%              | 0.00%   | 0.50%                 | 1.40%                   | 0.00%             | 0.00%   | 2.30%   |
|                      | Slightly Dissatisfied                           | Frequency          | 0                    | 1                  | 2       | 0                     | 1                       | 1                 | 2       | 7       |
|                      |                                                 | %Overall Sat.      | 0.00%                | 14.30%             | 28.60%  | 0.00%                 | 14.30%                  | 14.30%            | 28.60%  | 100.00% |
|                      |                                                 | % Service Provided | 0.00%                | 1.90%              | 22.20%  | 0.00%                 | 12.50%                  | 16.70%            | 20.00%  | 3.30%   |
|                      |                                                 | % of Total         | 0.00%                | 0.50%              | 0.90%   | 0.00%                 | 0.50%                   | 0.50%             | 0.90%   | 3.30%   |
|                      | Moderately Dissatisfied                         | Frequency          | 0                    | 0                  | 0       | 0                     | 0                       | 1                 | 2       | 4       |
|                      |                                                 | %Overall Sat.      | 0.00%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 25.00%            | 50.00%  | 100.00% |
|                      |                                                 | % Service Provided | 0.00%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 16.70%            | 20.00%  | 1.90%   |
|                      |                                                 | % of Total         | 0.00%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.50%             | 0.90%   | 1.90%   |
|                      | Very Dissatisfied                               | Frequency          | 1                    | 0                  | 0       | 0                     | 0                       | 1                 | 4       | 7       |
|                      |                                                 | %Overall Sat.      | 14.30%               | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 14.30%            | 57.10%  | 100.00% |
|                      |                                                 | % Service Provided | 0.90%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 16.70%            | 40.00%  | 3.30%   |
|                      |                                                 | % of Total         | 0.50%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.50%             | 1.90%   | 3.30%   |
|                      | Total                                           | Frequency          | 115                  | 54                 | 9       | 4                     | 8                       | 6                 | 10      | 213     |
|                      |                                                 | %Overall Sat.      | 54.00%               | 25.40%             | 4.20%   | 1.90%                 | 3.80%                   | 2.80%             | 4.70%   | 100.00% |
|                      |                                                 | % Service Provided | 100.00%              | 100.00%            | 100.00% | 100.00%               | 100.00%                 | 100.00%           | 100.00% | 100.00% |
|                      |                                                 | % of Total         | 54.00%               | 25.40%             | 4.20%   | 1.90%                 | 3.80%                   | 2.80%             | 4.70%   | 100.00% |



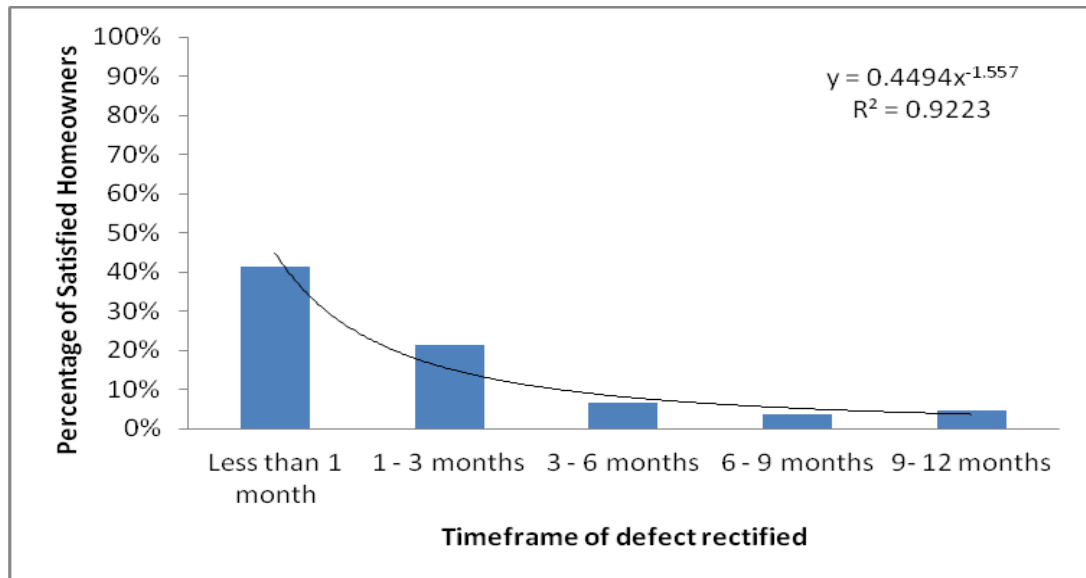
**Figure 6.16:** Percentage of homeowner with overall quality satisfaction and developer's service

#### 6.7.2.2: Timeframe of defect rectification

Similar to Section 6.7.2.1, this section will also considers only the category of 'Satisfied homeowners'. Figure 6.17 describes the relationship between the timeframe of defect rectification and the percentage of homeowners who have indicated that they are satisfied with the quality of their new homes. This is further presented in Table 6.18. Based on the results, there appears to be a strong negative correlation between the two variables so that an increase in the timeframe of defect rectification causes a decrease in the percentage of homeowners that are satisfied with the overall quality of their new homes ( $R^2 = 0.9223$ ). In other words, it appears that the more time taken for defect rectification, the lower the proportion of homeowners that are satisfied with the overall quality of their new homes. The correlation appears to be fitted by a power curve with the equation:

$$y = 0.4494x^{-1.557} \dots\dots\dots \text{Equation 3}$$

From equation 3, it is evident that the percentage of homeowners that are satisfied with the overall quality of their new homes decrease by a power of 1.557 with increasing timeframe of defect rectification.



**Figure 6.17:** Percentage of homeowner with overall quality satisfaction and time defects were rectified

**Table 6.18:** Overall satisfaction and time frame of defect rectification cross tabulation

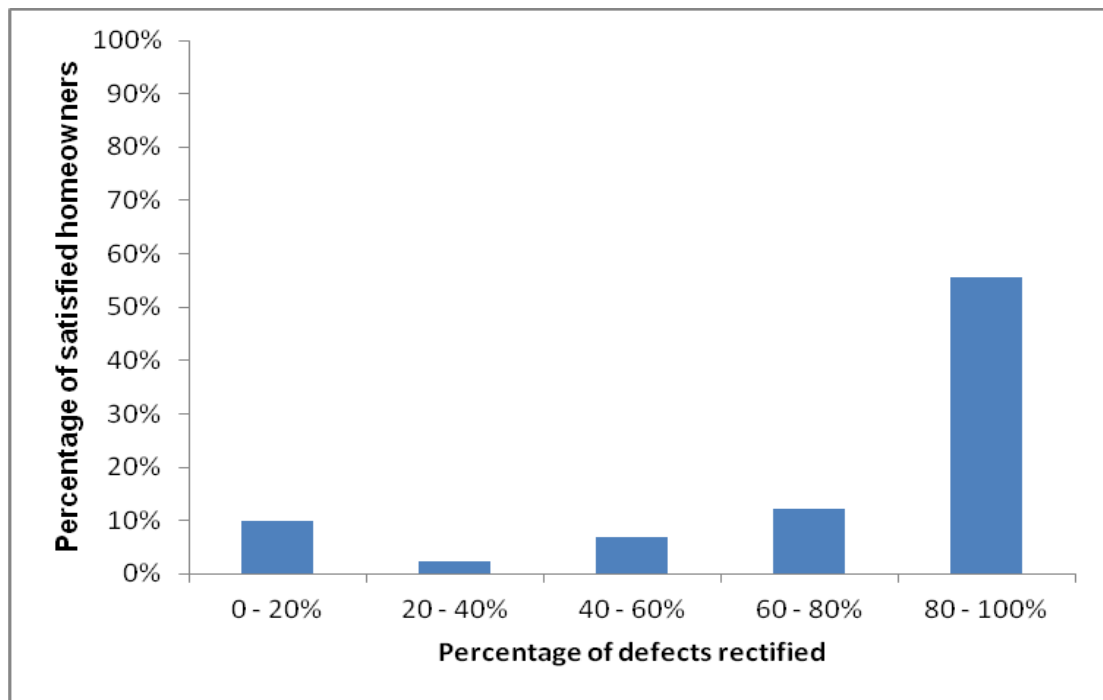
| Time frame of Defect rectification | Overall Satisfaction |                        |                |                      |                    |         |                       |                         |                   |         |
|------------------------------------|----------------------|------------------------|----------------|----------------------|--------------------|---------|-----------------------|-------------------------|-------------------|---------|
|                                    |                      |                        | Very Satisfied | Moderately Satisfied | Slightly Satisfied | Neutral | Slightly Dissatisfied | Moderately Dissatisfied | Very Dissatisfied | Total   |
|                                    | > 1 month            | Frequency              | 56             | 18                   | 2                  | 1       | 1                     | 0                       | 2                 | 80      |
|                                    |                      | % Defect rectification | 70.00%         | 22.50%               | 2.50%              | 1.30%   | 1.30%                 | 0.00%                   | 2.50%             | 100.00% |
|                                    |                      | % Overall Sat.         | 50.50%         | 40.00%               | 40.00%             | 20.00%  | 16.70%                | 0.00%                   | 28.60%            | 43.70%  |
|                                    |                      | % of Total             | 30.60%         | 9.80%                | 1.10%              | 0.50%   | 0.50%                 | 0.00%                   | 1.10%             | 43.70%  |
|                                    | 1 - 3 months         | Frequency              | 28             | 10                   | 1                  | 3       | 4                     | 1                       | 0                 | 47      |
|                                    |                      | % Defect rectification | 59.60%         | 21.30%               | 2.10%              | 6.40%   | 8.50%                 | 2.10%                   | 0.00%             | 100.00% |
|                                    |                      | % Overall Sat.         | 25.20%         | 22.20%               | 20.00%             | 60.00%  | 66.70%                | 25.00%                  | 0.00%             | 25.70%  |
|                                    |                      | % of Total             | 15.30%         | 5.50%                | 0.50%              | 1.60%   | 2.20%                 | 0.50%                   | 0.00%             | 25.70%  |
|                                    | 3 - 6 months         | Frequency              | 8              | 4                    | 0                  | 0       | 0                     | 0                       | 1                 | 13      |
|                                    |                      | % Defect rectification | 61.50%         | 30.80%               | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 7.70%             | 100.00% |
|                                    |                      | % Overall Sat.         | 7.20%          | 8.90%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 14.30%            | 7.10%   |
|                                    |                      | % of Total             | 4.40%          | 2.20%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.50%             | 7.10%   |
|                                    | 6 - 9 months         | Frequency              | 1              | 6                    | 0                  | 0       | 0                     | 0                       | 0                 | 7       |
|                                    |                      | % Defect rectification | 14.30%         | 85.70%               | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.00%             | 100.00% |
|                                    |                      | % Overall Sat.         | 0.90%          | 13.30%               | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.00%             | 3.80%   |
|                                    |                      | % of Total             | 0.50%          | 3.30%                | 0.00%              | 0.00%   | 0.00%                 | 0.00%                   | 0.00%             | 3.80%   |
|                                    | 9- 12 months         | Frequency              | 5              | 3                    | 1                  | 0       | 0                     | 2                       | 2                 | 13      |
|                                    |                      | % Defect rectification | 38.50%         | 23.10%               | 7.70%              | 0.00%   | 0.00%                 | 15.40%                  | 15.40%            | 100.00% |
|                                    |                      | % Overall Sat.         | 4.50%          | 6.70%                | 20.00%             | 0.00%   | 0.00%                 | 50.00%                  | 28.60%            | 7.10%   |
|                                    |                      | % of Total             | 2.70%          | 1.60%                | 0.50%              | 0.00%   | 0.00%                 | 1.10%                   | 1.10%             | 7.10%   |
|                                    | 6                    | Frequency              | 13             | 4                    | 1                  | 1       | 1                     | 1                       | 2                 | 23      |
|                                    |                      | % Defect rectification | 56.50%         | 17.40%               | 4.30%              | 4.30%   | 4.30%                 | 4.30%                   | 8.70%             | 100.00% |
|                                    |                      | % Overall Sat.         | 11.70%         | 8.90%                | 20.00%             | 20.00%  | 16.70%                | 25.00%                  | 28.60%            | 12.60%  |
|                                    |                      | % of Total             | 7.10%          | 2.20%                | 0.50%              | 0.50%   | 0.50%                 | 0.50%                   | 1.10%             | 12.60%  |
|                                    | Total                | Frequency              | 111            | 45                   | 5                  | 5       | 6                     | 4                       | 7                 | 183     |
|                                    |                      | % Defect rectification | 60.70%         | 24.60%               | 2.70%              | 2.70%   | 3.30%                 | 2.20%                   | 3.80%             | 100.00% |
|                                    | % Overall Sat.       | 100.00%                | 100.00%        | 100.00%              | 100.00%            | 100.00% | 100.00%               | 100.00%                 | 100.00%           |         |
|                                    | % of Total           | 60.70%                 | 24.60%         | 2.70%                | 2.70%              | 3.30%   | 2.20%                 | 3.80%                   | 100.00%           |         |

### 6.7.2.3: Percentage of defects rectified

A cross tabulation of the percentage of defects rectified and the satisfaction of homeowners to the overall quality of their homes was undertaken. The purpose was to see if there is a relationship between these two variables. The result is displayed in Table 6.19. This section also takes into consideration the category of 'Satisfied homeowners' as discussed in Section 6.7.2. It is apparent from the table that significant total percentage of homeowners (55.6%) who had between 80-100% of their defects rectified were satisfied with the overall quality of their homes. This is followed by 12.3% of homeowners who had between 60-80% of their defects rectified by their house developers. Figure 6.18 clearly shows this trend. However, it is surprising to see that about 10% of homeowners who had less than 20% of their defects rectified were satisfied with the overall quality of their homes.

**Table 6.19:** Overall satisfaction and percentage of defects rectified cross-tabulation

|                      |                        | Overall Satisfaction |                      |                    |         |                       |                         |                   | Total   |
|----------------------|------------------------|----------------------|----------------------|--------------------|---------|-----------------------|-------------------------|-------------------|---------|
|                      |                        | Very Satisfied       | Moderately Satisfied | Slightly Satisfied | Neutral | Slightly Dissatisfied | Moderately Dissatisfied | Very Dissatisfied |         |
| Percentage rectified | 0 - 20%                |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 8                    | 8                    | 1                  | 2       | 3                     | 1                       | 4                 | 27      |
|                      | % Percentage rectified | 29.60%               | 29.60%               | 3.70%              | 7.40%   | 11.10%                | 3.70%                   | 14.80%            | 100.00% |
|                      | % Overall Sat.         | 8.10%                | 17.80%               | 20.00%             | 40.00%  | 42.90%                | 25.00%                  | 66.70%            | 15.80%  |
|                      | % of Total             | 4.70%                | 4.70%                | 0.60%              | 1.20%   | 1.80%                 | 0.60%                   | 2.30%             | 15.80%  |
|                      | 20 - 40%               |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 3                    | 1                    | 0                  | 2       | 0                     | 0                       | 0                 | 6       |
|                      | % Percentage rectified | 50.00%               | 16.70%               | 0.00%              | 33.30%  | 0.00%                 | 0.00%                   | 0.00%             | 100.00% |
|                      | % Overall Sat.         | 3.00%                | 2.20%                | 0.00%              | 40.00%  | 0.00%                 | 0.00%                   | 0.00%             | 3.50%   |
|                      | % of Total             | 1.80%                | 0.60%                | 0.00%              | 1.20%   | 0.00%                 | 0.00%                   | 0.00%             | 3.50%   |
|                      | 40 - 60%               |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 7                    | 5                    | 0                  | 1       | 2                     | 1                       | 0                 | 16      |
|                      | % Percentage rectified | 43.80%               | 31.30%               | 0.00%              | 6.30%   | 12.50%                | 6.30%                   | 0.00%             | 100.00% |
|                      | % Overall Sat.         | 7.10%                | 11.10%               | 0.00%              | 20.00%  | 28.60%                | 25.00%                  | 0.00%             | 9.40%   |
|                      | % of Total             | 4.10%                | 2.90%                | 0.00%              | 0.60%   | 1.20%                 | 0.60%                   | 0.00%             | 9.40%   |
|                      | 60 - 80%               |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 8                    | 12                   | 1                  | 0       | 2                     | 2                       | 0                 | 25      |
|                      | % Percentage rectified | 32.00%               | 48.00%               | 4.00%              | 0.00%   | 8.00%                 | 8.00%                   | 0.00%             | 100.00% |
|                      | % Overall Sat.         | 8.10%                | 26.70%               | 20.00%             | 0.00%   | 28.60%                | 50.00%                  | 0.00%             | 14.60%  |
|                      | % of Total             | 4.70%                | 7.00%                | 0.60%              | 0.00%   | 1.20%                 | 1.20%                   | 0.00%             | 14.60%  |
|                      | 80 - 100%              |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 73                   | 19                   | 3                  | 0       | 0                     | 0                       | 2                 | 97      |
|                      | % Percentage rectified | 75.30%               | 19.60%               | 3.10%              | 0.00%   | 0.00%                 | 0.00%                   | 2.10%             | 100.00% |
|                      | % Overall Sat.         | 73.70%               | 42.20%               | 60.00%             | 0.00%   | 0.00%                 | 0.00%                   | 33.30%            | 56.70%  |
|                      | % of Total             | 42.70%               | 11.10%               | 1.80%              | 0.00%   | 0.00%                 | 0.00%                   | 1.20%             | 56.70%  |
|                      | Total                  |                      |                      |                    |         |                       |                         |                   |         |
|                      | Frequency              | 99                   | 45                   | 5                  | 5       | 7                     | 4                       | 6                 | 171     |
|                      | % Percentage rectified | 57.90%               | 26.30%               | 2.90%              | 2.90%   | 4.10%                 | 2.30%                   | 3.50%             | 100.00% |
|                      | % Overall Sat.         | 100.00%              | 100.00%              | 100.00%            | 100.00% | 100.00%               | 100.00%                 | 100.00%           | 100.00% |
|                      | % of Total             | 57.90%               | 26.30%               | 2.90%              | 2.90%   | 4.10%                 | 2.30%                   | 3.50%             | 100.00% |



**Figure 6.18:** Percentage of homeowner with overall quality satisfaction and percentage rectified

### **6.7.3: Determinants of the percentage of defects rectified**

This section explores the factors that affect the percentage of defects rectified by house developers. The analyses in this section has been carried out to explore what factors need to be taken into consideration when recommendations are made that aim to improve the total proportion of defects that are rectified. From previous sections, it is apparent that percentage of defects rectified is a significant determinant of overall satisfaction therefore, an exploration of its determinants will enable a better understanding of the indirect factors that affect overall homeowners' satisfaction levels. The factors considered are: lawyers' involvement, timeframe of defect rectification, and type of developers engaged to build.

#### **6.7.3.1: Lawyers' involvement**

Table 6.20 shows the cross tabulation of percentage of defects rectified to lawyers involvements. These results have been presented as such to show the effect of lawyer's involvement in the proportion of defects that were rectified in the new homes. The results show that out of all the homeowners who said they have not used lawyers, there is an increasing trend in the percentage of defects rectified. Out of homeowners who contacted their lawyers to pursue defect rectification, less than 1 in 3 of the houses have less than 60% of their defects

rectified (37.5%), while out of the homeowners who did not contact their lawyers, about 1 in 4 homeowners still had over half of their total defects yet to be rectified (27.3%). Of the people who indicated that they have used lawyers, over 50% have less than 60% of their defects rectified.

**Table 6.20: Lawyers Involvement and Percentage rectified Cross-tabulation**

|                     |        |                              | Percentage rectified |          |          |          |           |         |
|---------------------|--------|------------------------------|----------------------|----------|----------|----------|-----------|---------|
|                     |        |                              | 0 - 20%              | 20 - 40% | 40 - 60% | 60 - 80% | 80 - 100% | Total   |
| Lawyers Involvement | No     | Frequency                    | 22                   | 6        | 16       | 23       | 94        | 161     |
|                     |        | % within Lawyers Involvement | 13.70%               | 3.70%    | 9.90%    | 14.30%   | 58.40%    | 100.00% |
|                     | Yes    | Frequency                    | 3                    | 0        | 0        | 2        | 3         | 8       |
|                     |        | % within Lawyers Involvement | 37.50%               | 0.00%    | 0.00%    | 25.00%   | 37.50%    | 100.00% |
|                     | Unsure | Frequency                    | 1                    | 0        | 1        | 0        | 0         | 2       |
|                     |        | % within Lawyers Involvement | 50.00%               | 0.00%    | 50.00%   | 0.00%    | 0.00%     | 100.00% |
|                     | Total  | Frequency                    | 26                   | 6        | 17       | 25       | 97        | 171     |
|                     |        | % within Lawyers Involvement | 15.20%               | 3.50%    | 9.90%    | 14.60%   | 56.70%    | 100.00% |

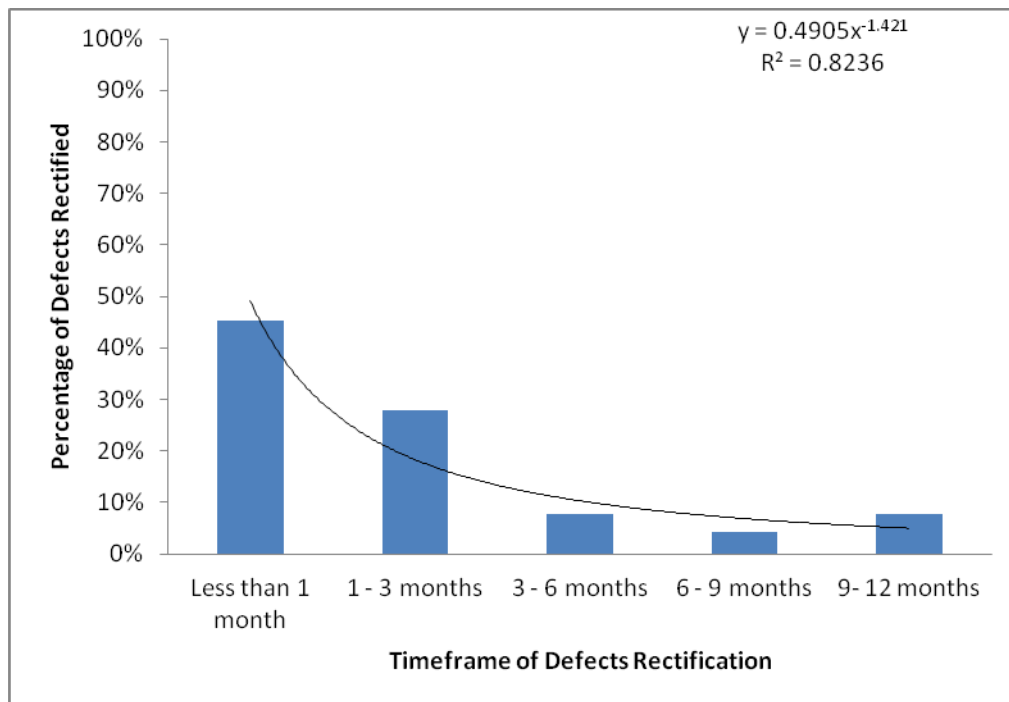
### 6.7.3.2: Timeframe of defect rectification

The relationship between the timeframe of defect rectification and the percentage of defects rectified within the homes is depicted in Figure 6.19. This relationship is analysed to show whether defect rectification is dependent on how long since the time of handover. The bar chart is produced from the result of the cross tabulation of the responses from the two variables. Based on the results, there appears to be a strong negative correlation between the timeframe of defects rectification and percentage of defects rectified. The relationship can be represented by a power curve with  $R^2$  value of 0.8236 and an equation:

$$y = 0.4905x^{-1.421} \dots\dots\dots \text{Equation 4}$$

From equation 4, it can be deduced that 82.36% of the time, with increasing timeframe since handover, the percentage of defects rectified drops with a

power of 1.421. In other words, the longer it takes before defects are rectified, the fewer the defects that will be rectified.



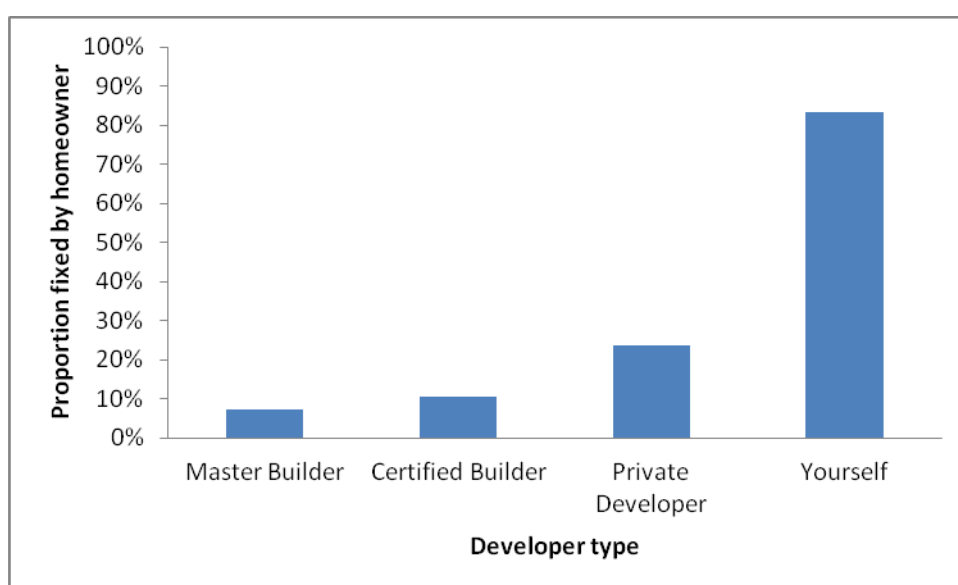
**Figure 6.19:** Percentage of defects rectified and time defects were rectified

### 6.7.3.3: Developer type

Figure 6.20 depicts the relationship between the type of developer and the proportion of total defects that had to be fixed by the homeowner themselves. This bar chart was obtained from a cross-tabulation that related the developer type to the defect rectifier (developer, home owner etc.). Table 6.21 present the result of the cross-tabulation. From the results obtained, it is apparent that homeowners had to rectify a low proportion of defects when they are not the developers themselves. In this case, residential buildings built by Masters Builders had the lowest proportion of defects that were fixed by homeowners (7.3%), followed by certified builders (10.7%), then private developers (23.8%). Predictably, owner-built homes were largely rectified by the owners themselves (83.3%). Thus, other than owners built houses, homeowners that used private developers had to rectify more defects compared to those who used MBF and CBANZ house developers.

**Table 6.21:** Type of developer and who rectified defect cross-tabulation

| Types of Developer | Who rectified defects   |                         |           |          |         |         |
|--------------------|-------------------------|-------------------------|-----------|----------|---------|---------|
|                    |                         |                         | Developer | Yourself | N/A     | Total   |
|                    | Master Builder          | Frequency               | 97        | 8        | 4       | 109     |
|                    |                         | % Developer type        | 89.00%    | 7.30%    | 3.70%   | 100.00% |
|                    |                         | % Who rectified defects | 68.80%    | 32.00%   | 40.00%  | 61.90%  |
|                    |                         | % of Total              | 55.10%    | 4.50%    | 2.30%   | 61.90%  |
|                    | Certified Builder       | Frequency               | 24        | 3        | 1       | 28      |
|                    |                         | % Developer type        | 85.70%    | 10.70%   | 3.60%   | 100.00% |
|                    |                         | % Who rectified defects | 17.00%    | 12.00%   | 10.00%  | 15.90%  |
|                    |                         | % of Total              | 13.60%    | 1.70%    | 0.60%   | 15.90%  |
|                    | Yourself                | Frequency               | 4         | 6        | 2       | 12      |
|                    |                         | % Developer type        | 33.30%    | 50.00%   | 16.70%  | 100.00% |
|                    |                         | % Who rectified defects | 2.80%     | 24.00%   | 20.00%  | 6.80%   |
|                    |                         | % of Total              | 2.30%     | 3.40%    | 1.10%   | 6.80%   |
|                    | Private Developer       | Frequency               | 14        | 5        | 2       | 21      |
|                    |                         | % Developer type        | 66.70%    | 23.80%   | 9.50%   | 100.00% |
|                    |                         | % Who rectified defects | 9.90%     | 20.00%   | 20.00%  | 11.90%  |
|                    |                         | % of Total              | 8.00%     | 2.80%    | 1.10%   | 11.90%  |
|                    | Don't Know              | Frequency               | 2         | 3        | 1       | 6       |
|                    |                         | % Developer type        | 33.30%    | 50.00%   | 16.70%  | 100.00% |
|                    |                         | % Who rectified defects | 1.40%     | 12.00%   | 10.00%  | 3.40%   |
|                    |                         | % of Total              | 1.10%     | 1.70%    | 0.60%   | 3.40%   |
|                    | Total                   | Frequency               | 141       | 25       | 10      | 176     |
|                    |                         | % Developer type        | 80.10%    | 14.20%   | 5.70%   | 100.00% |
|                    | % Who rectified defects | 100.00%                 | 100.00%   | 100.00%  | 100.00% |         |
|                    | % of Total              | 80.10%                  | 14.20%    | 5.70%    | 100.00% |         |



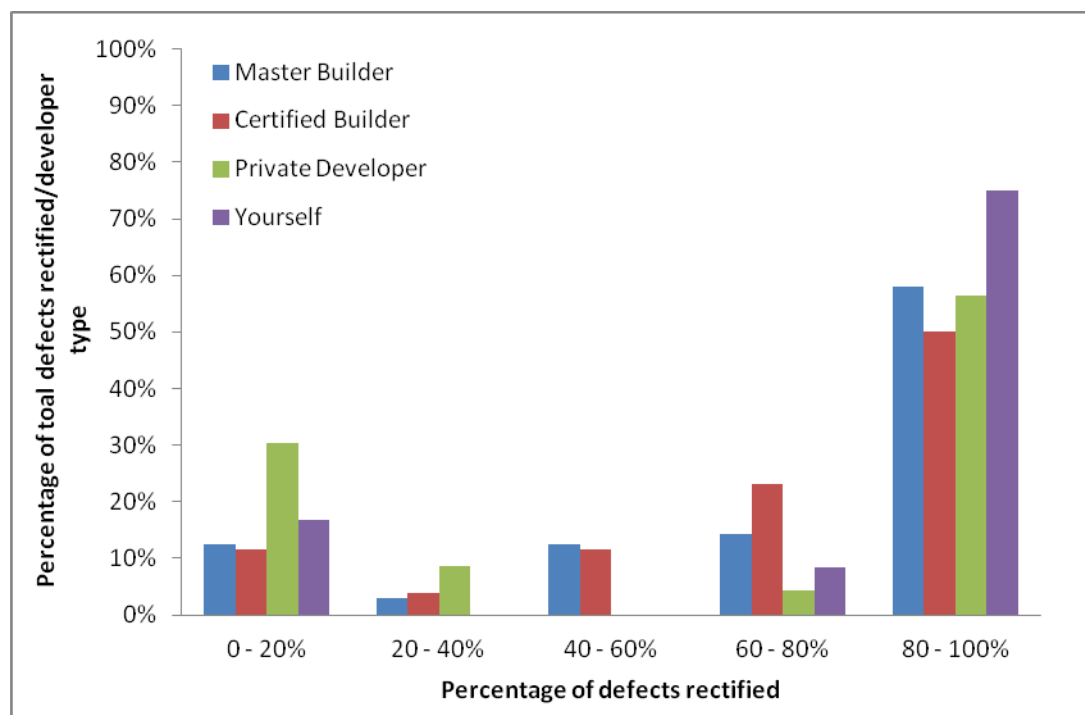
**Figure 6.20:** Percentage of defects rectified and time defects were rectified

#### 6.7.4: Determinants of timeframe of defects rectification

This section examines the factors that determine how long it takes for defects in a home to be rectified. The analyses carried out in this section aim to determine the various items that can prolong the time taken for defects to be rectified.

##### 6.7.4.1: Developer type

Figure 6.21 is a clustered bar chart showing the proportion of defects rectified by each developer. The clustered bar chart is produced for each developer type. The chart shows the relationship between the proportions of defects that were rectified for each category of 'percentage of defects rectified'. So that, for each developer, the chart allows us to determine how much of the total defects that they rectified was within categories; 0-20%, 20-40%, 40-60%, 60-80% and 80-100% completed. It is clear that for the 0-20% defects rectified, private developers have the highest proportion while certified builders have the lowest proportion. For the 80-100% defects rectified, the owner-built have the highest proportion while certified builders have the lowest proportion.



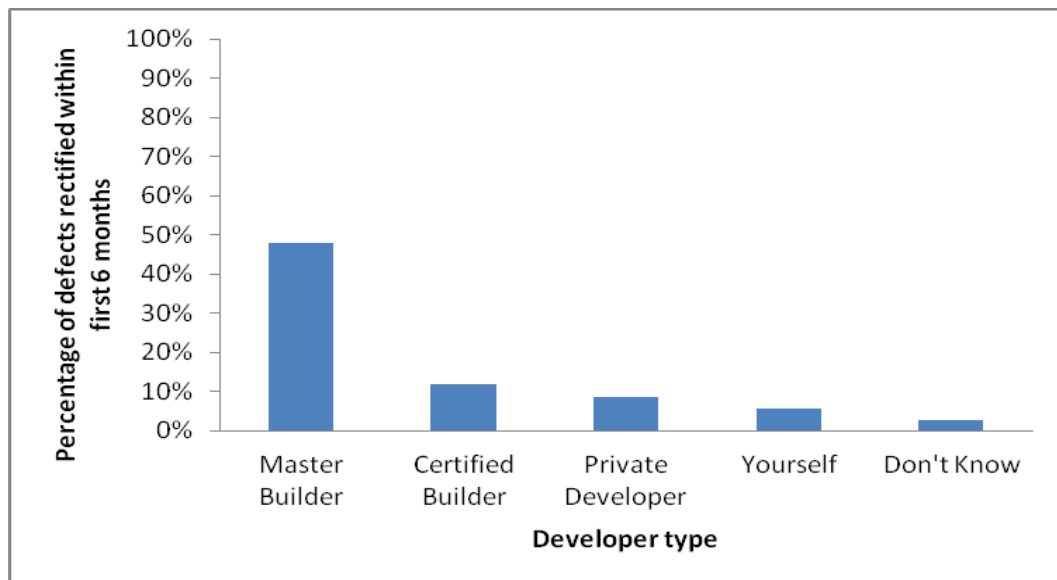
**Figure 6.21:** Percentage of defects rectified and developer type

Figure 6.22 shows the relationship between the developer type and the percentage of defects rectified within the first 6 months of handover. The bar chart is produced using the result from the cross tabulations presented on Table

6.22. The first 6 months has been analysed because Figure 6.16 (percentage of homeowners with overall quality satisfaction and time defects were rectified) shows that satisfaction level reaches area of stability after 6 months. The results show that the descending order in percentage of defects rectified is: master builders, certified builders, private developers, owners built and responses from homeowners who do not know the type of developers that built their houses. Of the homeowners who know the type of developers that built their houses, the Master Builders had the highest proportion of defects rectified within the first 6 months (47.8%) while owner- built had the lowest proportion (5.5%).

**Table 6.22:** Type of developer and Percentage rectified Cross-tabulation

| Type of developer | Time frame of Defect rectification |                         |                   |              |              |              |              |         |
|-------------------|------------------------------------|-------------------------|-------------------|--------------|--------------|--------------|--------------|---------|
|                   |                                    |                         | Less than 1 month | 1 - 3 months | 3 - 6 months | 6 - 9 months | 9- 12 months | Total   |
|                   | Master Builder                     | Frequency               | 46                | 34           | 8            | 6            | 7            | 116     |
|                   |                                    | % Developer type        | 39.70%            | 29.30%       | 6.90%        | 5.20%        | 6.00%        | 100.00% |
|                   |                                    | % Time defect rectified | 57.50%            | 70.80%       | 61.50%       | 85.70%       | 53.80%       | 63.00%  |
|                   |                                    | % of Total              | 25.00%            | 18.50%       | 4.30%        | 3.30%        | 3.80%        | 63.00%  |
|                   | Certified Builder                  | Frequency               | 17                | 3            | 2            | 0            | 4            | 28      |
|                   |                                    | % Developer type        | 60.70%            | 10.70%       | 7.10%        | 0.00%        | 14.30%       | 100.00% |
|                   |                                    | % Time defect rectified | 21.30%            | 6.30%        | 15.40%       | 0.00%        | 30.80%       | 15.20%  |
|                   |                                    | % of Total              | 9.20%             | 1.60%        | 1.10%        | 0.00%        | 2.20%        | 15.20%  |
|                   | Owners built                       | Frequency               | 6                 | 4            | 0            | 0            | 1            | 12      |
|                   |                                    | % Developer type        | 50.00%            | 33.30%       | 0.00%        | 0.00%        | 8.30%        | 100.00% |
|                   |                                    | % Time defect rectified | 7.50%             | 8.30%        | 0.00%        | 0.00%        | 7.70%        | 6.50%   |
|                   |                                    | % of Total              | 3.30%             | 2.20%        | 0.00%        | 0.00%        | 0.50%        | 6.50%   |
|                   | Private Developer                  | Frequency               | 10                | 3            | 3            | 1            | 1            | 21      |
|                   |                                    | % Developer type        | 47.60%            | 14.30%       | 14.30%       | 4.80%        | 4.80%        | 100.00% |
|                   |                                    | % Time defect rectified | 12.50%            | 6.30%        | 23.10%       | 14.30%       | 7.70%        | 11.40%  |
|                   |                                    | % of Total              | 5.40%             | 1.60%        | 1.60%        | 0.50%        | 0.50%        | 11.40%  |
|                   | Don't Know                         | Frequency               | 1                 | 4            | 0            | 0            | 0            | 7       |
|                   |                                    | % Developer type        | 14.30%            | 57.10%       | 0.00%        | 0.00%        | 0.00%        | 100.00% |
|                   |                                    | % Time defect rectified | 1.30%             | 8.30%        | 0.00%        | 0.00%        | 0.00%        | 3.80%   |
|                   |                                    | % of Total              | 0.50%             | 2.20%        | 0.00%        | 0.00%        | 0.00%        | 3.80%   |
|                   | Total                              | Frequency               | 80                | 48           | 13           | 7            | 13           | 184     |
|                   |                                    | % Developer type        | 43.50%            | 26.10%       | 7.10%        | 3.80%        | 7.10%        | 100.00% |
|                   | % Time defect rectified            | 100.00%                 | 100.00%           | 100.00%      | 100.00%      | 100.00%      | 100.00%      |         |
|                   | % of Total                         | 43.50%                  | 26.10%            | 7.10%        | 3.80%        | 7.10%        | 100.00%      |         |



**Figure 6.22:** Time defects rectified and developer type

### 6.7.5: Determinants of number of defects

The factors that determine the number of defects that homeowners record in their homes are examined in this section. The results obtained and the investigations carried out in this section are important as the number of defects seen in a home has been shown to be a major determinant of homeowner's satisfaction.

#### 6.7.5.1: Stage of involvement

Table 6.23 presents the analysis of a cross tabulation between stage of involvement of homeowner during building construction and the number of defects observed. This cross tabulation will provide some confirmation of the influence that homeowners could have on quality performance of house developers at stages within the building production. The result shows that homeowners who were involved from the beginning of their buildings appear to find the most total number of defects (80.5%, ranging from 0 – 20 defects). One would expect this category to have the most influence on quality performance as most defects could have been identified and corrected during building construction. Therefore it would be reasonable to expect that this category would have the least defects considering that they were part of the construction of the building from the beginning of the project. However those who became involved during the construction of their homes realised the least total defects (4.6%, ranging from 11 - 15 defects). Finally participants who became involved

after the building was completed realised defects ranging from 5 to 20 with a total defect of 14.9%.

**Table 6.23:** Stage of involvement and number of defects cross tabulation

| Stage of involvement                |           | 0 - 5 defects | 6 - 10 defects | 11 - 15 defects | 16 - 20 defects | Total        |
|-------------------------------------|-----------|---------------|----------------|-----------------|-----------------|--------------|
| <b>Beginning of Construction</b>    | Frequency | 137           | 32             | 3               | 2               | 174          |
|                                     | %         | <b>63.4</b>   | <b>14.8</b>    | <b>1.4</b>      | <b>0.9</b>      | <b>80.5%</b> |
| <b>During Construction</b>          | Frequency | 5             | 2              | 3               | 0               | 10           |
|                                     | %         | <b>2.3</b>    | <b>0.9</b>     | <b>1.4</b>      | <b>0</b>        | <b>4.6%</b>  |
| <b>After Construction Completed</b> | Frequency | 23            | 6              | 2               | 1               | 32           |
|                                     | %         | <b>10.7</b>   | <b>2.8</b>     | <b>0.9</b>      | <b>0.5</b>      | <b>14.9%</b> |
| <b>Total</b>                        | Frequency | 165           | 40             | 8               | 3               | 216          |
|                                     | %         | <b>76.4</b>   | <b>18.5</b>    | <b>3.7</b>      | <b>1.4</b>      | <b>100</b>   |

#### 6.7.5.2 Type of developers

Table 6.24 depicts the relationship between types of house developers in charge of construction and the number of defects observed by homeowners. It can be observed from the Table that homeowners who used house developers registered with the MBF significantly recorded the highest total number of defects (63%, ranging from 0 – 20 defects). However, out of the total 63%, 48.6% of homeowners recorded 0 – 5 defects. Whereas, homeowners who had their houses constructed by house developers' that were registered with the CBANZ recorded a total of 14.3% (with defects ranging from 11 – 15). Survey participants who do not know the house developers that constructed their houses had the least total number of defects (3.8%, ranging from 11 – 15 defects). The latter few survey participants could be those who bought already-completed buildings or did not care to find out who the developers were. Owner's-built houses also recorded comparatively low total number of defects (7.8%, ranging from 0 – 5). This low percentage of reported defect is not surprising considering that the house developer (in this case the owner and occupier) would have taken utmost precaution to ensure that their buildings meet their own quality standard.

**Table 6.24:** Types of developers and the number of defects cross tabulations

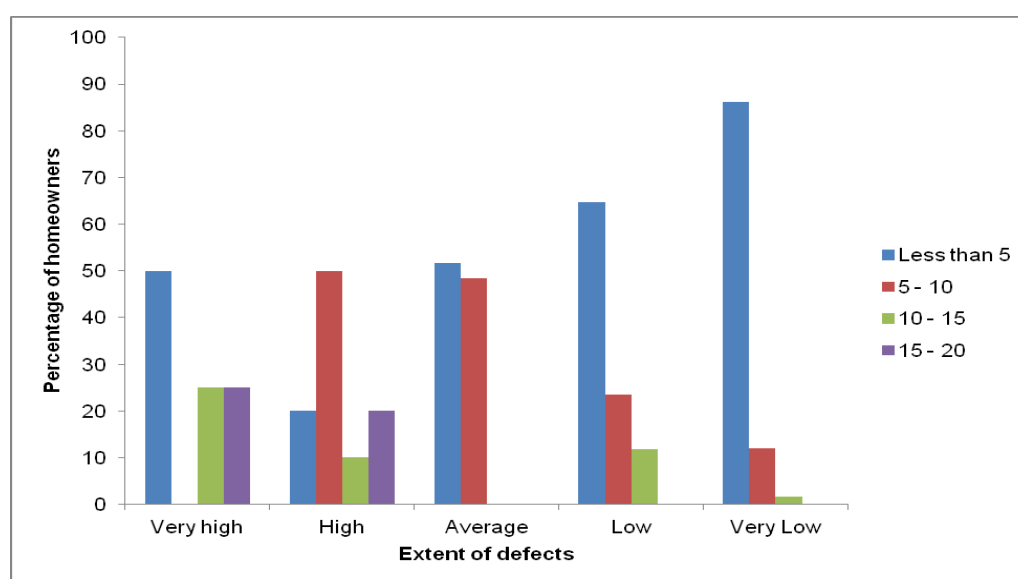
| Types of developers      |           | 0 - 5 defects | 6 - 10 defects | 11 - 15 defects | 16 - 20 defects | Total       |
|--------------------------|-----------|---------------|----------------|-----------------|-----------------|-------------|
| <b>MBF</b>               | Frequency | 105           | 28             | 2               | 1               | 136         |
|                          | %         | <b>48.6</b>   | <b>13.0</b>    | <b>0.9</b>      | <b>0.5</b>      | <b>63.0</b> |
| <b>CBANZ</b>             | Frequency | 22            | 7              | 2               | 0               | 31          |
|                          | %         | <b>10.2</b>   | <b>3.2</b>     | <b>0.9</b>      | <b>0</b>        | <b>14.3</b> |
| <b>Owner's Built</b>     | Frequency | 17            | 0              | 0               | 0               | 31          |
|                          | %         | <b>7.8</b>    | <b>0</b>       | <b>0</b>        | <b>0</b>        | <b>7.8</b>  |
| <b>Private Developer</b> | Frequency | 18            | 3              | 1               | 2               | 24          |
|                          | %         | <b>8.3</b>    | <b>1.4</b>     | <b>0.5</b>      | <b>0.9</b>      | <b>11.1</b> |
| <b>Don't know</b>        | Frequency | 4             | 3              | 1               | 0               | 8           |
|                          | %         | <b>1.9</b>    | <b>1.4</b>     | <b>0.5</b>      | <b>0</b>        | <b>3.8</b>  |
| <b>Total</b>             | Frequency | 166           | 41             | 6               | 3               | 216         |
|                          | %         | <b>76.8</b>   | <b>19</b>      | <b>2.8</b>      | <b>1.4</b>      | <b>100</b>  |

**6.7.5.3: Extent of defects**

Using a clustered bar chart, Figure 6.23 shows the relationship between the extent of defects and the percentage number of defects per house. From the figure it is obvious that there is an increase in the percentage of 0-5 defects, with decrease in the extent of defects. Also apparent in the result is the fact that higher number of defects (15-20 defects/household) is only experienced by homeowners with higher extents of defects, with homeowners observing lower extents of defects having no defects higher than 15. This shows that given that a homeowner experience lower extent of defects, there is a greater chance that the number of defects that they will observe will be less than 5. On the other hand, homes that have more extensive defects are more likely to have a higher number of defects. Data explaining this relationship is presented in Table 6.25.

**Table 6.25:** Cross tabulations of extent of defects and the number of defects

| Extent of defects |           | 0 - 5 defects | 6 - 10 defects | 11 - 15 defects | 16 - 20 defects | Total |
|-------------------|-----------|---------------|----------------|-----------------|-----------------|-------|
| Very High         | Frequency | 2             | 0              | 1               | 1               | 4     |
|                   | %         | 0.9           | 0              | 0.5             | 0.5             | 1.9%  |
| High              | Frequency | 2             | 5              | 1               | 2               | 10    |
|                   | %         | 0.9           | 2.3            | 0.5             | 0.9             | 3.7%  |
| Average           | Frequency | 17            | 15             | 0               | 0               | 32    |
|                   | %         | 7.9           | 6.9            | 0               | 0               | 14.8% |
| Low               | Frequency | 11            | 4              | 2               | 0               | 17    |
|                   | %         | 5.1           | 1.9            | 0.9             | 0               | 7.9%  |
| Very Low          | Frequency | 100           | 14             | 2               | 0               | 116   |
|                   | %         | 46.3          | 6.5            | 0.9             | 0               | 53.7  |
| Total             | Frequency | 166           | 41             | 6               | 3               | 216   |
|                   | %         | 61.1          | 20.0           | 2.8             | 1.4             | 82    |

**Figure 6.23:** Percentage distribution of extent and number of defects

## 6.8: Independent building inspection (defect reporting) (Section D)

The last section in the questionnaire labelled Section D covers questions that seek homeowners' views on the use of independent building inspectors for new homes. There are five questions in the section that are measured mostly using Likert scales of 1 to 7, 1 being very satisfied, very useful and completely agree to 7 being very dissatisfied; not very useful and completely disagree. The questions asked covers, use of independent building inspector, satisfaction to services provided by independent building inspectors, usefulness of the report

obtained from independent building inspection, likelihood of using building inspectors for new homes and their opinions about having new buildings inspected for defects before possession. The objective of this section is to determine the proportion of new homeowners that commission the services of independent building inspectors (defect reporting) and also in what circumstance(s) individual homebuyers would be likely to carry out building inspection. Further analyses will examine the relationship between the number of homeowners that used independent building inspectors and the level of defects experienced in these new homes. This aspect of the analyses is presented in later section.

#### **6.8.1: Use of independent building inspectors**

The first question in Section D presented on Table 6.26 requires participants to indicate if they had their buildings checked by an independent building inspector (defect reporters) prior to possession. The objective of this question is to determine whether homeowners saw the need for defect reporting of new homes. It is evident from the result that majority of the participants (64.7%) did not engage the service of an independent building inspector when they purchased their new homes. Only 27% had a building inspection carried out and 2.7% are unsure. From the result presented in Table 6.3, the majority of the participants (62.8%) and 14.4% had their homes built by master builders and certified builders respectively. It can be assumed that these owners could not see the need for building inspection considering that the houses were built by master builders and certified builders. These categories of developers are certified builders and are therefore able to provide building warranties as a protection against issues of defects when it arises. It can also be argued that since majority of homeowners (80.9) were involved in their building construction at an earlier stage (see Section 6.5.3), they may not see the need for defect reporting.

#### **6.8.2: Services of independent building inspectors**

This question requires participants to indicate if they were satisfied with the services they received from their independent building inspector. 86% of participants responded to this question and out of which 42% indicated that this

question is not applicable to them. The result further shows that 17.7% were very satisfied, 9.8% slightly satisfied, 7.9% were neither satisfied nor dissatisfied and 4.2% were moderately dissatisfied. 2.8% indicated that they were slightly satisfied, and an equal percentage (0.5%) indicated that they were moderately satisfied and very dissatisfied. This variation in result could be related to the fact that about 65% of participants did not engage the service of a building inspector when they took possession of their homes. They would not have answered the question in the first place.

#### **6.8.3: Usefulness of independent building inspector's report**

The third question in section D requires participants to indicate the usefulness of the report they received after an independent inspection. Similar to the Section 6.7.2, majority of the participants 49.8% indicated that the question is not applicable to them. This could be expected as the percentage of those who did not use building inspector in their home is about 65%. However, 12.6% indicated that the inspection report was very useful with 9.3% of the participants showing a neutral position. 7.4% of participant found the report from independent building inspectors to be moderately useful, 3.3% indicated that it is slightly useful, while 2.3% indicated not very useful. Only 1.4% and 0.5% of the participants shows that the report they obtained is slightly not useful and moderately not useful respectively. It is also apparent from this result that a good proportion of research participants had not engaged independent building inspectors and of the few that did (27% see Section 6.7.1). The usefulness of such reports is evident. Out of the 27% of participants that commissioned defect reporting for their new homes, 23.3% (one end of the scale) of them found the report to be useful.

#### **6.8.4: Likelihood of using an independent building inspector**

This question requires participant to signify the likelihood that the research participants would engage the service of independent building inspectors for future new homes. Participants were required to indicate on a five point likert scale with 1 being most likely and 5 most likely not. An additional option of 6 on the likert scale was given to participant to indicate if the question is not applicable to them. The results of the question presented in Table 6.26 shows

that about 35% of participants are likely to engage an independent inspector to inspect their future new homes, while only 15.4% are not likely to have their future new buildings inspected. 9.3% are neutral meaning they are likely or not likely to use an independent building inspector for future new homes. The remaining 29.8% of the participant indicated that the question is not applicable to them. It could be suggested that the high number of participants willing to have their future buildings checked and inspected could have responded positively because of their previous experiences with defect rectification with their house developers on their current properties.

#### **6.8.5: Building inspection at hand over**

The last question in the section requires participants to indicate whether they agree to the idea of having new residential buildings checked for defects by an independent building inspector at handover. The purpose of this question is to determine whether homeowners have seen the need for defect reporting in new homes. From the result on Table 6.26, it is obvious that over 70% of participants agree to have an independent building inspector to inspect their homes at handover, with 74% of those in agreement indicating that it is a very good idea. Only 1% of participants believed that building inspection is not necessary at handover, and of these, none completely disagreed with the idea of building inspection. The possibility of ignorance to the benefits of building inspection (defect reporting) for new homes cannot be discounted, hence the need for creating awareness to this fact.

#### **6.8.6 Use of independent building inspection from 2008 to 2011**

Figure 6.24 shows a yearly proportion over a period of four years of homeowners that commission independent building inspectors to inspect their homes when they took possession. It can be observed from Figure 6.24 that there is a clear trend from 2008 to 2010 of increasing number of homeowners that engaged the service of independent building inspectors for their new homes, but this decreased in 2011. The decrease could be as a result of the short period of data collection that was previously explained in Section 6.5.14.

The data in Table 6.27 gives another view of the use of independent building inspectors in residential buildings. For example the data shows that the

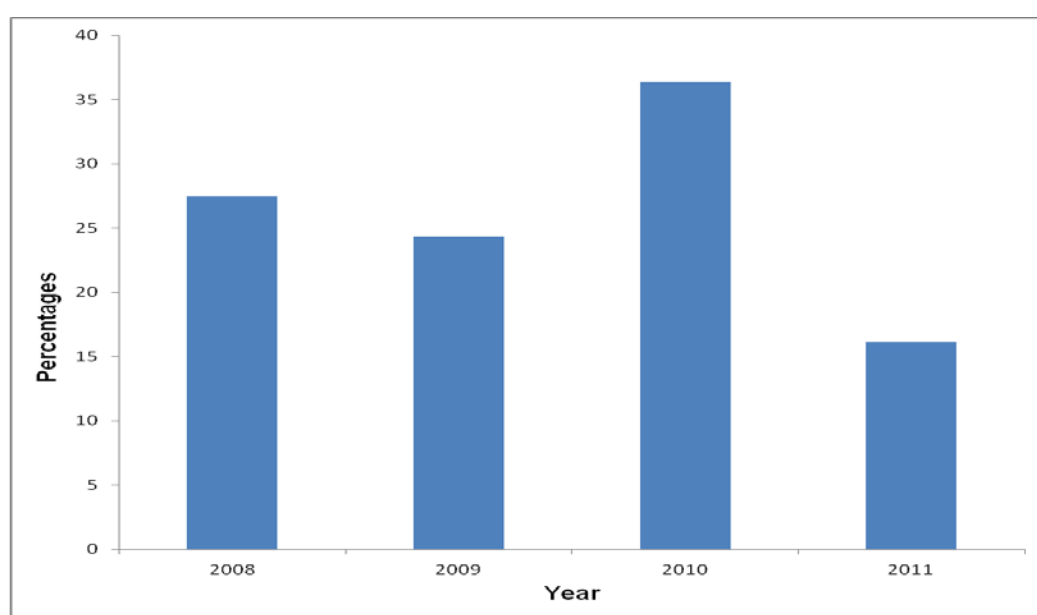
proportion of homeowners that engaged the service of building inspectors is significantly low (58 representing 27% only) compared to the total number of household (216) survey for the period 2008 to 2011. This low percentage may be a contributing factor to the occurrence of defects at handover. When compared to the pattern of defects displayed in Figure 6.6, the non-engagement of building inspection services could reasonably be the cause of the yearly increase in defects.

**Table 6.26:** Independent Building Inspection (Section D)

| Questions Asked                                                     | Response Option         | Frequency | Percentages |
|---------------------------------------------------------------------|-------------------------|-----------|-------------|
| <b>Use of independent building inspector (n=205)</b>                | Yes                     | 58        | 27.0        |
|                                                                     | No                      | 139       | 64.7        |
|                                                                     | Unsure                  | 8         | 3.7         |
| <b>Satisfaction with service of independent inspector(n=185)</b>    | Very satisfied          | 38        | 17.7        |
|                                                                     | Moderately satisfied    | 21        | 9.8         |
|                                                                     | Slightly satisfied      | 6         | 2.8         |
|                                                                     | Neutral                 | 17        | 7.9         |
|                                                                     | Slightly dissatisfied   | 1         | .5          |
|                                                                     | Moderately dissatisfied | 9         | 4.2         |
|                                                                     | Very dissatisfied       | 1         | .5          |
|                                                                     | N/A                     | 92        | 42.8        |
| <b>Usefulness of building inspectors report(n=186)</b>              | Very Useful             | 27        | 12.6        |
|                                                                     | Moderately Useful       | 16        | 7.4         |
|                                                                     | Slightly Useful         | 7         | 3.3         |
|                                                                     | Neutral                 | 20        | 9.3         |
|                                                                     | Slightly not Useful     | 3         | 1.4         |
|                                                                     | Moderately not Useful   | 1         | .5          |
|                                                                     | Very not Useful         | 5         | 2.3         |
|                                                                     | N/A                     | 107       | 49.8        |
| <b>Likelihood of using building inspectors for new homes(n=192)</b> | Most likely             | 53        | 24.7        |
|                                                                     | Likely                  | 22        | 10.2        |
|                                                                     | Neutral                 | 20        | 9.3         |
|                                                                     | Not likely              | 18        | 8.4         |
|                                                                     | Most likely not         | 15        | 7.0         |
|                                                                     | N/A                     | 64        | 29.8        |
| <b>Building inspection at handover(n=205)</b>                       | Completely agree        | 113       | 52.6        |
|                                                                     | Mostly agree            | 28        | 13.0        |
|                                                                     | Slightly agree          | 11        | 5.1         |
|                                                                     | Neutral                 | 4         | 1.9         |
|                                                                     | Slightly disagree       | 1         | .5          |
|                                                                     | Mostly disagree         | 1         | .5          |
|                                                                     | Completely disagree     | 0         | 0           |
|                                                                     | N/A                     | 35        | 16.3        |

**Table 6.27:** Yearly estimates of the use of independent building inspector

| Year         | No using BI | Total number of households | % using Bi |
|--------------|-------------|----------------------------|------------|
| 2008         | 14          | 51                         | 26.0       |
| 2009         | 19          | 78                         | 24.0       |
| 2010         | 20          | 55                         | 36.0       |
| 2011         | 5           | 32                         | 14.0       |
| <b>Total</b> | <b>58</b>   | <b>216</b>                 | <b>100</b> |

**Figure 6.24:** Yearly estimated of use of independent building inspector

### 6.8.7: Cross tabulation between participants who used independent building inspector and the number of defects

Further analysis was undertaken using cross tabulation, to show the relationship between participants' engagement of the services of independent building inspectors and the number of defects noticed. This cross tabulation is presented in Table 6.28. The result shows that all the participants who engaged the service of building inspectors (14.3%) found about 20 defects in their new homes. Whereas those participants that did not engage the service of building inspectors found defects ranging from 5 to over 20, but with a greater percentage (42.9%) identifying only 5 to 10 defects. It would seem from this result that the high number of defects recorded by the participants that engaged building inspectors was as a result of the professional services rendered by these inspectors. This seems plausible when one assumes that homeowners

may not have sufficient expertise to identify defects as they rely on visual inspections as opposed to thorough checks that could be carried out by professionals.

**Table 6.28:** Cross tabulations of use of IBI and the number of defects

| Independent building inspector |           | 0 - 5 defects | 6 - 10 defects | 11 - 15 defects | 16 - 20 defects | Total |
|--------------------------------|-----------|---------------|----------------|-----------------|-----------------|-------|
| Yes                            | Frequency | 108           | 26             | 3               | 2               | 139   |
|                                | %         | 52.4          | 12.6           | 1.5             | 1.0             | 67.4% |
| No                             | Frequency | 44            | 11             | 3               | 1               | 59    |
|                                | %         | 21.4          | 5.3            | 1.5             | 0               | 28.2% |
| Unsure                         | Frequency | 7             | 1              | 0               | 0               | 8     |
|                                | %         | 3.4           | 1.0            | 0               | 0               | 4.4%  |
| Total                          | Frequency | 159           | 38             | 6               | 3               | 206   |
|                                | %         | 77.2          | 18.8           | 3.0             | 1.0             | 100   |

### 6.9: General comments on the nature of defects and issues relating to residential building sector in New Zealand

The last part of the questionnaire was an open ended question designed to give research participants the opportunity to give supplementary information about the nature of defects and other issues of relevance to their new homes and the residential building sector in New Zealand. This part of the questionnaire uses qualitative analytical method (thematic analysis) as was described in the methodology chapter (Section 5.12). 35% (70) of the total research participants (216) responded to this part of the questionnaire. After careful observation of the responses, seven cogent themes emerged from their responses to the open-ended question. The themes include: poor quality achievement; homeowners' dissatisfaction; commendations for quality achievement; attitude of house developers; use of independent building inspectors; defects rectification and council building inspection. For ease of presentation, transcripts of the responses relating to each theme are collated in tabular format (see Table 6.29 to 6.35). To guarantee anonymity, the responses are coded as described in Section 5.11.3 and the codes included in the first column in the tables.

The following sub-sections cover the seven cogent themes that emerge from the open ended question.

#### **6.9.1 Theme 1: Poor quality achievement**

The first theme that emerged from the analysis of the open-ended question relates to the poor quality of house developers. The various opinions of the homeowners relating to this theme are collated in Table 6.29. 29% of the total responses to the open-ended question (i.e. 35% of entire research participants) had indicated that they noticed defects in their new homes when they moved in. On close observation, poor quality achievement was expressed by similar research participants who commented on the extent and types of defects they observed when they took possession of their homes. This is a further confirmation of the result from previous questions regarding the extent and number of defects in new residential buildings (see Section 6.5 and 6.4).

Generally poor quality achievement was experienced in aesthetics and finishing works (e.g. painting). Though these defects are minor participants expressed their feelings that these defects are annoying. The general opinion is that the occurrence of these defects at hand over has become normal and attributed mainly to poor workmanship. It is suggested by one of the participants that private house developers needs to take more responsibility of the quality of workmanship delivered by imported trades (e.g. from Asia), as this is a significant cause of poor quality. Others have also suggested poor design and quality materials as causes of defects in new residential buildings, though not at the same level of significance. An individual also commented on the quality of imported building material available in the market (E.g. plumbing material and light fittings). The participant explains that these building materials used for new homes are not durable for their intended purpose.

There was reference made to the poor quality of project management services on residential construction sites. For example three of the participants complained about poor communication which hampers relationships between homeowners and their project managers. A participant commented about little or no 'lessons-learned' exercises or project reviews thus mistakes are often

repeated in hot spot areas. Also this participant felt that their project manager was a 'jack of all trade', talked things up big but failed to deliver on promises.

Responses relating to poor quality achievement in new residential buildings demonstrate the need for more emphasis on getting things right first time in house building before buildings are transferred to homeowners, otherwise the reputation of the residential building developer would remain that of under-performers. Continuous quality improvement measures are needed in the house building process.

**Table 6.29:** Transcripts of comments on poor quality achievement

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H11/308            | The defects I have experienced have been rather small yet still annoying. I understand that things don't always go right first time, but what is important is that when these defects are discovered they are fixed immediately.                                                                                |
| H08/413            | Double glazing has conductive frames, so not good in cold weather water condenses on cold frames onto window sill causing puddles. Worse than single glazing, so double glazing is damaging our health and house. Building paper not straight in one place on rafters causing dripping onto ceiling insulation. |
| H08/341            | Concrete tile roof leaked, tile slipped, roofing crowd came back and fixed tile and husband fixed the wet gib etc. Bench top not sealed properly, not yet fixed. Kitchen Co. went into receivership and no longer operating and insurance won't cover.                                                          |
| H08/044            | ..... I know I was very lucky with minimal defects I had compared to other ***** homes built around the same time. I believe it is now sorted. The main fault lay with the plumber. Only too happy to provide further information.                                                                              |
| H08/378            | Too much emphasis on completion time not on quality by tradesmen                                                                                                                                                                                                                                                |
| H08/177            | Pipes in roof are not lagged (hot and cold) and the cold water can have water coming out at temperatures of 40oC in summer which is dangerous especially for young children.                                                                                                                                    |
| H09/235            | Poor workmanship in some private developers, not qualified enough. Should have responsibility of trade. Especially builders/developers from *****                                                                                                                                                               |
| H09/069            | Very minor defects to concrete flooring installation edges. Annoying defects to toilet cistern - will be fixed. Kitchen wooden work bench developed shrinkage - owner repaired. Some poorly finished gib stopping - Not identified until after painting. Will not repair as essentially cosmetics.              |
| H09/491            | 'We had to go into battle with the Quantity Surveyor of the developer - almost item by item - but we got what we wanted and had chosen a well established Master Builder with guarantees to do the job.                                                                                                         |
| H09/416            | Major cause of defects (or near defects) was poor workmanship; all design and build plan were available but hardly used by the contractors during the build; project management was average; we stepped in ourselves to prevent major failures during the build.                                                |
| H10/372            | Main cause of defects - poor workmanship, especially painters and plumbers. Another area appears to be the specific area or piece of work being left in poor condition by previous subcontractor. Project management in the building sector appears to be                                                       |

|         |                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | poor with little or no 'lessons being learned' exercises or reviews thus repeat mistakes/hot spot area.                                                                                                                                                                                                                                                                                            |
| H10/422 | The water retention over the water tank completely over the top.                                                                                                                                                                                                                                                                                                                                   |
| H09/415 | We did have trouble getting the design we wanted. Two main defects were plumbing.                                                                                                                                                                                                                                                                                                                  |
| H10/426 | There were some design defects: Kitchen hot pipe left out - long repair; Windows too close to corners; Inadequate curtain space; Laundry poor layout; Plumber work not up to agreed standard. Overall very good quality. Job too large for builder - slow, poor managed of time.                                                                                                                   |
| H10/228 | The defects we experienced were all minor and quickly attended to by our builder. Before moving in minor paint defects were attended to within first six months and minor leaking drain under the kitchen sink and minor electrical switch fault were fixed within two days by builder. This is the second home we have built with ***** homes and we would not hesitate to build with them again. |
| H10/086 | The aluminium window joinery has been scratched/marked during installation presumably which detracts from the overall appearance of the window areas.                                                                                                                                                                                                                                              |
| H11/378 | ..... Our builder was a member of the Master Builder (no problem there). However, the painting of the interior of our house isn't very good. As we were very busy at the time we asked the builder to finish the house to a standard that they would expect in their home. I don't think this was achieved.                                                                                        |
| H11/313 | The defects we incurred were from the house still drying out. It has been a good six months for that process to finish. As a result we had cracking around door frames and skirting and a couple of popped screws. This was easily fixed.                                                                                                                                                          |
| H11/385 | We built with ***** Homes and while ***** are great, the project manager has been a nightmare. Never return calls - doesn't want to deal with anything. Also having trouble with our tile roof and the gutters as they are open - have birds nesting in there.                                                                                                                                     |
| H11/027 | Main problem was the kitchen; doors were rejected by us because of very poor painting in respect of rough surface. Kitchen eventually finished 8weeks later, ongoing problems still with two cupboards doors not hang correctly. Faulty batch of down lights In lounge which is still ongoing.                                                                                                     |
| H11/155 | Once the final payment has been made the builder has been slow to come back and sort out problems. Most of the defects are expected eg paint finish missed bits of the sealing. But some like interior doors warping are due to poor quality material.                                                                                                                                             |
| H08/424 | The defect was a minor problem and was fixed promptly. We are extremely happy with our lovely house. Everyone involved in the building of our house were wonderful and I would recommend anyone building a house ' get in touch with ***** homes.                                                                                                                                                  |
| H08/409 | High spec buildings, exceptional quality of finish, high quality fittings. Minor cracks in garage slab probably due to shrinkage.                                                                                                                                                                                                                                                                  |
| H11/384 | I have just built my first home using a local builder who used local subcontractors, our defects were minor and few. I personally knew most of them (subcontractors) I had spoken with other people for whom my builder had constructed homes and was assured of this competence and high standards.                                                                                               |
| H08/010 | our house won regional master builder of the and third in NZ (250-350,000 category) we only had a squeaky door in nearly 3 years, so I really cannot not comment on this issues. Choose a competent builder and developer with good working relationship.                                                                                                                                          |
| H10/380 | My house was built by a developer (building company). Before possession an inspection was arranged with the project manager, myself and family (with building experience). This was most satisfactory and minor defects were identified . This worked well for us.                                                                                                                                 |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/129 | 'our problem was with an error concerning the painting. The main structure was completed by the builder and I carried out the most of the work as I have a lot of experience with building houses. For people who do not have these skills ths should use an inspector.                                                                                                                                                                                                                                                                                                                                                |
| H08/450 | Uneven external painting still not fixed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| H08/329 | It would have been great to have an independent inspector look over the new house with prospective house- buyers. We dealt only with the building company and they have only their interest. Since moving in we have watched many neighbouring houses being built, and there are a few building practice s which clearly need to be monitored. Workplace safety - OSH would have a field -day if they visited some sites. Poor practice, no protection. Generally the houses in our development are well built structurally using quality materials, but it is the finishing you notice, and that is not so well done. |
| H09/496 | Most of the property in Riverglade parkway are rented and managed by a company called NZ Invest. We were interested in buying at one point but "off the record" we were advised not to buy by a person from the rental company. Main problem: Cheap Chinese plumbing when leaked and had to be swapped. Cheap light fittings which break and only accept 60W bulbs. Vermin entry through unsealed gaps at pipe entrance point. Apparently other houses have been inspected by council inspector. In my view council inspectors just seem to be there to clip the ticket.                                               |

### 6.9.2: Theme 2: Homeowner dissatisfactions

The second theme that emerged from the analysis of the open-ended question relate to the dissatisfaction of homeowners to the quality of their new homes. Table 6.30 collates the opinions related to this theme.

Generally research participants have expressed their dissatisfactions with developers' performance, saying that works are not being done to specification because there was apparent lack of communication between office and construction managers as discussed in Section 6.9.1. According to one participant, sometimes construction is rushed which leads to mistakes in the overall finish of buildings. Also reference was made to poor workmanship as a source of homeowner dissatisfaction. A participant expressed that they were dissatisfied with the quality of workmanship because there was much pressure on the tradesmen to deliver which may have resulted in poor quality outputs.

A further example of dissatisfaction came from a participant who suggested that they would have answered the customer satisfaction survey conducted immediately after they had moved in differently, if they had completed the survey 3 months later. This was because their house developer did not rectify defects within the 90 day notification period they had agreed on.

As discussed previously in chapter three of this thesis, customer satisfaction is important to any business organisation. It is right and appropriate for house developers to ensure homeowners' needs and expectations are met at all times.

**Table 6.30:** Transcripts of comments on dissatisfaction

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/102            | Our dissatisfaction with workmanship arose from pressure from the developer on the tradesmen. The building process was rushed which led to mistakes for finish. We battled the developer from day one.                                                                                                                                                                                                                                             |
| H10/191            | We were sent a form to complete for our builder to apply to become Certified builders as we had to rate service and customer satisfaction. We rated them quite highly on form, as we had just moved into our house, but would have answered the question very differently had we been asked to complete 3 months later. It took them over 9 months to complete the defects in the 90 days notification!!! Very unimpressed.                        |
| H09/124            | ..... Provisional costs were well under actual cost, and we were disappointed about this because we were building to a tight budget and did not want any surprises.                                                                                                                                                                                                                                                                                |
| H10/343            | ..... Dissatisfied by things not being done to spec because of no communication between office and construction manager.                                                                                                                                                                                                                                                                                                                           |
| H11/319            | I will enclose a copy of the defects identified by a Master Builder that my lawyer employed after all efforts to get the original builder to repair the faults failed. I then employed another builder and now have my compliance certified. It has been a battle through the court and I am still awaiting to be reimbursed after three court visits and a judge finding in my favour. I find it disappointing that the court does not follow up. |
| H10/450            | Trying to get the building company to reply to our emails is an ongoing issue. We have withheld our final payment and as this is a year on it is very frustrating.                                                                                                                                                                                                                                                                                 |
| H10/093            | We have project manage building our home and moved in before completion. We have held contractors accountable for unsatisfactory work but have been affected by Christchurch February earthquakes                                                                                                                                                                                                                                                  |

### 6.9.3: Theme 3: Commendations for quality achievement

As expected not all participants would feel the same way about issues, therefore there were participants who expressed their satisfaction with the quality of their homes when they took possession. 11% of the total number of responses to the open-ended questions expressed their satisfaction with the quality of their new homes.

In one instance a participant commended the quality of build because the building was able to withstand the Canterbury earthquake in 2010 and 2011.

The participant had suggested that compared to other buildings in their locality, theirs was solidly built. Some of the participants had indicated that they would recommend their house developers to anyone desiring to build a house. Another participant was of the opinion that their involvement in the house building process may have accounted for the good quality of the finished product. In this particular case the home owner had project managed the building from the beginning of the house construction to when it was completed.

**Table 6.31:** Transcripts of comments on high quality

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/409            | High spec buildings, exceptional quality of finish, high quality fittings. Minor cracks in garage slab probably due to shrinkage.                                                                                                                                                                                                                                |
| H08/424            | The defect was a minor problem and was fixed promptly. We are extremely happy with our lovely house. Everyone involved in the building of our house were wonderful and I would recommend anyone building a house ' get in touch with ***** homes.                                                                                                                |
| H08/010            | our house won regional master builder of the and third in NZ (250-350,000 category) we only had a squeaky door in nearly 3 years, so I really cannot not comment on this issues. Choose a competent builder and developer with good working relationship.                                                                                                        |
| H08/353            | our house is superb - in location, design, building, workmanship and finish. We purchased in the day before the September earthquake ( and virtually right on top of it) - the house came through that and subsequent ones - completely well, We have met the builder at local events - he takes pride in his work- everyone who knows him speaks highly of him. |
| H09/213            | Because I project managed the build myself any issues were dealt with during construction. Therefore there were no outstanding issues upon completion and we are 100% satisfied with result.                                                                                                                                                                     |
| H10/380            | My house was built by a developer (building company). Before possession an inspection was arranged with the project manager, myself and family (with building experience). This was most satisfactory and minor defects were identified . This worked well for us.                                                                                               |
| H10/055            | Overall satisfied with the quality of the house and the houses in the neighbourhood. Leaky homes should never have existed if inspection were done properly, houses are designed correctly and built by proper developer.                                                                                                                                        |
| H10/050            | Our ***** built home is exceptional as zero defects were experienced. ***** quality control is undoubtedly of a very high standard, and outstanding. The ***** team's attention to detail and very high standards is exceptional.                                                                                                                                |

These commendations notwithstanding, some of the participants that indicated their overall satisfaction with the quality of their new homes have also indicated that there were minor defects when they moved in. This would suggest that the

defects were relatively minor and did not impact on the performance reputation of the affected house developers. More details on positive opinions expressed by homeowners are included in Table 6.31.

#### **6.9.4: Theme 4: Attitude of house building developers**

Another common theme that emanated from the analysis of the open-ended question is homeowners' opinions on the attitude of house developers. Transcript of comments relating to this theme is given in Table 6.32. 24% of the participants expressed concerns and identified difficulties with getting house developers to take responsibility for their work. For example, a participant indicated that house building companies are only builders by name and have little or no administrative staff (support) services during the construction process. That way they could easily blame others without accepting responsibility for any wrongdoings. Another participant suggests that work practices of house developers was poor but could be made effective by constant monitoring. Particular concern was expressed by this participant for workplace safety and worker protection.

Poor time management and lack of documentation was also criticised by the research participants. One participant explained that they never received paper work (e.g. invoices) promised to them by their building developer. Proper documentation of activities will not only show the level of transparency but also enable monitoring of quality performance of house developers.

Another comment that could suggest that the attitude of house developers was not satisfactory to homeowners is their willingness to support referrals of their developers to other clients. Good recommendations reflect the relationship between the house building company and the homeowners. While some would not mind, others have indicated that they would not recommend or use their developers again. In a business that thrives on referrals or 'word of mouth', this is significant. H08/424 expressed that they would recommend their house developer for anyone. In contrast to this opinion, H10/188 explains that they would not recommend or use their building company again. However, these contrary opinions in a similar circumstance suggest that house developer should follow up on issues raised by homeowners. Good relationship is

significant in any construction organisation. This is because homeowners' mostly source house developers from their friends and families as this could assure them of the competencies and standards of the house developer. This may well indicate the importance of referrals or "word of mouth" in house buying process within the residential house building sector as discussed in Section 2.6.1.

**Table 6.32:** Transcripts of comments on attitude of house building developers

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H09/352            | Building company kept cost of home very reasonable, so I think low pay for tradesmen, thus providing not so good workmanship.                                                                                                                                                                                                                                                                                                                     |
| H09/290            | ...Because they said they will use double glazed glass at major part of glass, we trusted them but we found they haven't used the double glazed glass at all at final checking a few days before moving in. they didn't give us any chance to inspect the house before final checking. When we asked why double glazed glass hadn't been used they answered "the engineer said double glassed is not needed for your house.                       |
| H09/148            | I have learnt that it is of high priority to use a Master builder.                                                                                                                                                                                                                                                                                                                                                                                |
| H10/376            | 'We used a major building company as opposed to use an individual builder, part of this was to avoid issues around workmanship etc. Large firm have to manage their reputation and have greater resources to - usually to follow up on any issues.                                                                                                                                                                                                |
| H10412             | Only issues I had was not with Certified builder. It was the shower supplier/installer I engaged separately to provide a fit for purpose shower. What was recommended and installed was not. I had great support from ***** Building Inspectors working with supplier to resolve so issues so I did not have to take them to small claims Tribunal.                                                                                               |
| H10/476            | After going through the experience of owning a leaky home which we purchased from 'Joe Bloggs' developer, it has been a pleasure dealing with this reputable building company and their commitment to getting it right on our demolition and rebuild.                                                                                                                                                                                             |
| H10/157            | Too much sub-contracting. Companies only builder in name and have no/little staff services in build process. That way they easily blame others not accepting responsibility themselves.                                                                                                                                                                                                                                                           |
| H10/188            | The builder on our project quit once the trusses were up (about 4 weeks into the build) as their partnership dissolved. The company found another builder to continue/complete the build, taking 9 months!! We never saw any paper work, invoices or received copies as promised by the company. We would not recommend or use this company again. The project manager was a 'jack of all trade', talked it up big but failed to deliver on time. |
| H10/348            | Developers who are not trade qualified should not be allowed to join the Master Builder Federation - gives false sense of security to customers. Being a member of the Master Builder does not guarantee good workmanship. Developers should Earn it and have a proven track record. Did inspection with friend Architect                                                                                                                         |
| H11/098            | Was happy with the builder, excellent and accommodating. The design build started off very well but they got bogged down and were not so good at the                                                                                                                                                                                                                                                                                              |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | end. Long time and we became a pain in their side. Very quick built when all brought together.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| H11/384 | I have just built my first home using a local builder who used local subcontractors, our defects were minor and few. I personally knew most of them (subcontractors) I had spoken with other people for whom my builder had constructed homes and was assured of this competence and high standards.                                                                                                                                                                                                                                                                                                                   |
| H11/326 | Good decision to use owner building company. Used a design, build, fixed price, MB contract.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| H08/366 | In regards to the developer - as I am not a builder I do not know the pros and cons of the myriad of materials and design choices. Our job is to choose without insight as to the long term ramifications and I think they should outline all the cost and benefits implications of all materials and design options so that I know what I will get.                                                                                                                                                                                                                                                                   |
| H08/329 | It would have been great to have an independent inspector look over the new house with prospective house- buyers. We dealt only with the building company and they have only their interest. Since moving in we have watched many neighbouring houses being built, and there are a few building practice s which clearly need to be monitored. Workplace safety - OSH would have a field -day if they visited some sites. Poor practice, no protection. Generally the houses in our development are well built structurally using quality materials, but it is the finishing you notice, and that is not so well done. |
| H10/378 | I believe the inspectors could have done a more thorough inspection and report. Our builder was very reluctant to admit poor workmanship and an inspection report would have backed our concerns. In the end we employed an independent to inspect the work/build and report for us.                                                                                                                                                                                                                                                                                                                                   |
| H10/450 | Trying to get the building company to reply to our emails is an ongoing issue. We have withheld our final payment and as this is a year on it is very frustrating.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| H08/424 | The defect was a minor problem and was fixed promptly. We are extremely happy with our lovely house. Everyone involved in the building of our house were wonderful and I would recommend anyone building a house ' get in touch with ***** homes.                                                                                                                                                                                                                                                                                                                                                                      |
| H09/064 | Building company insisted that we communicate with subcontractor, plumbers, electrician, painter, it was a nightmare trying to co-ordinate as the subcontractors didn't have us a client so refused to follow up told us to go back to building company. Was sorting issue when September and February earthquake happened.                                                                                                                                                                                                                                                                                            |
| H08/329 | It would have been great to have an independent inspector look over the new house with prospective house- buyers. We dealt only with the building company and they have only their interest. Since moving in we have watched many neighbouring houses being built, and there are a few building practice s which clearly need to be monitored. Workplace safety - OSH would have a field -day if they visited some sites. Poor practice, no protection. Generally the houses in our development are well built structurally using quality materials, but it is the finishing you notice, and that is not so well done. |

### 6.9.5: Theme 5: Use of independent Building Inspectors

A theme that complements other parts of the questionnaire is the use of independent building inspectors during the house buying process. Table 6.33 presents the comments related to this theme.

There was conflicting opinions on the use of independent building inspectors by the homeowners. Whilst some participants did not see the need to commission an independent building inspector, majority have indicated that for the homeowners who do not have the skills and experience with house construction, it will be beneficial to engage the services of one. This is because it is more likely that a more thorough inspection and reporting will be carried out when those professional services are engaged. The need for defect reporting was further emphasised by a participant. The participant explains that house developers might be reluctant in admitting issues of defect, but a building inspection report will back up any concern.

**Table 6.33:** Transcripts of comments on the use of independent building inspectors

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/329            | It would have been great to have an independent inspector look over the new house with prospective house- buyers. We dealt only with the building company and they have only their interest. Since moving in we have watched many neighbouring houses being built, and there are a few building practice s which clearly need to be monitored. Workplace safety - OSH would have a field -day if they visited some sites. Poor practice, no protection. Generally the houses in our development are well built structurally using quality materials, but it is the finishing you notice, and that is not so well done. |
| H08/129            | 'our problem was with an error concerning the painting. The main structure was completed by the builder and I carried out the most of the work as I have a lot of experience with building houses. For people who do not have these skills should use an inspector.                                                                                                                                                                                                                                                                                                                                                    |
| H10/450            | Trying to get the building company to reply to our emails is an ongoing issue. We have withheld our final payment and as this is a year on it is very frustrating.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| H10/177            | No snagging used – trusted placed in statutory building inspection and final code of compliance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| H10/378            | I believe the independent inspectors could have done a more thorough inspection and report. Our builder was very reluctant to admit poor workmanship and an inspection report would have backed our concerns. In the end we employed an independent to inspect the work/build and report for us.                                                                                                                                                                                                                                                                                                                       |

#### **6.9.6: Theme 6: Defects rectification**

Rectification of defects by developers is also a significant theme from the open ended question. Opinions relating to this theme are collated into Table 6.34. The general opinion is that identified defects, when brought to the notice of the developers were not attended to immediately by the house developers. One participant explained that it was a nightmare trying to coordinate between their building company and the subcontractors on who does the rectification of the defects that were discovered. Some participants have had to rectify defects themselves because they could not get their developers to do so. Such feelings expressed by the participants reflect general work practices of some house developers and their poor after-sales customer care. In the words of one of the participants, house developers should be able to take responsibility and stand by their work when defects occur.

In a particular instance, it took 9 months to rectify defects which should have been rectified within 90 days of being notified. There were reported cases of buck-passing amongst house developers, and an attitude which sees reported defects as being minor, so do not deserve high priority. It was suggested that it is not the extent of defect that matters, but the ability to fix these defects immediately they are discovered that is important to homeowners. Another participant express that Since they could not follow up inspection during the construction of their home because of their busy schedule, they have asked their house developer to finish the house to a standard that they would expect in their home, however this was not achieved. This particular homeowner had indicated that another builder was called in to rectify the defects, after three court cases with the original builder.

To cope with the reality of defects not being rectified, many participants suggested solutions. For instance, it is suggested that there could be provisions made within purchase agreements that will allow homeowners to identify defects over three months of possession, after which the house building developers would be made to rectify the defects. Another suggestion is for building inspection to be made mandatory for every new house purchases and that house developers should be compelled to rectify any defect noticed by homeowners.

**Table 6.34:** Transcripts of comments on defects not fixed

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/450            | Uneven external painting still not fixed.                                                                                                                                                                                                                                                                                                                                                          |
| H09/028            | The house was built for an architect who was inspecting progress during construction. This minimised any defects as they were mainly inspected/rectified before handover.                                                                                                                                                                                                                          |
| H09/064            | Building company insisted that we communicate with sub-contractor, plumbers, electrician, painter; it was a nightmare trying to co-ordinate as the subcontractors didn't have us a client so refused to follow up told us to go back to building company. Was sorting issue when September and February earthquake happened.                                                                       |
| H09/351            | Cabra owned the land would not fix poor drainage and slipping in section, but GJ Gardner was very helpful.                                                                                                                                                                                                                                                                                         |
| H09/408            | Not fixed yet very minor defects.                                                                                                                                                                                                                                                                                                                                                                  |
| H10/495            | Defects not done.                                                                                                                                                                                                                                                                                                                                                                                  |
| H09/244            | Agreed time frame that participants document issues over three months and developer came back to rectify.                                                                                                                                                                                                                                                                                          |
| H09/069            | Very minor defects to concrete flooring installation edges. Annoying defects to toilet cistern - will be fixed. Kitchen wooden work bench developed shrinkage - owner repaired. Some poorly finished gib stopping - Not identified until after painting. Will not repair as essentially cosmetics.                                                                                                 |
| H11/308            | The defects I have experienced have been rather small yet still annoying. I understand that things don't always go right first time, but what is important is that when these defects are discovered they are fixed immediately.                                                                                                                                                                   |
| H10/286            | I think there should be a compulsory building inspection for new homes. That way developer will be forced to rectify any defects.                                                                                                                                                                                                                                                                  |
| H11/308            | The defects I have experienced have been rather small yet still annoying. I understand that things don't always go right first time, but what is important is that when these defects are discovered they are fixed immediately.                                                                                                                                                                   |
| H10/228            | The defects we experienced were all minor and quickly attended to by our builder. Before moving in minor paint defects were attended to within first six months and minor leaking drain under the kitchen sink and minor electrical switch fault were fixed within two days by builder. This is the second home we have built with ***** homes and we would not hesitate to build with them again. |

### 6.9.7: Theme 7: Council building inspectors

The last theme in the open-ended question are opinions expressed concerning council building inspectors. The transcripts are presented in Table 6.35. The research participants have expressed that the work practices of council building inspectors in the residential building sector are relevant to the study. Three individuals have observed that council building inspectors seem not to have

adequate skills to carry out building inspection works. They allude to the fact that experienced building inspectors with the right skills are able to identify defects before their final sign off on buildings. Their comments suggests that having the right skills may significantly reduce the extent and magnitude of defects observed at handover. Aside from improving their skill base, it was made apparent that measures need to be taken to ensure consistency in the checking process for building quality. One of the participants indicate that building council inspectors are extremely difficult to deal with. Another suggests that construction progress is as good or bad as the relationship between the house developers and the council inspectors. Three of the participants also indicate that the consent process is cumbersome and time consuming.

**Table 6.35:** Transcripts of comments on council building inspectors

| Participants Codes | Transcripts of Comments                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H08/192            | 'The progress inspection by council at the required times are only as good or bad as the relationship with the builder/developer. I have seen pipes covered and yet inspection past - how/why? What use is that?                                                                                                                    |
| H08/232            | Building inspection during construction. Would recommend the services of a good architect when contemplating a building project'.                                                                                                                                                                                                   |
| H11/416            | I believe that building inspectors should always be checking the quality of the build - they should deal with the builders (and the owner, if the owners wants) but at the end of the day, if the building inspector is not happy with the workmanship - they should not sign off the house                                         |
| H10/261            | I do not believe that the building inspectors are skilled enough. I felt that they missed very important details and pulled the builders up on barely important details...                                                                                                                                                          |
| H10/291            | We found the inspector from the local council building authority extremely difficult to deal with they all told us different things eg "you need to remove that cesspit from your plans and then we'll consent them" and (once this was removed) "you need a cesspit there .....) one inspector was particularly rude and arrogant. |
| H10/003            | The house had 4 - 5 inspection during construction, but at no stage did the builder have to remedy any fault. The biggest problem was the time lag between requesting an inspection and the building inspection coming on site to carry out the actual inspection - often up to 6 working days.                                     |
| H09/353            | 'Building inspectors should have some background experience also the exorbitant cost relating to obtaining building consent as government has advised this is under review.                                                                                                                                                         |
| H09/343            | Most painful part was the council consent process.                                                                                                                                                                                                                                                                                  |
| H09/043            | CCC had not been issued since after occupancy (8months) for abstract reasons. Feels council is excessive in fussy detailing.                                                                                                                                                                                                        |
| H08/269            | ' 'Local body cost - and delays ie Resource consent, Building consent, cost of inspection, lack of follow-up with building inspectors (rude and arrogant).                                                                                                                                                                          |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>H08/365</b> | It all comes back to local council and code of compliance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>H09/099</b> | Having built my second home now I agree with the drive to have tradesmen registered and be held accountable for at least 10 years of post build. I still believe the city councils still need to be involved and be equally responsible for building failures through faulty design/workmanship.                                                                                                                                                                                                                                                                      |
| <b>H08/321</b> | Inspection team are improving slowly, although recently I have had two errors approved at consent stage, only through experience was able to affect a redesign by the architect and re submitted to team leader ARC central. If a new builder to the industry had followed approved plan they would face a 20 - 30K repairs at the final stage when approved plan could have been rejected, trust in planner and code interpreter is at an all time low.                                                                                                              |
| <b>H09/496</b> | Most of the property in Riverglade parkway are rented and managed by a company called NZ Invest. We were interested in buying at one point but "off the record" we were advised not to buy by a person from the rental company. Main problem: Cheap xxxxx plumbing when leaked and had to be swapped. Cheap light fittings which break and only accept 60W bulbs. Vermin entry through unsealed gaps at pipe entrance point. Apparently other houses have been inspected by council inspector. In my view council inspector just seem to be there to clip the ticket. |
| <b>H08/412</b> | 'A competent experienced building inspector I was one before retirement is well able to identify and building defects before possession of new and existing homes. The council code compliance certificate, confirms compliance with the NZ Building Code, and identifies inspection carried out during construction of new homes and additional and alterations to existing homes.                                                                                                                                                                                   |

## 6.10: Summary

This chapter has presented the analysis and result of data collected from new residential homeowners across New Zealand. Interpretive statistics with the use of charts and cross tabulations were adopted for the most part of the analysis, while more qualitative type approach was used for the open-ended questions. These approaches were to clearly achieve the research objectives 2, 3, 4 stated in section 1.6 of this study.

It is apparent from the result of the analyses that defects are common features of new residential buildings, though majority of homeowners indicate that the defects they observed when they took possession of their homes were minor. However homeowners felt that these minor defects were annoying and should have been taken care of before possession or shortly after the defects are notified. Further the results reveal that significant proportion of homeowners was satisfied with the overall quality of their new homes despite the fact that defects were visible.

The survey has found that most defects occurring after possession were aesthetic in nature and generally involved finishing works (uneven painting surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet/WC, concreting and locks). A clustering of these defects would suggest that the defects fall into aesthetic Category. Few homeowners engaged the services of independent building inspectors to check their homes when they took possession. Defect reporting is uncommon for newer buildings because of the expectation that new buildings will be defect free. From the analyses, it was observed that professional services offered by independent building inspectors may help to uncover more defects than most homeowners would have identified themselves.

Finally, the survey found that seven key themes are significant to homeowners. These themes are: poor quality achievement; homeowners' dissatisfaction; commendations for quality achievement; attitude of house developers; use of independent building inspectors; defects rectification and council building inspection. Addressing these themes could help to improve quality achievement within the residential sector.

The next chapter presents the result of further investigations into house building practices through interviews with house developers. The information obtained from the interviewees are analysed in line with the objectives of the study.

## **CHAPTER SEVEN**

### **ANALYSIS AND PRESENTATION OF INTERVIEW RESULTS**

#### **7.1: Introduction**

The analysis of the research questionnaire in Sections 6.2 to 6.8 shows that an understanding of defects in new residential buildings is significant to improve quality performance in the house building sector in New Zealand. The need to improve house developer's quality performance and customer satisfaction levels are pertinent to this current study as they also significantly impact on the performance of building organisations. These needs are crucial in defining the themes that are covered by the interviews with house developers and subsequent validation within the research.

The data from this second stage of field investigations were collated from transcripts produced after face-to-face interviews. While results from the initial questionnaire survey were valuable for capturing issues around defects in new residential buildings, interviews with house developers provided more in-depth understanding from their perspectives. This chapter starts by presenting the results and analyses of interviews with house developers using a qualitative analytical method (thematic analysis). This approach to data analysis was described in the methodology chapter in section 5.12 and has the objective of giving clarity to the opinions expressed by the research participants. Thematic analysis helps to summarise participants' common experiences and individual differences that could provide a deeper level of understanding of the underlying reasons for participants' responses. In the current chapter the word 'defect reporting' 'independent building inspection' and 'pre-purchase inspection' will be used interchangeably.

The later part of the chapter presents the opinions of subject matter experts on the general issues covered by this research. The approach to the presentation of their opinions is also by thematic analysis. Interviews of subject matter experts served to validate and extend knowledge acquired prior to the interviews.

## **7.2: Analysis of interviews**

Data was collected from both private and multi-house building organisations. The participants for the interviews were purposively sampled as was described in section 5.10.2. Interviews were with 10 house developers operating within the research coverage area. The difficulty experienced with setting up interviews at the early stages of the research limited the sample size. However, the sample size is significant, based on Creswell's (2003) recommendations of an interview sample of at least 10. Criteria for selecting the subjects were explained in Section 5.6. This interview was conducted at the end of the first field investigation (i.e. of homeowners).

The overarching aim of the interviews with house developers was to understand their current quality practices and to clarify the available warranties they provide for newly built homes. A range of questions were asked, covering demographic information of the interviewees, issues of quality monitoring, customer satisfaction, available warranties for new homeowner's, and participants' opinions on the use of independent building inspections (defect reporting). A semi-structured questionnaire was designed for this purpose to facilitate cross-questioning in the process as explained in Section 5.11.2. Four key themes emerged from the interviews, three of which aligned closely with the themes covered in the questionnaire survey. However the fifth theme (warranties) became more significant to the research in the course of the interview analysis. Sections 7.4 to 7.8 present the thematic analysis of the interviews with a final section, 7.9, covering other miscellaneous issues useful to the research objectives. The next section presents demographic information on the research participants.

## **7.3: Demographic information of interviewees**

The first question to the research participants required them to give the background of their organisation since they began operating as house developers in the residential sector (see Appendix B2). The objective was to provide a basis for building on subsequent questions and any other emergent themes.

Table 7.1 summarises the information on demography obtained from the interviewees. The analysis of the first question and information obtained during the interview regarding the number of years the house developers have been operating shows that 6 out of the 10 of the participants are multi-house developers (building more than one house) while the remaining 4 are private developers building one house at a time. Of note is that one of the companies has been operating for 105 years in the residential sector in New Zealand. The minimum number of years of operation of those interviewed is 6 years. The majority (6) of the persons interviewed are project managers within their organisations, while the remaining are owners of the business. Thus the opinions and information collected from the participants are credible and reliable.

**Table 7.1:** Demographic information of interviewees

| House developers | Year of establishment | Private or Multi house developer | No of franchisees | Participant's designation |
|------------------|-----------------------|----------------------------------|-------------------|---------------------------|
| HD1              | 1983                  | Multi developer (Franchisor)     | 11                | Project manager           |
| HD2              | 1908                  | Multi developer (Franchisor)     | 9                 | Project manager           |
| HD3              | 1986                  | Multi developer (Franchisor)     | 17                | Project manager           |
| HD4              | 1937                  | Multi developer (Franchisor)     | 10 branches       | Manager                   |
| HD5              | 1996                  | Private developer                | 1                 | Project manager           |
| HD6              | 1993                  | Private developer                | 1                 | Project manager           |
| HD7              | 2007                  | Private developer                | 1                 | Project director          |
| HD8              | 2003                  | Multi developer (Franchisee)     | 1                 | Owner of franchisee       |
| HD9              | 1998                  | Multi developer (Franchisee)     | 1                 | Owner of franchisee       |
| HD10             | 2007                  | Private developer                | 1                 | Owner of business         |

#### 7.4: Theme 1: Issues around defect and quality monitoring

The first key theme covers issues around defects and quality monitoring of house developers of new residential buildings. It required participants to explain how they monitor quality during house construction and after the buildings have

been handed over to their owners. The sub-themes applicable within this theme are outlined in tables 7.2.

**Table 7.2:** Theme 1 and sub themes

| Theme                                             | Sub – themes               |
|---------------------------------------------------|----------------------------|
| Defect and quality monitoring of house developers | Quality monitoring process |
|                                                   | Record of defects          |
|                                                   | Common defects experienced |
|                                                   | Causes of defects          |

#### **7.4.1: Quality monitoring process**

This sub–theme covers the monitoring of the quality of new residential buildings by the house developers. It seeks to understand the processes that individual developers have in place to ensure that quality standards are achieved in their house builds, on the basis that quality processes are significant to the quality of final products. The process should include tracking and monitoring of work performance and where defects are identified these should be rectified immediately. Also it is possible with the line of questioning to confirm if house developers are conscious of the needs of homeowners in terms of their response to defect rectification. The theme also shows whether house developers are working towards delivering defect-free buildings or otherwise.

A wide range of responses were received from the house developers during the interviews. Some of the transcripts of the interviews are included to support the discussion.

Of note is that all house developers interviewed indicated that they have a process in place to monitor work performance (quality) during construction. However, there are disparities in the way different house developers monitor quality during construction. Whilst some approaches could be considered standard practice, one of the organisations has developed extra measures (using creative web-based monitoring systems) to ensure its quality achievement.

We have a work flow system ... The process includes checks along the way that Project managers uses. For each project there is an online maintenance register used in advance of project handover. Basically the PM can log an issue. Obviously on-site without internet you cannot use the system but there is a quality management booklet which the PM can use. Information keyed into the booklet is transferred to the work flow system (HD1).

The web-based monitoring system alluded to by HD1 is used to keep a record of work activities for individual customers. The software is interactive and includes checklists that project owners can log into, to record any defect they noticed during the construction and maintenance periods. The record of work activities captured by the web based system begins from when potential homeowners signify their interests to employ the service of the organisation for their home construction, and ends after the maintenance period. HD1 also indicated that the quality performance of its individual franchisees are monitored through customer surveys that collect opinions on service quality. However, defect monitoring does not seem to extend to the cover of individual franchisees of HD1's organisation.

We do not monitor the defects that occur in each of the businesses. Rather we survey our clients for the quality of the service. At completion we send out a survey and if there are issues we contact the builder in charge... (HD1).

Generally, different methods of quality monitoring processes exist on residential construction sites. There was reference to the use of council building inspector checklists as a guide to the monitoring of defective performance during construction stages.

We use the checklist from the council inspector as a guide during construction to monitor the quality of our work on site. We project manage the building ourselves... (HD5).

Significantly, participants noted that regular meetings with their subcontractors are an important means by which quality is monitored on their construction sites. The meetings range from daily meetings for private house developers and once a month for multi house developers.

House developers that have franchises have indicated that they meet with their franchisees once a month to review project development. During these meetings, quality issues are discussed so that if necessary the franchisees may be trained on any aspects of their project that may pose challenges to them.

The following transcript gives further indication of the type of monitoring that takes place between franchise owners and franchisees, corporate offices and project managers, and private developers with their subcontractors/ tradesmen.

We have a regular way of monitoring both quality and health and safety issues on our construction sites. We have a breakdown of items to be inspected. We have regular meetings for reviews. We meet every day at 3pm to discuss issues that arise during the day. We also meet every Monday to discuss what needs to be done during the week. We talk about the progress of work and to health and safety issues and quality control on site. We ensure that our subcontractors work according to specification by regularly inspecting their work to avoid failure of inspection by the council inspector (HD6).

We have highly skilled on-site supervision for the entire build process and carefully check the quality of materials and workmanship at every stage of construction through to completion. A customer satisfaction survey is conducted three months after homeowners have taken possession of their home. The survey is called service assessment for new homeowners. This is a way of ensuring that projects are done up to standard (HD2).

We use quality products from reputable providers. You can expect the same high standard of workmanship you see in our show homes. By building in a controlled environment we can closely manage the quality control of the build and minimise delays. We regularly go round during construction to check our tradesmen to ensure they work according to specification (HD4).

I check my tradesmen. I use tradesmen who know what they are doing. I check their work every time. They are good tradesmen (HD7).

Spending more time with PMs to help improve performance and ensure everyone is up. We have a structured order process. We meet our franchisees every month and discuss through issues. If they are not getting good satisfaction result, these are discussed with them (HD1).

We use the checklist from council inspector as a guide during construction to monitor the quality of our work on site. We project manage the building ourselves. We take quality very important during construction. This is the checklist from council on different stages there is inspection specified on the consent document (HD5)

We carry out physical observation. Any problem we found, we immediately notify the tradesmen to fix. We avoid tradesmen who make mistakes. Our tradesmen now know what we want and the quality of their job is satisfactory (HD10)

In spite of the quality monitoring process that house developers have in place within their organisations, all the participants interviewed generally agree that their customers have noticed differing levels of defects after possessing their properties. They were quick to point out, however, that these defects were mostly minor and were attended to immediately they were brought to their

notice. For example HD3 explained that “The call backs from our customers are normally minor issues. Once they give us a call we send someone to fix the problem immediately”. Similarly HD1 explained that because of the way their business works in terms of defect monitoring they experience “very little call backs after handover because we would not handover a house if the client is not happy”. The developers’ opinions about minor defects and defect rectification seem to tally with the previous findings of the questionnaire survey. Within the questionnaire survey to homeowners, a low number of defects was recorded, and also 65.1% of house developers fix defects once they have been notified of them (see Section 6.5).

Whilst quality performance was invariably justified on the basis of quality monitoring processes, quality of building material and workmanship were also important considerations expressed by the participants. Even though some of the house developers stressed that they check the quality of their building materials and workmanship, these two factors were also identified in the questionnaire analysis (Section 6.5.7) as significant causes of defects in new residential buildings. From the comments made by HD5 for example, it would seem that council inspection processes should provide the ultimate standard for quality monitoring that developers should aim to achieve.

Whether or not participant’s opinions fairly or accurately reflect the existence of quality monitoring activities in new residential construction, it is apparent that the issue deserves attention and that a minimum standard operating procedure (SOP) for quality achievement may need to be maintained across all house developer companies in New Zealand.

#### **7.4.2: Record keeping of defects**

Another sub-theme that emerged out of the interviews is record keeping of defects (call backs). Call backs within the current study are referred to as defects that were identified by homeowners. Within this sub-theme, the research determines whether house developers have a system for recording issues pertaining to such defects. This sub theme relates to aspects of the questionnaire survey covered in section 6.8 in which homeowners were

required to identify common defects they noticed when their homes were handed over to them.

Record keeping is significant in quality monitoring during construction and at the handover of new buildings. Documentation of defects will allow house developers to identify areas where improvements are most needed. The analysis of the transcripts shows that some of participants interviewed indicated that they do not keep a record of call backs. This group explained that though they do not record call backs, they make sure that they respond to defects once they are brought to their attention. The following transcripts from the interview gives some of their explanation.

No we do not have a standard way of keeping record of defects during construction either minor or significant defects. We don't have a system to keep a record of call backs. We allow 60 days for this type of defects. But we respond quickly to any problem. Any defects during construction, we notify the subcontractor involved and this is fixed immediately (HD5).

We do not keep records of defects as they are mostly minor. Once we identify any defects during construction, we notify the subcontractor involved and this is fixed immediately. We make sure that buildings are up to standard before we hand over to our customers because we want to get our last payment (HD6).

They are minor problems. We don't keep a record. We fix it once we know there is a problem. They are small issues... HD10).

I don't keep a record of any call-backs. Once our customers give us a call for any defect we respond quickly (HD8)

While some developers do not keep a record of defects because the defects are minor, some participants have indicated that they record any form of defects. HD1 explained that their company record call backs for both minor and major defects. The participant mentioned that any defect detected by new homeowners goes into a maintenance register where they are attended to as quickly as possible. Excerpts of the transcripts of house developers that keep record of defects are presented below:

We keep a record of call backs. It goes into the quality manual or the work based system. And a maintenance register. We notify the contractor and note when the rectification was done. Generally it is a phone call and it gets dealt with (HD1).

...the project manager inspects the property three times to make sure that everything is functioning. This is to record any defects and make necessary rectification as soon as possible (HD2).

Unfortunately it really isn't in any accessible form. Minor defects are attended to immediately. The defects are largely sorted in what we call a 30 day maintenance period and included as part of our job cost prior to the job being closed off. Any details on what might have needed fixing are archived 3-6 months after the job is complete (HD4)

None of the participants was willing to produce data on their call backs to the researcher. Therefore there was no opportunity to quantitatively compare their record with those collected through the questionnaire survey to homeowners. Their reason for this was that such records are not held for long. One of the participants explained that their records of defects are kept for a short period and once this period elapses, the project is closed and archived.

#### **7.4.3: Common residential building defects**

The interview question covering common residential building defects was necessary to complement inaccessible data on call backs. The research participants were able to express their opinions about common defects in completed residential buildings, based on their experiences. This aspect of the interview is important, in order to confirm Section 6.5.6 of the questionnaire analysis where new homeowners were required to indicate the defects they observed when they purchased their home.

There were 8 types of defects that house developers mentioned as regularly occurring on the list of the call backs they get from homeowners. These include painting issues, faulty door handles, poorly fixed architraves, minor cracks, nail pops, general finishing issues, gaps in skirting, and leaky spouting. These defects listed by house developers are in line with the 10 most common defects identified by new homeowners in the questionnaire analysis (see Section 6.5.6).

...They are mostly minor defects. The problems generally are painting, door handles, architraves, cracks, nail pops. These are aesthetic checks; the aesthetics check is normally done at the end of the project (HD5).

But generally the issues are minor like general finishing, painting, gaps in skirting, architraves, nail pops. Sometimes we experience cracks in the building, but there is really nothing you could do about it. It is because of the movement of the house you just allow the building to settle over time (HD6).

Most of the call backs we receive are minor defects like Roller door catches (on dummy doors), Leaking spouting (turns out to have been a design fault on rubber ring joint spouting and subsequently taken off the market by the manufacturer Iplex), Gib cracking - as we deliver the majority of our buildings this can at times

result in gib cracking although this is usually noticed by us prior to handover. These problems are attended to immediately they are brought to our attention (HD4).

The other issue is that of minor defects e.g. paints. When there are issues at handover, they are mostly minor. To my knowledge we don't have any leaky home claims. We are not architects trying to make a statement. We meet with clients not needing architects because they have seen our show homes which they like. A lot of our buildings were built after the leaky building era (HD1).

The problems mostly are minor... painting, door handles, cracks, things like that. Sometimes you can't avoid it (HD10)

From the above transcripts, it is apparent that common defects are usually referred to as '*minor defects*'. The majority of the participants indicated that the defects identified by homeowners after they have taken possession of their homes were relatively minor. This may account for the poor documentation by the house developers on these defects.

#### **7.4.4 Causes of defects**

Questions asked under this sub-theme required participants to identify the causes of defects they have experienced in their completed residential buildings. This aspect of the interview backs up section 6.5.7 of the questionnaire analysis where new homeowners were required to give their views on the causes of defects they observed when they purchase their home.

From the interviews it was gathered that several causes could account for the defects (call backs) experienced in completed residential buildings. Some of the participants ascribed defects to the quality of building materials available in the construction market. For example HD10 believed that "Sometimes the problem is with building materials. Though they are cheap but they do not last". HD6 was also of a view that house builders in New Zealand tend to use lesser quality building materials because they are cheaper. HD6 suggested that there needs to be more effective product certification of building materials sourced from outside New Zealand.

There are some buildings materials that are not supposed to be in the market. These building materials are sourced from China. Because of the cheap cost of the building materials people tend to use them. I will give you an example; there is this fibre light material produced by Hardy, the imitation product is in the market now. Some dodgy developers will use the fake material to cut costs and after some time

customers will begin to have problems with their building. I will give you another instance where some dodgy developers cut corners. In the shower area during construction, Gib aqua line is supposed to be used to provide a water resistance lining as a base for finishing systems in wet areas like the bathroom, but some developers use ordinary Gib board. This is why we have problems with our new homes. I am surprised how some of these issues are not picked up by the building council (HD6).

Lack of training of tradesmen was also expressed as a fundamental cause of defects in new residential buildings. HD1 allude to the fact that there is an absence of tradesmen with the right skills within the residential building sector in New Zealand and suggested that addressing this issue could improve the quality of its new residential buildings.

There tends to be specialization as we use a lot more builders on a job. However there is a fundamental flaw in the training of trades in New Zealand. Licensed contractors abound in the residential building sector. There is more of unskilled in residential than in commercial building sector. Is it to say the residential sector is any less skilful? (HD1).

The problem in the residential industry is poor workmanship; there is lack of training of tradesmen and too many unskilled workers particularly immigrant tradesmen. Hopefully the LBP scheme will keep this in check (HD3).

Poor workmanship is the problem. Tradesmen have little experience want to work in the industry. Some of them need to have more experience before practicing (HD8).

Our young tradesmen have little skill and experience to work in the industry. I believe there should be more training for young school leavers. The problem really is ... poor workmanship (HD9)

Insufficient training was considered an issue with work done by tradespeople in the construction industry as a whole. One participant (HD1) believed that the influx of early school leavers' tradesmen with poor qualifications and experience accounts for poor workmanship in the building sector. This participant also referred to the situation in the Waikato area as an example, where it seems some spec buildings were being built by new migrants (painters and Gib stoppers) with little knowledge of New Zealand building standards. HD6 also mentioned that the problem of poor workmanship is as a result of communication problems with tradesmen especially those for which English is a second language. This means there could be difficulties with understanding building practices by these tradesmen.

Poor workmanship is also a big problem, though we do not have issue with that, some of the developers do not understand English so difficult to communicate with them. And some of them do not even understand our building process; they end up doing the wrong thing. These developers do not have any reputation at stake. They can fold up and start business again in another name (HD6).

One participant (HD1) suggests that training could be in the form of continuing professional development (CPD), which could require that each tradesman acquires certain credit points every year of practice.

Other issues pertinent to New Zealand workmanship levels include: how to get into the trades, how to become qualified and the value of the qualifications. There was also reference made to the fact that operational standards on commercial projects were higher than those in the residential construction sector, which should not be the case. Further, HD1 noted that the difference in pay rates between the skilled and unskilled workforce is relatively small in New Zealand. Therefore there seems to be no incentive to train or be certified. HD3 explained that with the introduction of the mandatory LBP scheme the residential industry could keep this in check.

Such opinions expressed by research participants reflect the significance of training to the quality of workmanship and the consequent impact on the quality of new homes. Overwhelmingly, participants were of the opinion that defective work in new residential buildings could be linked to poor workmanship. The relative importance of workmanship quality was also confirmed by the questionnaire analysis in Section 6.5.7. From the questionnaire analysis, homeowners identified that the most frequent causes of defects is poor workmanship.

Research participants also indicated that subjectivity around what was quality (quality standards) in new residential buildings could also be a cause of defects. It is clear from the context in which subjectivity was discussed during the interviews that different perceptions exist for what could be considered a standard quality of finish, for example. The different grading for levels of finishes are not self-evident and very often are as interpreted and understood by the developers themselves.

By implication, for the level of finish to be accurate, considerable responsibility lies with house developers to be completely truthful when using different levels of finish in new homes, as they are more likely to rely on their individual perceptions than those of end users.

I think the cause of this problem is from residential side, the level of finishing for residential buildings for us we use level four we don't use level five. Level five is only used for expensive buildings, where you need better subcontractors. It is very subjective, level four depends on individuals, and so what we call level four might not be same as another person. It is very subjective. The homeowners by nature are very panicky because they are the ones that are paying they want something of the highest grade. Majority of residential buildings are done on level four. For me I think it is not the sub trades rather the problem of subjectivity (HD5).

It is clear that these influences expressed by the interviewees are significant and contribute to quality achievement levels in New Zealand. The role of house developers is central to understanding and achieving desired improvements in the residential building sector in New Zealand. House developers without effective quality monitoring processes often find it difficult to identify and address the underlying causes of defects in their builds.

### **7.5: Theme 2: Customer satisfaction survey**

This theme deals with customer satisfaction surveys that the current study considers should be fundamental in the house buying process, hoping that this will allow house developers to understand both the current and future needs of their customers. The interview was designed to identify house developers' attitudes towards customer satisfaction and their views about satisfaction surveys. Importantly, their opinions could give indications to the improvements house developers could make to meet customers' needs and expectations. Customer satisfaction surveys as a theme can also be linked to the theme of quality monitoring. The reason could be because customer satisfaction survey was also identified under theme 1 as a way of monitoring the quality performance of house developers.

The following transcripts show the responses from the research participants. A succinct review of the responses revealed that some opinions are shared by many participants while other responses are more individual. Close examination of the responses show that many of the participants expressed their lack of

interest in conducting customer satisfaction surveys after handover of new homes. Whilst some participants do not conduct customer satisfaction survey, other participants believe that it is a way of measuring the quality performance of their organisation especially their franchisees. It is apparent from the opinions of some of the participants that assessing house developers' quality performance through customer surveys appears not to be a common practice in organisations as described by HD4, HD5 and HD6:

I have never done that. We know our customers are happy with us we haven't had any major problem since we started in 1997. We just rely on the feedbacks our customers give on the website (HD5).

We do not conduct customer satisfaction. Customers will never be satisfied. We don't do it. We always make sure we do the right thing and according to specification (HD6).

We have a feedback system on our website, where customers can express their opinion since they start their project. This is part of listening to our customers and quality monitoring exercise; we have provided a feedback forum for our customers wanting to talk about their experiences during the process of building their home. This feedback has helped us to continuously improve our process and quality (HD4).

We encourage our customer to put their comments on the website. We rely on this comment as we use it to improve our services (HD7)

There were many reasons why some house developers indicated that they were not interested in conducting customer satisfaction surveys, but two major factors stand out: reliance on feedbacks on their website; and the impracticality/impossibility of achieving total customer satisfaction. Relying on feedback during work progress is useful for the building process and performance improvement; however this may not accurately capture customer impressions/opinions at the end of projects. Customer satisfaction surveys for new homeowners may be a more useful performance indicator, because a listing of visible defects at that stage would give better feedback. Also the significance of homeowner feedback during work progress is highly dependent on homeowners' knowledge of the building systems and practice.

Most people in New Zealand would employ the service of a house developer based on recommendations from friends. Therefore referrals or "word of mouth" is important in the house buying process within the residential sector. One individual (HD2) identified recommendation as one of the reasons they conduct

customer surveys. HD2 explained that the most important question in the survey questionnaire they administered to homeowners is one that requires them to indicate whether they will recommend their services to others. This question is significant because new homeowners will base their response on the quality of their home and the service they received from their house developer. The response to this question determines the quality performance of the house developer. The issue of recommendation was first identified from previous questionnaire survey results (see Section 6.8.4). It was suspected that homeowners may have been conservative in their attitudes towards selecting their house developers. However, a careful review of homeowners' opinions relating to this issue coupled with HD2 opinion reveal otherwise; as HD2's explained:

The service assessment survey is conducted directly from the head office. This will allow us to monitor quality performance of individual franchisee. The questionnaire will help... to measure the overall satisfaction of their customers to the service they rendered. The most important question that will show that the franchisee is performing well is the question that requires their customers to indicate if they would be happy to recommend them to others. If the response is a yes, it shows that the franchisee is doing well in terms of quality performance (HD2).

Such findings indicated that the recommendations of house developers are based more on competencies and standards rather than simply conservative attitudes of homeowners. A more in-depth examination of interview transcripts suggested that customer surveys after handover will enable the measurement of the overall satisfaction levels of customers to the service rendered by house developers. These findings also confirmed responses from the previous questionnaire survey result regarding the key determinant of the overall satisfaction of homeowners. HD2's opinion clearly suggested that any previous experiences of new homeowners during the building production process will determine their relationship with their house developers. Additionally, their experience with the services rendered by their house developer is another significant key determinant to the overall satisfaction to the quality of their homes.

In addition to the recommendations of house developers, quick sales and determining best franchisee of the year were also found to be significant

reasons why some house developers conduct customer surveys as HD1 described:

Client survey is done immediately the building is possessed. It is an early indicator for our business. If the building is not sold immediately, the survey may pick up on why this is so? Sometimes the surveys don't pick up all the bad stuff because people tend not to complain much. (That is a kiwi thing, when they go out to lunch they don't complain when the service is bad. Rather they will not go there next time). The incentive for the franchisees is to get it right as it will affect their sales volume. The survey report is one criterion for selecting the... franchisee business of the year (HD1).

HD1 explained that house developers are motivated by the sales volume of new homes and this is achieved by getting it right the first time. According to the response of HD1, most New Zealanders may not complain even when they do not get a good service from their house developers. This suggests that they are not likely to use the same developer in future or recommend them others. This suggestion further confirms the emphasis laid on questions on the recommendation by HD2. Evident from the opinion of HD1 is that customer surveys are an assessment of the quality performance of the house developer (individual franchisee). HD1 explained that as a project manager that oversees other franchisee, customer surveys are conducted from the main office to accurately determine the performance of the house developers.

This section shows the significance of customer satisfaction surveys in the house buying process. Different opinions emerged from the interviews. These varying responses suggest mixed opinions and attitudes of house developers towards the most important party in the house buying process (the homeowner).

### **7.6: Theme 3: Building inspection process**

The second theme that emerged from the interviews deals with issues around building inspection processes. This theme is important to the current study because it covers the opinions of house developers on inspection processes during and after residential construction work. Further, the interviews enabled an understanding of the role of council and independent building inspections in building purchase decisions. Three sub themes are evident from the interviews under this main theme. These include: house developer inspection processes,

council inspection processes and the use of independent building inspectors by new homeowners (see Table 7.3).

**Table 7.3:** Theme 2 and sub themes

| Theme                         | Sub – themes                            |
|-------------------------------|-----------------------------------------|
| Building inspection processes | House developer inspection processes    |
|                               | Council inspection processes            |
|                               | Use of independent building inspections |

### 7.6.1: House developer building inspections

The process of inspection by house developers is significant to construction performance, and is similar to the monitoring covered in Section 7.4.1. Proper inspection should ensure that performance meets specifications and ultimately satisfies homeowners' needs and expectations. The purpose of this sub theme is to establish from the interviewees the effectiveness of current inspection processes. Some of the transcripts of the responses to the interview are highlighted below.

...inspection is by our Project Managers. ...our inspections are at the key audit stages of the project. The PM goes around (visual inspection) with the client with the check book with a checklist and if there is a problem will issue a site notice to the contractors... It is their responsibility to meet our standards. (HD1)

This depends on individual franchisees. Some of the franchisees have project managers that oversee their project and some of them project manage the building themselves. Regular inspection is done to ensure that the subcontractors are doing the right thing (HD3).

We regularly go round during construction to check our tradesmen to ensure they work according to specifications. We manage the project for you from start to finish ensuring quality of workmanship (HD4).

We ensure that our subcontractors work according to specifications by regularly inspecting their work to avoid failure of inspection by the council inspector. As the project manager, I have to make sure that the project conforms to what we have on the contract document. We always want to make sure that our project is passed by the council inspectors once they visit the site. It costs more to bring back the council inspectors for the same job (HD5).

I physically go around checking my tradesman to make sure they are working according to specifications. If there are any issues it is fixed immediately (HD10)

Generally participants indicated the existence of inspection processes within their organisations and highlighted the importance of regular checks of tradesmen during construction. However, only one of the participants (HD2) actually conducts further checks after the buildings have been possessed. In this instance, the post-occupancy checks are carried out three times on different occasions before a customer survey assessment is conducted. Defects observed by the project manager are recorded and rectified immediately. Afterwards new homeowners are given an assessment form (i.e. questionnaire) to assess the performance of the developer.

Prior to the customer survey assessment, the project manager inspects the property three times to make sure that everything is functioning. This is to record any defects and make necessary rectification as soon as possible (HD2).

HD9 also explained that they carry out a final check before handing over to their customers. HD6 stated that:

We check the building before finally handing over to our customers because customer assessment is done from the main office. And if our quality is not good enough we could have problem with the main office (HD9)

The participants noted that inspection involved walking around (visual and physical inspection) during construction progress by their project managers. They explained that these spot checks ensure that their subcontractors build according to specification. HD5 noted that inspection enables construction to be passed by council inspectors once because it costs more to have a second inspection.

It seems evident from the interviews that developers' inspections focus on passing council inspections. This would mean that the barest minimum of performance may be pursued rather than any quality standards that are expected by individual home owners. This finding is in line with Sommerville (2007), that house builders erroneously believe that once they have built to the initially set requirements, they have conformed to homeowners' entire requirements.

In contrast, HD1 (a franchisor) explained that their organisation has a standard that each subcontractor has to meet. They believe that because of the working relationship they have with their subcontractors, it is easy to establish supplier

agreements with them, so that warranties are provided by the sub-contractors and if there is any issue the sub-contractors will have to deal with it in advance. HD1 further explained that they require their subcontractors to do high quality work and any deviation from doing the right thing means they do not get paid. If there is an issue it is brought to the attention of the subcontractor in charge. If the subcontractors are not up to standard (i.e. poorly performing) they are not re-employed on future projects. HD1 mentioned that due to their many years of experience in the industry (upwards of 25 years) they believe they have a good understanding of the quality of different contractors. HD1 indicated that because of their volume of work they are able to use this as an effective tool to get things done right.

### **7.6.2: Council building inspection**

Another sub theme that emerged under the theme of the building inspection process deals with council building inspections for residential buildings. Although the council inspection process has become an integral part of house construction, interview participants presented mixed opinions when asked to comment on the work practice of council building inspectors. A significant number of the participants (5 out of 10) are of the opinion that some council inspectors are not competent enough and lack the required skills and experience to carry out building inspections.

I feel there needs to be more training for the council inspectors. Some of them do not have enough experience to carry out the task (HD3).

Some of them know their job and some don't (HD6).

I think it depends on the level of their skills and experience. There are some experienced ones among them (HD5).

Some of them need training and experience. Very few good ones. They are also always in a hurry to finish and go (HD8).

I believe council inspectors should have some background experience on the job. Some of the council inspectors lack the required skill to do their job (HD7).

This finding is in line with those of the questionnaire analysis in section 6.8.7. Homeowners believe that council building inspectors seem to have inadequate skills to carry out building inspection work. Homeowners expect that experienced building inspectors with the right skills should be able to identify

defects before their final sign-offs on buildings. While competency and training have been identified by interviewees as key issues with council building inspections, there is also concern about the limited time spent on carrying out inspection work. About a third of the participants are of the view that inspection work is not thorough enough because of the rush to complete inspection and move onto another site, by the council staff.

Generally I feel council inspectors do not have enough time when they come for inspection. So they do not do a thorough job. You do not actually know if they have the right skill. For example there was one of our projects that was passed for the final inspection and we are awaiting the compliance certificate, another council inspector happened to visit the site and failed the project. I agree with the second inspector because what he pointed out that needs to be rectified were right. But we did not need to rectify this because the CCC was already in the process. The council inspectors focus too much on their checklist. I would recommend that the checklist be amended to capture wider things (HD6).

Time is another problem with council inspectors; during their peak period it is difficult to get them over to the site for inspection, we have to wait and last year we had to wait for about two weeks despite that we informed them earlier. I suggest that they get more hands so that they can cope with their work during high demands. Time is money and it is important for both the developer and the desperate homeowner. Once construction stops it is costing everyone (HD5).

To get CCC, there are several inspections. Engineers and council don't care much about quality, they are looking for compliance. If it is a rough painting job, they don't really care... 12-16 week build with series of inspections. Is that not a whole lot of inspection going on? On one quality inspection and on the other compliance inspection, plus your own inspections for such a short build time (HD1).

Further, HD6 mentioned that in addition to poor inspection due to time constraints, council inspectors also focus too much on their checklist so that they do not utilise their initiative sufficiently. Apart from focusing on the checklist, HD7 was of the opinion that "the council inspectors concentrate on (so many) little things that they miss important ones".

In HD6's opinion, council checklists lack some relevant information to be able to capture a wider range of defective work. From another perspective, HD5 suggested that there are insufficient council staff to meet inspection requirements especially at peak demand periods. In agreement with HD5, HD10 stated that: "Sometimes inspection could hold up work progress. They need more staff to cope with work load". HD5 explained that the time factor in any building construction is crucial to both house developers and desperate

homeowners, as time delays cost money to the parties involved. HD5 suggested that the approving authorities need to be staffed with more competent people and with the right expertise and integrity so that building inspections can be conducted more efficiently. These opinions are consistent with the findings of the questionnaire survey in Section 6.8.7. The time lag between a request for an inspection and the actual building inspection was considered disappointing by new homeowners.

HD1 also raised another issue around building inspections in New Zealand. HD1 was of the opinion that the number of stage inspections is too many for residential building projects that last only about 12-16 weeks. Other issues raised by HD1 are contained in excerpts of the interview below:

Engineers design for structural performance, carpenters have to interpret design documentations to get that right. Fundamental inspections like that have to remain. Do the trades know what needs to be done all the time? Not really. Are the consents/compliance documents as good as they could be? They are never right. Some plans/drawings have up to 20-30 design errors. Having those checks is important. Though this may impact on productivity, possibly yes but council will not take liability for such buildings otherwise. The inspection systems have to remain. Big developers may take on such liabilities. They bond their builders and the big developers also bond councils so they can take on a lot of liability (HD1)

Probably useful to this research is the issue of subjectivity of inspection work raised by HD5. The example given by HD5 suggests inconsistencies exist among council inspectors because they may have conflicting opinions on the same issue. HD5 noted that:

Generally council inspectors are subjective. For example a building inspector came and insisted we have to water proof the bathroom floor (we call it tanking) even though we are using a cubicle. He made us do the water proofing. This is my first experience since working in the industry and when another council came he said it is rubbish that we are not supposed to do that. Sometime it is confusing. I think it depends on the level of their skills and experienced. There are some experience ones among them (HD5).

Some of them know their job and some don't. Generally I feel council inspectors do not have enough time when they come for inspection. So they do not do a thorough job. You do not actually know if they have the right skill. For example there was one of our projects that were passed for the final inspection and we are awaiting the compliance certificate, another council inspector happened to visit the site and failed the project. I agree with the second inspector because what he pointed out that needs to be rectified were right. But we did not need to rectify this because the CCC was already in the process. The council inspectors focused too much on

the checklist. I would recommend that the checklist be amended to capture wider things (HD6)

According to HD5 and HD6 the issue of subjectivity is the result of incompetency of council inspectors as discussed in the previous section.

### **7.6.3: Use of independent building inspection**

The interview under this sub-theme complements the questionnaire survey in section 6.7.1 and is aimed at determining the level of awareness of the benefits associated with defect reporting. Building inspection processes are significant in ensuring performance in residential building construction. Having additional inspections after handover could enable the detection of defects and could allow for quicker rectification work. Defect reporting after handover may perhaps guarantee homeowners' and even house developers' peace of mind. It could also provide confidence that buildings will ultimately achieve the desired levels of quality performance because the culture of building it right first time would have been absorbed. Defects that occur after handover are referred to as visible defects (see Section 4.6). This category of defects are normally noticed by new homeowners themselves or through some form of inspection conducted by external parties but are rarely identified by house developers.

Two contrasting opinions were held by the developers interviewed. One group was for, and the other against, the engagement of the services of independent building inspectors when buildings are completed. The interviews found that the majority of the participants seem to have a common perception about not engaging independent building inspectors. For example, HD10 believed that an additional inspection is "not necessary, we have confidence in what we have built". In agreement with HD10's opinion, HD8 explained that "the council inspectors have done the inspections and the CCC has been issued, why another inspection for a new house?". The participants are of the opinion that independent building inspection would not confer any real benefits to homeowners and developers. The following interview transcripts (of HD1, HD3 and HD4) explain their viewpoints.

I think it is a bad idea because they have their own agenda, which is to create work for themselves [i.e. independent inspectors]. On a commercial contract e.g. schools,

there are independent Q.S. consultants and quality inspectors who are paid by them. If you bring that in to the residential sector, who will pay for it? The margin on a 250K home is about 20K and so where will the external inspection fee come from? There is some kind of self-regulation system whereby bad contractors end up not getting jobs on the long run. High end architectural projects will most likely use inspectors to ensure compliance. Better products don't guarantee performance or make performance better (HD1)

In my opinion I do not think an independent inspector is necessary. When you do a good job you stand by it. We are always efficient in dealing with issues that our clients have. We do pre handover inspection before finally handing over the project to our client. Any problem that may have been detected during the pre handover inspection we deal with it quickly (HD3).

We are proud of our buildings. We do not need an independent inspector. I do not see a need for an independent inspector. Not for residential building. We deal with our contractors, subcontractors based on our previous relationship (HD4).

We do inspect our building before handover. I personally feel the inspection by independent inspectors is not needed. We know the quality of houses we build (HD9)

Although HD1, HD3 and HD4 held a common perception that defect reporting at handover is not necessary, their reasons vary. For example, HD1 believes that independent building inspection should be restricted to commercial buildings because only 'high end' architectural projects will most likely use inspectors to ensure project compliance. HD1 raised a useful observation relating to who picks up the bill for inspection. HD1 also believed that the residential building sector is able to self-regulate because eventually bad and under-performing developers and sub- contractors will lose out in new commissions. HD3, HD4 and HD9 on the other hand were confident that the quality of their performance would not justify the need for independent inspections. HD3 and HD9 did point out that they conduct pre handover inspection before finally handing over projects to their customers, and that any defects detected during the pre-handover inspection are dealt with quickly. HD4 suggested that better relationships within the construction supply chain could improve quality achievement. These opinions contradicted the opinion of homeowners as discussed in Section 6.7.5. The majority of homeowners (70%) felt a need to engage independent building inspectors to inspect new homes at handover.

In contrast, some of the interviewees believed that independent building inspection could benefit homeowners and house developers. HD5 suggested that such an inspection should include the council inspector, house developer

and homeowner only at handover. HD5 was concerned about the cost associated with independent building inspections. This concern, over who will be responsible for the fees of an independent building inspector, echoes across most interviewees. Of note is that the two participants, who indicated that having a check at handover by an independent building inspector may be good, are private house developers who build one-off buildings. Some excerpts of interviewees with this opinion follow:

It may be a good idea, but who pays the bill? I would rather suggest that before the CCC can be issued the developer, council inspector and the house buyer should go round together during the final inspection (HD6).

I think it is a very good idea. Then we can fix the problem at once so we don't have, it is not common though for new homeowners to do a pre purchase inspection. Sometime our customers do it privately without our knowledge (HD5).

#### **7.7: Theme 4: Warranty provided by house developers**

In an effort to establish comparable warranties from different house developers to remedy structural and non-structural defects, this interview question asked research participants to comment on the warranty they provide to their customers upon house purchase. The primary purpose of a warranty in house purchase is to provide some form of security for homeowners when issues of defects arise after handover. Seeking redress and identifying accountability may appear to be difficult when things do not go right. Hence, the theme (warranties) is significant when discussing issues of defects in new buildings. This section will show the different responses from house developers on the type of warranties they provide to their customers. These include both structural and non-structural (minor defect) covers provided. A further objective of this theme is to understand whether there is a uniform warranty for non-structural defects or not. This theme will throw more light onto the responses to Section 6 of the questionnaire survey. Because of the varying response of homeowners to the questions (Sections 6.1 and 6.2) within the questionnaire survey on issues of warranty, it was essential that such findings were selected and explored further during the face-to-face interviews.

### 7.7.1: Available warranty

It is apparent from the analysis of the transcripts that there are mixed opinions on the warranty provided for new homes by the research participants. The following transcript describes different warranties provided for new homeowners. HD5 noted that:

For minor defects we allow 60 days. We use the Master Builders warranty. We fill the application at the beginning of the project and then lodge for approval. Once it is approved it becomes a valid document. Most homeowners do not know that the application is supposed to be completed at the beginning of the project. So it is our duty to tell them. For minor defects it's 60 days. Any issue we go back and fix it. We tell them if there is a problem they should let us know. Make a list and keep on telling us for minor ones. We tell the homeowners to write down the problems they found and then give us a call, for the minor defects we wait and then we go back. It does not cost much so I expect builders to fix it (HD5)

We provide 10 years as given by the code. Within this period we fix any problem that comes up. We also give 3 months for any minor problem, starting from the day we hand over the building (HD10).

The Master Builder warranty covers our customer upon this we give one year for any issue that may come up. We normally do not have issues with our buildings (HD9).

A review of the transcript above reveals that HD5 and HD9 provide the Master Builder (MB) warranty scheme for their customers to cover all structural defects observed. However for minor defects a 60 days and one year cover is provided respectively. HD5 explained that homeowners are to record any issues within the 60 day maintenance period and should then contact their developer, so that it could rectify the defects. This suggests that minor defects might not be attended to immediately, however the developer is happy to fix the problems because these do not cost much. Another significant point mentioned by HD5 is that in some cases homeowners do not understand that the application form for the MB warranty is supposed to be completed at the initial stages of residential projects.

Similarly to the opinions expressed by HD5 and HD9, HD6 also provides some form of warranty for their customers though only three weeks is provided compared to HD5's 60 days and one year. HD6 explained that a maximum of three weeks is provided to cater for issues relating to minor defects because sometimes the defects identified by homeowners after handover are caused

while relocating. HD6 provides a period of 10 years for all structural defects as indicated in the building code. However HD6 did point out that from their experience as house developers they have seen other house developers provide 5 years warranty for their customers for structural defects even though the building code specifies 10 years. HD6 further explained that these unscrupulous house developers write the 5 years in fine print within the purchase contract and house buyers do not pay attention to such fine prints.

Other significant issues identified in the response of HD6 is that as a private developer they are not registered with any professional body or trade organisation that could provide cover for their customers.

For minor defects we allow maximum of three weeks, I feel three weeks is enough to be fair on the developer, because sometimes problems of defects could come up during customers' relocation. But for the whole building we give 10 years provided by the building code. But this depends on individual developer. We are not registered with the master builder or CBANZ. Personally I do not see the need. Some developers give five years for the whole building and this is normally written in fine prints within the contract. House buyers do not pay attention to it (HD6).

Similarly HD7 and HD10 explained that they rectify any defects within the 10 year period specified by the code. While HD6 considered the MBF warranty package as unnecessary, HD2 and HD3 believed that the MBF warranties could guarantee that their homeowners are well protected when defect issues arise. Therefore HD2 and HD3 provide a Master Builder's 10 years Classic Guarantee on their buildings. HD2 explained that within the first three months of handover their project manager inspects the house three times for any defects. This inspection is done prior to a customer survey assessment. Any defects identified within the three month period before the assessment are rectified as soon as possible. This finding could suggest that minor defect rectification usually falls within the first three months after handover.

HD3 explained that all their new homes carry a full one year warranty. Their warranty covers the repair cost of any defect due to faulty construction or defective materials for a full year from the date of possession. This warranty is an additional cover over the MB warranty. HD3 explained that this warranty is unique to their organisation because customer satisfaction is their major priority.

A customer satisfaction survey is conducted three months after homeowner have taken possession of their home. The survey is called service assessment for new homeowners. Prior to the survey, the project manager inspect the property three times to make sure that everything is functioning. This is to record any defects and make necessary rectification as soon as possible... comes with the renowned Master Build 10 year Classic Guarantee (HD2).

We recognise that our customers' satisfaction is our priority every... carries a full One Year Warranty. This warranty applies to both the construction methods and the materials used. ...will repair without cost to the customer any defect from faulty construction or defective materials for a full one year from date of possession. This warranty is fully comprehensive and is over and above our Master Builders Guarantee

On the other hand HD4 explained that their organisation provides a personal warranty to ensure that their customers are well covered. From HD4's opinion they believe that their warranty is better and more comprehensive than any other building company and even better than an MBF guarantee. The reason for their personal warranty is to ensure that their homeowners have peace of mind and confidence in the quality of their work.

We are sure of the quality of our homes that they come with... own personal guarantee, so that customers are protected and they have peace of mind about their home. No other building company does this. This guarantee is more comprehensive than any other building company and even better than a Master Builder's guarantee (HD4).

To cope with the reality of defects rectification by the provisions of sustainable warranties for new homeowners, HD1 explored alternative solutions. HD1 explained that they have a unique warranty scheme that ensures that all their house developers within their franchises are bonded to them. Thus their warranty covers all homeowners for all structural and minor defects.

The insurance in NZ is not working. The MB is struggling to keep up with the problems around quality issues. HD1 has its own warranty scheme. Our builders are bonded to us and we have a fund... We are offering more than the MB and ours is unique.

I cannot see the MB guarantees is sustainable because at the moment they have got many members. The members are little guys. If they price a job wrong and muck up, the MB may not be able to do much with a 3K bond when the issue requires 30K claim to be resolved. The system is not sustainable, they have too many businesses and they don't audit the businesses (HD1).

The need for a sustainable warranty scheme in New Zealand was emphasised by HD1. According to HD1, New Zealand insurance policies are ineffective for

homeowners. This research participant particularly criticised the MBF warranty system, stating that the large numbers of members and businesses registered with them make their services unsustainable and therefore leading to poor auditing processes. They believe that this contributes significantly to the persistent problems associated with the responses provided by the MBF regarding quality issues.

On closer examination of the transcripts in this section, there appears to be some level of inconsistency and lack of uniformity in the warranties provided by house developers to new homeowners. It is apparent that while some participants provided between 20 days to one year cover for minor defects, some other participants were not categorical in terms of the cover they provide. The problem of inconsistency is also reflected in the type of cover they provide for structural defects, despite the fact that the building code (NZS 3604) specifies 10 years for new buildings (B11) which is either set out in the purchase contract or not as explained in Section 3.7. The questionnaire survey also found that warranty periods specified in building contracts for new homeowners varied (see Sections 6.5.1 and 6.5.2). These findings suggest that there would need to be consistent and appropriate warranties and that they should be clearly included in purchase contracts.

The MBF warranty scheme has been criticised as being unsustainable, yet it remains the most widely used warranty scheme in New Zealand. This finding is supported by the result of the questionnaire survey that shows that 62.8% of homeowners had their houses built by registered Master Builder house developers.

#### **7.7.2: National warranty scheme**

Another theme that emerged from the analysis of the interview with house developers is their opinions on a national warranty scheme that could operate across the residential sector. The purpose of the question was to investigate the need for a consistent application of warranty cover for new homeowners. As discussed in Section 3.7.1, there are two prominent bodies that provide some form of cover for new homeowners when defect issues occur in New Zealand. They are the Master Builders Federation and the Certified Builders Association

of New Zealand. From the questionnaire survey analysis (see Section 6.4) the majority of homeowners (62.8%) indicated that their houses were built by registered Master Builders. Therefore the MBF warranty scheme applies to them. Section 7.4 also confirms this finding, as a significant number of house developers are bonded by the MBF warranty scheme.

The theme national 'warranty scheme' can be linked to Sections 6.7 and 7.4 that seek to understand whether there is a standardised warranty scheme provided by house developers. Findings from these two sections show a lack of uniformity of warranties available for new homeowners. Even though significant homeowners are covered by the Master builder warranty scheme, some house developers believe that this scheme is not operational. The reason is that the audit system is ineffective. The participants alluded to the fact that the MBF is struggling to keep up with issues of defects. In particular, it was noted that:

The insurance in NZ is not working. The MB is struggling to keep up with the problems around quality issues. HD1 has its own warranty scheme. Our builders are bonded to us and we have a fund. If there was a national body, it will wipe out our own warranties. I don't know if the NHBC scheme will work here in NZ. We are offering more than the MB and ours is unique (HD1).

I think if there was a national scheme that may be ok. The case of the South Canterbury finance may happen where the audit system failed may well apply. Auditing a firm may not solve the problem too. For example a 1 year financial statement does not guarantee that a business will not fail. Having a cash bond requirement and a guaranteed fund with an insurance scheme may be a better way. We already have done it (HD1).

In this particular instance the house developer agreed to the need for a national warranty scheme. However this participant expressed concern on the effect of a national scheme on the individual warranty scheme they provide for their customers. They believe that their own warranty is unique and effective.

From the above statements, it is clear that the participant was disappointed in the lack of effectiveness of warranty schemes available for new homeowners. These negative experiences have directly impacted on their trust in the warranties available and consequently affected their future decisions in the viability for a national warranty scheme. Again, the driving forces behind such perceptions are closely linked to the previously identified (see Section 7.4)

criticism of the unsustainability of the MBF scheme, and which seems to be the most widely used scheme.

Integrating theme 3 (warranty provided by house developer) of Section 7.4 with this section, it can be deduced that there is no consistency and uniformity in the warranty schemes available for new homeowners for defect rectification. It is also apparent from the response of house developers that most new homes are covered by the MBF warranty scheme. This finding also supports the result of the questionnaire analysis (see Sections 6.5.1 and 6.5.2). The need for a national warranty scheme is based on the importance of warranty schemes in the house buying process. In some cases, house developers either did not have the time to fully communicate the scope and operation of available warranties, or chose not to completely disclose the conditions to new homeowners. Therefore there still exist gaps in homeowners' understanding around residential building warranties.

### **7.8: Areas of improvement**

The last theme that emerged from the face-to-face interviews with house building developers deals with opinions expressed about improvements that could be made to the residential construction sector in New Zealand. The objective of the line of questioning is to identify key areas where improvements could be made to ensure improved performance in the industry.

Participants identified a number of improvements. Some of these are closely linked and influenced by previously discussed themes, such as suggestions for checking the quality of imported building materials, as the participants believe this impacts on the quality of residential buildings. Also some participants are of the opinion that changes have to be around the way construction businesses are established. For example HD1 and HD6 note that:

... I would recommend that incoming buildings materials should be checked properly (HD6)

The percentage of fund invested in the country has to be improved upon. Most of the building products are imported and not produced locally. The building construction industry needs to increase its product delivery to be able to help the economy grow more. Currently its involvement in building production using imported products does not help the economy much... The Australian economy is a big drain on NZ human resource (HD1).

A research participant mentioned the lack of indemnity insurance for LPB members as an area that needs improving. The participant acknowledges that the LBP scheme could prevent builders without a proper track record from being licensed; hence the bad ones would be weeded out. However some participants believe that the responsibility given to LBP is huge considering that there is no indemnity insurance to cover these LBPs if things do not go according to plan. One participant suggested that the scheme only creates an avenue for government to generate money, while another participant was of the opinion that the criteria for registration are too easy, and that anyone can be licensed.

I feel the LBP is good because those with no proper track record will not be able to be licensed. The problem I see is that with the amount of responsibility given to the LBP there is no indemnity assurance if something go wrong. It is a major downside. Even if an LBP makes a mistake there is no insurance to cover. Councils have pushed the responsibility away from them. The council still does the inspection so they have to take some form of responsibility. However we do not know the full effect of the LBP scheme now... the indemnity assurance is worth consideration and the Council should employ more building inspectors (HD5).

It is another avenue for government to generate revenue. Anybody can be a licensed practitioner. All you need is to have records of about six month experience in the industry (HD6).

HD10 believes that the implementation of the LBP scheme "is a government way of passing liability to us".

Significant numbers of participants (5 out of 10) expressed concern over the performance of council inspectors. It was suggested that the councils will have to resource the consent and inspection processing departments to be able to cater for the volume of demand for certification of new residential buildings. HD9 also suggested more training for young school leavers so that they can gain good knowledge and work practice in the industry.

HD1 for example says:

The web based system drives a sequential way of doing things. It may not necessarily drive productivity but provides an action step which allows a whole of business to follow every project/franchisees performance etc... The system might be proposed for building consent process wherein every consent application is administered on the web. It may ensure consistency in the consent process and reduce variability in the consent requirements experienced by builders now (HD1).

Reference was made to changes in immigration policy to check the negative migration currently being experienced of critical workforce personnel with the requisite experience in house building. In particular, HD1 explained that New Zealand needs positive growth rather than the net migration currently being experienced.

There has to be a key change in the immigration policy. The population demographics are also not helping out. It may be healthy for building in Auckland but not in other cities. There has to be positive growth rather than the net migration being experienced now (HD1).

Analysing the interview transcripts, six key thematics were suggested for improving performance within the residential construction sector. These are outlined below:

- Proper certification of imported building materials
- Consideration of indemnity insurance for LBPs
- Tougher criteria for registration as a licensed building practitioner
- Stricter conditions for establishment of construction businesses
- Introduction of a web-based system for building consent processing
- Change in immigration policy to restrict the drain on construction skills.

### **7.9: Research Verification**

This is the last phase of the research investigation, and was designed to verify the findings from the questionnaire survey to homeowners and interviews with house building developers. This aspect of the research identified three key industry stakeholders as subject matter experts (SMEs) for the study. These subject matter experts were selected to represent homeowners, councils and house building developers. Therefore the research interviewed a high level executive of the Home Owners and Buyers Association of New Zealand (HOBANZ), a senior building control officer at the Auckland City Council (ACC), and a senior executive member of the Master Builders Federation.

At the conclusion of the analysis in Sections 6.2 to 6.9, and Sections 7.2 to 7.4, a compilation of the summary of the key issues that emerged from the investigation was made. These summaries were then presented to these subject matter experts in the form of verification interviews. A face-to-face interview was conducted and transcribed and the transcripts used for the discussion. The three industry stakeholders commented on the research results and made contributions that could improve the quality of the research findings. The three key industry players were considered because of their valuable contributions to policy formulation around quality issues in the house building sector.

The following sub-sections give an explanation of the opinions of the SMEs on the issues that arose from the research findings described in previous sections. An outline of the key issues linked with performance improvement in new residential buildings in New Zealand are presented, followed by the SMEs' comments and contributions to the themes covered by the research.

- A major concern is the quality of new residential buildings in New Zealand. The study has shown that the level of defects in new residential buildings are low, however the defects could be reduced or completely eliminated, if there was effective and efficient quality monitoring processes in place. It is highly desirable to get residential construction right first time to the satisfaction of home owners.
- A homeowner satisfaction survey is vital in the house buying process as this could enable performance improvement by house developers, and aspects of construction activities that require improvement could be identified through such surveys. The research analysis shows that there are high satisfaction levels amongst new homeowners despite the defects observed when they take possession of their buildings. These findings suggest subjectivity in customer perceptions of quality. However it is important to understand their needs and expectations and this can be achieved through customer satisfaction surveys.
- The research shows that defect reporting for new homes is rarely done. Both new homeowners and house developers need defect reporting to ensure

that they base their decisions on factual information from experts. The question that needs addressing is: could defect reporting be made mandatory in the house buying process?

- Finally, and a theme that emerged from the research investigations is the concern around the lack of uniformity and inconsistencies in the warranties available to new homeowners in New Zealand. The findings from this research show that new homeowners have no clear picture of their warranties and are uncertain of how the warranty process operates. A useful question that the industry stakeholders could comment upon is: would a national warranty system provide uniformity in warranty schemes operable in the New Zealand housing sector?

#### **7.9.1: Verification of issues around defects**

Two key issues of defects in new residential buildings which the SMEs were required to validate included:

1. The reason(s) for the low level of defects determined from the analyses of questionnaires to new homeowners and interviews with house developers. House developers claim that the majority of the call-backs they received were for minor defects.
2. Confirmation of the underlying causes of defects in new residential buildings. Several causes had been highlighted by new homeowners and house developers, including suggestions on how performance could be improved in residential construction generally.

##### **7.9.1.1: Opinions of SMEs on issues of defects in new residential buildings**

The issues highlighted above were re-phrased into the interview questions to solicit the opinions of the SMEs. Excerpts of the responses are provided in quotes within the following paragraphs. Their views are discussed within the context of the respective issues that are raised by the current study.

SME1 believed that the low number of defects and the aesthetic nature of them were the result of a lack of knowledge by homeowners on what to expect when

purchasing a new home. SME1 explained that until homeowners buy more than one new home, they may not understand what to look for. According to SME1,

...a lot of New Zealanders grew up in old homes and a new home is a new concept to most New Zealanders. So they wouldn't know what to look for. Most of them grew up in their old parent's house or a farm house. And the urban city expanding now you've got these new homes that are popping up and until people are starting to know what new homes are they'll start picking the defects as they go so otherwise they won't be able to identify which is which (SME1)

SME1 believed new homeowners tend to be carried away by the excitement of owning a new home, as it is one of their biggest goals in life. Therefore homeowners may not focus on the minor defects and quality problems of their buildings.

...basically with the New Zealand society a lot of people are excited just to own their first homes. So basically their conception is that getting a home is... their goal in life and when they get their home most of them are satisfied to be in their home. So depending on the background of New Zealanders people don't even know what new building looks like because it will be their first homes. (SME1)

SME3 shared the view that homeowners lack technical knowledge and are only able to notice visible defects rather than what is hidden under the plaster board. SME3 suggested that this may account for the aesthetic nature of defects identified by new homeowners in the current study. A more accurate assessment of the quality of new homes at handover would require an expert judgement. SME3 stated that:

On the face of it they appear higher because they have much more glossier finishes and are very impressive generally... the defects that you have mentioned are typical of those that would be experienced by a home owner because they are visible, and what is hidden is often very poor workmanship and the covering up of big mistakes (SME3)

In a slightly different light, SME2 submitted that the extent of defects experienced by new homeowners (as observed from the questionnaire survey) are reasonable because it is unusual to achieve defect-free construction work. This opinion suggests that the occurrence of defects at handover is normal for new homes as was discussed in Section 6.8.1. SME2 noted that:

...but I would have thought that five defects at handover is a very low number.....So it's really unusual I would say to get totally non-defects... So you will always get things like doors jamming perhaps and not closing properly and they need to be

adjusted after a period... I would have thought, that the homeowner just noticed things that were aesthetic rather constructionally material. (SME2).

On the reason why defects are observed in new homes, SME2 and SME3 believed that it is because the building industry rarely concentrates on every detail of general finishing in new homes. SME3 suggested that builders are always in a hurry to finish their work and in the process they miss out on little but vital things, while SME2 believed that the problem is to do with franchisors engaging unqualified franchisees. In SME3's own words:

We just lack a building industry that has the required eye for detail in terms of finishing and often some of the defects you've mentioned like cracking in wallboards are all due to poor installation with the finishing plasterboards, not following manufacturer's instructions, and also in many cases it's a result of movement in the framing timber because they haven't let it dry properly to the required moisture levels before they installed the plasterboards. So it's the haste and lack of following the proper manufacturer's instructions (SME3)

...and in many cases one of the problems has been that the franchisor has sub-contracted the building work to poor quality builders. Some of them who aren't even trade certified in the past. And/or they've let their local; so you have a central franchisor be it in Auckland or be it in Christchurch ...whatever but some of them are not fussy about the sub-franchises that they dish out... So it's like having your car serviced by someone who's not a qualified mechanic. Anyway that's okay (SME2).

Upon closer examination of the opinion of SME2, it is evident that many of the defect issues experienced by new homeowners could be fundamentally linked to an underlying lack of trade qualifications and poor apprenticeship schemes. This view is consistent with the research findings from the interviews with house developers, where unskilled tradesmen were identified as a significant cause of defects in new residential building.

### ***Comparing quality now to ten years ago***

Generally the SMEs were of the opinion that newer methods of house production and over-subcontracting of building work has a great impact on the quality of new residential buildings now than a decade earlier. The SMEs believed that house developers used to be specialist in most aspects of building construction and they took pride in this. However, currently house developers now specialise in few aspects of building construction, which means most of the

stages of such building work are subcontracted with little oversight from the main house developer.

SME2 in particular pointed out that current house production practice is more production-orientated and has fundamentally affected quality control on construction sites, although there is no evidence that there is a relationship between system buildings and performance quality. An excerpt of the interview with SME2 explains further:

One of the things that concern me is 10 or 20 years ago you had direct trade; or the builder would be undertaking more of the house construction than they currently do. So in those days the builder would be possibly; if it's a concrete floor the builder might well be boxing and pouring the concrete floor. Whereas nowadays you get specialist contractors for pouring the concrete floor... The builder would be standing all the frames; doing all the cladding; doing all the window installation; the windows would still be coming from the joiners, but the builder/carpenter would actually be doing that installation. Nowadays you get specialists doing that. The builder would be doing the Gib fixing, nowadays there are specialist Gib fixers.

...I do not have any evidence to know whether there are more defects now than 10 or 20 years ago. But what I do know is that the process has become more production orientated and systemized. And to my mind that could lead to quality control issues (SME2).

...because previously the carpenter took ownership of the whole product, now that has been disseminated to different trades. (SME2)

While too much subcontracting of building work was agreed to affect current house production, building material importation is also a source of concern to the SMEs. This issue coupled with continuous changes in architectural design of residential buildings has posed huge quality challenges on the housing industry. These have resulted in complexities in house production as was discussed in Section 2.3 of this study. Both SME1 and SME2 noted that:

We are now going into more Mediterranean plaster houses. And like weatherboard, you know we have plenty of weatherboard houses and builders actually took pride in actually building these houses. ...Where as these days there's a lot of sub-contracting going on (SME1).

People are now requiring more out of their house design than they used to. So we used to all live in quite simple houses. That doesn't appear to be good enough nowadays... The more you have something that's complex the higher the degree of skill that's required (SME2).

SME1 believed that faster production of residential buildings has meant more mistakes and errors. SME1 was of the opinion that the focus on business

turnover causes builders and developers to take on too many projects. Consequently, quality monitoring of construction work becomes difficult.

So basically what they've done now is they take on too many jobs and it's all about the turnover of actually getting jobs done and not the actually quality of the builders. Back then the builders were just out on one job, they do the whole job, the footings, and the foundation. Whereas now you get sub-contractors doing different stages... (SME1)

### **Poor workmanship**

Prior investigation around the causes of defects (see Sections 6.4 and 7.4) in new residential buildings had found poor workmanship as a major cause of defects in new homes. This was further confirmed by the SMEs as a significant cause of defects in the housing industry. Unlike previous analyses where there were certain degrees of variation in views and opinions, all three SMEs uniformly agreed that poor workmanship in new buildings is an issue that needs immediate attention.

The three SMEs were of the opinion that a lack of training and poor apprenticeship schemes are the main contributing factors to the poor workmanship of tradesmen in New Zealand. These consequently contributed to in poor performance on building projects. Their opinions suggested that poor workmanship (poor understanding of good building practice and a lack of care) is a feature in all defective homes. Their views supported the findings from the questionnaire analysis (see Section 6.8.4). The SMEs elaborated on this issue:

That apprenticeship is; there are no apprentices out on site and if there are they're only there for a minimal time. So that scheme is starting to cause a lot of issues with inspections, going out there and seeing new, not so called apprenticeships, with little experience at all and because the main contractors not; he's probably never around, he's got probably three or four jobs...(SME1)

The quality of training, I suspect trade training is much poorer and that goes to the workmanship issue (SME2)

Well we think we need to make them accountable, you know the whole chain in terms of head contractors, sub-contractors and product manufacturers need to be accountable. I think it's more training and making the builders finally understand that they are ultimately responsible for the performance and durability of these buildings and they need to make sure that they get it right the first time. (SME3)

The researcher gathered from the SMEs that in the past, right up until probably the late 1970s early 1980s the requirement for carpenters in terms of their skill

levels were higher than is the case in the present day. For instance, carpentry apprentices were required to do a joinery component as part of their training, and as the joinery trade is detailed and fastidious, tradesmen became really skilled at various elements of putting building project together. This does not seem to be the case in modern day carpentry training.

SME1 expressed frustration over the poor quality of work building inspectors' encounters during site visits. SME1 believed that poor workmanship is linked to not taking ownership of the whole building work and distributing it to different tradespeople. According to SME1, this may account for the over-reliance of house developers on the building inspection process to help identify defective work. The expectation is that every fault will be picked up by council building inspectors.

SME1 believed that imported tradesmen contribute significantly to poor workmanship, because some cannot communicate well in English. Therefore a flow of information is difficult. Added to this, is that in the house industry becoming a tradesman requires few or no qualifications, so it is easy for anyone to enter the trade, as described by SME1:

During inspections there's a lot of... different ethnic groups out there and it is the communication... There's a big communication problem in regards to what we expect and what they know... A lot of builders come from overseas and they just get on the tools and run. It is like a 'give it a go' attitude. There is nothing stopping them from picking up a hammer. Like anyone can pick up a hammer and that's why the quality of building now is like it's just a DIY attitude is everyone give it a go. You don't even have to be a professional (SME1)

These comments would suggest that the government needs to focus more on cadetship and apprenticeship programmes, otherwise there could be succession problems between old and new builders coming through the housing industry. Poor training of the construction workforce in the housing industry has been consistently highlighted in this research. These concerns and their impacts on the quality performance of new buildings were consequently reflected by the SMEs.

### ***Building materials***

Another cause of defects mentioned by the SMEs is the quality of imported building materials used by the industry. All three SMEs verified the research

position that this requires some attention by approving authorities. There are lots of building products being sourced from overseas because they are cheaper than those produced locally. SME1 was of the view that the quality of monitoring of imported building materials coming into the country is inadequate. SME1 further believed that regulations to control importation are loose, while SME3 believed that the certification process for building products is inadequate.

According to SME3 there are products currently available in the New Zealand market that do not meet building code specifications, yet approval is given. These views are exemplified in the following extracts:

Yes with the Asian market and all that we're finding a lot of replicas of materials coming into New Zealand. So there is no control on it. Anything pops up but there's no way of us verifying it is compliant. I think basically there is no tariff on materials coming into New Zealand. Basically it is open season on what you put in their Product Certification there's pretty much no regulation on; there's no banned items underneath the Department of Building & Housing. So even asbestos is not banned. So there's no banned item (SME1)

As far as materials are concerned I don't really have enough knowledge about materials other than to know that the timber quality I think has not improved, it might have deteriorated even in spite of the stricter grading requirements (SME2).

....the product certification process in our opinion is somewhat lax and we see product certification of products that have been approved where they are failing in service and the installation instructions for example are very bad - I can't mention a brand name - but on a very prominent fibre cement weatherboard it doesn't specify turned up flashings on the end of head flashings; the turned up ends on the end of head flashings for example. Yet that is contrary to the Building Code and yet that product and its installation instructions became approved ..... And we've found that, that has caused leaking in houses that are less than two years old. So we don't have much faith in the product certification process and it is driven by the manufacturers themselves and therefore it lacks credibility and objectivity (SME3)

We cannot as a country produce these items at a cheap rate and that is why we import in. But then there's so many things coming from overseas that have been rejected that we've taken on board because it's cheap and anybody can export in. There's no restriction of who can export materials in.

The opinions of the three SMEs would suggest that until there is stricter product certification for imported building materials, the housing industry will continue to suffer from the issue of defects.

## ***Suggestions for improvement***

The SMEs gave suggestions on how to improve the quality of new residential buildings in New Zealand. The training and licensing of tradesmen was predominant among the suggestions offered by the SMEs and as an area requiring improvement in the residential construction sector particularly. In the words of the SMEs:

Concerning workmanship, I think there needs to be an overall building card where if you don't have a licence at all you can't pick up a hammer. 'Cause you know if you drive a car you need a licence even if it's a Learner Licence and then you go onto your Restricted and then you go onto your Full Licence. There needs to be some sort of scheme in that regards (SME1).

I think the trade training, going back to the old apprenticeship system whereby you get apprentices working onsite and doing block courses. But you need theory and practice, and if you get the two segmented too much, in my view, they don't gel to the same extent. So good trade training. Better intake/uptake of apprenticeships (SME2)

I think it is more training and making the builders finally understand that they are ultimately responsible for the performance and durability of these buildings and they need to make sure that they get it right the first time (SME3)

Following on from proper training and up-skilling of the residential construction workforce is the need for accountability in the entire construction chain from head contractors to sub-contractors and product manufacturers. SME3 believed construction parties have the ultimate responsibility of performing in accordance with expectations. This way it is also possible to raise the level of satisfaction of homeowners when buildings are built right first time. Probably in the same light, SME1 believed that it should not be the case of nobody taking responsibility for the problem, and therefore leaving the problems associated with under-performance for homeowners to deal with. According to SME1 because the majority of construction businesses are small, getting them to release labour to rectify defective work is difficult. It would therefore be reasonable to expect that the projects are done properly the first time.

And because New Zealand is predominantly small businesses and that includes the builders and that, they do not have the manpower to actually go back to old jobs because there is always going to be a new job. And so there is only about a two, three, four man working team and to have one person to go back to another job, that is pretty costly to their next project (SME1).

Another useful suggestion given by an SME that could improve the quality of new residential buildings in New Zealand is the establishment of a mandatory defects period. In residential construction, this would be similar to the defect liability period in commercial contracts. SME1 suggested that a one month mandatory defects period be implemented after house occupation, and that only after this is the CCC for a building issued.

I think before the CCC's is issued there should be a stand-down period, even a month where the owners have moved in, actually a defect period. I think that defect period should be known to the owners. Most of the owners buy new houses and they are so excited to rush in they do not know which warranties are there (SME1).

### **7.9.2: Verification on new homeowner satisfaction levels**

There are two key issues pertaining to new homeowner satisfaction levels that were validated with the SMEs. These include:

1. The reasons for the high levels of satisfaction recorded during the questionnaire analysis.
2. The need for customer satisfaction surveys after new buildings have been handed over to their owners.

#### **7.9.2.1: Opinions of SMEs on homeowner satisfaction level**

Integral to the house buying process is the need to understand a homeowner's needs and expectations through customer satisfaction surveys. This concept has been consistently highlighted throughout this research study. This aspect of the interview required the SMEs to give their opinions on the high satisfaction levels indicated by new homeowners in the questionnaire survey. Both SME1 and SME3 explained that:

It is the general mentality that it is a new home, they've put all their money; probably this is going to be the biggest asset purchase in their lifetime and they do not want anything wrong. It is a misconception that, "there is nothing wrong with it, I love it, anything can be fixed," you know. They've got excuses for everything. Like if the taps are leaking, "Well that is part of it, we can get that fixed." They have just taken it on board that they can fix anything, so basically it is just having that house there that's clouded their mind on the actual quality of the house (SME1).

I think people are enamoured by the beauty of new home. You know it's the new home smell, it is the new appliances, it is the crisp carpet under their feet. It is

just all of that. It is like buying a new car. It overwhelms people and it is also that pride and ownership; sometimes they become blinded to some of the problems. But also they're not aware, they're not educated in what a defective house would look like and when you point it out to them they're horrified... So we haven't got owners educated to the point where they are actually discerning enough to determine whether a house is of high quality or not (SME3).

Both SME1 and SME3 in the transcripts showed that the high satisfaction levels recorded by the questionnaire might not be real. They were both of the opinion that homeowners are very often carried away by the newness of homes such that they could not see any problem. SME2 on the other hand, suggested that homeowner's high satisfaction levels could be attributed to their poor construction knowledge.

That's not the outcome I would have expected. 90+% of the homeowners would not have sufficient skill to understand. So all they can do is really look at it and decide whether or not they like what they're seeing (SME2).

On whether there is a need for a customer satisfaction surveys after new homeowners have taken over their house, SME1 and SME 3 both agreed that:

I think it is a must. It depends on the builder; if they have done a good job then they know that they're confident in doing it. The survey should be done and it should be done by an external source, not the builders themselves (SME1).

It lacks independence, that is the problem. And you'll find that the bad feedback they get is just swept under the table, and you'll always see the satisfied people appearing in their television ads or in their media ads in other places, but they will never wheel out the dissatisfied customers and show you how badly they dealt with them (SME3)

SME3 was of the opinion that such surveys could be conducted independently of house developers to reduce any bias. For example, SME3 believed negative feedback from homeowners about quality of work performed by house developers may not otherwise be made known.

It is apparent from the opinions expressed by the SMEs that a lack of knowledge of what to look for in a new home is the cause of the high satisfaction levels indicated in the questionnaire survey. These opinions can be linked to the previous discussion on the low extent of defects experienced by new homeowners (see Section 7.6.1). The SMEs agreed that customer satisfaction surveys as a performance measurement for house developers could help to understand customers' needs and expectations.

### **7.9.3: Verification on issues around the building inspection process**

An outline of the key issues presented to the SMEs on the building inspection process is as follows:

1. There are issues around the use of independent building inspectors for new homes in New Zealand. Should independent building inspection be made mandatory in the house buying process?
2. There are issues around council building inspection processes. What could be done to improve this?

#### **7.9.3.1: Opinions of SMEs on issues around building inspections**

The first phase of the research had identified low level of use of independent building inspections (pre-purchase inspection) for new homes in New Zealand. Rather, inspection is common for older building stock. SME1 put this down to naivety on the part of homeowners, especially first time owners, and the fact that homeowners would consider not engaging independent building inspections as 'cost saving'.

It goes back to cost saving... a lot of them don't want to pay the money which is another issue as getting a pre-purchase home... for peace of mind, depending on the house itself, if it's a plaster house then definitely, it is a must, every plaster house should be done (SME1).

Similarly SME2 believed that "... homeowners would not have sufficient skills to understand. So all they can do is really look at it and decide whether or not they like what they're seeing". SME3's comments seemed to support the notion of the naivety of homeowners by explaining that: "...we traditionally look at pre-purchase inspections being ones that are done on second-hand homes".

On whether the use of independent building inspections could be made mandatory in the house buying process, SME1 agreed in totality that they should be mandatory. SME3 also shared the same view but suggested there needs to be inspectors with good practical knowledge and the skills to carry out this task. SME3 stated:

Well yes. I mean otherwise it is like playing a game of Russian Roulette. But the biggest problem is that the people that are out there providing pre-purchase inspections are unlicensed; uncontrolled. They may be members of professional organisations such as BOINZ or the NZIBS, but it doesn't necessarily make them competent to be making critical analysis of buildings. And we find that so many of them pull back from making a critical analysis because they're scared of getting a name in the industry that they always write buildings off. So the Real Estate Agent's do not recommend them and the word gets round. (SME3).

SME3 further explained that reports to be produced for new homeowners need to be of high quality. The excerpt from the SME3 interview is as follows:

So that makes it accessible; it's high quality that you can rely on and that we say it should also be included as part of the valuation process. So you get the real value of the house. It also gives the vendor an opportunity to address any defects that there might be that needs to be replaced. So they can fix that and do it properly. And then that report goes out, but it makes it accessible (SME3).

The SMEs' viewpoints would suggest that the low number of building inspections for new homes is not unusual. They unanimously agreed that pre-purchase inspections are important during the house buying process, as they will enable house developers to rectify any defect identified immediately and ultimately help them to get things right first time. Further, this practice would benefit homeowners, who are vulnerable in this situation, so that they could have the quality homes they desire.

The SMEs were also asked to give their opinions about council building inspections. The intent was to confirm prior findings of issues around council inspections. For instance there were issues around staffing and the inability to meet deadlines during peak periods.

In SME1's opinion on council inspection issues focussed around logistics:

... They are pretty staffed up quite good because they do different areas. I think it is just logistically getting from one area to another area that is difficult... I do not know if it is because of the traffic, but basically it is just the congestion of Inspectors getting to areas because it is so broad (SME1).

In contrast SME3 believed that council inspection staff are "under-resourced and under-trained. But also they are only provided 10 minutes. They allocate 10 or 15 minutes on site to do a whole lot". In SME3's view, building inspection presents enormous challenges to council staff. SME2 agreed that under-staffed council inspectors are a concern, but the drop in new house

production in recent years may have accounted for drops in the number of building inspectors.

I think that it has always been a concern... In 2007, 2008 or something we were building nearly 30,000 houses a year and then it dropped down last year to something like 14,000 ...and in a downturn you don't have the income coming in for the councils to keep their staff so I guess that the severe downturn in the industry means that when demand increases, as it is starting to do now, there will be a shortage of skilled inspectors. As a part of this roller coaster rides that the construction industry continues to have. So you just can't have people standing around waiting without any work to do. (SME2)

SME3 further explained that the council inspectors rely on producer statements rather than their own actual physical inspection:

...they are just ticking boxes. But also they have a policy of looking but not seeing. So if they get too involved in it; you know they can fail an inspection, but if they get too involved with the builder looking at a particular issue then the Council can potentially assume more liability ...so they tend to rely on Producer Statements rather than actually doing the physical inspection (SME3).

SME1 confirmed that council inspectors under the current dispensation have had to cut down on the number of inspections, relying more on producer statements. SME1 noted that:

...for residential what we are doing is cutting down inspections from a standard 12 to 4 inspections, just the main inspections. And everything else can be a Producer Statement. In regards to the LBP's we are trying to tie them along. They got the foundations, sign off by LBP then there's no reason for us to look at it. Or if the brick's done by LBP's we don't need to look at it. Plumbing is all registered.

SME1's opinion seemed to suggest that councils are trying to push the responsibility onto LBPs, because by the new amendments to the Building Act, once they sign off any building work, they become liable for such work in cases where something goes wrong.

According to SME3 it would seem that the inspection regime only tries to create a paper trail so that it can ring-fence itself from liability in the event of failure. SME3 noted that council inspectors:

...have failed to properly discharge their duty to inspect and just relying on a piece of paper just doesn't cut it when they could see that in many cases, this is not up to scratch. (SME3)

#### **7.9.4: Verification on issues around warranties**

The last theme which became significant to the current research during the questionnaire and interview analyses is the issue around warranties that are available for new homeowners in New Zealand. The interviews with house developers had found that there were no uniform and consistent warranties for new residential homes in New Zealand. Their response to the issues of warranties in the questionnaire survey also showed a lack of clarity in the warranties provided for new homeowners. Therefore two key issues will be addressed.

1. Clarity of warranties for new home buyers and how they operates.
2. The development of a National warranty that will provide uniform and consistent standards for new homeowners.

##### **7.9.4.1: Opinions of SMEs on issues of warranties for new homeowners**

SME1 agreed that warranties provided for new homeowners could be made clearer so they understand what they entail. However, the responsibility for understanding the warranties lies partly with the home owners. SME1 explained that “like with everything, when you go into the shops and you buy a stereo or something and there is a warranty period you always ask, What’s the warranty period? Well with houses too you should ask”. Excerpts from the transcripts show that:

... It should be spelt out clearer that the defect period should be between a month and a year and not anything less. And people should realize that when you are signing a house look at that fine print and say, “What is my warranty...” it should be a common factor when you are buying a house, “Oh what’s the defect period it should be made clear in the contract agreement (SME1).

That’s right. I’ve had a few friends and family who have moved into their houses and after about a month they just you know the plumbing was leaking and all that but they did not realize what the defect period was and it was too late. So basically what they have done was they just got new plumbers and new builders in there just to fix it up (SME1).

SME1 suggested creating awareness for new homeowners through advertisements on different warranties, and how the warranties work and operate.

On the issue of uniform warranties for new homeowners in the housing industry, all three SMEs agreed that there is a lack of uniformity in the warranties provided and they agreed that they should be made uniform for new homeowners. SME3 and SME1 believed that warranties should become part of purchase contracts so that homeowners will understand the conditions of their warranty cover.

I think there should be adherence to a standard warranty (SME2)

...we think there has to be uniformity. We say that the Government should legislate a mandatory home warranty and fidelity fund system because the current insurance backed warranties in the market place are in our opinion inadequate. I would go so far as to say as being totally inadequate. And the one that we've had the most dealings with in terms of the poor performance has been the Masterbuild Warranty system and basically it is not worth the paper it is written on. And when you get a house that suffers really significant building defects the limitation on that warranty is only \$100,000.00 and we have one member whose home requires over \$300,000.00 in repairs, so the warranty goes nowhere. And so owners and people procuring a new build don't realise that they actually have an automatic warranty under the Building Act anyway, which is the implied warranties for ten years, so why pay for one. What they need to make sure of is that there is an insurance backed warranty there in the event that the company fails, and that's the biggest concern we have. Because it is all very well having the ability to sue a builder for failed works under the implied warranties but if they fold their company, which they so often do, then it's worthless. (SME3)

So we advocate the building fidelity fund like they have in the UK; so the NHBC Fidelity Fund is an ideal solution. You know it drives up standards; it is about prevention rather than the ambulance at the bottom of the hill or the cliff. So they invest in training, they invest in improving skills and accountability. They pick up defective designs in materials; so they see a spike in claims for low pitched roofs so they say we will not insure low pitched roofs, so the designers have to push it out. And so that's a very positive thing in terms of front ending the protection. And over time we say in New Zealand that we'll reduce the claims made anyway if we improve the standards, improve the design, and improve the training of the practitioners. You know, improve their commitment to the industry. And we also educate the consumer to that sort of system which is born out of that Fidelity Fund (SME3).

We insist on certain conditions being put into the contracts. But unfortunately the builders and some of the large group housing companies are pretty arrogant and they just say, "We are not putting that in" and so people are buying really at their own risk (SME3).

But the builders, depending on what the contract is they will have defect and liability at the back and they will stipulate what the timeframe is (SME1).

Further the SMEs were asked to give their opinions on the possibility of having a national warranty scheme in the housing industry in New Zealand. Again the

three SMEs believed that it is possible to have a national warranty scheme, considering that New Zealand is a small country. Excerpts from the interview transcripts show their range of opinions on the issue:

It definitely needs to be there. For the LBP Scheme to work you need the National Warranty Scheme because there's no way that it will work (SME1).

Yes, no reason why not. I mean there are not enough differences; there is not enough weather type or geographical differences; New Zealand is so small there should be a standard warranty (SME2).

We see no reason why. We say tip all the money out of..., tip all the money out of the building construction industry training organizations. They have got millions of dollars floating around that they have not spent; and also New Zealand Standards. Put all that money into a big pot and then create this organization which will provide this fidelity fund and the insurance backed warranty system, and then that money is spent on training, on creating standards, on consumer education and on monitoring of the building works. It sounds simple but we know it is a very difficult ask, but if we are going to free ourselves from the problems that we have and are perpetuated we have to be radical in the way we approach it (SME3).

SME3 goes further to suggest that an NHBC-type warranty system will be suitable for the New Zealand housing industry. SME3 notes that: "It is a system that is tried and proven. Like any system that you would import from overseas it probably needs to be tweaked to local conditions, but not much". SME3's suggestion is consistent with findings in the preliminary reviews made in chapter three and largely in agreement with the intent and purpose of the current study.

#### **7.9.5: SMEs' suggestions on improvements necessary within the residential building sector.**

The three SMEs were required to comment further on general issues that are relevant to the current research and could improve quality achievement levels in new residential buildings in New Zealand. The key issues are discussed in the following subheadings.

The first issue is their suggestions on how the LBP scheme could be made more effective in the residential sector. The three SMEs were of a general opinion that, the lack of indemnity insurance to cover LBPs is a fundamental downside to the success of the scheme. They believe that with such huge

responsibility placed on LBPs, there should be insurance to cover them when things go wrong. More details are contained in excerpts of the interviews:

...and my concern has always been the risk of the liability, it is not the fact that you can be sued successfully, but it is the fact that you can be sued on the inconvenience and the cost to an individual of that happening (SME2).

...the Indemnity Insurance is the key of our professional engineers and our architects; they have got that Indemnity Insurance to back them in regards to work they can do. Whereas for the LBP's there is nothing. So if they go under then there is nothing to cover the homeowner because there is no insurance behind them. So you can cover LBP, they can do a million dollar job and then go under but there's nothing to cover him for that work (SME1).

Yes, they can get insurance because they are a known risk. But someone who does not have any trade qualifications; and this is why we say the Insurance Backed Warranty and Fidelity kind of process becomes; it's self-levelling, it gets rid of the cowboys. Because if you're uninsurable you can't work on my house, I'm sorry. You know, it is as simple as that (SME3).

The study revealed a general concern about unqualified tradesmen being licensed. SME1 believed that "the LBP Scheme is flawed in that you've still got the Full Driver's Licence person, say the main builder, but everybody underneath him still doesn't have anything to pick up a hammer. So basically you've got the first half of it but the second bit and third bit is open". It can be deduced that as long as the main developer is LBP-licenced, unqualified tradesmen can perform work on their behalf. In the words of SME1 "so that person at the top can have like four or five, there is no limit to who works underneath his card. So there is no way of monitoring who is doing the job. So that is a big issue in regards to buildings".

In somewhat similar lines to SME's assertion, SME3 believed that there are LBPs using sub-contractors that are not LBP's. SME3 suggested that to improve performance in the industry would need an overhaul of the licensing arrangements under the LBP scheme. According to SME3:

So the whole Licensed Building Practitioner regime is just a farce really. And we talked to some of the really good builders that we know and trust and they are really disappointed because they thought it was actually going to be worth something. But when they see guys down the road who do not have building qualifications being licensed, answering two questions to get through the door, it is just not good enough. It is not rigid enough; it is not robust enough... And so we

have people who have got licences but don't understand that actually they become personally liable when they are using their licence as well. So the system is being misused a little bit as well. A head contractor will employ a whole lot of Licensed Building Practitioners and leave them onsite. He will leave to do another job and it is these guys who are actually taking responsibility. They will be the ones who'll be sacrificed in the process because their licence number is on that work. And they don't have insurance to back it either (SME3).

Also SME3 highlighted the lack of training of LBPs as an important issue that needs to be addressed. SME3 explained that a significant number of LBPs have been licensed, and so far most of them are not trade qualified. According to SME3:

...40% of all the Licensed Building Practitioners do not have trade qualifications. And so their whole idea was to get them in the system and then monitor them and cut them off at the knees if they do wrong. Well in that process there is always going to be a consumer that has had a problem isn't there? They can get insurance because they're a known risk. But someone who does not have any trade qualifications; and this is why we say the Insurance Backed Warranty and Fidelity kind of process becomes; it is self-levelling, it gets rid of the cowboys. Because if you are uninsurable you can't work on my house, I'm sorry. You know, it is as simple as that.

Diverse opinions exist with regards to ways in which the LBP scheme could be improved. SME3's view was to licence only insurable tradesmen. SME1 suggested that a pool of money would need to be set aside to cater for any defective performance by LBPs.

...the LBP is going to be standing alone in regards to warranty. There is no compulsion to actually be warranted... But there should be a pool of funds that all these builders put their money in depending on the value of the work they are building and then that money only gets pulled out even after a year of that warranty period... And there should be between a one month and a year that pool should just hold that money until there is no defect. And that is one way of actually assessing that there is money in the pool, so if that guy is gone overseas there's always money in that pool for them to pull it out (SME1)

SME1 suggested a trust system for house developers to be bonded for any eventualities. However, SME1 believes that "only time will tell when we come back and see where the claims have been". While it is presently difficult to say if the LBP scheme would be a success, SME3 further emphasised the need for an insurance backed warranty for the LBPs. SME3 believed that:

...the whole system needs to be geared around the core; the core of the whole system. Licensed Building Practitioner regime is good and in the long term it will

mean there's a greater level of control over builders, particularly those that do it wrong. But the core of this whole system must be that Fidelity Fund and Insurance Backed Warranty Scheme. (SME3).

Apart from an insurance backed warranty for the LBPs, SME3 gave a different suggestion:

...one of the things that we need to get rid of is the 10 year limitation under the Building Act. That's a perverse incentive to quality .... All I have to do is build a house that lasts 10 years and one day... (SME3).

SME3 believes that the 10 years limitation provided by the BA is not effective in New Zealand as builders tend to hide under the minimum provided period. SME3 was of the opinion that significant changes could be made such as that made in Canada.

It happened in Canada they pushed it out to 25 years. The building industry again choked but then they go, well if we build it right and it doesn't fail we won't be liable (SME3).

SME3 also suggested that the housing industry should “have criminal penalties under the Building Act. You know there has to be consequences for these people”. SME3 believed that the ultimate focus of the housing industry should be in getting it right the first time. Finally SME3 believed that this could be achieved if the housing industry invests across the board. For example consumer education, creating standards, approving building materials and better designs, as well as, training the building industry as a whole and monitoring its processes.

This section on research verification has presented the comments and contributions made by the three SMEs on the emergent themes of this current research. Their comments and opinions have significantly confirmed the research investigations. Some of their comments have extended knowledge beyond those held by the current study. The key results from the verification exercise are discussed further in Chapter 8.

## **7.10: Summary**

This chapter has presented the results of the second and third field investigations of the current research. The objective of the second field

investigation is to determine the current house developer's quality monitoring processes and the warranties provided for new homeowners. The third investigation validates the findings and recommendations of the current study. The investigations have clearly achieved research objectives 5 and 6 stated in section 1.6 of this study. Despite the relatively small sample of the participants, the interview provided invaluable insight into the quality monitoring process and the type of warranties available for new home buyers within the residential building sector in New Zealand.

Five key themes emerged from the interview analysis: quality monitoring, inspection processes, warranties provided for new homeowners, home owner satisfaction levels, and the use of independent building inspections (defect reporting) for new homes. These themes cover the real life experiences of the participants connected with the residential building sector. Results from the questionnaire survey, as presented in chapter 6, were re-visited and referred to in the interview analyses in this chapter to aid and complement the discussion.

These results have provided interesting and important information to the research objective, while suggesting areas of improvement. The next chapter will present a synthesis of the overall research by comparing the investigations with some of the information reviewed from literature analysed in chapters 2, 3, and 4.

## **CHAPTER EIGHT**

### **GENERAL DISCUSSIONS**

#### **8.1: Introduction**

In Chapters 6 and 7, the issues that relate to defects, customer satisfaction, defect reporting, available warranties and the current quality monitoring of house developers, were explored and analysed using both descriptive and thematic analysis.

In this chapter, significant findings are drawn together to answer the research questions and deliver the stated research objectives that will be presented in the final chapter of the thesis. The chapter is divided into four sections in line with the significant themes that emerged from the analysis in Chapters 6 and 7. Each section recapitulates the critical findings of the questionnaire survey, combined with interviews with house developers and subject matter experts. The intention in this approach is to capture their internal relationships and extract the most concerning issues of most concern. The issues are further addressed in relation to current literature around the subject area of this study. The implications within the New Zealand context are discussed. A synergy of all the information collated from the literature review through to the research investigations is therefore presented under the following sub-headings.

#### **8.2: Synthesis**

Guided by the chosen methodological framework and research methods, the investigation began with a set of specifically formulated survey questions designed to gather information from new residential homeowners. Information gathered includes their personal backgrounds and their general opinions towards any defects they experienced after they took possession of their new homes. In addition, homeowners were asked to give information on their warranties, satisfaction levels, and their use of independent building inspectors in New Zealand. The survey results were reported in Chapter 6 where issues of most concern were extracted to form guidelines for the follow-on in-depth interviews with house developers. The interview participants were verbally given a set of semi-structured open-ended questions relevant to their experiences on

the themes that emerged from the questionnaire analysis. Interview transcripts were examined individually and cross-compared in groups for the systematic classification of common characteristics from the participants' experiences. The results of the interviews were reported in Chapter 7.

Significant findings from both the survey of new homeowners and house developers formed the basis for the interviews with SMEs. A summary of the key issues was compiled and presented to three SMEs in the form of verification interviews. This involved face-to-face semi-structured interviews with the key representative in the selected companies. During the analysis of the three investigations, four major aspects around quality in new residential buildings in New Zealand were considered. Namely, defects in new homes, customer satisfaction levels, defect reporting in new homes and available warranties for new homeowners. These four themes are discussed in the next sub headings.

A number of disparities and gaps were identified around issues of defects in new homes. Situating the current research results in relation to literature confirms the fact that the findings of this study within the New Zealand context by turns both support and contradict existing understandings. Pursuing the four most significant areas of discussion presented previously, this study presents the following new insights.

### **8.3: Defects in new residential buildings**

Research on defects at handover of new residential buildings in New Zealand is sparse. This is surprising, given the impact of the residential building sector on the wider construction industry and its current high profile in the context of housing affordability in New Zealand. As discussed in Section 1.2, the current residential housing construction is estimated at 17,000 per annum. To handle such a quantity and the production of defect-free new homes requires the culture of building things right the first time. This will have a positive impact on the performance of construction organisations and the residential housing sector.

The reviews in chapter 4 show that defects are evident in new residential buildings in other countries and the cost of rectifying these defects is enormous.

However little or no research has been conducted on defects occurring at handover of new residential buildings in New Zealand. Therefore the reviews have identified some knowledge gaps within the context of the current study. The following key gaps were identified relating to new residential buildings.

1. There is limited knowledge of common defects that are observed at handover of new residential buildings to homeowners.
2. There is no record to show the extent of defects at handover.
3. There is a significant need to identify the common causes of such defects at handover by new homeowners.
4. The current knowledge of quality practices by house developers is poor and inconsistent in New Zealand.

The knowledge gaps summarised above were then re-structured so that the issues could be investigated further during the next phases of the study (Chapters 6 and 7). Issues around defects were covered in Sections 6.5 to 6.5.11 and Sections 7.4 to 7.4.4. There were four themes relating to residential building defects described in the following paragraphs. These themes are presented coupled with the outcome of the research verification with three key subject matter experts.

### **8.3.1: Common defects in new homes**

This research explored the New Zealand residential sector to determine common defects at handover of new residential buildings. These common defects were identified from new homeowner perspectives through a questionnaire survey. An initial review of existing literature was performed to establish whether there are common defects observed at handover of new residential buildings in New Zealand. This search shows an absence of such information within the New Zealand context, hence a knowledge gap. The reviews are contained in Chapter 4 of this thesis. Of significant relevance is a study conducted in the UK by Craig (2008) which was an impetus to start the current research project. Craig's (2008) study produced a standard list of defects for the house building sector. The current study generated a list of defects from Craig's study that was included in the questionnaire to

homeowners who were required to indicate the defects they observed when they took possession of their homes. The result is summarised in a tabular format (see Table 5.5). The list of defects generated was mostly of an aesthetic nature. This confirms research that had shown that this particular class of defects are most important to new homeowners as they believe that technical defects would have been addressed by the various building control standards and regulations (Craig, 2008; Sommerville et al., 2007; Autherloiune 2004; Page, 2011; Kang, 2006).

The results of this study found 10 most common defects in new residential buildings in New Zealand. They include: Uneven painting surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet and WC, locks, and concreting.

The second field investigation with house developers further confirmed the common defects identified by new homeowners. House developers identified eight types of defects that regularly occurred on the list of call backs they got from new homeowners. These include painting issues, faulty door handles, poorly fixed architraves, minor cracks, nail pops, general finishing issues, gaps in skirting, and leaking spouting. The current study found that house developers believe that these defects are minor. Consequently the need for their documentation is minimal. The type of defects found in this study supports some previous studies conducted within residential buildings in the UK and Spain (Craig, 2008; Forcada, Macarulla & Love, 2012).

Regardless of the type of defects, what is clear from this New Zealand study is that defects are obvious at handover and new homeowners had to call back their house developers to fix these problems. This finding is in agreement with Page's (2010) conclusions that a significant percentage (72%) of new homeowners in New Zealand, call back their developers for defect rectification. Further, the current study found that significant numbers of the call backs were addressed by the house developers with a very small percentage needing to go through a lawyer before the defects were fixed (see Section 6.5).

This research contends that a focus on this list of common defects will enable the residential building sector to set realistic performance standards and direct efforts where these are most needed. Further a reduction in common defects will mean a reduction in costs. Consequently productivity within the residential sector will improve.

The current study has reached a conclusion that the aesthetic nature of defects found in new residential buildings is a common feature of the housing sector, which in turn confirms the importance of this category of defects to new homeowners. A home buyer for example seeks value for money invested into a building, and seeks comfort (i.e. develop an emotional attachment) within the building. In contrast, major house developers and council inspectors focus on meeting technical specifications and how a project functions when occupied. The current research supports previous findings on the significance of aesthetic defects in residential buildings (Auchterlounie & Hinks, 2001; Craig, et al., 2010). While this category of defects may be significant to new homeowners, it is important to note that because they lack technical knowledge and are only able to notice visible defects, rather than what may be hidden for example, they may not be able to identify other categories of defects.

The current study takes the premise that, regardless of the nature of defects (technical or functional), their complete elimination by developers is necessary at handover to new owners in New Zealand. Craig's (2008) study concluded that the most common defects at handover relate to the functional aspects of quality. Therefore, reducing this category of defects will mean reducing the extent of defects at building handover and consequently increase the overall satisfaction levels of homeowners. However this study finds that a more accurate assessment of the quality of new homes at handover may require expert judgement beyond current reliance on defect notification by homeowners.

### **8.3.2: Extent of residential building defects are low**

The lack of detailed research in the area of defects at handover within new residential buildings somewhat inhibits discussing the findings of this research directly with prior work within the New Zealand context. However, within the UK,

Craig's (2008) study established an industry benchmark figure of 53 defects per house, but this figure was derived from reports produced by independent building inspectors. The review of past literature on the extent of defects (covered in Chapters 2 and 4) established that a knowledge gap exists in this particular area. There are no industry standards in New Zealand to compare new homes, which is consistent with Auchterlounie's (2009) UK study that there are no standards for new house buyers to compare their new homes. The two field investigations (survey of new homeowners and interviews with house developers) helped to determine the extent of defects in new homes.

The overarching aim of this aspect of the research is to determine the total number of defects in each property type and the average number of defects per house. Thus the study found an average of 5 defects per new house with a maximum recorded number of 19 in a four bedroom house. The list of defects presented to new homeowners was grouped into 4 categories: 0 - 5, 6 - 10, 11 - 15, and 16 - 20. The majority of homeowners recorded the lowest number of defects (0 – 5) and these were homeowners that had used MBF registered house builders. The current study found that four bedroom houses had the highest number of defects of between 6 - 10 defects. Further the study found that as the number of bedrooms in a house increase, so did the number of defects.

The current study found a similar extent of defects as those conducted in Malaysia by Fauzi, Yusof, and Abidin (2011). This study recorded a generally low number of defects in Build-Then-Sell houses. However it is at variance to research in the UK that indicates a much higher incidence of defects in new houses. For example in one instance, Craig (2008) identified 452 defects in a single house. Also in the UK, Sommerville and McCosh (2006) found 389 defects in a single property. Of note is that the identification of defects in the current study was from the homeowners' perspectives, rather than those identified by professional building inspectors as in the UK studies. It is therefore possible that the homeowners' perspective may not have captured real defects that are non-aesthetic in new houses. Thus the low level of defects reported by new homeowners is fundamentally linked to their lack of experience and technical expertise on what to look for when buying a new home.

This study found that though the extent of defects is low, there is a reluctance amongst developers to go back and fix these defects. Because a majority of residential construction businesses are small, getting them to release labour to rectify defective work is difficult. This is an area that most homeowners would like to see improved. Most homeowners when they observe defects in their new homes immediately contact their house developers to make arrangements to fix the problem. However, very often it was difficult to get the developers back to fix the defects. In extreme situations, home owners have resorted to legal action.

An interesting observation that emerged from this study was that a majority of new homebuyers were more involved in the construction of their new homes in New Zealand. The process of house procurement in this country is different from the speculative house construction common in the UK. Interestingly, most homeowners who became involved at the beginning of their building construction found the most defects. One would expect this category to have the most influence on quality performance as most defects could have been identified and corrected during building construction. However considering that these homeowners would have become more knowledgeable as a result of their involvement in the building process, it may not be surprising. There is a tendency to expect more in terms of functional quality (which is what they have greater control over) than technical quality. The study reveals that the extent of defects in new homes is a function of the stage and extent of involvement of new homeowners in the building process, as well as the type of developers that build the house.

The position of the current study on the extent of defects is that even though a low number of defects were observed generally in new residential buildings, the industry could nonetheless work towards the achievement of defect-free new homes at completion and handover. It would seem reasonable to expect that residential building projects should be built properly the first time.

### **8.3.3: Causes of defects**

The preliminary reviews on the causes of defects (presented in Chapter 4) identified 22 causes of defects in residential buildings. The majority of authors concentrated on issues of 'workmanship'. The outcome of the current research

also found that poor workmanship was the most common cause of defects as perceived by homeowners. This study produced results which corroborate the findings of a great deal of the previous work in this field. Therefore that workmanship is the cause of the majority of defects in residential building has been further confirmed.

The current study draws attention to the high level of subcontracting of building work on construction sites. Large numbers of subcontractors with differing quality objectives are expected to work together towards a common goal of project success. In this situation, house developers specialise in fewer aspects of building construction work, which means most of the stages of building work are subcontracted with little supervision from the main house developer. Thus accountability for any poor performance by the subcontractor becomes difficult. The current study reveals that poor workmanship is linked to house developers not taking sufficient ownership of the whole building project.

A faster pace in new house production was also found to cause mistakes and errors in residential building construction. Lack of training and poor apprenticeship schemes in the housing industry were also consistently highlighted in this research. These were found to be the main contributing factors to poor workmanship of tradesmen in New Zealand in general. This finding is generally in agreement with Craig's (2008) study in the UK which found that the main source of defects is 'humans'. The human element cannot be eliminated and the source of defects is often the result of a lack of education, skills and technical knowledge. The study provides valuable suggestions for improving workmanship through skills training and education. These suggestions are presented clearly under the discussions in Sections 6.10, 7.4.4 and 7.9.1.

Further, the current study found that imported tradesmen with little or no spoken English makes communication difficult among project parties. This is highly significant in New Zealand, because of the relative ease of entry, at least at the lower end of the market, and because of this many new house developers are attracted to residential housing construction. There are potential high risks as well as high rewards in residential building construction. Added to this is the fact that becoming a tradesman requires few or no formal qualifications, so it is

relatively easy for anyone to enter the building trades. The major impact of poor English amongst such tradesmen is their inability to comprehend building code provisions and requirements. This places huge responsibilities on council inspectors who have to communicate requirements with these site operatives. Poor performance and rework will not be unusual in such situations, contributing to the productivity issues in the residential building sub-sector. This finding is significant because it is in line with the focus areas identified by the Skill Productivity Partnership in 2011. The key focus area that the study aligns with is one that deals with raising awareness at all levels of the cost of rework, and the ripple effect flowing from building products that do not meet quality standards.

Apart from poor workmanship, the research within this thesis has demonstrated that poor building materials available in the construction market are also a significant cause of defects in new residential buildings in New Zealand. Particular emphasis was made to building materials sourced from Asia. Most are purchased because they are cheaper than those produced locally without consideration of their performance quality. It would appear there is inadequate monitoring of the quality of imported building materials by authorities in New Zealand.

The current research takes the premise that despite the importance the building industry places on housing for New Zealanders as a primary infrastructural need, it seems it is not treated like that. One of the most fundamental infrastructural requirements of any country is its construction of either residential or commercial buildings. If good, high quality houses are not available the importance of other infrastructure is defeated. The current study suggests that stricter product certification for incoming building materials is necessary if the aim of defect-free homes is to be achieved. In addition the study suggests that proper training and up-skilling of the residential construction workforce is necessary for the entire construction chain from head contractors to sub-contractors and product manufacturers. This will improve quality performance both in the residential building sector and the wider construction industry.

#### **8.3.4: Quality monitoring of house developers**

The research within this thesis has demonstrated that the current monitoring of defects in new residential buildings is generally at a basic standard level, which could affect the performance of construction organisations. The research results make it apparent that a standard operating procedure (SOP) for quality achievement would need to be maintained across all house developer organisations in New Zealand. This would help in the tracking and monitoring of work performance, and where defects are identified these could be rectified immediately.

The study found that the recording of defects by house developers is not a common practice. The generally held belief is that the defects identified at handover are essentially of an aesthetic nature and as a result there is little or no need to keep records of them. The significance of record keeping is borne out of the fact that, lists generated over time will help identify areas where improvements are most needed. The research concludes that the documentation of defects by house developers is important for construction organisations to benchmark their quality performance.

#### **8.4: Level of homeowner satisfaction**

Homeowners want a product that is defect-free and worth the utmost value for their residential investment. Issues around homeowner satisfaction were reviewed in chapter 3 of this thesis. The literature review found that customer satisfaction correlated with quality achievement levels of new homes. Therefore the major benefit of identifying common defects in new residential buildings as an upstream quality improvement practice is the positive effect it could have on new homeowner satisfaction levels. The identification of common defects and their extent will allow individual house developers to know areas where attention is most needed. The few studies conducted on customer satisfaction in New Zealand shows that significant number of new homeowners are satisfied with the quality of their new homes. Homeowner satisfaction is an important tool in improving developer organisation performance. Using homeowner feedback systems could enable developer organisations to establish goals in terms of quality performance achievement.

The current study provides invaluable insight into the level of customer satisfaction regarding quality achievement in New Zealand. The results of the current study reveal that new homeowners in New Zealand are generally satisfied with the overall quality achievement levels of their new homes as well as the service provided by their house developers. Critically, these results differ from some published studies such as Sommerville (2007) and Craig (2008) in the UK. However, they are internally consistent with those of Page (2010) and Curtis (2011) in New Zealand. A point of note is that the high level of homeowners' satisfaction that was recorded might not be real, because homeowners are very often carried away by the newness of their homes such that they may not see some minor defects as a problem. This could also be related to their lack of technical knowledge of what to expect in new homes, as discussed previously.

Furthermore, this study reveals that the extent of defects, timeframes of defect rectification, and service provided by house developers, are all key determinants of new homeowners' relationships with their house developers. The study found that the higher the homeowners' satisfaction levels with services provided by developers, the better the relationship that exists between them. Also the longer it takes for developers to rectify defects reported by homeowners, the lesser the cordiality of their relationships. Homeowners' relationships with house developers are therefore sensitive to these three factors.

It was further observed that the developers' service, the timeframe of defect rectification and percentage of defects rectified, determine overall satisfaction levels regarding quality by new homeowners in New Zealand. The current study found that the longer the time taken for defect rectification, the lower the level of homeowners' satisfaction with the overall quality of their new homes. Likewise, the better the service provided by the house developer, the higher the overall quality satisfaction levels of new homeowners. The research result also shows that the longer it takes for house developers to rectify defects, the less the owners are satisfied with the overall quality of their new homes.

The significance of homeowner satisfaction surveys was made apparent in this study. Such a satisfaction survey is seen as a tool that could be used to

measure the performance of house developers, and could help them to strive to get things right the first time. Apart from being a performance measurement tool, customer satisfaction surveys could help individual construction organisations to understand the needs and expectations of their customers. These findings support the existing literature on the importance of customer satisfaction surveys (Craig et al., 2010; Auchterlounie & Hinks, 200; Karna, 2009). It is suggested that there needs to be an assessment survey that will be conducted by an independent person to reduce any bias. These findings add to the construction management body of knowledge as little or no research has been conducted within the house building sector that demonstrates the existence of the aforementioned relationships.

The current study takes the position that house developers should take greater consideration of the needs and expectations of homeowners. Customers are satisfied when their needs and expectations are met. This could simply be achieved through customer satisfaction surveys. Good relationships are significant in any construction organisation. If customers are satisfied they will be able to disseminate by favourable word of mouth to other potential homeowners. This is highly significant in the residential sector in New Zealand, because new homeowners' mostly source house developers through friends and families. This finding supports Chee and Peng's (1996) explanation that satisfied customers are a good means of disseminating good quality practices which in turn could improve future sales. Ultimately the customer satisfaction surveys will permit individual house developers to compare and benchmark their quality performance with other organisations. Also, doing this will help in the achievement of one of the key focus areas suggested for improving productivity by 20%, by the year 2020, within the New Zealand construction industry.

### **8.5: The building inspection process**

In the review of issues around building inspection presented in Chapter 4 of this research, it was established that improvement is needed in the working attitudes of construction operatives, in the management of the defect reporting process, and in the overall building management process. In the New Zealand residential construction sector, building inspection is usually carried out at

specific stages corresponding to construction progress. The inspection regime ends with a final inspection of the completed building, which indicates that all work has been done in accordance to plans and specifications. The inspection is normally carried out by council building inspectors. This inspection is to ensure that buildings are safe and fit for their intended purpose. Several issues of concern about the council inspectors were highlighted in the current research. It was found that some council inspectors lack the competency, skills and experience to carry out a satisfactory building inspection. Council building inspectors should have the necessary skills and experience to carry out such building inspection work. With the right skills they should be able to identify defects before their final 'sign offs' on buildings. The study found that council inspectors focus more on overall standard rather than the finishing touches that make all the difference to homeowners.

Further, in support of most existing literature, this study confirms that the use of defect reporting organisations (independent building inspectors) for new homes is generally low within the residential building sector in New Zealand. Inspection and defect reporting is predominantly done for older and existing buildings. The current study found that homeowners who used a defect reporting organisation identified more defects in their homes. This seems reasonable when one considers that homeowners are unlikely to have sufficient expertise to identify defects because they rely on visual inspections as opposed to the more thorough checks that could be carried out by independent building inspectors. The reviews in chapter 4 show that defect reporting has been suggested in the UK as a viable solution to identifying defects in new homes before they are handed over to their owners. By examining the findings of this study, two possible explanations become evident. Firstly, the possibility of ignorance of the benefits associated with the use of independent building inspection (defect reporting) for new homes cannot be discounted. Secondly, the naivety on the part of homeowners', especially first time owners, who would consider the lack of such an inspection a 'cost saving' measure.

From the study it is apparent that some new homeowners are beginning to see the need to engage the services of independent building inspectors. Inspecting new houses for defects before or after handover will enable developers to rectify potential defects before they become burdens to homeowners. This

finding is consistent with a previous study in the UK, on the need to promote independent inspection (through a snagging process) for new homes at handover. The current study takes the premise that no matter the stage at which homeowners become involved in the building process within the residential building sector in New Zealand, it is important that inspection and quality control be carried out on their new homes which will aid the overall quality process. While developers may be reluctant to admit to issues of defects, building inspection reports will back up any concern about construction performance.

The current study suggests that the use of independent building inspectors will benefit all stakeholders at handover of new residential buildings in New Zealand. Defect reporting at handover will enable house developers to rectify defects identified immediately and ultimately help them to get things right first time. Further, this practice will benefit homeowners who are vulnerable in this situation so that they can attain the high quality homes they desire.

The current study takes the position that getting new buildings checked and corrected for defects as soon as they are identified, is one way of ensuring customer satisfaction and consequently ensure industry best quality practice. While council inspection and house developers may focus on technical aspects during construction, defect reporting organisations will look at both the technical and functional aspects of quality. The research therefore concludes that the benefits in using independent building inspectors outweigh any expenditure that may be involved.

## **8.6: Warranties for new homeowners**

The issue of warranties for new residential buildings has been extensively researched in construction management literature. Studies on the leaky homes problems in New Zealand agree that warranties could play a significant role in addressing the issues of defects in new homes (Gibson, 2010, PWC, 2009, Kaye, 2011). To ensure that homeowners are protected and are able to seek redress when defects issues arise, government bodies and professional associations have introduced specific legislation, policy frameworks and guidelines to ensure adequate levels of protection for new homeowners. Some of these include the Weathertight Homes Resolution Service, Financial

Assistance Package (FAP) and the implementation of the LBP scheme (see Chapter 3) in New Zealand. Other initiatives include continuous amendments to the Building Act to reflect construction realities. These initiatives may be criticised for focusing solely on weathertightness problems.

Within the residential building sector in New Zealand two prominent bodies provide some form of cover for new homeowners: the MBF and the CBANZ as discussed in Sections 3.7.1 and 3.7.2 respectively of this study. However these covers are only applicable to new homeowners whose house developers are registered with these bodies. For homeowners whose developers are not registered with these bodies their developers would need to have insurance cover which could be extended to include homeowners. The current study found that a significant number of new homeowners in New Zealand use house developers that are registered with the MBF. These house developers are either group developers or private individual developers.

The study found that most new house buyers are so deeply immersed in the process of owning a new home that they pay little attention to warranty provisions, because often these play little part in the decision to purchase a home. While the warranties provided by house developers is confined to the context of the residential sector within New Zealand, the knowledge they have generated may offer some measure of insight to warranty improvement in the industry as a whole. At the same time, it may provide a basis for future research in the specific area of sustainable warranties in the residential sector and the wider construction industry.

In spite of the awareness and initiative created for warranties, it seems common for many homeowners to enter into contracts without understanding their rights both when defects need to be remedied and who is liable to fix them. With greater involvement by new homeowners in the house buying process, it could be expected that they would enquire about house warranties that may be available. However the current study found (in Sections 6.5.1 and 6.5.2) that new homeowners are often not completely aware of the period of cover for their new homes. This is consistent with the Sommerville (2008) study in the UK, that there are a number of gaps in homebuyers' knowledge concerning home warranties. Sixty three percents of homeowners in the study openly admitted

that they had limited or no familiarity with the warranty on their homes. The study found a similar situation in New Zealand as its homebuyers are not familiar with the coverage of their new home warranties, how they operate and who provided them. These findings bring up some interesting issues with regard to the significance of warranties when new homes are purchased. The study suggests creating more awareness of different warranties through advertisements, so that new homeowners will understand how the warranties work and operate. In addition, it would be beneficial for warranties to be part of purchase contracts so that homeowners will understand the conditions for their warranty cover.

While the current warranties provided for new homeowners in New Zealand are meant to provide some form of cover when issues of defect arise, it appears that such covers do not serve their purpose adequately beyond merely conforming to normal practice. The findings of this study show no apparent uniformity and consistency in the warranty provided for new homeowners. The lack of uniformity and consistency is evident from the responses described in Section 7.7.1 regarding the warranties available for new homeowners. Homeowners themselves lack in-depth understanding and appreciation of the warranty cover on their properties. Thus it can be inferred that warranties did not play any significant role in their decision to purchase homes.

A significant insight provided by the current study is the need to establish a mandatory defect liability period that will compel house developers to fix any defects notified by homeowners. Such a standard mandatory time frame could also encourage homeowners to document any defects they have identified over a period. This could encourage the employment of the services of independent inspectors to capture building defects more accurately (see Section 8.5).

This said, it is important that house developers clearly communicate warranty schemes on offer to their customers before the commencement of construction work. Very often homeowners have little opportunity to make informed decisions as to whether there are other choices they could make in terms of warranties. The warranty schemes vary from developer to developer. Thus, the current study believes that much could be done in the administration of the warranty schemes to improve their uniformity and consistency in New Zealand. However,

the current study also takes the position that the responsibility for understanding warranties lie with homeowners too, because they need to understand the types of cover on offer before signing house contracts.

#### **8.6.1: The need for a national warranty scheme in New Zealand**

The lack of uniformity and consistency in warranty schemes offered by house developers was continuously highlighted. A review of available warranties was presented in Chapter 3 of this study. In the review, it was highlighted that, the achievement of customer satisfaction and high quality performance is a matter for concern which cannot be regulated simply by building control systems or using the currently available warranties. Therefore the opinions expressed by research participants in Chapter 6 and 7 show that there needs to be a national warranty scheme that could operate across the residential sector in New Zealand. A national warranty would ensure a consistent application of warranty cover for new homeowners.

In the light of these findings, this research would tend to argue in favour of establishing an NHBC-type warranty system (operational in the UK) for the New Zealand housing industry. Considering that the system has been tried and proven to be beneficial in countries such as China, South Africa, Holland, Australia, Canada and the USA, the need in New Zealand cannot be over-emphasised. By such means the most important member of the house buying process is protected when issues of defects arise. Overall, the new insights that arise from this study reflect the most important and significant findings in terms of the four identified areas of concerns. Some of the discoveries support and reinforce propositions from existing literature but more importantly, the new perspectives that emerged contribute to knowledge on how defects could be mitigated in new residential buildings. Future research endeavours to cover other aspects of the current study that have not been covered are suggested in the next chapter.

#### **8.7: Other relevant areas suggested for improvement**

The research has shown that there is concern about the recently implemented LBP scheme in the residential building sector of the construction industry. A review of the LBP scheme is presented in Chapter 2 and includes the

significance and benefits of licensed practitioners. However the analysis of information presented in Chapter 7 of this thesis consistently highlighted that the major downside to the success of the LBP scheme is the lack of indemnity insurance for this new category of practitioners. There is a huge amount of responsibility placed on the LBPs to sign off building work and yet there is no insurance to cover them when things go wrong. The need to have an insurance backed warranty that will cover the LBPs when the defect issues arise cannot be overstated.

The research also revealed a general concern about unqualified tradesmen being licensed under the new licensing regime. The LBP Scheme is inconsistent in that a main house developer could be licensed but persons working down the chain, such as sub-contractors may not have the required qualifications to practice. Once the main developer is LBP-licensed, unqualified tradesmen could perform work on their behalf. The current study suggests that there needs to be an overhaul of the licensing arrangements under the LBP scheme to improve quality performance within the industry.

Finally an issue emphasised by the study is the need to improve industry best practices through the culture of getting things right, first time. Thus more investment is needed across the board for building consumer education, creating quality performance standards, building materials approval processes and better building designs. In addition training and re-training of trades' people within the residential building industry as a whole, and monitoring of quality processes are a necessity in New Zealand.

## **8.8: Summary**

This chapter has provided a synthesis of the research investigation over the study programme. Important findings of the research have been discussed in detail, coupled with key results in relation to the findings of previous research on issues around defects in new residential homes. The findings of the research show that quality improvement, customer satisfaction and awareness of quality standards are central to achieving productivity improvement within New Zealand's construction industry. Improvement opportunities around performance in the construction industry have been identified by the

Productivity Partnership in New Zealand, and which the current study has addressed. Discussions within this chapter conclude the research phase of the study and have described five major outcomes which the study has achieved.

## **CHAPTER NINE**

### **GENERAL CONCLUSIONS AND RECOMMENDATIONS**

#### **9.1: Introduction**

This study addresses a gap around quality achievement levels of new residential buildings in the New Zealand context. The study adds new data to existing literature, with respect to current quality performance in the New Zealand house building sector. The chapter has four sections; the first section presents a summarisation of the fulfilment of the research questions. The second section outlines a list of recommendations that could facilitate improved quality performance in the house building sector. The next section presents the contributions to knowledge made by this study on defects in new residential buildings within the house building sector and the wider construction industry. Thereafter the chapter concludes with suggestions of areas for further research that could extend the current study and explains the limitations of this research study.

#### **9.2: Fulfilment of the research questions**

The aim of the present study is to improve quality achievement in new residential buildings by reducing the number of defects that are observed at handover of buildings to their owners.

The study established that there were problems around quality achievement in new residential buildings in New Zealand. However there is a dearth of information around this subject matter, despite the abundance of literature from countries such as the UK, Australia and Spain. Therefore the research problems consisted essentially of:

- A lack of an established understanding of common defects and their extent in new residential buildings at handover.
- A lack of information on the satisfaction levels of new homeowners to quality of residential buildings.

- A lack of understanding of the use of defect reporting as a means of minimising defects in new homes at handover, and
- A lack of understanding of the current house developers' quality practices and the warranties available for new homeowners.

To effectively tackle the above research problems, a number of research questions and sub-questions were formulated. The research questions are represented here so that the research findings can be correlated with the problems and aim, objectives and questions that the study sets out to achieve. The main research questions that the study addresses are the following:

1. How can defects be minimised so that the quality of new residential buildings is enhanced in New Zealand?
2. What is the satisfaction level of new homeowners to quality achievement in new residential buildings?

Other sub –questions addressed by the study include:

- What are common defects occurring at handover of new residential buildings?
- What is the extent of defects in new residential buildings in New Zealand?
- What are the key causes of defects in new residential buildings?
- What are the satisfaction levels of new homeowners with the quality of their new homes?
- What is the level of use of independent building inspections at handover of new residential buildings?
- Are there uniform warranties available for new homeowners?
- What is the current quality performance of house developers?

To correlate the findings of the study with these research questions that were initially laid out to guide the study process, the following sub-sections describe the fulfilment of the research questions in turn.

### **9.2.1: What are common defects occurring at handover of new residential buildings?**

The identification of common defects occurring at handover of new residential buildings has been achieved by three means. These include the review of literature in Chapters 2 and 3, the questionnaire analysis in Chapter 6 and analysis of interviews in Chapter 7. The study found the 10 most common defects occurring at handover of new residential buildings in New Zealand to be: uneven painted surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet/WC, locks, and poor concreting. The list of common defects generated is new knowledge which the researcher believes will enable the residential building sector to set realistic performance standards and focus efforts where they are most needed. This would also contribute to the current initiatives to increase productivity by 20% in 2020 within the New Zealand construction industry. Thus, this research question has been fulfilled.

### **9.2.2: What is the extent of defects in new residential buildings in New Zealand?**

The research investigation commenced by administering mailed questionnaires to new homeowners in New Zealand. The results of the questionnaire were presented in Sections 6.5.5 and 6.5.6. The survey results largely confirm the extent of defects in new homes. It was established from the current study that the extent of defects in new residential building at handover is low in New Zealand, with an average of 5 defects per new home. Although this figure was generated using the perspective of new homeowners, the reality is that defects are still evident in new residential buildings in New Zealand. Home buyers will be able to use the figures generated to gauge the levels of quality within their new homes. This research is significant because it is the first to capture the extent of defects at handover of new residential buildings in New Zealand, particularly from the new homeowners' perspectives. As a result, this research question has therefore been answered.

### **9.2.3: What are the key causes of defects in new residential buildings?**

This research question was set to understand the causes of defects identified in question one. The three main causes of defects identified by the current research are poor workmanship, poor building materials and design errors. However the main causes of defects relates to poor workmanship. It was established in the current study that the causes of poor workmanship are often the result of a lack education, skills, an imported work force and associated problems of communication on construction sites. Sub-standard building materials, particularly imported materials were also identified as significant causes of defects in new buildings. It would appear that authorities need to adequately monitor the quality of building materials sourced from outside New Zealand, and to provide more effective product certification of them. The significance of these findings is borne out of the fact that no empirical study in New Zealand has been carried out to determine the causes of defects in new residential buildings. These findings answer this third research question regarding the causes of defects at handover of new residential buildings.

### **9.2.4: What are the satisfaction levels of new homeowners with the quality of their new homes?**

The main purpose of question four was to determine the level of satisfaction of new homeowners with the overall quality of their new homes. The current study has found that there is high level of overall quality satisfaction of new homeowners in New Zealand. This research shows that there is a strong positive relationship between services offered by house developers and the satisfaction levels of new homeowners. Other salient factors responsible for new homeowner satisfaction are the extent of defects and the time frame for defect rectification when defects are reported by the homeowners. This finding adds to knowledge about homeowner needs and expectations within the context of residential buildings in New Zealand. Prior to the current research little has been done in the form of research to understand the level of satisfaction of homeowners in the quality of their homes. Further, an understanding of the determinants (as outlined above) of homeowner satisfaction is significant and far reaching. These findings confirm that question four has been achieved.

### **9.2.5: What is the level of use of independent building inspections at handover of new residential buildings?**

Question five was designed to investigate the number of new homeowners that would commission the service of independent building inspectors when purchasing newly-built houses. The research found that a significant percentage (65%) of homeowners did not use an independent building inspector before they took possession of their homes. It is a widely held belief that defect reporting is only necessary for older building stock in New Zealand. Also new owners do not see the need of building inspections for new houses because they were built by registered developers (e.g. master builders and certified builders). The assumption is that these categories of developers, being registered with a professional body, are able to provide building warranties as a protection against defects issues when they occur. In addition, homeowners do not see the need for defect reporting since a majority of homeowners (81%) were involved in the construction of their buildings from an early stage (see Section 6.5.3). This finding has answered this research question. It is the first research project to determine the level of use of defect reporting organisations by new homeowners, showing clearly the latter's tendency to use defect reporting for older buildings rather than new ones. More awareness could therefore be created to change the current levels of defect reporting in New Zealand.

### **9.2.6: Are there uniform warranties available for new homeowners?**

To address this research question, the research investigation commenced by administering mailed questionnaires to new homeowners in New Zealand to determine the period of cover provided for their new homes. This was followed by interviews with residential building developers, which gave an insight into the warranties and protection offered to homeowners. The study found that there is no uniform warranty scheme for residential houses, and the MBF and CBANZ are the only new home warranty providers. Both warranties are similar, but provided by different organisations. There seems to be a poor awareness of warranty schemes on offer and home owners are generally unaware of the protection cover available when defects arise in new buildings. The SMEs interviewed for the study expressed the view that improvements are required to

ensure uniformity and consistency across the residential building sub-sector in New Zealand. While several initiatives are being pursued to protect new homeowners when they purchase their new homes, no research has established that there is a lack of uniformity and inconsistency in new home warranties in New Zealand. This finding is significant as it gives an indication that the current practice produces sub-optimal outcomes.

#### **9.2.7: What is the current quality performance of house developers?**

The purpose of this research question was to determine the quality performance of residential building developers and to gain an understanding of the processes that individual house developers have in place to ensure that quality standards are achieved in their house builds. The research investigation involved interviews with house developers and the result of the investigation is presented in Sections 7.4.1 and 7.4.2. The research shows clearly that there are disparities in the way different house developers monitor quality during construction. Some of the quality monitoring processes were standard practices, whilst some developers have developed additional measures (using creative web-based monitoring systems for example) to ensure quality achievement. However the study found that record keeping of defects for monitoring the quality of construction appears to be inadequate among house developers. The general opinion is that since most defects at handover are minor, documentation is not necessary. However, it is important that standard operating procedures (SOP) are introduced and maintained for quality achievement across all house developer organisations in New Zealand. This research sub-question concluded the research aspects of the study and permitted a synthesis of all the information gathered to be presented in Chapters 8 and 9.

As a general conclusion to this section, the following explanations demonstrate the achievement of the two main research questions of the study. The study employed a mixed method research approach involving a questionnaire survey, interviews, and research verification using key industry stakeholders (subject matter experts). This triangulation approach yielded information which answered all the research questions previously mentioned. Intermediate research outputs were produced to disseminate the study findings and were

used to collect feedback on the general direction of the study. A list of all the research publications generated from this study is included as Appendix D. Copies of some selected publications are included in Appendices D1 to D7. The current research published part of the research in the 'Build' magazine in April 2011, which emphasised the need to examine the quality of new residential building in New Zealand (see Appendix D7).

Defects in new residential buildings can be minimised or completely eradicated using information on common defects occurring at handover, which the current study identified. These defects mostly relate to functional aspects of building quality. To reduce this category of defects requires more effective quality monitoring systems, improvement of quality performance, and the use of independent building inspectors. Consequently, the overall level of customer satisfaction with the quality of new buildings will be improved. Creating awareness of building warranties and establishing a national scheme to implement and standardised such warranties is a further aspect of this study that could also improve building consumer confidence in the service provided by residential house developers.

Finally the research suggests specific improvements that could be made to facilitate performance improvements in the house building sector in New Zealand. The complete recommendations emanating from the current study are given in the following section.

### **9.3: Recommendations**

The following recommendations are made for improving quality achievement levels in new residential buildings in New Zealand. The recommendations are intended to help mitigate defects in new residential buildings and consequently increase customer satisfaction levels regarding residential building quality.

To facilitate efficient and effective monitoring of defects during building production processes, it is important to improve the quality monitoring systems of residential building developers. A comprehensive and effective monitoring system could enable defects to be traced and categorised so that their root cause(s) could be determined. Homeowners could thereby have better recourse to address the issue of defects, particularly with respect to how the defects can

be rectified, who should be responsible, and what not to accept. With effective quality monitoring, residential house developers would be able to provide services that could directly and positively impact on their customers' satisfaction. Therefore, the current study recommends the establishment of standard operating procedures (SOP) for quality achievement. These SOPs are to be maintained across all house developer organisations in New Zealand. For example, the use of quality registers may be encouraged with a clear set of guidelines on the kind of data that could be recorded on the diary, especially for developers with franchisors. The diary should include an indication of how the developers' respond to the issues recorded on the register. Such a diary helps to document the different categories of defects (technical or functional) that are identified.

This study specifically recommends the establishment of an independent non-profit distributing organisation like the NHBC, which operates in the UK, for new homes built in New Zealand. This study believes that such an organisation would help raise standards in the house building industry and provide uniform and consistent consumer protection for new homeowners. The study shows that there is no uniform and consistent application of warranty cover for new homeowners when problems of defects arise. Standards that are more stringent than the minimum legal requirements could enhance industry best practice and create the culture of do it once and do it right. It should be contended that establishing such an organisation could increase consumer confidence and improve homeowners' satisfaction levels to the quality of new homes.

The current study found poor awareness levels concerning the warranties available to home owners unacceptable. This needs to be improved so that home owners are better placed to demand better quality service from their house developers. Therefore the study recommends public awareness initiatives regarding building warranties by the relevant responsible consumer agencies in New Zealand. This should give new homeowners a clear picture as to how their home warranties are structured and operated.

The study recommends that the use of independent building inspectors for new homes be made mandatory against the backdrop of the lack of understanding of the benefits that such inspections could give to homeowners. Even though the

extent of defects observed in the current study is low, and the defects were mostly aesthetic, the study believes that professionally inspected buildings could yield a greater number of defects. It is necessary to mention that because homeowners lack technical knowledge and are only able to notice visible defects, the engagement of professionals would help them identify all categories of defects. The use of independent building inspection for new homes could be made part of pre-purchase agreements and would make developers liable for functional defect rectification within a reasonable time frame. It may also be useful for financial institutions to make the release of mortgages conditional upon the provision of an independent building inspector's report for all categories of buildings. The majority of homebuyers in New Zealand need financial assistance (mortgage) when buying a new house. The more checks and inspections that are made on building performance, the more probable new buildings will meet the required quality standards.

In the same light as the previous recommendation, the study recommends that a standard time frame for which residential building developers are liable for defect rectification be made mandatory. This provision would allow homeowners enough time to record observed functional defects, which developers will be liable to rectify to their satisfaction. This is because the ultimate responsibility lies with house developers to build it right the first time. The study encourages the use of independent building inspectors who could help uncover functional defects professionally. This will enable accurate assessments of defects for the sake of timely and adequate rectification.

This study has shown that customer satisfaction surveys are not usually undertaken for new residential buildings in New Zealand. The few residential developers who carry out surveys are mostly interested in opinions about the general administration service provided to their customers, and which could enhance their reputations. Thus the focus of existing customer surveys is not on determining construction performance improvement opportunities. If this was the case, residential developers would have data with which to improve construction performance (and in the case of franchisors, able to train franchisees based on factual performance data). It is therefore recommended that yearly customer satisfaction surveys be carried out for new residential buildings independently of house developers.

It was made apparent within the current research that the new LBP scheme introduced under the new Building Act amendments needs to be reviewed. The study found there needs to be indemnity warranties for LBPs so that they can be backed by insurance when defects and quality performance issues arise. The study recommends that the Ministry of Business, Innovation and Enterprise re-examine at this aspect of the new LBP scheme to enhance its effectiveness in building quality achievement.

### **9.3.1: Recommendations for future studies**

This study identifies areas requiring further studies. These potential areas of investigation are highlighted in the following paragraphs:

- Research on defects in new residential buildings was found to be particularly rare in New Zealand. More specific research is required in this area in order to determine the actual extent of defects in comparison with other building sub-sectors. This potential research could then be used as a comparison to this research and would hopefully identify areas of commonality and paramount concern.
- The low record of defects found in this study could be because of the method of data collection. This information was used because of the lack of datasets of defects available within the house building industry. This research recommends that further investigations should be conducted using a dataset from building inspectors or record of call backs (defects) from house developers. This is necessary so that a common industry dataset can be produced which could be standardised across the house building industry.
- This research found that a majority of new homeowners in New Zealand are satisfied with the quality of their new homes. Further investigation is required into the current levels of homeowner satisfaction within the house building industry. This is important so that a yearly industry-wide survey of satisfaction levels of new homeowners could be conducted. This would present a trend line that in turn could develop a critical and detail understanding of industry performance.

- The current research identified workmanship as the major cause of defects in new residential buildings. Despite this identification little is known about the trades that are responsible for this poor workmanship. It would be useful to know which specific trades so that attention could be directed towards skills training and education. In this light, further research is recommended to investigate training needs that could improve quality performance.
- Further research is required to investigate the financial implication of defects identified at handover of new homes. This will enable an understanding of the severity of the problem of defects on the performance of house developers organisation, and consequently on the productivity of the construction industry. At present the industry cannot accurately estimate the financial impact of defects as there are no reliable methods of estimation available. Nevertheless an estimating model that can accurately calculate the cost of defects to both the house building sector and the wider construction industry would be financially beneficial.
- In the course of this study, several developments have taken place. Significantly the Building Act (2004) is continuously being amended. Recent amendments to this document came into effect in March 2012. The study therefore recommends future research investigations into the effect that these recent changes may have on the performance of house developers. We may see a better achievement of quality with the recent LBP scheme because liability for defects will be borne by the LBP rather than BCAs.
- Further the merger or the creation of a unified Auckland Council has resulted in a great deal of restructuring which could significantly impact on consent processing (and consequently building quality achievement). It is recommended that research investigation be conducted to determine the influence of this merger on the performance of the house building sector and the wider construction industry.
- This study has shown that the available new home warranties are not consistent and uniform. Further, homeowners have little or no knowledge of how their home warranties operate. This study also recommends further research into how a national warranty scheme could operate in New

Zealand. As recommended previously, an NHBC-type organisation, determining how similar attributes could be transferred to New Zealand, would be beneficial to the industry. Such actions may result in strengthening of legislation around warranties which would encourage house building developers to get things right first time.

#### **9.4: Contributions to existing body of knowledge**

This study has contributed to the body of knowledge on defects in new residential buildings in New Zealand, especially considering that so little research exists in the subject area. The information contained in the research adds useful literature for future researchers who have similar interests in the field of quality achievement in buildings. In addition, this research provides essential data necessary for future industry improvement initiatives in reducing defects and consequently improving industry performance. The significance of this study to residential building stakeholders is outlined in the following sub-sections.

##### **9.4.1 Contribution to house developers**

- This research has provided a list of common defects observed at handover of new residential buildings. The house building sector now knows where attention is most needed, so that they can do it once and do it right.
- Despite low recorded levels of functional defects, homeowners find these defects annoying and believe that the industry could perform better. This will help house developers to work toward achieving defect-free new homes.
- House developers will be able to benchmark their quality performance.
- An expanding client base can be expected to follow from an increase in the satisfaction levels of homeowners. Turnover therefore increases and an organisation's financial profile is enhanced.
- The building industry is highly competitive and a firm's survival may be dependent on a good reputation for quality achievement in construction. Superior quality differentiates a firm from its competitors. It is likely that long term players in the construction industry are those who have acquired a

reputation for meeting their clients' needs for quality through consistently lowering the number of defects. Companies developing their capabilities using the data generated in this study will be able to significantly increase their performance.

#### **9.4.2: Contribution to the house building sector**

- This research will help the residential sector to focus more on improving the quality of imported building materials. This will be achieved by adequately monitoring the quality of incoming building materials, and also providing more effective product certification of them.
- Increased productivity coming from a reduction in the cost of defects compared to the value of the constructed product.

#### **9.4.3: Contribution to the construction industry**

- This research, whilst being directed towards the residential building sector, is also directly applicable to the construction industry in general. Many of the research findings and principles have been grounded and tested in the wider construction industry.
- This research has increased the understanding of the extent of defects as well as the most common defects occurring at handover of new residential buildings.
- Improved defects reporting processes will allow more detailed assessment and auditing of quality achievement within the building industry. The results of those assessments will differentiate high, medium and low performers, and may provide a good form of benchmarking for good practice.

### **9.6: Conclusions**

This research established through relevant literature that while the construction industry has pursued a number of initiatives to address the issue of defects, it is evident that defects still remain an issue. The research identified several knowledge gaps on defects in New Zealand which were formulated into research questions and consequently answered. Issues around the

achievement of quality performance in the house building sector were systematically addressed through a mixed methodological approach. The overall aim was to improve quality achievement levels in new residential buildings in New Zealand.

The research project is a unique study in New Zealand because no research has done such an extensive empirical study on defects at handover stage particularly for new residential buildings. Previous New Zealand studies had focused on weathertightness problems, while the current research examined visible defects experienced by new homeowners. In the same light, the current research views the defects issue from the perspectives of homeowners, different from UK studies that had used data from building inspection reports

Some of the current research findings support existing knowledge while others are new knowledge in the general area of defects in residential buildings, as were explained in Section 8.3 to 8.6. Of significant relevance is the list of common defects generated for new residential buildings in New Zealand. These common defects are mostly aesthetic and have been demonstrated by the study as being important to new homeowners. This provides useful information to new house buyers of the list of common defects (and their extent) that they should expect when they purchase their new homes. One major cause of these defects was found to be poor workmanship which is attributable to lack of training and poor apprenticeship schemes, and imported trades. Another cause for common defects is the quality of materials imported for use in New Zealand construction works which results from poor monitoring of these imported building products. It was made apparent from the current study that new homeowners are generally satisfied with the quality of their new homes. However, the same homeowners believe that house developers could perform even better. Residential house developers would need to develop a consistent set of quality criteria that will enable the achievement of the ultimate goal of defect-free homes. Such criteria would facilitate both quality performance improvement and other sustainable development drivers.

Defect reporting for newly built homes are low in New Zealand. The few within this study that used the services of inspectors have found more defects in their homes than those who did not. This would suggest that there are obvious

benefits from the use of defect reporting. Integrating best building inspection practices into the New Zealand construction industry will not only pick up aesthetic defects but also other categories of defects.

One other finding that is significant in the current study is the lack of uniformity of new home warranties. The significance of new home warranty in addressing the issue of defects was identified by previous studies. Therefore a national warranty was suggested by the current study that will provide consistent warranty for new homes. However awareness initiatives are required so that homeowners will understand how these warranties work and operate.

It is hoped that the current research will impact upon defects issues that currently exist within the industry and more importantly, inform new house buyers of both common defects and extent of defects they should expect when they purchase their new homes. The reduction or complete elimination of defects in the final product will lead to a reduction in the overall cost of house production. Consequently there will be an improvement in the quality performance in the house building sector and in the construction industry generally. Indeed the current study is equally important in the context of low productivity within the industry as a result of poor building practices. This will assist in achieving the goal of 20% by year the 2020 proposed by the productivity partnership in 2011. Homeowners want a product that is defect-free and worth the utmost value for their investment. The study therefore concludes that the measures of quality achievement lie on the perceptions of the end-user. Returning to the research questions posed at the beginning of this study, it is now possible to state that defect-free new homes could be achieved with effective and efficient quality monitoring systems.

Finally an issue emphasised by the study is the need to improve industry best practices through the culture of getting things right, first time. Thus more investment is needed across the board for building consumer education, creating quality performance standards, building materials approval processes and better building designs. In addition training and re-training of trades' people within the residential building industry as a whole, and monitoring of quality processes, are a necessity in New Zealand.

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# MEMORANDUM

## Auckland University of Technology Ethics Committee (AUTEC)

To: John Tookey  
From: **Dr Rosemary Godbold** Executive Secretary, AUTEC  
Date: 26 August 2011  
Subject: Ethics Application Number 11/165 **Evaluating the incidence of snags and defects in new residential buildings in New Zealand; Causes, effects and remedies.**

Dear John

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 27 June 2011 and that on 22 August 2011, I approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 12 September 2011.

Your ethics application is approved for a period of three years until 22 August 2014.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/research/research-ethics/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 22 August 2014;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/research/research-ethics/ethics>. This report is to be submitted either when the approval expires on 22 August 2014 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz) or by telephone on 921 9999 at extension 8860.

On behalf of AUTEC and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Dr Rosemary Godbold  
**Executive Secretary**  
**Auckland University of Technology Ethics Committee**

Cc: Funmilayo Ebun Rotimi [frotim@aut.ac.nz](mailto:frotim@aut.ac.nz)

# Participant Information Sheet

APPENDIX A2



## For Homeowners Questionnaire

### Date Information Sheet Produced:

02 June 2011

### Project Title

Evaluating the incidence of snags and defects in new residential buildings in New Zealand: Causes, effects and remedies

### An Invitation

My name is Funmilayo Rotimi, I am a doctoral student with the School of Engineering (Construction Management Programme), Faculty of Design and Creative Technologies, Auckland University of Technologies. My PhD research is on defects in new residential buildings in New Zealand. My research will capture the magnitude of snags within the residential housing sector, determine the current use of snagging inspectors (building inspectors) in new residential buildings and determine homeowners' satisfaction with their newly purchased homes, in New Zealand. The intent of the research is to improve quality achievement levels in newly built residential buildings and ultimately increase homeowner's satisfaction levels. This research is funded by BRANZ as one of its initiatives around quality improvement and productivity in the construction industry.

I therefore invite you to participate in my research by filling the survey questionnaire. Please know that your participation in this survey is voluntary. By completing this questionnaire, you are indicating your consent to participate in the survey.

Completed questionnaire should be returned in the self-addressed envelope attached.

### What is the purpose of this research?

The study aims to improve quality achievement levels in new residential buildings through the eradication of snags and defects that occur before or after handover of projects in New Zealand.

Some other objectives to be achieved include:

1. To determine the importance of snag reporting from a homeowner perspective within three major cities in New Zealand.
2. To recommend improved quality achievement processes that will be beneficial to residential homeowners, developers and the wider construction industry

**How was I identified and why am I being invited to participate in this research?**

You have been selected randomly from a list of new homeowners within Auckland, Wellington and Christchurch to participate in this research. Your details were obtained from the council.

**What will happen in this research?**

The data collected and its analysis will provide an insight into the extent of defects in new residential building and the level of customers' satisfaction to quality achievement in New Zealand. The results obtained from the data analysis could be published in academic conferences and journals.

**What are the discomforts and risks?**

Potential discomfort and risk associated with this research are limited to privacy and confidentiality. All responses will be treated in strict confidence and the information you provide will be used solely for this research.

**How will these discomforts and risks be alleviated?**

The information I ask for is totally anonymous as your name and address is not required on the questionnaire. As a result there will be no issues of discomfort and risks regarding privacy and confidentiality. You will in no way be identifiable in your responses in any future publications since no demographic details will be disclosed.

**What are the benefits?**

The findings from this research are to improve quality achievement levels in new residential building in New Zealand. Some other contributions include:

- i. Comparison and benchmarking of performances within the housing sector.
- ii. Improved image and reputation of the property and construction industry
- iii. Improved house building service delivery

Ultimately this study will improve the performance of the residential sector and improve productivity within the wider construction industry.

The research is in partial fulfilment of a PhD award to the researcher on completion of this research

**How will my privacy be protected?**

This research does not seek to gather personal information from participants. The questionnaire is anonymous.

**What are the costs of participating in this research?**

The cost associated with your participation is the time involved. The questionnaire will take between 10 to 15 minutes to complete.

**What opportunity do I have to consider this invitation?**

Please take a few days to consider this invitation. If you require further information or clarification on any aspect of the research, contact Funmi Rotimi (09) 9219999 Ext 8109, email [frotim@aut.ac.nz](mailto:frotim@aut.ac.nz)

Please do remember that your participation in this research is voluntary.

**How do I agree to participate in this research?**

If you decide to participate in this research please complete the questionnaire. Your completion of the questionnaire will be considered as your consent.

**Will I receive feedback on the results of this research?**

A summary report of the findings will be available on request. However the full report will be available as a thesis accessible at the AUT library.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisors, Associate Professor John Tookey, Construction Management Programme, School of Engineering, Auckland University of Technology. Ph. (09) 921 9512, email: [john.tookey@aut.ac.nz](mailto:john.tookey@aut.ac.nz)

and Professor Thomas Neitzert, School of Engineering, Department of Engineering Mechanic and Production Technology, Auckland University of Technology. Ph. (09) 921 9258 email: [tneitzer@aut.ac.nz](mailto:tneitzer@aut.ac.nz)

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEK, Madeline Banda, [madeline.banda@aut.ac.nz](mailto:madeline.banda@aut.ac.nz) , 921 9999 ext 8044.

**Whom do I contact for further information about this research?*****Researcher Contact Details:***

Funmilayo Rotimi Construction Management Programme, School of Engineering, Auckland University of Technology. (09) 9219999 Ext 8109, email [frotim@aut.ac.nz](mailto:frotim@aut.ac.nz)

***Project Supervisor Contact Details:***

Associate Professor John Tookey, Construction Management Programme, School of Engineering, Auckland University of Technology, Ph. (09) 921 9512, email: [john.tookey@aut.ac.nz](mailto:john.tookey@aut.ac.nz)

Professor Thomas Neitzert, School of Engineering, Department of Engineering Mechanic and Production Technology, Auckland University of Technology. Ph. (09) 921 9258 email: [tneitzer@aut.ac.nz](mailto:tneitzer@aut.ac.nz)

Approved by the Auckland University of Technology Ethics Committee on 27 June 2011, AUTEK Reference number 11/165.

# Consent Form

APPENDIX A3



**Project title:** *Evaluating the incidence of defects in new residential buildings in New Zealand*

**Project Supervisor:** *Dr. John E Tookey*

**Researcher:** *Funmi Rotimi*

- ☐ I have read and understood the information provided about this research project in the Information Sheet.
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ I agree to take part in this research.
- ☐ I wish to receive a copy of the report from the research (please tick one): Yes ☐ No ☐

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....  
.....  
.....  
.....

Date:

**Approved by the Auckland University of Technology Ethics Committee on 27 June 2011, AUTECH Reference number 11/165**

*Note: The Participant should retain a copy of this form.*

## Research Survey

### Evaluating the Incidence of defects in New Residential Building in New Zealand: *Causes, Effects and Remedies*

#### Homeowners Questionnaire

*Note: The word 'defects' as used in the questionnaire refers to either minor or major defects that are observed before or shortly after a building is completed; while 'snagging' refers to the process of identifying and rectifying these minor defects.*

The completion of this questionnaire is deemed to be consent to participate.

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#### SECTION A: PROPERTY DETAILS

*This section covers details about your property and your building developer*

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Are you an owner occupier?      Yes    ☐                      No    ☐

How long have you owned your home?    (Circle one)

- (a) Less than 1month      (b) 1 - 6 months    (c) 6 months - 1 yr.    (d) 1 - 2yrs.    (e) Over 2yrs

Please indicate the category of your home. (Circle one)

- (a) House    (b) Town House    (c) Apartment    (d) Unit    (e) Retirement village

How many bedrooms do you have? (Circle the appropriate one)

- (a) One    (b) Two    (c) Three    (d) Four    (e) Five or more

Please indicate number of occupants (Circle the one applicable)

- (a) One    (b) Two    (c) Three    (d) Four    (e) Five or more

Who built your home? (Circle the appropriate one)

- (a) Developer (Master Builder)    (b) Developer (Certified Builders)    (c) Yourself    (d) Developer (Private)    (e) Don't know

---

#### SECTION B: DEFECTS

*This section covers defects you observed after possession and any warrantee provided for your building*

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How many years warranty have you got for structural components? (Circle one)

- (a) 1 - 2 years    (b) 2 - 5 years    (c) 5 - 7 years    (d) 7 - 10 years    (e) More than 10 years

How many months/years warranty have you got for minor defects? (Circle one)

- (a) 1-3 months    (b) 3 - 6 months    (c) 6 - 9 months    (d) 9 -12 months    (e) More than 12 months

At what stage did you become involved in the construction of your home? (Circle one)

- a. Since the beginning of the building (from the design stage)
- b. During the construction of the building
- c. After the building was completed

When did you begin to notice defects in your building? (Circle one)

- (a) Less than 1 month    (b) 1-6 months    (c) 6 – 1 yr    (d) 1-1.5yrs    (e) 1.5 - 2yrs

What is the extent of defects at the time of possession? (Circle one)

- |           |      |         |     |          |
|-----------|------|---------|-----|----------|
| Very high | High | Average | Low | Very low |
| 1         | 2    | 3       | 4   |          |

Please indicate which of the following was defective or defects noticed when you possessed your home? (Tick as many)

|                 |                      |                    |                   |                    |  |
|-----------------|----------------------|--------------------|-------------------|--------------------|--|
| Poor finish     | Door stopper         | Toilet/WC          | Concreting        | Plaster board      |  |
| Uneven painting | Extractor            | Glazing            | Bath panel        | Trickling vent     |  |
| Nail pops       | Hob and Oven         | Roof flashing      | Piping work       | Spouting           |  |
| Ceiling joint   | Socket/Switches      | Cracks             | Drainage          | Creaking/Squeaking |  |
| Kitchen units   | Skirting/Architraves | Staircase          | Leaks             | Labels             |  |
| Flooring        | Brackets             | Locks              | Handrails         | Stains             |  |
| Wall tiling     | Sinks/WHB            | Roofing/Tiles      | Walls             | Others             |  |
| Door/Window     | Window sills         | Roof gutter        | Garage door       |                    |  |
| Worktops        | Seals/Rubber linings | Insulation/Lagging | Wardrobes/Shelves |                    |  |

What do you think is the major cause of defects experienced above? (Circle one)

- (a) Poor workmanship (b) Design error (c) Material faults (d) Omission

Did you notify the developer when you noticed these defects? (Tick one)

- (a) ☐ Yes ☐ No ☐ Unsure

What percentage of the defects was rectified? (Circle one)

- (a) 0 - 20% (b) 20 - 40% (c) 40 - 60% (d) 60 - 80% (e) 80 - 100%

Who rectified these defects? (Circle one)

- (a) Developer (b) Yourself (c) Unsure

Did you have to go through a Lawyer or third party before the rectification was done? (Tick one)

- Yes ☐ No ☐ Unsure ☐

How quickly was rectification works carried out? (Circle one)

- (a) Less than 1 month  
(b) 1 - 3 months  
(c) 3 - 6 months  
(d) 6 - 9 months  
(e) 9 - 12 months  
(f) N/A

## SECTION C: CUSTOMER SATISFACTION

*This section covers details about your level of satisfaction with your building*

How satisfied are you with the quality of your new home? (Circle one)

- |                   |                         |                       |         |                          |                            |                      |
|-------------------|-------------------------|-----------------------|---------|--------------------------|----------------------------|----------------------|
| Very<br>satisfied | Moderately<br>Satisfied | Slightly<br>Satisfied | Neutral | Slightly<br>Dissatisfied | Moderately<br>dissatisfied | Very<br>Dissatisfied |
| 1                 | 2                       | 3                     | 4       | 5                        | 6                          | 7                    |

How satisfied are you with the service provided by your developer/builder? (Circle one)

- |                   |                         |                       |         |                          |                            |                      |     |
|-------------------|-------------------------|-----------------------|---------|--------------------------|----------------------------|----------------------|-----|
| Very<br>satisfied | Moderately<br>Satisfied | Slightly<br>Satisfied | Neutral | Slightly<br>Dissatisfied | Moderately<br>dissatisfied | Very<br>Dissatisfied | N/A |
| 1                 | 2                       | 3                     | 4       | 5                        | 6                          | 7                    | 8   |

How would you rate the relationship between you and your developer? (Circle one)

- |             |           |           |      |      |      |           |     |
|-------------|-----------|-----------|------|------|------|-----------|-----|
| Exceptional | Excellent | Very good | Good | Fair | Poor | Very poor | N/A |
| 1           | 2         | 3         | 4    | 5    | 6    | 7         | 8   |

**Overall how would you rate the quality of the followings, from 1 being Very satisfied to 7 very dissatisfied?**  
(Circle one)

|             | Very satisfied |   |   |   | Very dissatisfied |   |   |
|-------------|----------------|---|---|---|-------------------|---|---|
|             | 1              | 2 | 3 | 4 | 5                 | 6 | 7 |
| Workmanship |                |   |   |   |                   |   |   |
| Design      |                |   |   |   |                   |   |   |
| Material    |                |   |   |   |                   |   |   |

## SECTION D: USE OF INDEPENDENT BUILDING INSPECTORS

*This section covers details on the use of independent building inspectors' service in new buildings*

**Did you engage the service of a snagging/building inspector before or after the purchase of your home?** (Circle one)

Yes ☐ No ☐ Unsure ☐

**To a large extent are you satisfied with the service of the Building inspector?** (Circle one)

|                |                      |                    |         |                       |                         |                   |     |
|----------------|----------------------|--------------------|---------|-----------------------|-------------------------|-------------------|-----|
| Very satisfied | Moderately Satisfied | Slightly Satisfied | Neutral | Slightly Dissatisfied | Moderately Dissatisfied | Very Dissatisfied | N/A |
| 1              | 2                    | 3                  | 4       | 5                     | 6                       | 7                 | 8   |

**How useful was the Building inspector's defect identification report?** (Circle one)

|             |                   |                 |         |                     |                       |                 |     |
|-------------|-------------------|-----------------|---------|---------------------|-----------------------|-----------------|-----|
| Very Useful | Moderately Useful | Slightly Useful | Neutral | Slightly Not Useful | Moderately Not Useful | Very Not Useful | N/A |
| 1           | 2                 | 3               | 4       | 5                   | 6                     | 7               | 8   |

**What is the likelihood that you will use a building inspector for new homes?** (Tick one)

|             |        |         |            |                 |     |
|-------------|--------|---------|------------|-----------------|-----|
| Most Likely | Likely | Neutral | Likely Not | Most Likely Not | N/A |
| 1           | 2      | 3       | 4          | 5               | 6   |

**Do you agree to having a building inspection at handover of new buildings?** (Circle one)

|                  |              |                |         |                   |                 |                     |     |
|------------------|--------------|----------------|---------|-------------------|-----------------|---------------------|-----|
| Completely Agree | Mostly Agree | Slightly Agree | Neutral | Slightly Disagree | Mostly Disagree | Completely Disagree | N/A |
| 1                | 2            | 3              | 4       | 5                 | 6               | 7                   | 8   |

Please feel free to comment on the nature of defects and any other issues relating to the residential building sector in New Zealand.

Please return the completed questionnaire using the self-addressed envelope attached.

**THANK YOU FOR YOUR VALUABLE TIME**

**House developers**

**Dates:**

**Brief background of organisation**

**Q.** How many franchisees do you own?

**Defects and quality monitoring**

**Q.** What sort of process do you deal with in terms of monitoring quality

**Q.** Do you have record of call-back and how do you keep records of significant defects?

**Q.** What types of call-backs?

**Customer satisfaction survey**

**Q.** Do you carry out customer satisfaction survey for new homeowners

**Q.** When is the client satisfaction survey done?

**Building inspection process**

**Q.** What do you feel about the council inspections?

**Q.** What do you think about the use of external building inspectors?

**Q.** What is your opinion about the LBP scheme?

**Warranties**

**Q.** What form of guaranty do you provide?

**Q.** Uniformity of warranty and opinion on national warranty

**Q:** What would you suggest as areas of improvement in the residential sector?

### Validation exercise

#### Defects

The questionnaire survey to new homeowners came back with over 200 responses. We have asked owners to indicate the type of defects they found when they moved into their new home. 55 defects were identified in total. From this list of defects we were able to come up with 10 common ones. Ranging from uneven painting surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet/WC, concreting and locks. These defects were further confirmed by the house developers we interviewed.

With the recent drive in countries like the UK on zero defects at hand over. Do you think we can achieve defect free new residential buildings in New Zealand?

**Q1. From your opinion how do you see the quality of new residential building? Compared to what we have a decade ago.**

We have also established that the main cause of these defects is poor workmanship (Tradesmen from Asia).

**Q3. What do you suggest can be done to improve this?**

Imported building material is also a cause of concern. **Do you agree with this?**

**Q4. What is your opinion about this? Is this to do with product certification?**

How can house developers be encouraged to keep records of call back? My study found that they did not hold such records.

#### Warranties

In terms of warranties provided for new homeowners, there are various warranty out there, for example, we have the MBF with its own terms and condition and there are some developers that have their own warranties too.

We have found that there is no uniformity/consistency in warranties given to new homeowners

For structural defects we have between 5 to 10years

For minor two weeks to 1 year.

**Q5. Do you think there can be uniformity?**

**Q6. What do you suggest can be done to improve this?**

**Q7. What do you suggest can be done to ensure that homeowners understand how the warranties operate? Insurer behind the developer**

**Q8. What is your opinion about a national warranty scheme?**

### **Customer satisfaction**

We have found that new homeowners are satisfied with the quality of their home.

**Q8. What do you think caused this satisfaction level? Do you agree with this?**

**Q9. What is your opinion about customer satisfaction survey after possession?**

### **Building inspection**

We found that about only 25% of new homeowners have pre purchase inspections.

What is your opinion about having pre purchase inspection for new homes?

Do you think it can be made mandatory?

Another significant point that emerged from our interview is that the council is not staffed enough with building inspectors to cope with peak periods.

What is your opinion about this?

Some of the builders we interviewed believe that some of the council inspectors do not have enough skill and experience to carry out inspection.

**Q10. What is your opinion about this?**

**Q11. What improvement would you recommend in terms of building inspection process?**

**Q12. What is your opinion about the LBP scheme? (Indemnity insurance). Will it improve quality/reduce defect.**

**Q13. What recommendation can you make to improve quality of new residential buildings?**

## APPENDIX C1

### Interview Transcript

Q: I've looked at defects in your buildings within New Zealand and my **foreclose** [0.1.] particularly was on defects that new home owners observed when they have taken possession of their buildings, and I have conducted a nationwide survey of new owners and builders too, interviews with builders, and as part of my research I did validate the findings from my analysis and that's why I am here. You have chosen because of your involvement with home owners particularly. And my questions are centred around four major things that emerged from my findings and they are defects; issues around defects and warranties and customer satisfaction level and then finally the building inspection process you have.

So if I begin please, I just want to give you a consent form to sign. All our conversation today will be kept anonymous. Your personal details will not be mentioned in any form and the information will be used solely for this research. There are two copies; you will sign one and keep one, and then I will keep the other one please.

A: Thank you. [signing]

Q: So I'll go straight into the first thing, which is New Zealand quality. The questionnaires we conducted with new home owners came up with a really good response of our 200 responses. And we have asked a lot of questions and some of the questions we have asked was for new home owners to indicate the kind of defects they identified when they moved into their new homes, and interestingly over 55 defects were identified but we were able to identify common ones among these 55 defects and across all the owners surveyed. And we identified ten common ones and they are mostly aesthetics in nature, they are mostly cracks, broken doors and windows, and [3.49] kitchen units and just things that aren't as aesthetics generally. And with the recent drive in countries like the UK, especially for zero defects at handover, do you think its possible here in New Zealand?

A: Yes it is, yeah. We just lack a building industry that has the required eye for detail in terms of finishing and often some of the defects you've mentioned like cracking in wallboards are all due to poor installation with the finishing plasterboards, not following manufacturers instructions, and also in many cases it's a result of movement in the framing timber because they haven't let it dry properly to the required moisture levels before the installed the plasterboards. So it's the haste and lack of following the proper manufacturer's instructions.

Q: And from your opinion, how do you see the quality of new homes now compared to what we have a decade ago?

A: On the face of it they appear higher because they have much more glossier finishes and are very impressive generally, but our concern remains for what is hidden behind the walls. And that's the thing; the defects that you have mentioned are typical of those that would be experienced by a home owner because they are visible, and what is hidden is often very poor workmanship and the covering up of big mistakes.

Q: And from what we have identified too, most of these defects homeowners identified where we asked them what was the causes of these defects from - their own perspective. And a

significant number have said most of them are caused by poor workmanship. So what do you think about it, do you agree with this?

A: Totally agree. You know poor workmanship is a feature in all of the defective homes that we've had dealings with and these are the more serious defects, you know, what's hidden behind the walls. It's just poor workmanship; a poor understanding of good building practice and a lack of care. You know the builders actually don't care. And so yes, and what new homers see in terms of the patent defects they are generally caused by poor workmanship as well.

Q: Do you think there's anything that can be done to improve this?

A: Well we think we need to make them accountable, you know the whole chain in terms of head contractors, sub-contractors and product manufacturers need to be accountable. I think its more training and making the builders finally understand that they are ultimately responsible for the performance and durability of these buildings and they need to make sure that they get it right the first time.

Q: And building materials too was a cause of concern that homeowners expressed their feelings about. Do you think its about product certification?

A: Yes the product certification process in our opinion is somewhat lax and we see product certification of products that have been approved where they are failing in service and the installation instructions for example are very - I can't mention a brand name - but on a very prominent of fibre cement weatherboard it doesn't specify turned up flashings on the end of head flashings; the turned up ends on the end of head flashings for example. Yet that is contrary to the Building Code and yet that product and its installation instructions became approved by brands; so go figure. And we've found that that has caused leaking in houses that are less than two years old. So we don't have much faith in the product certification process and it is driven by the manufacturers themselves and therefore it lacks credibility and objectivity.

Q: I'll move on to the second thing which is about warranties generally. Warranties provided for new home owners in different forms, there are various ones out there, we've got ones from the Master Builder's Federation, we've got one from Certified Builders Association and we have individual [9.03] too having their own warranties. So it appears there's no uniformity across the board. What do you think about this? Do you think there can be uniformity with warranties?

A: Yes we think there has to be a uniformity. We say that the Government should legislate a mandatory home warranty and fidelity fund system because the current insurance backed warranties in the market place are in our opinion inadequate. I'd go so far as to say as being totally inadequate. And the one that we've had the most dealings with in terms of the poor performance has been the Masterbuild Warranty system and basically its not worth the paper its written on. And when you get a house that suffers really significant building defects the limitation on that warranty is only \$100,000.00 and we have one member whose home requires over \$300,000.00 in repairs, so the warranty goes nowhere. And so owners and people procuring a new build don't realise that they actually have an automatic warranty under the Building Act anyway, which is the implied warrantees for ten years, so

why pay for one. What they need to make sure of is that there is an insurance backed warranty there in the event that the company fails, and that's the biggest concern we have. Because its all very well having the ability to sue a builder for failed works under the Implied Warranties but if they fold their company, which they so often do, then its worthless.

So we advocate the building fidelity fund like they have in the UK; so the NHBC Fidelity Fund is an ideal solution. You know it drives up standards; its about prevention rather than the ambulance at the bottom of the hill or the cliff. So they invest in training, they invest in improving skills and accountability. They pick up defective designs in materials; so they see a spike in claims for low pitched rooves so they say we won't insure low pitched rooves, so the designers have to push it out. And so that's a very positive thing in terms of front ending the protection. And over time we say in New Zealand that we'll reduce the claims made anyway if we improve the standards, improve the design, improve the training of the practitioners. You know improve their commitment to the industry. And we also educate the consumer; so that sort of system which is born out of that Fidelity Fund.

The Government doesn't like it because it sounds too much like the ACC. But in Canada they've got the insurance backed warranties; they mandated it there. They mandated the insurance bonds and that got rid of all the ratbags because if they couldn't get insurance they couldn't get the jobs, and if they did bad jobs they didn't get insurance. So it meant that the bad builders got drummed out of business. And you will hear industries say, "Oh but that will increase the cost and it will open ended and it will mean that the cost of building increases." Well the Canadian experience from the people that we've talked to was quite different. They say that they didn't like it at first having their insurance premiums go from \$7,000.00 per year to \$70,000.00 per year but they had to get smarter, and they are, they are very smart in the way they do their work. They realized that they had to make a... it was a paradigm shift in the way they did business.

So rather than sitting back and saying woe is me, they said what can we do to make this different? (a) we need to avoid problems so that we avoid claims, therefore we won't assume liability, so we need to take control of the supply chain and make sure that we're not reliant on the lowest common denominator. You know a tiler who doesn't know how to do waterproofing membrane and so he causes us grief, so we have to bring our own people in, have them in-house and we train them and we make sure they understand what it means to us to have this done right. The side benefit of that was that they actually had complete control over the timing and therefore they increased their turnover and they increased their profitability and absorbed the \$70,000.00, or the \$63,000.00 increase in insurance costs.

They got smarter and so they've never had failures. They produced a home warranty and maintenance plans so they could go back and watch the performance of a building and go "ooh that's not working so we'll fix that," and they prevent the problem from becoming a cancer.

Q: So its all about getting it right the first time?

A: Yes.

Q: And another thing that came out from my research is, most new home owners don't understand the warranties they have.

A: No.

Q: Yeah, they don't. What do you think can be done?

A: Well there has to be a plain English version. We would love to have our own warranty system and we would like to have our own building contracts. So we would like to be in a position to force the building industry to sign a contract which is providing an even playing field - protection for all parties. And we would like to see the Escro System used to protect the home owner and to protect the head contractor and even more importantly to protect the sub-contractors. We see too many head contractors cash flowing their business by not paying their sub-contractors and we don't like that.

So we say a really good plain English building contract; plain English warranties that come in behind that and this Escro System which protects the payment, and then ultimately we have the warranty that comes out of that at the back end. So you have two forms of warranty, one is the completion warranty and one is the ultimate building warranty for the building. And the building warranty should also impose a duty on the home owner to maintain, 'cause they do have a responsibility. You know they have a part to play in achieving the performance and durability.

Q: Do you think its possible to make this clear on the purchase agreement?

A: Yes, well certainly people that come to us, we give advice if they're buying a readymade house. We insist on certain conditions being put into the contracts. But unfortunately the builders and some of the large group housing companies are pretty arrogant and they just say, "We're not putting that in," and so people are buying really at their own risk.

Q: So we've talked NHBC, do you think New Zealand can have a national warranty?

A: Yes. We see no reason why. We say tip all the money out of brands, tip all the money out of the building construction industry training organizations. They've got millions of dollars floating around that they haven't spent; and also New Zealand Standards. Put all that money into a big pot and then create this organization which will provide this fidelity fund and the insurance backed warranty system, and then that money is spent on training, on creating standards, on consumer education and on monitoring of the building works. It sounds simple but we know it's a very difficult ask, but if we are going to free ourselves from the problems that we have and are perpetuated; we have to be radical in the way we approach it.

Q: Where do you see [18.05] come in, in terms of warranty?

A: Well if we had the financial resources we would be providing contracts and warranties and all that sort of stuff, but we're not for a profit organization and we struggle to make money. But that whole warranty system ought to be managed by a not for profit organization such as HOBANZ. And that's why we're concerned about the likes of the Masterbuild and the CBA contracts; its all just a commercial incentivized in terms of the revenue that they

generate from a product that really isn't worth it. So we won't a meaningful warranty and independence which is really important.

Q: So what would you suggest, in just one word, in terms of warranty improvement?

A: Independence.

Q: Now we'll move onto the third thing and its about customer satisfaction level. My analysis shows that a significant number of home owners are satisfied with their new homes. Despite identifying some defects they are still happy about the overall quality. What do you think 'causes the satisfaction level?

A: I think people are enamoured by the beautiful new home. You know it's the new home smell, it's the new appliances, it's the crisp carpet under their feet. Its just all of that. Its like buying a new car. It overwhelms people and its also that pride and ownership; sometimes they become blinded to some of the problems. But also they're not aware, they're not educated in what a defective house would look like and when you point it out to them they're horrified. I went out with a young lady who was buying a house up in Hobsonville Point and of course there was the lovely bathroom and lovely kitchen, and oh look at the sound system, and I said yes but what about all the penetrations on the outside that haven't been sealed so that's going to leak. So she had no idea what she was looking at. So we haven't got owners educated to the point where they are actually discerning enough to determine whether a house is of high quality or not.

Q: And most house developers we interviewed, some of them carry out a survey to just find out what their customers feel about their new homes. What do you think about customer satisfaction surveys, would you think these are a good idea?

A: Yeah, again it lacks independence.

Q: Performance measurement.

A: Yeah it leaks independence, that's the problem. And you'll find that the bad feedback they get is just swept under the table, and you'll always see the satisfied people appearing in their television ads or in their media ads in other places, but they'll never wheel out the dissatisfied customers and show you how badly they dealt with them.

Q: There was a particular home owner that mentioned that after the survey if they were asked to repeat the survey again it would have been another story completely.

A: Yes, yeah the timing is also, it's a bit suspect, yeah.

Q: So I'll move on to Building Inspection. From what we have found only 25% of new home owners do Pre-purchase Inspection.

A: Mm hm.

Q: In your opinion what do you think about Pre-purchase Inspection, do you think it's a good idea?

A: Well yes. I mean otherwise it's like playing a game of Russian Roulette. But the biggest problem is that the people that are out there providing Pre-purchase Inspections are unlicensed; uncontrolled. They may be members of professional organisations such as BOINZ or the NZIBS, but it doesn't necessarily make them competent to be making a critical analysis of buildings. And we find that so many of them pull back from making a critical analysis because they're scared of getting a name in the industry that they always write buildings off. So the Real Estate Agent's don't recommend them and the word gets round.

So there's varying levels of competency; huge variation in competency. A report came in over the weekend and it was a thermal imaging report done on a house down in Christchurch. Of course it's been the driest summer for a very long time. So that in itself makes the report worthless.

But the reporter took pictures of defects that I don't even have to visit the site, I can see that the cladding's buried down into the ground; there's no flashings; there's holes in the roof flashings and there's a whole range of defects. Didn't report on any of that, just said the house was dry and it's been well maintained. Well that was a lie.

And so I dug a little deeper and found out this guy was a; he owned a little café and decided he'd become a Thermal Imager, so he brought his camera off the net; he did his thermographer's licence on the net as well and he's out there charging people \$600 to do that.

Q: That's a lot of money.

A: He doesn't know what he's looking at. Again so there are real problems. So we say, people must get a pre-purchase building condition survey but the risks at the moment is that they'll go to the phone book or do a search online and get someone who's totally incompetent.

So it's a problem that we're addressing. We're moving towards an accreditation programme for Building Surveyors to do pre-purchase surveys. Yep and to make it more accessible, because the thing is that if you're looking at buying a house you'll find something you like and you go, "Right it's going up for auction next week, I'll get a building inspection this week," might cost you \$800. To get a decent one it'll cost you \$1,500, to get one from someone we would recommend will cost about \$1,500.

So you do that once and you miss out on buying the house. So you go to another house and you fall in love with that, so you get another pre-purchase inspection, another, call it \$1,000. You go to the Auction; you miss out. And then you say to yourself, "We keep on missing out so I can't afford to keep on spending \$1,000 or more to get a decent inspection."

So the next one they don't you see. So that's the problem. So we're looking at a system where we will generate a report that is commissioned by the seller and the seller will then approve the report; then we will licence the use of the report; so we'll sell a report on a house for a few hundred dollars.

So that makes it accessible; it's high quality that you can rely on and that we say it should also be included as part of the valuation process. So you get the real value of the house. It also gives the vendor an opportunity to address any defects that might; there might be a leaky gutter or a corroded piece of roofing iron that needs to be replaced. So they can fix that and do it properly. And then that report goes out, but it makes it accessible.

So at the moment it's a rort; there are too many people out there who have hung out their shingle and called themselves Pre-purchase Inspectors and they are just rogues.

Q: Because then I feel suggestions on making pre-purchase inspection a mandatory exercise during the buying process.

A: Yes.

Q: So that once the report comes out the builders are compelled to fix the defects before they disappear, yeah.

A: Yeah so that's a good point because we traditionally look at pre-purchase inspections being ones that are done on second-hand homes. But we have a builder on our staff here and we often go out and look at a house at handover time. But we like to actually get in to have a look at it before the wall linings go on to see what's hidden behind the walls as well.

So we become part of that process but the builders don't like it 'cause we have long lists...

Q: They won't like it.

A: No, 'cause we have long, long lists that they have to address. So they don't like people looking over their shoulders.

Q: No they don't.

A: No. But that's the thing they can cover up a raft of mistakes with plasterboard.

Q: Yeah. For any homeowner you don't know what is behind the board?

A: No.

Q: Yeah it's just what you see?

A: Yeah, "So oh it's a lovely colour, nice carpet," yeah.

Q: What is your opinion about Council Inspectors? From what we have found most significant amount of homeowners indicated that Council Inspectors are not skilled enough to carry out their job. That they don't have enough experience, some of them come and say something else; another one comes in and says...?

A: Yeah but it's been a problem for a very long time that they have been under-resourced and under-trained. But also they're only provided 10 minutes. They allocate 10 or 15 minutes on site to do a whole lot of...

Q: Check list?

A: Yes, and so they're ticking boxes. But also they have a policy of looking but not seeing. So if they get too involved in it; you know they can fail an inspection, but if they get too involved with the builder looking at a particular issue then the Council can potentially assume more liability. So they tend to not look.

Q: They don't want to see?

A: Yeah. So they tend to rely on our Producer Statements rather than actually doing the physical inspection. So they'll say, "Well we can see the waterproof membrane but actually I'm not looking at that you give me a Producer Statement."

So all they're doing is trying to ring-fence themselves from liability because what we've heard for 10 years now is that, "Oh but we relied on the professionals on site to have done their job. So how can we as the Council be responsible." And so what they are doing now is creating a paper trail that proves that they have relied on people on site so that they can ring-fence themselves from liability when it fails.

But we say they have failed to properly discharge their duty to inspect and just relying on a piece of paper just doesn't cut it when they could see that it's, in many cases, not up to scratch.

Q: What improvement would you suggest in this area?

A: Well again it's quite radical, doing away with it all together. If we're going to pay them to do it, but they're not actually doing it to the standard that most homeowners would expect it to be done then why pay them; why actually have them involved in the process.

If they want to avoid liability, the Councils should make sure that the whole thing is pushed back to the Building Practitioners and we have a Building Warranty Programme. And the Warranty Programme would include inspections by the warranty company.

Q: And now the LBP.

A: Yes.

Q: What is your opinion about LBP?

A: Very low.

Q: Do you think it can reduce defect?

A: No, and at the moment it's just a nasty experiment. They've licenced 40% of all the licensed Building Practitioners don't have trade qualifications. And so their whole idea was to get them in the system and then monitor them and cut them off at the knees if they do wrong. Well in that process there's always going to be a consumer that's had a problem isn't there?

Q: Exactly.

A: So the whole Licensed Building Practitioner regime is just a farce really. And we talked to some of the really good builders that we know and trust and they're really disappointed because they thought it was actually going to be worth something. But when they see guys down the road who don't have building qualifications being licensed, answering two questions to get through the door, it's just not good enough. It's not rigid enough; it's not robust enough.

And so we have people who have got licences but don't understand that actually they become personally liable when they're using their licence as well. So the system's being misused a little bit as well.

A head contractor will employ a whole lot of Licensed Building Practitioners and leave them onsite. He'll leave to do another job and it's these guys who are actually taking responsibility. They'll be the ones who'll be sacrificed in the process because their licence number is on that work. And they don't have insurance to back it either.

Q: Exactly, that's what I'm just about to talk about. Because most of the other developers we interviewed said considering the huge responsibilities put on the LBP there's no indemnity insurance to cover them.

A: Aye.

Q: Yeah.

A: No and the good builders who've had a long history in trade and have formal qualifications, they can get insurance.

Q: A reputation too, yeah.

A: Yes, yeah they can get insurance because they're a known risk. But someone who doesn't have any trade qualifications; and this is why we say the Insurance Backed Warranty and Fidelity kind of process becomes; it's self-levelling, it gets rid of the cowboys. Because if you're uninsurable you can't work on my house, I'm sorry. You know, it's as simple as that.

So the whole system needs to be geared around the core; the core of the whole system. Licensed Building Practitioner regime is good and in the long term it will mean there's a greater level of control over builders, particularly those that do it wrong. But the core of this whole system must be that Fidelity Fund and Insurance Backed Warranty Scheme. And that Fidelity Fund needs to invest across the board as I said in consumer education, creating standards, approving building materials and looking at better design. Training the building industry as a whole and monitoring it.

Q: Do you think the NHBC will work here in New Zealand?

A: Yes. Yes. Yep, it's a system that's tried and proven. Like any system that you would import from overseas it probably needs to be tweaked to local conditions, but not much.

Q: Not much yeah, yeah, not much.

A: And, as I said we need to take a radical approach and look at the money that gets poured into brands; look at the money that gets poured into New Zealand Standards; look at the money that gets poured into the Building & Construction Institute Training Organizations. Well that should come into an equivalent of the NHBC in New Zealand and then those funds are used to prop up...

Q: Support, yeah.

A: ...the building industry, but also just to provide all that continuous support. And this is the sad thing is that the... so housing for New Zealanders is one of our primary infrastructural needs yet it's not treated like that.

We talk to the Department of Building & Housing, Maurice Williamson, who says, "Infrastructure it's roads and rail and pipes and wires." And you go, "Well if you don't have houses you don't have roads and..."

Q: You don't...

A: You don't have all that infra...

Q: Exactly, one comes before the other.

A: Yes that's right. So you populate an area, you have industry and then you have infrastructure that supports that and if it is roads and rail and pipes and wires that's fine. But the building of either residential or commercial buildings is one of the most fundamental infrastructural requirements for our country.

Q: Exactly.

A: And they just don't invest in it sufficiently as a Government that is investing in it.

Q: So what other areas of improvement would you suggest generally within the [36.16] industry?

A: Well we've sort of traversed most of them, it's that fidelity, warranty system; a real focus on improving standards across the board; consumer education and everything flows from that really. And one of the things that we have pushed for too is to have criminal penalties under the Building Act. You know there to be consequences for these people.

Q: Exactly.

A: And so if you have commercial consequences because they can't get insured, you should also have criminal consequences for the gross negligence that causes people to suffer loss.

Q: Lack of care, yeah.

A: Yeah. Yeah and we see, you look at the; I think one of the things that we need to get rid of is the 10 year limitation under the Building Act. That's a perverse incentive to quality because we have one builder who gave us a middle finger, you know forgive me, but you know he's saying, "All I have to do is build a house that lasts 10 years and one day."

Q: And that's it?

A: And that's it. And so that's the sort of temporary mentality we have in the building industry. No care; a lack of competency and all they have to do is make it look good. My own house had failed; covered memos from the Developer saying, "Oh make it look like a \$500,000 house but cut costs where you can." Well the end result was a failed building.

And so the 10 year limitation, all those other things are great and a really good start, but the 10 year limitation is one of the most...

Q: Significant...

A: ...significant changes. And that happened in Canada they pushed it out to 25 years. The building industry again choked but then they go, "Well if we build it right and it doesn't fail we won't be liable."

Q: Of course we have similar problem with what is happening in Canada too...

A: Yes.

Q: ...with the water tightness programme.

A: Yeah. Yeah and they've lived it and they now realize, in fact we've become very good friends with a number of Canadians 'cause a lot of them have come down and we've shared information and we have an understanding of how they work. It's what we do; I'm an Airline Pilot, that's my primary employment, that's what we do in the airline industry.

We spend a lot of money on getting it right because we know the consequences of failure of huge. Not only in human life, but also brand reputation.

Q: Exactly.

A: And every time, and it really angers me, every time a significant court case gets decided you'll see Lawyers write opinions and they'll write it in the Building Magazines. "Oh you better check your insurances and talk to your Lawyer about Family Trust." That's all about evading their responsibility and I've written to many of those lawyers and say, "The best piece of advice you could give to any of your clients is to actually get it right the first time."

Q: Exactly.

A: That's how they can avoid liability. Don't tell them about how to structure things so they can avoid it because they just have to get it right.

Q: Thank you John. Just to wrap it up. For example, I'm a new homeowner wanting to buy a house.

A: Mm hm.

Q: Which area do you think you can support me, what can you do for me?

A: We provide assistance to the limits of our resources to help you step through the process so that you take control. You have sufficient understanding the processes. We help build in special conditions to contracts; we have builders on staff who go and look at properties; we can introduce other experts along the way as well as required. And so that you feel protected but empowered in that process. That's what we're about.

So we don't step over in front of you, we walk on your shoulder and we help you go through the process. So we would ultimately like to be funded to the point where we can provide you with your own owner's representative and so it's a support service that we provide in a very limited way at the moment, 'cause it is a matter of funding.

Q: Yeah, do you charge?

A: Do we charge?

Q: Yeah.

A: No we don't like to, but sometimes we have to. It depends on the level of support that's required. But in a model where people would join up and become a member of HOBANZ and access those services we sort of think that it's appropriate to be charging a small fee for those services because we've got other opportunities to generate revenue which can help subsidize that sort of thing. So we're busy trying to develop those opportunities so as we can actually be a self-sustaining organization financially.

Q: I think it's a good idea because it will create some awareness for new homeowners. At least they will know what they are going into.

A: Yes.

Q: Yeah because I remember when we brought our own home we didn't know much. Even though I'm a Civil Engineer, but we didn't know much about it. What we did was we drove around and look at houses that has been completed, look at the ones that are still under construction and the ones that are yet to even tick off. And we just settle down on the one we saw. We didn't even care to look at the status of the builder...

A: Mm hm.

Q: ...and we just went into it and it was a few months after we start noticing some problems and we couldn't get the developer back to fix the problem.

A: No, no and that's the difficulty. That process where; we see a lot of new immigrants getting caught badly.

- Q: Exactly because if I knew something, an organization like HOBANZ is in existence we might probably have gone through.
- A: Yes, yeah.
- Q: Just to seek advice and we will know what we are going into.
- A: Yeah.
- Q: On the [42.54] process itself, yeah.
- A: Yes. And we provide sort of comparative market analysis for getting your head around the pricing, how much you pay for a house and yeah we would be really love to have a package and as I said, it's just a matter of resourcing and so we've got these other things. In fact I'm meeting with some people from AUT about doing some stuff. We want this whole building inspection system that we're trying to design we need Building Surveyors, so now we can create employment for Building Surveyors. So we wanted is an adjunct to an engineering degree. So you can do a Building Surveying Course and so that that will fuel us because our only limitation at the moment is competent people.
- Q: Yeah, yeah, yeah.
- A: So we want tertiary educated people with some practical hands-on experience as well to come in and fill that role. And it's an expansive role in terms of what we're looking at in terms of Building Surveying. It's all about energy efficiency and quality of homes in terms of their design and sustainability, all that sort of stuff as well.
- Q: Yeah and as part of what we're looking into too, one of our recommendations is to see whether it would be possible to have a Pre-purchase Inspection. In that case you're creating job for the Building Surveyors.
- A: Yes.
- Q: And if you can have a stream in the University that can train students on that aspect that will be beautiful because I think there's nothing at the moment in terms of a practical stream for Building Surveyors.
- A: No and I think the Universities have looked at it but there was no employment for them. So what...
- Q: Yeah, yeah, there's no outlet for them.
- A: So what we're saying is actually we're going to create employment opportunities throughout the country for Building Surveyors and it's an exclusive job really in terms of us creating a system which goes nationwide that allows people to acquire these building reports. But we need this pool of qualified people to do it.
- Q: Absolutely, absolutely, yeah. Well thank you so much John for your time.

A: That's all right, you're very welcome. I'll look forward to seeing the paper.

Q: Yeah, yeah definitely, definitely. When I finish I will send a copy to you.

A: Yes that would be lovely. But any questions you have; you know you'll go away and listen to that again, if you have any more just send them through.

Q: Okay I will, I will definitely do.

A: So where are you from originally?

Q: Nigeria.

[End of recording 45.36]

**Interview Transcript**

**20 April 2012**

Q. Productivity dynamic related to QM. Where do you see the future likely to go in terms of how you see

A. Apprenticeship through the trades, Worked in industry, Residential and Commercial management. Contractor. 10.5years with Signature Homes. Ran own business for 10yrs.

This is the franchisor, with many franchisee. Every franchisee is an independent business that purchases the right to . Role is to manage franchisee on the way they do business, train and recruit team members for their businesses. Tender for contracts e.g. Government colleges (over 100 schools for the ministry of education. Currently working on 2 colleges.

Built a 5 star rated new school. Also includes a resort that looks like boats in the North Shore. Taibo resorts and other resorts. Up till the dollar change, business was okay but

Supporting franchisee

We set up our own estimating and accounting work based system which was custom made for them in NZ, The old system was not helpful and difficult to understand what was going on in other operational areas.

Q. What sort of process do you deal with in terms of monitoring quality?

A. Firstly everything is done using the web-based system, basically we have a process, from start to finish of a project. From first phone call to the end of maintenance. We have a work flow system for single storey, The process includes checks along the way that PM use. For each project there is an online maintenance register used in advance of project handover. Basically the PM can log an issue. Obviously on-site without

internet you cannot use the system but there is a quality management booklet which the PM can use. Information keyed into the booklet is transferred to the work flow system. Only for major issues, minor issues are dealt with on phone. The way the business works, very little call backs after handover because they would not handover a house if the client is not happy. We put the client up in accommodation and so they have to pay in full at handover, clients will not pay in full when they are not happy. We will not get the money. In the situations when client is dissatisfied, we may ring the franchisee that there is an issue. We force the franchisee to deal with the issue and get it right before the client goes on. Most of the defects are minor for example painting, door locks.

Q. Is there a walk-around inspection

A. We don't retain an external inspector, inspection is by our PMs. In the last 10 years only being a handful of project that we used external inspectors, where there has been a delay. Our inspection are at the key audit stages of the project. The PM goes around (visual inspection) with the client with the check book with a checklist and if there is a problem will issue a site notice to the contractors. Site instruction if they are not there. Snagging as they go along. The process picks up the issues. But the way we work that the relationship with the subbies potentially we reach supplier agreements with them, so we agree on rates and the warranties that have to be provided by the contractors and if there is any issue they have to deal with it in advance. It is their responsibility to meet our standards. Signature Homes have the volume of work. In advance we are requiring them to do a high quality of work and we will not pay if they don't do it right and then we complain to them. We let them know that there is an issue with their work and that is the reason for the complain. If they are not up to the standard (poorly performing) we offload them. Because we have been operating upwards of 25 years now, we pretty much know who are the good contractors. The issues we then get are very small. The business volume is about 45 bespoke homes (over 500K without land) will be handed over every year between 1<sup>st</sup> April and 31<sup>st</sup> March of the following year. We try to engage the right people to do the job.

Q. Do you give them a piece rate a year?

A. Yes, some items are quoted some are rates. So we have agreed plumbing, tiling rates etc. We have a whole list of rates. On top of that we have supplier agreements that we agree to. More than that what is the volume of work. If the PM rings to say

We are always inspecting after the work is done and really training is the issue in the industry as a whole. We got a lot of early school leavers going into the trade, poorly qualified. If you look at the Waikato, with new immigrants building spec homes. We see projects we newly arrived immigrants are the painting and stopping contractors. The industry as a whole is still quite loose as to who can do what and that is where a lot of the big quality issues come from. And even the local guys, could they be trained better? Of course they could. Even as an architect there has to be CPD. With the trades it is quite weak in his view. How to get in, how to get qualified. the value of the qualifications. What applies to residential does not apply to commercial projects. You get a license does not make you any better.

Pay rates does not reflect... in NZ. The difference between a highly skilled and a hammer hand is too small. There is no difference in the pay. Therefore, no incentive to train.

We have quite a volume of work, this is our biggest tool to getting things done right.

Q. 12-16 weeks being the build period. Do you

A. To get CCC, there are several inspections. Engineers and council don't care much about quality they are looking for compliance. If it is a rough painting job, they don't really care.

Q. 12-16 week build with series of inspections. Is that not a whole lot of inspection going on? On one quality inspection and on the other compliance inspection, plus your own inspections for such a short build time.

A. Engineers design for structural performance, carpenters have to interpret design documentations to get that right. Fundamental inspections like that have to remain. Do the trades know what needs to be done all the time? Not really. Are the

consents/compliance documents as good as they could be? They are never right. Some plan/drawings have up to 20-30 design errors. Having those checks is important. Though this may impact on productivity, possibly yes but council will not take liability for such buildings otherwise. The inspection systems have to remain. Big developers may take on such liabilities. They bond their builders and the big developers also bond councils so they can take on a lot of liability.

Q. NHBC in the UK. Basically big builders/developers, pay into an indemnity scheme which covers them for a 5-10 yrs period.

A. The insurance in NZ is not working. The MB is struggling to keep up with the problems around quality issues. Signature Homes has its own warranty scheme. Our builders are bonded to us and we have a fund. If there was a national body, it will wipe out our own warranties. I don't know if the NHBC scheme will work here in NZ. We are offering more than the MB and ours is unique.

I cannot see the MB guarantees is sustainable because at the moment they have got some many members. The members are little guys. If they price a job wrong and muck up, the MB may not be able to do much with a 3K bond when the issue requires 30K claim to be resolved. The system is not sustainable, they have too many businesses and they don't audit the businesses.

I think if there was a national scheme that may be ok. The case of the South Canterbury finance may happen where the audit system failed may well apply. Auditing a firm may not solve the problem too. For example a 1 year financial statement does not guarantee that a business will not fail. Having a cash bond requirement and a guaranteed fund with an insurance scheme may be a better way. We already have done it.

Q. What is the difference between Signature home guarantee and the one provided by the MB?

A. We require our builders to put a bond in place. Our large franchisee businesses (with >25M dollars returns f.e.). They put a bond in with our guarantee business. If there was an issue, Signature homes will step in to address the issue. MB doesn't bond their

builders, so they have nothing to fall back on. The MB is struggling at the moment. With a bond in place, the income from the bond will cover any issues.

Q. How do you keep records of significant defects?

A. It goes into the quality manual or the work based system. And a maintenance register. We notify the contractor and note when the rectification was done. Generally it is a phone call and it gets dealt with.

Q. How do you monitor the types of the defects?

A. We do not monitor the defects that occur in each of the businesses. Rather we survey our clients for the quality of the service. At completion we send out a survey and if there are issues we contact the builder in charge. We don't have a lot of issues though. Clients don't pay until all that needs to be done is done. Issues with clients are two fold. One is with the dissatisfaction with sales, with the salesmen (conflict with regards specifications). The other issue is that of minor defects e.g paints. When there are issues at handover, they are mostly minor. To my knowledge we don't have any leaky home claims. We are not architects trying to make a statement. We meet with clients not needing architects because of they have seen our show homes which they like. A lot of our buildings were built after the leaky building era. We have been building more conserve building types.

Q. Do you do any architecture type buildings?

A. Mostly homes are custom built in Auckland. Depends on the territory. We have standard plans.

Q. Poor workmanship is not an issue because you have long term relationships and the volume of potential work keeps them in line etc.

A. The recession also keeps them in check, with fewer jobs and large number of builders, quality seems to be on a high. There tends to be specialization as we use a lot more builders on a job.

There is a fundamental flaw in the training of trades in NZ. Licensed contractors abound in the residential building sector. There is more of unskilled in residential than in commercial building sector. Is it to say the residential sector is any less skillful?

Q.

A. Often in the sales process we bring the QM book out. We talk about the sort of QM systems in place and the guarantees with the client.

Q. Inspection follows progress. What do you feel about the council inspections?

A. Some are good. Our process is such that there are few issues and so we are able to build a good relationship with council inspectors.

A. Spending more time with PMs to help improve performance and ensure everyone is up. We have a structured order process. We meet our franchisees every month and discuss through issues. If they are not getting good satisfaction result, this are discussed with them.

On commercial contracts, there is a different protocol.

Q. What do you think about the use of external building inspectors?

A. I think it is a bad idea because they have their own agenda, which is to create work for themselves. On a commercial contract e.g. schools. There are independent Q.S consultants and quality inspectors who are paid by them. If you bring that in to the residential sector, who will pay for it? The margin on a 250K home is about 20K and so where will the external inspection fee come from. There is some kind of self regulation system whereby bad contractors end up not getting jobs on the long run.

High end architectural projects will most likely use inspectors to ensure compliance.

Better products don't guarantee performance or make performance better.

Q.

A. If you want to increase productivity in construction, there has to be an increase in the volume of construction work to be able to do that. The boom bust cycle in NZ does not help productivity so much.

Q. Does it make any difference if the time of construction is increased?

A. Not really, the volume of work does not help to create any change in productivity at all . In America they are able to be more productive because they could schedule works e.g. concrete slabs to be laid on Monday and something else another day. They are able to do this (sequence) because of the mass of work they have.

Q. Could you do houses better?

A. The newer systems are not very popular. For example kitset buildings produced by Lockwood homes is not being patronized, demand is low.

Q. Where do you see? What sort of new techniques do you see for the future which could be a game changer in the residential construction sector?

A. Not really, will there be a significant change in techniques. It may be more of the same. Except there is a new product system e.g. walling frames etc. People don't trust it then they won't like it. I don't think there will be a system that can significantly be referred to as a breakthrough.

Again some of the new systems introduced recently may not have had good business models to be able to sell the products. Some of the manufacturers of new systems also produce other things so without a sustainable demand they end up concentrating on the products that sell.

'Actionsteps' is a product which has a good business model and has been able to market the web based system worldwide.

Q. When is the client satisfaction survey done?

A. Client survey is done immediately the building is possessed. It is an early indicator for our business. If the building is not sold immediately, the survey may pick up on why this is so? Sometimes the surveys don't pick up all the bad stuff because people tend not to complain much. (That is a kiwi thing, when they go out to lunch they don't complain when the service is bad. Rather they will not go there next time). The incentive for the franchisees is to get it right as it will affect their sales volume. The survey report is one criterion for selecting the Signature home franchisee business of the year.

TSW?

Q.

A. Hamilton house building scenario. Too many businesses involved in building production. Margin is low and thus quality may suffer.

It is too easy to start off construction business, which invariably affects quality. The licensing scheme is not much of the problem but the start up of firms/contractors/builders etc.

There has to be a key change in the immigration policy. The population demographics are also not helping out. It may be healthy for building in Auckland but not in other cities. There has to be positive growth rather than the net migration being experienced now.

The percentage of fund invested in the country has to be improved upon. Most of the building products are imported and not produced locally. The building construction industry needs to increase its product delivery to be able to help the economy grow more. Currently its involvement in building production using imported products does not help the economy much.

The Australian economy is a big drain on NZ human resource.

The web based system drives a sequential way of doing things. It may not necessarily drive productivity but provides an action step which allows a whole of business to follow every project/franchisees performance etc.

The system might be proposed for building consent process wherein every consent application is administered on the web. It may ensure consistency in the consent process and reduce variability in the consent requirements experienced by builders now.

# THE UK SNAGGING PROCESS – A BENCHMARK FOR RESIDENTIAL CONSTRUCTION

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The residential construction sector is under pressure to meet an ever increasing customer expectation of quality improvement on their development projects. But not all completed residential projects turn out on a clean slate and these have become a source of concern to homeowners and approving authorities. Recent study provides evidence that a significant percentage of new homeowners call back their developers to rectify snags and latent defects. Therefore this paper is undertaken to provide a benchmark for the implementation of a snagging process similar to the UK for the residential sector in New Zealand. The methodology adopted is a meta-study of published literature relating to snagging practice in the UK. This is compared with existing building inspection practice in New Zealand and improvement areas systematically identified. It is hoped that the study would benefit the entire construction industry by serving as improvements to quality performance in residential construction in New Zealand.

*Keywords:* Benchmarking, UK, New Zealand, Residential construction sector, Snagging process.

## 1. Introduction

The construction industry is an important bellwether and stimulus for the New Zealand economy, as it contributes about 5% of total Gross Domestic Products (GDP) (Alan *et al.*, 2008). The sector has significant social and economic relevance, since it generates employment, induces development in other economic sectors through the multiple effects of investment in buildings (Pedro *et al.*, 2008). The residential housing sector is one of three distinct sub-systems in the New Zealand construction industry. In a typical year, residential housing construction accounts for approximately 24,000 new builds and 32,000 renovations to existing homes (Building and Construction Sector Productivity Taskforce, 2009). This places residential housing centrally in any economy and an important sector in every national development plan. The relevance of the residential housing sector therefore means that any performance improvement of the sector will translate to benefits to the general economy. Therefore the current

paper focuses on the need to reduce snags and latent defects in residential buildings as a way of improving quality performance of building developers and in consequence productivity of the sector. There is little doubt that proper quality management systems within construction organisations and their productivity are positively related (Page, 2010).

'Snags' and 'snagging' is gradually becoming terms used in construction environments outside the UK construction industry which was the origin of this terminology. Snagging items are quality failure items that are identified near the completion stage of a construction project by an individual who could be termed as 'the snag identifier', while the process of identifying and rectifying these quality failures is known as snagging or building inspection (Sommerville *et al.*, 2004). Snagging describes the process of checking for faults or defects in a property and correcting them before the property is handed over to a new owner. 'Snagging' problems in this context are items of work that still require

# IDENTIFYING COMMON DEFECTS IN NEW RESIDENTIAL BUILDINGS: A NEW ZEALAND STUDY

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## ABSTRACT

Improved quality performance within the residential sector has been an issue of concern for both government and building approval authorities in New Zealand. As a result, the quality of new residential buildings has come under scrutiny, particularly the nature of the defects occurring in new homes at handover. Therefore the objective of this study is to compile common defects identified by new homeowners in new residential buildings in New Zealand with a view to improving quality achievement levels. A questionnaire survey approach was employed to administer mail questionnaires to new homeowners in five major regions in New Zealand. A list of common defects was included in the questionnaire with research participants required to indicate the defects that they observed at the time they took possession of their properties. The analysis of data from 216 respondents is presented as part of a larger study being undertaken in New Zealand that seeks means of improving quality achievement levels in new residential buildings in the housing sector. It is hoped that the result of this research will help the residential construction industry to establish more aggressive and proactive measures of monitoring its final product to the satisfaction of new homeowners.

Keywords: defects, homeowners, New Zealand, quality, Residential buildings,

## INTRODUCTION

The residential building sector forms an essential part of the New Zealand economy. The sector alone has a total market value of between NZ\$450 and NZ\$500 billion making it the largest asset class in New Zealand (DTZ New Zealand, 2004)). More recently (in March 2012) there is indication that the value of residential buildings has picked up since the recession, with the value of residential building consents rising by 30% compared with March 2011. This current spike is the highest value of residential building consents recorded since September 2008 (Bascand, 2012). This increase in the number of residential buildings will mean that more proactive measures are required to monitor the quality of the final product in a way that it meets project owners' needs. Recognising also that home ownership means so much to New Zealanders and settlers, good quality homes will mean high satisfaction levels with

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# STAGE BUILDING INSPECTION: A POSSIBLE SOLUTION TO BUILDING FAILURES IN NIGERIA

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Building quality failures have become rampant in Nigeria, with the worst cases resulting in collapse of buildings and loss of lives. Several studies have attributed quality failures to a myriad of factors some of which are traceable to insufficient/lack of quality inspection during construction. Stage inspections are a common feature of most developed countries, which ensure that building works comply with consent documents issued by approving authorities. The more the checks and inspection on building performance, the more probable the final build will meet the required quality standards. Thus the primary objective of this paper is to suggest stage inspection during construction by approving authorities, as a feasible solution to building failures in Nigeria. Literature review methodology is used to discuss building inspection regimes operable in different developed countries. This is with a view for the Nigerian building construction industry to consider stage inspection as a mandatory process during building production. It is hoped that the findings of this paper will benefit property owners, building occupants and the overall construction industry through improved quality achievement levels. Stage inspections may guarantee peace of mind and confidence that buildings will eventually attain desired levels of performance because the culture of building it right first time would have been imbibed.

Keywords: building failures, construction industry, Nigeria, stage building inspection

## INTRODUCTION

House building is significant to the national development plan of every country. This is because the sector plays a crucial role in economic performance and prosperity. For example the construction industry contributes more than 50% of gross fixed capital budget in Nigeria (Wase, 2004). In New Zealand, the industry contributes about 5% of Gross Domestic Product (Building and Construction Sector Productivity Taskforce, 2009), while the residential output accounts for a total market value of between NZ\$450 and NZ\$500 billion making it the largest asset class in New Zealand (DTZ New Zealand, 2004). The house building sector has witnessed increasing quality failures which sometimes result in building collapse and their impacts have been found to be negative on economic growth and invariably on the sustainable development of the built environment (Windapo, 2006). Therefore, because of the significance of the house buildings sector and how it supports the economy of many countries, it is necessary to improve on its quality performance levels through innovative approaches (Sommerville & Craig, 2006). Achieving this quality objective in house building projects depend on the content of the original design and

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# Improved snag reporting in new residential buildings in New Zealand

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## Abstract:

Snagging is common practice for new and existing buildings in the housing sector in the UK. However the snag reporting process is yet to be fully developed in New Zealand. Whilst inspections for defects and repairs are mostly carried out for old and existing residential buildings, very little is being done to capture snags in new builds in New Zealand. This paper reports on research which is being undertaken in New Zealand to investigate the magnitude of the snagging problem and to identify means by which snag reporting can be introduced within the house building production process. The primary source of data will be the record of defects collected from well established developers and building inspectors and a semi-structured questionnaire administered to new homeowners. The results from the data analyses will be validated through a verification exercise involving subject matter experts. It is hoped that the result of the research investigations will be beneficial to homeowners, developers and the wider construction industry in New Zealand and thus serve to improve quality performance in residential housing construction.

## Keywords:

defects, New Zealand, quality, residential building snagging

## 1 Introduction

Quality and its achievement continue to generate interest in the building sector and the wider construction industry. This is because the building and construction sector is crucial for economic performance and prosperity. The housing sector is one of the most important sectors in the national development agenda of every country (Mohd and Buang, 2010). In New Zealand, the sector contributes 5% of Gross Domestic Product (Building and Construction Sector Productivity Taskforce, 2009). The residential property sector alone has a total market value of between NZ\$450 and NZ\$500 billion making it the largest asset class in New Zealand (DTZ New Zealand, 2004). Because of the importance of the residential sector and how it supports the economy, the current study is motivated by the belief that improving quality achievement levels in new residential buildings will impact positively on the performance of the overall construction sector. This study hopes to improve quality performance by first capturing the magnitude of snags that occur before or after handover of new buildings and the effect it has on new homeowners. Then an investigation will follow to determine the potential for introducing snag reporting into the New Zealand building production and house buying process.

Snagging items are quality failure items that are identified near the completion stage of a construction project by an individual who could be termed as ‘the snag identifier’, while the process of identifying and rectifying these quality failures is known as snagging (building inspection) (Sommerville, Craig, and Bowden, 2004). Snagging is a modern term for a quality failure which is

# OPPORTUNITIES FOR DEFECT REPORTING IN NEW RESIDENTIAL BUILDINGS: A CASE FOR NEW ZEALAND

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When new homes are purchased, homeowners expect their new homes to be problem free until such a time that normal wear and tear begins to occur. Unfortunately this is not generally the case, since the majority of new build homes have been found to contain significant numbers of defects. The quality of finished construction products is therefore a main issue for concern to developers, approving authorities, end-users and the construction industry at large. Survey data obtained from recent home purchasers/owners is presented as part of a preliminary investigation into developers' quality performance in New Zealand. The intent is to show that opportunities exist for snagging/defect reporting that will act as a mechanism to measure performance and thus improve the quality of finished construction products in New Zealand. This research is exploratory in nature and uses simple descriptive and interpretive analyses. The study concludes that there are benefits to defect reporting in new build homes in New Zealand which could be embraced as part of a wider best practice initiative. Defect reporting in residential properties before or after handover will enable developers to rectify potential defects before they become burdens for homeowners. Ultimately this research aims to increase the confidence that new homeowners can have in their developers and the quality of their new homes.

Keywords: defects, homeowners, new homes, snagging.

## INTRODUCTION

The housing sector is one of the most important sectors in the national development plan of every country. For example in New Zealand, about 59% of the total building consents issued for the month of April 2011 was for residential buildings (Bascand, 2011). The residential sector is under pressure to meet an ever increasing customer expectation of quality improvement and innovation on every development project. Innovative quality management approaches are therefore a necessity for homebuilders (Sommerville *et al.*, 2006), and one such approach is to develop quality management processes that will identify defects in constructed items before or after a new building is handed over to the end user. Once these defects are identified, rectification work can then be carried out to the end-users' satisfaction.

Snagging items are quality failure items that are identified near the completion stage of a construction project by what could be termed as 'the snag identifier', while the process of identifying and rectifying these quality failures is known as snagging (Sommerville *et al.*, 2004). Snagging is a modern term for a quality failure which is not commonly used within the New Zealand construction environment. For the

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# LEVEL OF CUSTOMER SATISFACTION ON QUALITY ACHIEVEMENT IN NEW RESIDENTIAL BUILDINGS IN NEW ZEALAND – AN EXPLORATORY STUDY

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## ABSTRACT

*The overall aim in any house building project is to design and construct to meet the specific requirements of the Client/Homeowner, at optimal quality. Quality in construction depends on the content of the original design and specifications, and the level of workmanship and conformity to the design requirements during construction work. However house builders rarely achieve sturdily built houses that are fit for their intended purpose. New residential buildings are normally susceptible to quality defects, often leaving home owners unhappy with their purchase.*

*The paper investigates the level of homeowner satisfaction with quality achievement in new residential buildings in New Zealand. A survey data is obtained from recent homeowners, as part of a preliminary investigation. The intent is to provide information that will improve the level of homeowners' satisfaction by improving the quality of finished new buildings in New Zealand. The paper presents this exploratory study using simple descriptive and interpretive analyses.*

*The paper concludes that the measure of quality achievement lies on the perception of the end-user. Homeowners want a product that is defect free and worth the utmost value for their investment. Therefore house builders need to recognise that meeting customer requirement will give competitive advantage in today's competitive market environment. Ultimately the house builders will redeem their image through improved quality of products and services they deliver.*

**Keywords:** Home Owner Satisfaction, New Zealand, Quality Achievement, Residential Buildings.

## 1. INTRODUCTION

The overall aim in any house building project is to design and construct to meet the specific requirements of a client or homeowner at optimal quality. Achieving this quality objective in construction projects depend on the content of the original design and specifications, and the level of workmanship and conformity to the design requirements during construction work. Studies have shown that quality failures and non-performance is common and the completed products unfit for their intended purposes (Sommerville and McCosh, 2006). New residential buildings are normally susceptible to quality defects, often leaving home owners unhappy with their purchase (Craig, 2008). Some have questioned the quality of the end product, with the wider question being: are builders up to it (Gamble and Corbett, 2001)?

The vulnerability of new residential buildings means that home owners have to bear the burden of snags and latent defects sometime without any recourse to developer warranties. Housing investment is one of the most important decisions of most homes. For example, to purchase a home has always been at the heart of the New Zealand dream. When these new homes are purchased, owners expect that the buildings would be problem free until such a time that normal wear and tear begin to occur. According to Leishman *et al.* (2004 cited Sommerville *et al.*, 2006) new home buyers are attracted to their homes primarily because of the quality or newness of the property. Though this is not often the case as defect-free new homes are hard to find.

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**Table 1: Coding criteria with explanation of particular code.**

| Code   | Technical quality (TQ), functional quality (FQ) or omission | Description of potential item                                            | Example                                            |
|--------|-------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| Code 1 | FQ                                                          | FQ items basic in nature                                                 | Damaged corner of a kitchen worktop                |
| Code 2 | TQ                                                          | Items of a technical nature which could be aesthetic                     | Floors creak due to not being fixed down correctly |
| Code 3 | TQ                                                          | Items of a technical nature which often breach regulations               | No frosted glass on the en-suite skylight          |
| Code 4 | TQ                                                          | Items of a technical nature and an omission that affect home performance | No jacket to tank in airing cupboard               |
| Code 5 | Omission                                                    | Something simply not there (may be coded under codes 4/6)                |                                                    |
| Code 6 | FQ                                                          | An omission item that is also visual but does not affect performance     |                                                    |
| Code 7 | FQ/TQ/Omission                                              | A combination of all codes                                               |                                                    |

the responsibility may sit with the numerous buyers who accepted products with lower than anticipated quality standards.

### New Zealand focus

So, where to next with this research? As part of the BRANZ funded collaborative Construction Industry Productivity Research Programme, this research is being replicated in the New Zealand context through a PhD research project at AUT University in Auckland (see below). It is hoped that the findings of the New Zealand research are somewhat more positive in terms of customer satisfaction and the affect that snagging has on the new home buyer. ◀

# EVALUATING SNAGS IN NEW ZEALAND

**Owners expect new homes to be problem free, at least until normal wear and tear begins to occur. However, this is often not the case and defect-free new homes are hard to find.**

By **Funmilayo Rotimi**, PhD Scholar, Construction Management, AUT University, Auckland

**S**nags and defects are common in most construction industries, but they can have dire consequences on construction project stakeholders and end users. New Zealand is no exception – its worst cases of quality failure have manifested as leaky buildings from weathertightness problems. A report prepared by Pricewaterhousecooper in 2009 *Weathertightness – Estimating the cost* concludes that between 22,000 and 89,000 dwellings are affected, with a consensus forecast of 42,000 failures. The repair cost for the consensus forecast is said to be \$11.3 billion (2008). New residential buildings are particularly vulnerable with homeowners having to bear the burden of snags and latent defects without any recourse to developer warranties.

Although extensive research has been carried out on the weathertightness problem in New Zealand, no research has focused on snags and defects that occur before or after handover of new residential buildings.

### Improving quality through research

A doctoral research study asks the question – how can snags and defects be minimised so

that the quality of new residential buildings is enhanced in New Zealand? The aim of the research is to improve quality achievement levels in new residential building projects by minimising the number of snags and defects that occur before and after handover of building projects in New Zealand.

The study will establish the current performance of the building sector and suggest ways to improve the quality of new builds in New Zealand. It covers snags and defects in new residential houses in the main urban areas, including Auckland, Hamilton, Wellington, Christchurch and Dunedin. Data will be collected from a wide range of construction stakeholders, including developers, homeowners and building inspectors.

The root causes and effects of snags will be examined so that remedies can be suggested by the research. The intention is to develop systems that can operate after this work is completed and to provide an ongoing benchmark for future development.

The research project is being carried out with BRANZ sponsorship. It complements other BRANZ initiatives on quality improvement and

productivity in the construction industry.

### Benefits to New Zealand

The research will capture the magnitude of snags and defects and show that opportunities exist for snagging new properties in New Zealand. Snagging properties for defects before or after handover enables developers to rectify potential snags before they become burdens for homeowners. Homeowners want completed products that are defect-free and provide the utmost value for their investment. Developers should make this a performance criterion and should view meeting customer requirements as a way of gaining a competitive advantage.

Ultimately there would be increased confidence of developers by new homeowners on the quality of their new homes. If new builds are to stand the test of time, it is important that the production process does it once and does it right. ◀