

**CAUSES, EFFECTS AND IMPACT OF SHORTAGES OF SKILLED ARTISANS ON  
CONTRACTOR PRODUCTIVITY**

**A dissertation submitted to the Department of Construction Management  
and Quantity Surveying, Faculty of Engineering  
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in fulfilment of the requirements for the degree of Master of Technology  
Construction Management**

**By**

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## DECLARATION

I, Sisa Mbeki, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards a qualification elsewhere. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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**Signed**

.....

**Date**

## **ABSTRACT**

This study investigated the causes and impact of the effects of shortages of skilled artisans on contractor productivity. The objectives of the study were as follows: (i) to identify causes of shortages of skills during the construction production phases; (ii) to define the effects of shortages of skills during the production phase of a project; (iii) to examine how to deal with shortages of skills when they happen; (iv) to determine ways in which the shortage of skills may be reduced; (v) to determine whether shortages of skills cause poor contractor performance.

The study was inspired by many international and local studies demonstrating a lack of concern for the impact of shortages of skilled artisans on project performance, and their effects on project time. The research method adopted for study was a survey of construction sites and staff within the NMC group in the Cape Peninsula metropolitan area of the Western Cape Province. The study collected data from 65 participants from 10 different NMC sites. The participants in the survey included Project managers, site managers, quantity surveyors and artisans on sites. The findings of the study revealed that there is lack of formal training of artisans; performance of artisans is not highly regarded and there is lack of motivation, these factors contribute to the shortages of skilled artisans. It is also evident that shortage of skills causes' poor contractor performance and leads to poor quality of work. The researchers also found that, setting out errors occur due to lack of coordination between the main contractor and subcontractors and the lack of skills on the part of the artisans. In addition, inexperience on the side of the leading hand and / or supervisor and trades foremen and their inability to interpret the drawings contributed to rework during construction phase. A reason also given for shortage of artisans is that young people are afraid to get their hands dirty. Young people would rather work with computers than for engineering and its associated professions. It is recommended that to increase the supply of artisans some measures will have to be implemented to encourage young people to become artisans.

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## DEFINITION OF TERMS

**Delay** : according to Oxford dictionary (2010), a delay is a period of time when something has to wait because of a problem that makes something to slow down or later slow down.

**Contractor:** a person or company that has a contract to do work or provide goods or services for another company.

**Factors:** one of several things that cause or influence something.

**Omissions errors:** can be defined as failures to follow due procedure when undertaking a task (Wills & Willis, 1996).

**Rework:** is defined as the unnecessary effort of redoing an activity that was inaccurately done the first time (Love, 2002).

**Value-adding:** is to change the form, fit, or function of a product in order to satisfy the customer (Allen, 2000).

**Errors:** are unintentional deviations from correct and acceptable practice, and therefore, are avoidable (Kaminetzky, 1991).

**Causes:** according to Oxford learner's Dictionary (2010), a cause is the person or a thing that makes something to happen.

**Effects:** according to Oxford Learner's Dictionary (2010), an effect is the change that somebody or something causes to something or somebody else.

**Shortage:** Skill shortage will be defined generally as meaning shortages that exist when employers are unable to fill or have considerable difficulty in filling vacancies for an occupation, or specialized skill needs within that occupation, at current levels of remuneration and conditions of employment, and reasonably accessible location (DEST, 2002).

**Skill:** In the report on the Skills Development Strategy for Economic and Employment Growth in South Africa (2001), skill is defined as applied competence. Applied competence is the overarching term for three kinds of competence.

## LIST OF ABBREVIATIONS

CPUT	:	Cape Peninsula University of Technology
SA	:	South Africa
SPSS	:	Statistical Package for Social Science
SAICE	:	South African Institute of Civil Engineering
AACE	:	American Association of Cost Engineers
NPHE	:	National Plan for Higher Education
JIT	:	Just in Time
FET	:	Further Education and Training
JIPSA	:	Joint Initiative on Priority Skills Acquisition
ASGISA	:	Accelerated and Shared Growth Initiative for South Africa
EPWP	:	Expanded Public Works Programme

# CHAPTER ONE

## INTRODUCTION

### 1.1 Introduction

According to Grawitzky (2006), the launching of the Joint Initiative on Priority Skills Acquisition (JIPSA), a key component of Accelerated and Shared Growth Initiative for South Africa (ASGISA) reflects the failure at various levels to drive the government's national skills improvement plan and ensure coordination between demand and supply of skills in the economy. However, since their establishment, SETA'S have been marred by claims of non-delivery and mismanagement. Criticism and scepticism about their ability to deliver increased in early 2006, at the time of the introduction of government's Accelerated and Shared Growth Initiative for South Africa (ASGISA), which identified the skills shortage as the most pressing constraint on the economy and biggest impediment to achieving 6 percent growth.

In a report prepared by the University of Cape Town's Development Policy Research Unit for JIPSA, in May 2007, Daniels (2007) highlights government's own shortcoming in having defined skills shortages without taking into account their relationship to productivity in the firm. It was noted that this has resulted in disputes between government departments (e.g., Department of Labour, Department of Home Affairs, etc.) over the precise numbers of occupational skills shortages. This particular shortcoming could also be a factor in the apparent slow response by industry to the skills shortage problem.

Shah and Burke (2003) declare that the inadequacy of a shared understanding of what 'skill' truly means can make it difficult to describe skill and can obscure identification of challenges, their causes and promising solutions. The Concise Oxford Dictionary (1995) defines skill as "expertness, exercised ability, capability in an action; dexterity or tact". A literature review reveals that according to some researchers, the significance of skill would differ with the context in which it is used.

Shah and Burke (2003) “define skill as an ability to perform a productive task at a certain level of competence. As a skill is related to a particular task, a person who does not possess such a skill is unlikely to be able to perform this task or will be less productive than a person who possesses this skill. Skills are normally associated with a qualification and its achievement through formal education and training”. According to Australia’s Department of Employment and Workplace Relations (DEWR) (2005) “the term skill, when applied to individuals, usually denotes knowledge or ability, both of which are more or less acquired by people through education, training and experience at work. However, skill may also refer to the requirements of a job, in which case it is best viewed as a property of the task rather than the individual. When applied to occupations, skill often denotes prestige or social status, which may be loosely associated with practitioners’ abilities or the tasks they perform. The skills are the ability that an employee possesses to perform a certain task that an employee is entrusted with”.

In a survey conducted amongst members of the South African Property Owners Association (SAPOA) to explore the client’s awareness relative to contractors’ performance, Smallwood (Smallwood, 2000) established the main challenges to be rework, poor productivity and poor quality of work. Smallwood (2000) determined that the causes of poor contractor performance, as perceived by clients, were a lack of concern for the environment, late information, and poor supervision of the design activities, inadequacies or poor planning, poor managing and low skills level amongst the workers. Other writers (Lobelo, 1996, Allens, 1994; Henry, 1994) firmly agree with Smallwood’s investigation. Furthermore, researchers determined problems to be cost overruns, rework, and late completion, and excessively high accident rate, insensitivity to environmental considerations, poor work practices and adversarial relationships. A collective thread running through all these cases is the failure of many contractors to fully understand the meaning of some key construction problems that extremely affects contractor performance, such as combination of the design and construction process, as well as the quality administration process (Smallwood, 2000).

In construction, delays could be well-defined as the time overrun either beyond completion date stated in a contract, or past the date that the parties decided upon for delivery of a project. It is a project slipping over its intended schedule and is considered as a common problem in construction projects.

Burati, Farrington and Ledbetter (1992) state that, to the client, delays mean the loss of returns and / or revenue through lack of production facilities and rent-able space or a dependence on current facilities. In some situations, to the contractor, delays mean higher overhead costs because of extended work periods, expensive material costs through inflation, and attendant due labour cost increases.

Burati, Farrington and Ledbetter (1992) reveal that the increasing competitiveness of the Construction Industry (CI) encourages companies to evaluate performance and implement effective development strategies in order to obtain competitive benefit. Therefore, focus is to be directed towards the site constructors. To raise the levels of effectiveness, contractors need to increase the use of performance valuation tools as a means of supporting performance development programmes. Contractor performance is understood to embrace construction costs, construction period, construction quality and sustainable improvement, the viewpoint being that the success of one aspect of performance should not be at the expense of another (Busby and Hughes, 2004)

From the standpoint of Lampert (1991), the major factor of contractor performance is client satisfaction. Poor contractor performance, as categorized by poor work quality and low productivity, is common in the industry. It is against this introduction that the study seeks to define the causes and effects of inadequate skills on construction projects during the construction phase, from a contractor's perspective. The determination of these factors, the causes of poor performance, and a measurement of their severity, would afford useful evidence that would allow management to act to reduce their destructive effect in advance (Civil Engineering and Building Contractor, 1998).

According to a round table discussion by NMC (2011), the causes and effects of delays during the construction period of a development, are primarily caused by poor planning, maladministration of funds, delay in making decisions and approvals by the client, the use of cheap materials, poor communication, late deliveries, contractors lack of experience, inconsistencies between architectural, structural and mechanical drawings, insufficient and unclear drawings, bad weather conditions and lack of immediately available funds for the project. The other factors that cause poor performance and delays during a construction project are inadequate subcontractor performance and diversity of the construction team.



This indicates that a smaller labour force of the contractor does not necessarily mean that the performance would be badly affected. Neither does the diversity of the labour force in terms of cultural background, tribe or business objectives tend to result in poor performance of a contractor (CIDB, 2007).

### **1.1.1 Errors**

According to Busby and Hughes (2004) and Cooper (1993) faults are often not instantly identifiable and only become visible after a period of development in the system. The effect of the errors depends on how long it has remained unnoticed.

Love, Skitmore and Earl (1998) specified that a delay caused by mistake made during the design process appears downstream in the procurement process. The Construction Industry Institute (CII) (1989) study of nine (9) large engineering construction projects establish that delays due to design error contributed an average of 79% to 85% of total delays cost.

For instance, a dimensional mistake or three-dimensional struggle contained within design documents may not arise until the project is being physically constructed on-site (Rodrigues & Williams, 1998, Rodrigues & Bowers, 1996, Cooper, 1993). According to Love, Edwards and Irani (2005) mistakes happen because of a complex range of interactions, and hence, attempting to isolate a singular contributory variable is deemed to be an unseemly strategy to undertake.

Once an understanding of the distinctive nature and underlying dynamics of errors is acquired, then mistake reduction and error containment strategies can be implemented in projects (Love, Edwards & Irani, 2008).

### **1.1.2 Changes**

Burati et al. (1992) stressed that a change is essentially a directed action that alters current established requirements. Design related delays in the form of change orders are the major source of work delays in construction projects (Abdul- Rahman, 1993; Barber, Sheath, Tomkins & Graves, 2000; Burati et al., 1992; Josephson & Hammarlund, 1999; Love, Mandal & Li, 1999b). Changes can have an effect on the aesthetics and functional aspects of the building, the scope as well as the nature of work, or its operational aspects. According to CII (1990), delays, specifically in the form of changes, can have a negative impact on productivity and project performance.

Burati et al. (1992) moreover stated that, a design-change-client, for example, would indicate that a client would initiate a change to a design of a building and therefore delays result due to a reprogramming of the work schedules.

### **1.1.3 Omissions**

According to Reason (2002) omission errors arise when the mental process of action control is subjected to strain or distraction. Reason (2000) opined that omission errors are a result of pathogens within a system that translate into error provoking conditions within a firm and project. Examples include time pressure, understaffing, fatigue, and inexperience. Failure to undertake procedural tasks during the design process (Andi and Minato, 2003a; Andi and Minato, 2003b; Busby, 2001b) and continual design reuse (Busby, 1999) are leitmotifs that emerge as practices contributing to omission errors.

The work practices implemented by organizations can provoke similar errors, regardless of the skills and experiences of the people involved in a project. A typical example is the study conducted by Love, Edwards, Irani and Walker (2009) to investigate the anatomy of omission errors in construction and resource engineering projects. It became apparent that the issue of design fees was identified by respondents in the construction sector as a factor contributing to an omission and design-related delays. Contractors and subcontractors are also susceptible to omission errors, for example, quality, safety and environmental management system constraints may not be strictly adhered to, and as a result tasks or processes may need to be delayed.

## **1.2 Back ground of the study**

There are many important causes of delay related to owner involvement, contractor performance, and the early planning and design of the project. Important causes are financial problems, changes in the design and scope, delay in making decisions and approvals by owner, difficulties in obtaining work permits, and coordination and communication problems. The other factors that cause delays are as follows: poor risk management and supervision, unforeseen site conditions, slow decision-making, client-initiated variations, and work variations (Austin, Baldwin and Newton, 1994). The research conducted among general Contractors (GCs) in South Africa by Smallwood and Rwelamila (1996) investigated among other, the causes of poor performance in terms of health and safety, productivity and quality.

The computation of an overall average percentage for each aspect enabled the aspects to be ranked. Inadequate training was ranked first, followed by lack of management expertise, worker participation, quality management systems (QMSs) and improvement processes. Tam and Harris (1996) cite, among other, equipment, and quality of management team as factors that affect the performance of contractors. However, according to the Department of Public Works (DPW) (1999), international precedents indicate that many of the difficulties associated with the aforementioned issues arise at the design stage.

The current tender adjudication practice by the public sector and most clients in South Africa places undue emphasis on price at the expense of overall value for money. This has compelled sectors of the construction industry to seek immediate cost savings to remain competitive with little regard for long-term consequences among other, inadequately trained workers with resultant consequences for industry. The DPW (1999) further maintains that the promotion of health and safety, productivity, quality and environmental protection and the enhancement of contractor performance in South Africa will be difficult as long as the division between design and construction persists.

Busby and Hughes (2004) indicate that influencing factors on many projects in the construction industry are caused by the fact that cost overruns occur more frequently and a more severe problem than time overruns. They pointed out that the major factors influencing cost overruns are material cost increases due to inflation, inaccurate material estimation and degree of complexity. The study did seek to illustrate that delays can be caused by all parties involved in projects. However, main causes come from inadequacy of sub-contractors, organizations that lack sufficient resources, incomplete and unclear drawings and deficiencies within consultants and contractors. The literature survey indicated that cost, quality and time are the traditional project performance measures and that contractors generally do not meet requirements thereto. Other aspects influence performance relative to the traditional performance measures; the type of procurement system influences overall performance; and the separation of design and construction negatively affects the construction process; and various interventions can contribute to enhanced performance and consequently image (Busby and Hughes, 2004).

The study suggested that inadequate skills can be minimized by discussions that lead to understanding. Inadequate skills have strong relationship with failure and ineffective performance of contractors.

The main causes of delay were related to lack of skills, designer user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity according to the round table discussion by NMC (2011). The following is the summary of what was discussed in the previous pages. Burati, Farrington and Ledbetter (1992) state that the increasing affordability of the Construction Industry (CI), encourages firms to evaluate performance and Implement productivity improvement strategies in order to obtain reasonable advantage.

Consequently, emphasis is to be directed towards the site constructors which are the contractors. To increase the heights of competitiveness, contractors need to accelerate the use of performance valuation tools as a means of supporting performance development programmes. Contractor performance is defined to hold construction cost, construction time, construction quality and sustainable development, the philosophy being that the success of one aspect of performance should not be at the expense of another (Busby and Hughes, 2004).

### **1.2.1 Skills Requirements**

Important prospects exist to mature more established workers already active in the workforce. It is a bigger pond to attract upon and decent work habits may have been established (Modern, 2008). Innovative methods offer the opportunities to tap into this source of skilled labour and mature a pride in workmanship on a greater scale (Anderson, 2008; Mulder, 2007). It is mostly significant to develop older workers when employing from localized communities. Progressive artisan training offers a route into expert work for mature talent (Anderson, 2008; Mulder, 2007). It essentially offers a quicker apprenticeship with 24 weeks of taught theory joint with 54 weeks of practical work on site (Burati, Farrington & Ledbetter, 1992).

Department of Labour skills programmes have a significant part to play (Harris, 1994). All initiatives have required a focus on acknowledgement of prior skill and learning, a progression which has long played a key role in accrediting levels of skills and learning in South Africa. Recognition of prior learning (RPL) was the focus of a National Training Board report which defined it as (Harris, 1994) a way of identifying what individuals already know and can do. RPL is based on the premise that people learn both inside and outside formal learning structures (including learning from work and life experience) and this learning can be worthy of recognition and credit. It is a significant building block in many adult learning programmes.

Anderson (2008) states that, the role in “grandfathering” artisans with experience but no qualification is key. Anderson (2008) states, It is a vital tool in “brush-up” programmes for those who have not had the opportunity to practice their skills and, although they have some qualifications cannot meet required standards due to the fragmented nature of their project-based employment. Sustained employment with the ability to continuously practice skills is rare. Most commonly, RPL is assessed in the form of practical tests. In brush-up programme testing experiences at Murray and Roberts reveal that only two out of ten will pass. Those performing reasonably well, although not meeting the standards can then be put through an appropriate trade school experience to brush up their skills (Harris, 1994).

### **1.2.2 Why Shortage of Skills**

Absolute scarcity refers to suitably skilled people that are not available, for example in a new or emerging occupation (e.g. biotechnology, information technology), a lack of sufficient numbers of workers with specific skills, or insufficient numbers to satisfy replacement demand (Edwards, 2002). Relative scarcity, on the other hand, refers to a situation where suitably skilled people exist, but do not meet other employment criteria, for example they live in different geographical areas, or do not satisfy Black Economic Empowerment criteria (Badroodien, 2004).

Critical skills refer to specific skills within an occupation. In the SA context there are two groups of critical skills: (1) generic skills, including problem solving and learning to learn; language, literacy or numeracy skills; and working in teams for example; (2) particular occupational skills required for performance within that occupation (Edwards, 2002). The latter form accounts for the problems that emerge when a firm experiences technological change or reorganises production methods (Badroodien, 2004). These definitions underpin the understanding of skills shortages and must be kept in mind when diagnosing the nature of skills shortages. However, skills shortages are not only about scarce and critical skills, which imply some form of advanced qualification in a ‘high skills’ environment.

Indeed, one of the central tenets of Kraak’s work (2004, 2005), has been that the emphasis on ‘high skills’ is not sufficient in a developing economy such as South Africa. The author notes that emphasising low skilled strategies should be viewed in a positive light, particularly with respect to addressing unemployment and stimulating labour-intensive forms of production (Andre, 2004).

Furthermore, exclusive emphasis on the 'high skills' strategy ignores the tough conditions and constraints that developing economies face in their attempts to move up the value chain (Andre, 2004).

### **1.2.3 How to remedy inadequate skills**

Statistics South Africa (2003) states that, the important note is to recognise the improvement of the work skills of all South Africans, which is critical to grow the national economy. The Skills Development Act (SDA) was promulgated to create the structures and framework for the national development strategy. In terms of the SDA employers are obliged to provide formal structured education to their workers. Furthermore, the Act encourages partnership in this effect between government, employers, workers, education and training providers, and beneficiary communities.

The national Advisory Council (2003) states that trained people are the beneficiaries from the community. According to SDA, the needs of employers, the economy and the communities must dictate which skills development should be developed. The SDA covers structured, targeted and generic training implying that all training interventions should be planned and managed as projects that is the reason why Group Five has "people at the gate" which is Corporate Social Investment Project. In SDA, employers together with their workers formulate workplace skills plans (WSP) to enable them to realize their employment training targets. All designated employers pay a monthly skills development levy of 1% of their budgeted payrolls to the National Skills Fund (NSF) via South African Revenue services (SARS). Of this amount the employer can claim back 70% in the form of discretionary grant, provided that they submit WSP and Implementation Report (IR) annually and conduct special training projects. These levies finance the implementation of the National Skills Development Strategy (NSDS).

Statistics South Africa (2003) confirms that, Construction Education and training Authorities (CETA) receives 10% of the skills levies paid by construction employers for administration costs, NSF receives 20% and 70% is available to be claimed back by these contributing employers. However, international trends show that companies need to spend between 4% and 7% in order to be successful in addressing the current shortages and gaps (National Advisory Council on Innovation (NACI). Furthermore, there appears to be over-reliance of a number of levels in the micro and provincial economy on the SETA's as being responsible bodies for coordinating the identification of scarce skills in South Africa.

### **1.3 Research Question**

The problem addressed in this research study is:

- What are the causes of shortages of skilled artisans during the construction phase of building development projects and how do these shortages impact productivity?

### **1.3 Hypothesis**

The hypotheses presented to address this question are:

- By minimizing the skills shortage, its impact on work productivity can also be minimised.
- By increasing the effectiveness of site management and providing enough skilled labour for a proposed project, rework and late completion could be mitigated for?

### **1.4 Objectives of the study**

- To identify causes of shortages of skills during the construction phase;
- To define the effects of shortages of skills on project productivity;
- To determine how to deal with shortage of skills;
- To determine ways in which shortage of skills may be reduced
- To determine whether shortages of skills causes poor contractor performance

### **1.5 Research Methodology**

The research undertaken is quantitative in nature and involves responses that are focused on the causes and effects of shortages of skills on a project during the construction phase. Primary data was gathered using closed and open-ended questionnaires that were designed around the core research objectives.

The research methodology highlights various types such as qualitative and quantitative methods. However, the overall methodological approaches used to achieve the aims and objectives of this research study encompass the study of theory and literature and collection of empirical data by a case study using questionnaires.

A five-point scale was used to measure the attitudes of respondents. Each question consisted of a statement that consists of five possible responses: disagree = 1, disagree = 2, Neutral = 3, Agree = 4 and strongly agree = 5, and open-ended questionnaires giving an opportunity to the respondents to express him/herself. Other aspects covered in this research investigation include:

- Literature Review: Literature of past authors concerning the study was gathered to identify the causes and effects of inadequate skills on projects during the construction phase of a project lifecycle.
- Empirical data via case study: A case study was used to assess the causes and effects of inadequate skills during construction projects which resulted in overruns and additional cost to the project budget. There was a follow up to questionnaires distributed for the data collection.
- The objectives were achieved through by the distribution of questionnaires to the selected companies/company. The questionnaires were closed ended and open-ended type of questions. The case study focused on the Construction sector; particular Neil Muller Construction (NMC) which will be the company that will be used to conduct the case study.
- Questionnaires: Data collection on the research was supported by the closed ended questions and open-ended questions. These are used to explore and establish the causes and effects of inadequate skills in a project lifecycle. Two types of questionnaire will be considered. Type -1: questionnaire focused on the causes and effects of inadequate skills on the progress of the project.  
Type-2: was focused on how to deal with inadequate skills when they happen.
- Data analyses: This section was considered for two activities. Firstly respondents to the two types of questionnaires distributed and data obtained from the case study was analysed at this stage. The analysis made was, then be presented in the form of tables at the second stage.



## **1.6 Significance of the study**

The significance of this research study is to establish the causes and effects of inadequate skills on the progress of the project and the main factors that cause lack of skills during the construction phase on a project lifecycle. Having identified the effects of delays due to lack of skills on the project and the outcomes of the factors caused by the inadequate skills in a construction project, the study will further consider purposes and various strategies to reduce delays due to lack of skills on construction projects during the construction phase, which would result in the waste and latent defects at the end of the day. This study further reviews the organizational behaviour concept linked to this case study. These include perception, leadership, culture, communication and motivation.

## **1.7 Limitation of the research study**

The study was limited to data gathered from the construction industry in the Cape Town area in the Western Cape Province of South Africa. Information was gathered from the following stakeholders in both construction firms; site managers, quantity surveyors and engineers.

The NMC PTY (Ltd) was used as one of the selected companies to conduct the case study to collect the data that will assist in the findings of the study.

## **1.8 Structure of study**

**Chapter 1** provides an introduction to the study. The problem statement for the study is presented together with the research hypothesis, objectives and summary of the research methodology. A background and overview of the study, which was conducted is also presented. The structure of the study is also explained in this chapter.

**Chapter 2** consists of critical reviews of literature with an emphasis on past work of different authors related to the research study. A brief overview of related literature on the definitions, principles and practices with respect to factors that cause delays on construction projects and effects of the delays on the schedule planning of the project is presented. This chapter further reviews the organizational behavioural concept linked to this study. These include leadership, culture, communication and motivation.

**Chapter 3** describes the research methodology and endeavours to find the most suitable instruments for the investigation. This includes the research design, data collection, data analysis, validity, reliability, bias and ethical considerations.

**Chapter 4** presents the research findings, analysis of the data and interpretation of these results in accordance with the theory discussed in the literature review.

**Chapter 5** presents the overall conclusions obtained of the research, recommendations for the research study and scope for further research.

### **1.9 Work Programme**

<b>Activities</b>	<b>Duration</b>
Proposal	January - August 2011 (8 Months)
Literature Review	September 2011 – April 2012 (6 Months)
Research Methodology	May – July 2012 (2 Months)
Data Collection	July – October 2013 (4 Months)
Presentation, Analyses, Conclusion And Recommendations	November 2013 – June 2014 (7 Months)

### **1.10 Summary**

Having introduced the study in Chapter 1, the next chapter presents a review of the literature gathered on the various topics related to the study and includes an examination of causes of delays, effect of that are the results of delays , models, principles and practices.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **1.1 Introduction**

The construction industry is an important player in the economy of South Africa. Although the industry's current contribution to the gross domestic product has shrunk to approximately 3%, compared to 7% in the 1970's, it remains an important economic sector (International Conference on Construction in the 21st Century, 2002).

According to the Department of Public Works (2012), It is also estimated that the construction sector employs one million people, with some 424 000 individuals employed in the formal sector. Annual employment growth in the period of September 2005 – 2006 was 9.5%, with employment in the sector increasing by some 390 000 people 2001 – 2006. In 2006, the construction sector saw a real growth of 14%, compared to 10% in 2005; this is also reflected in double digits in the cement sales. In medium term the sector will continue to be underpinned by strong public infrastructural expenditure.

According to the Department of Public Works (1999), public sector infrastructural expenditure has increased by 15.8% per year between 2003/04 and 2006/07. The industry contributed 35% to the total gross domestic fixed investment and employed approximately 230,000 employees. The gross capital formation of the construction (civil engineering) was R53.5 billion (16.7%) of total capital formation in 2006. To this could be added a further R35.8 billion for residential buildings and R33.4 billion for non-residential buildings. Thus, the total value of the sector was R122, 345 billion (38, 2%) of the total Gross capital formation in 2006. The South African Government is the single biggest construction client, making up between 40% and 50% of the entire domestic construction expenditure.

## **2.2 Background of the Study**

### **2.2.1 Construction Industry in South Africa**

Construction industry has a critical role to play in fostering development in the formal and informal sector of the South African economy. The industry, however, faces some serious challenges in its endeavour to deliver infrastructure projects effectively. Smallwood and Rwelamila (1996) states that contractors face many problems when delivering construction projects, Poor contractor performance, as characterized by poor work quality and low productivity are common in the industry.

The biggest challenge facing the South African construction industry is the problem of skills shortage. In a survey that was done in July 2007 (Business Day), the annual international Business Report from Grant Thornton showed that a shortage of skilled workers is the main obstacle to expansion for 58% of medium-to-large business in South Africa. Official data has shown that shortage is already being experienced in the construction industry and is set to double in size over the next six years. Officials estimate that in 2012 the sector needed an additional 11000 engineers and 50000 artisans, including bricklayers, welders, electricians and draughtsmen.

On the other hand, the South African Institute of Civil Engineering's (SAICE) executive director Dawie Botha believes that the construction and civil engineering industry may have to import some skills to facilitate implementation capacity. He added that training and education forms a vital part of the industry's success for going forward, but he believes that it is inevitable for certain skills to be imported, such as tunnel experts for the Gautrain project. Botha noted that the need for skills is overwhelming. For example, one Gauteng municipality required 25 engineers, but had only seven on the payroll.

### **2.2.2 Review of International Literature**

In construction, higher productivity means seeing the final result sooner, which in turn creates satisfaction. Borcharding and Oglesby (1975) reported that job dissatisfaction can be one factor that will increase costs, produce time delays and generally reduce productivity on most types of projects. One way that construction management can influence productivity is by determining how smooth the work will flow and how much work can be accomplished.

Another more important way that construction management influences productivity is by how it influences worker's attitude, which is a major element in worker motivation and determining how much work will be accomplished. The experience of individuals within social settings is interpreted and given meaning by the actions and communications of the fellow constituents to the social setting. On construction sites, the discourse, language and behaviour of the participants forms a medium through which the organization expresses itself. The meaning comes from adherence to key values, with people left free to make choices over particular actions (Watson, 1994).

## **2.3 Remedy Strategy through Human Resource Development**

### **2.3.1 Employee Motivation**

A definition of motivation is the set of processes that determine the choices people make about their behaviours. Motivation is an abstract term. In business, motivation is not synonymous with salaries; money is a means for accommodating the economic needs of workers. Motivation means an inner wholesome desire to exert effort without the external stimulus of money (Wilbert Scheer 1979). Motivating is the ability of indoctrinating the personnel with a unity of purpose and maintaining a continuing, harmonious relationship among all people. It is a force that encourages and promotes a willingness of every employee to cooperate with every member of the team.

To maintain it is to create and perpetuate the climate which brings harmony and equilibrium into the entire work group for the benefit of all who are involved – the company as a whole (Wilbert Scheer 1979). Since effective motivation comes from within, by motivating others, the manager can do more than create proper conditions that cause people to do their work with willingness and enthusiasm. According to McClelland (1961) individuals tend to develop certain motivational drives on the cultural environment in which they live and these drives affect the way people view their jobs.

McClelland (1961) suggests that achievement, affiliation, competence and power are four types of motivational drives that are found in individuals that are self-motivated and this may be the case for many construction workers. Motivation plays a part in enhancing construction labour productivity (Smithers and Walker, 2000) and forms the basis for identification of the work environment factors. For example, Laufer and Moore (1983) advocated the use of financial incentive programmes to improve construction labour productivity, reinforcing Maloney's (1982) thesis of driving forces that led to productivity improvements.

Autonomy and comradeship (Edwards and Eckblad, 1984) are also found to be important aspects that add to the way construction workers are self-motivated about their work. However, much work in linking motivation and productivity relied on Herzberg's sample involving mainly white-collar professionals (Mullins, 1996).

### **2.3.2 Equity Theories of Motivation**

Huczynski and Buchanan (2007) note that employees make comparisons of their jobs based on job inputs and outcome. Job inputs are effort, experience, education and competence. On the other hand, the following constitute outcomes, namely salary levels, raises and recognition relative to those of others; if the perceived ratio is equal to that of the relevant others with whom comparison is made, a state of equity is said to exist. It can be concluded that our situation is fair – that justice prevails. When the ratio is unequal, equity tension is experienced.

The theory establishes the following propositions relating to inequitable pay:

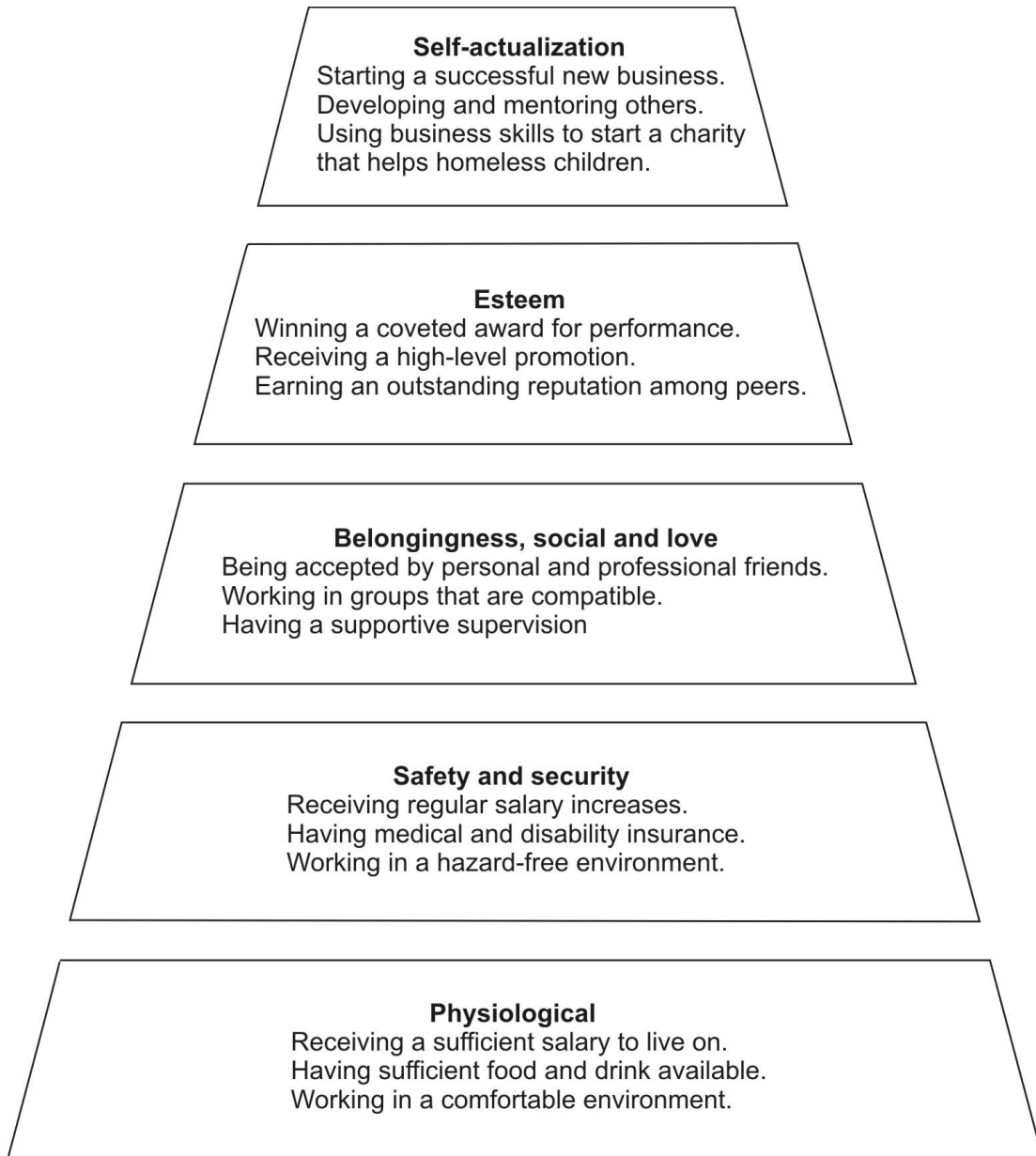
Given payment by time, over-rewarded employees will produce more than equitably paid employees. Hourly and salary employees will generate high quality of production in order to increase the input aspect of the ratio and bring about equity. Given payment by quantity of production, over-rewarded employees will produce fewer, but higher-quality units than will equitably paid employees. Individuals paid on a piece-rate basis will increase their effort to achieve equity, which can result in greater quality or quantity.

However, increases in quantity will only increase inequity, since every unit produced results in further over-payment. Therefore effort is directed towards increasing quality rather than increasing quantity. Given payment by time, under-rewarded employees will produce less or poorer quality of output. Effort will decrease, which will bring about lower productivity or poorer quality output than equitably paid subjects, and given payment by quantity of production, under-rewarded employees will produce a large number of low-quality units in comparison with equitably paid employees. Employees on piece-rate pay plans can bring about equity because trading off quality of input or quality will result in an increase in rewards with little or no increase in contributions.

### **2.3.2.1 Maslow's Hierarchy of Needs Theory**

According to Robbins (2001), Maslow hypothesised that within every human being there exists a hierarchy of five needs. These needs are:

- Physiological : Hunger; thirst; shelter; sexual, and other bodily needs;
- Safety : Security and protection from physical and emotional harm;
- Social: Affection, sense of belonging, acceptance and friendship;
- Esteem: Internal esteem factors such as self-respect, autonomy and achievement, and external esteem factors such as status, recognition and attention, and
- Self-actualisation: The drive to become what one is capable of becoming. It includes—growth; achieving one's potential, and self-fulfilment.



**Maslow's hierarchy of need pyramid (Ivancevich, 2005).**



## **2.4 Development of Artisans in South Africa**

Schultz (2003) posits that in the last two decades, South Africa experienced a drastic decrease in the number of people trained as artisans, both by the private sector and public training centres. This trend has been accompanied by a drop in the number of apprenticeship contracts registered with the Department of Labour. One could spend a great deal of time debating the reasons for this dearth of skills. Emigration, crime, affirmative action, a lack of quality maths and Science matriculants, and poaching with more lucrative salaries abroad, are all in the mix. More important than the why's, however, is the challenge of addressing this calamity and finding ways to increase the number of school-leavers opting to study Construction and Engineering and encouraging them to enter a training pathway for a myriad of scarce skills (electricians, fitters, turners and carpenters).

Informal skills training and apprenticeship has thus become common, especially among young people who, for various reasons, are unable to progress up the academic ladder; or gain admission to vocational training institutions; or those of all ages who cannot find employment in the formal sector (Kent and Mushi, 1995; Johanson and Adams, 2004). In Kenya, the informal sector is estimated to be training more school leavers than all formal vocational training institutions combined, making it a significant contributor to skills development (Barasa and Kaabwe, 2001).

Additionally, informal skills training is attractive in developing nations because it is self-financing in that it takes place without any funding from budget-constrained governments or formal levy funding by relying mainly on user fees or low wages for the apprentices during training (Ziderman, 2003). Moreover, informal skills training and apprenticeship has expanded because many of the existing formal training institutions are ill-prepared to equip trainees with the skills needed to operate in an informal sector which is fast becoming the dominant employer (Kent and Mushi, 1995; Ziderman, 2003; Johanson and Adams, 2004).

Informal skilling has weaknesses that stem mainly from its characteristics. These challenges have been identified through a number of studies (Franklin, 1973; Middleton *et al.*, 1991; Kent and Mushi, 1995; McGrath *et al.*, 1995; Barasa and Kaabwe, 2001; Ziderman, 2003) and include:

- The narrow and static range of skills offered. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets. This limits the marketability of the graduates as existing techniques become obsolete; serves to perpetuate traditional techniques that may not be optimal; and demands high levels of supervision (Cattell, 1997).
- Restricted opportunity for learning to work effectively. Due to the use of learning-by-doing, coupled with instructing by providers lacking both teaching and certified trade skills, learning takes place by accident rather than by intent. This is most prevalent where the masters/trainers have limited skill and often leads to a diversity of qualifications and competencies even within the same occupation; i.e. limited standardisation of both the method of skilling and the graduate.
- The minimal knowledge of materials (behavior and characteristics) and processes may affect the quality, reliability and safety of use of the final product.
- The minimal theoretical knowledge and *ad hoc* curriculum erodes the necessary foundation for new skills thus making it difficult to learn. This is especially critical in the face of new materials entering the market.
- Lack of standardised training and independent testing makes it difficult to control the quality of the training i.e. there is a lack of appropriate scale of equivalence by which the knowledge and skills acquired can be externally vetted hence the competence of the graduates is difficult to vet. This, in turn, means that the consumer of the services has no guarantee of what he is purchasing.

## **2.5 The Necessity of Improving Artisan Skills**

### **2.5.1 Skills Requirements**

Significant opportunities exist to develop more mature workers already active in the workforce. It is a larger pool to draw upon and good work habits may have been established (Modern, 2008). Innovative approaches provide the opportunities to tap into this source of skilled labour, and develop pride in workmanship on a larger scale (Anderson, 2008; Mulder, 2007). It is particularly important to be able to develop older workers when recruiting from localized communities.

Advanced Artisan Training provides a route into skilled work for mature talent (Anderson, 2008; Mulder, 2007). It essentially provides an accelerated apprenticeship with 24 weeks of taught theory combined with 54 weeks of practical work on site (Burati, Farrington & Ledbetter, 1992). The department of Labour skills programmes have an important role to play (Harris, 1994). Their task specific vocational programmes are useful in up-skilling or re-skilling workers (Harris, 1994). All initiatives have required a focus on recognition of prior experience and learning, a process which has long played an important role in accrediting levels of skills and learning in South Africa. Recognition of prior learning (RPL) was the focus of a National Training Board report which defined it as (Harris, 1994): a way of recognizing what individuals already know and can do. RPL is based on the premise that people learn both inside and outside formal learning structures (including learning from work and life experience) and this learning can be worthy of recognition and credit. It is a significant building block in many adult learning programmes.

Anderson (2008) states that, the role in “grandfathering” artisans with experience but no qualification is key. Anderson (2008) states, it is a vital tool in “brush-up” programmes for those who have not had the opportunity to practice their skills and, although they have some qualifications cannot meet required standards due to the fragmented nature of their project-based employment. Sustained employment with the ability to continuously practice skills is rare. Most commonly, RPL is assessed in the form of practical tests. In brush-up programme testing experiences at Murray and Roberts reveal that only two out of ten will pass.

Those performing reasonably well, although not meeting the standards can then be put through an appropriate trade school experience to brush up their skills (Harris, 1994).

Walker and Shen (2000) point out that skills gaps which are labour related, negatively affect project delivery.

Wahab *et al.* (2008) declare that, despite the wide spectrum of factors affecting construction productivity, it is notable that workforce skills development and training featured as a commonly cited factor that affects timely project delivery (Naoum, 2001).

### **2.5.2 A Need for Productivity**

According to Stefan (2001:1) states that productivity is not a monetary ratio. Productivity is a relative concept, which can be said to increase or decrease only when a comparison is made, either with regards to competitors or against an established norm at a certain point in time. This concept of relativity is partly shared by the American Association of Cost Engineers (AACE). The output component of any operation or task undertaken is dependent on the volume of work done, quality of work done and the value of the work done which is measured in monetary terms. The input component is dependent on the resources consumed in executing the work.

The variables of the input resources are the labour cost, labour time utilised, material cost including power (i.e. electricity and fossil fuels), materials utilized and equipment resources measured in monetary terms ( Stefan, 2011:1) . The permutation of the output and input variables yields several terms/concepts of which most of the derived terms have all been referred to as productivity. The terms profitability, efficiency, effectiveness and performance (performance is further dependent on quality, flexibility, speed and delivery) have being used interchangeably with the term productivity (Stefan, 2011:1).

There are two categories of productivity; partial and total productivity. Partial productivity, which is also referred to as single factor productivity, relates a single measure of output (labour or capital etc) whereas total productivity which is also known as multi-factor productivity relates a particular measure of output to a group of inputs (Building Future Council, 2005:4). The productivity definition put forward by the AACE is partial (single-factor) productivity and that of Stefan represents a multi-factor productivity (Stefan, 2011:1).

### **2.5.3 Efficiency and Effectiveness**

Historically many researchers have seen productivity as an efficiency concept. Currently the concept of effectiveness, together with that of efficiency is regarded by many to imply productivity. An executed operation or task is said to be effective if the output achieved conforms to the specified criteria. The value of input resources put in does not matter; it is only dependent on the output variables. Efficiency measures the actual input resources utilised with respect to the expected resources that were estimated to be used.

Thus, the efficiency and effectiveness of any project cannot be measured if the objectives of the project at the planning stage do not make an estimate of how much time and money will be required, and also what the quality of work should be. Effectiveness requires a task or an operation to be done correctly whereas efficiency requires the task to be done through the correct means. Therefore, an achievement of effectiveness does not presuppose that efficiency was excellent (Arturo, 2004:1).

**An Analysis of Effectiveness and Efficiency**

$$\text{Effectiveness} = \frac{\text{Actual Output}}{\text{Expected Output}} \dots\dots\dots 1$$

$$\text{Efficiency} = \frac{\text{Resources expected to be consumed}}{\text{Resources actually consumed}} \dots\dots\dots 2$$

Although these two equations are ratios and have no units, each of these two terms is not a ratio of output to input and as such is distinct from productivity in this regard. Both equations have components of productivity (i.e. actual output and resources actually consumed) and hence relate to productivity.

Therefore an effectiveness ratio of one and an efficiency ratio greater than or equal ( $\geq$ ) to one will increase productivity significantly. If either of the ratios of the two equations or both are less than one, it will not lead to higher productivity. It is thus possible for an effective system to be inefficient (Arturo, 2004:1).

**2.5.4 Labour Productivity**

Labour production is a partial productivity since the output is related to one type of input (man-hours) (Croswell and McCutcheon, 2003:387-400). It measures the quantity of work done to a stipulated specification per unit of man-hours spent. This is commonly referred to as a task rate (Croswell and McCutcheon, 2003:387-400).

It has been established that for the execution of the same task, labour productivity amongst a task based workforce is generally higher than amongst time-based workers (Croswell and McCutcheon, 2003:387-400).

In the former scenario, the workforce is paid according to the quantity of work done within the day, whereas in the latter, payment is fixed for the day and is irrespective of the magnitude of work done (Horner and Talhouni, undated: 10-32). For the task-based worker, this serves as an incentive to enable him or her to work harder, faster and better in order complete the task earlier. Unfortunately, research has shown that this system in many instances has led to the abuse of workers either through exploitation of workers by management or self-exploitation on the part of the workers.

Exploitation can arise under accelerated working conditions (Horner and Talhouni, undated: 10-32). In order to curb this, the labour laws in several countries puts a limit on the quantity of work a person should do in a day. Again, there is a limit on how many hours constitute a fair day's work; in the building and civil sector, this has averaged at eight (8) hours per day in many countries since the 1950's (SAB, August 1959:45).

## **2.6 WHY SHORTAGES OF SKILLS**

Absolute scarcity refers to suitably skilled people that are not available, for example in a new or emerging occupation (e.g. biotechnology, information technology), a lack of sufficient numbers of workers with specific skills, or insufficient numbers to satisfy replacement demand (Edwards, 2002). Relative scarcity, on the other hand, refers to a situation where suitably skilled people exist, but do not meet other employment criteria, for example they live in different geographical areas, or do not satisfy Black Economic Empowerment criteria (Badroodien, 2004).

Critical skills refer to specific skills within an occupation. In the South Africa context there are two groups of critical skills: (1) generic skills, including problem solving and learning to learn; language, literacy or numeracy skills; and working in teams for example; (2) particular occupational skills required for performance within that occupation (Edwards, 2002). The latter form accounts for the problems that emerge when a firm experiences technological change or reorganises production methods (Badroodien, 2004).

These definitions underpin the understanding of skills shortages and must be kept in mind when diagnosing the nature of skills shortages. However, skills shortages are not only about scarce and critical skills, which imply some form of advanced qualification in a 'high skills' environment.

Indeed, one of the central tenets of Kraak's work (2004, 2005), has been that the emphasis on 'high skills' is not sufficient in a developing economy such as South Africa.

The author notes that emphasising low skilled strategies should be viewed in a positive light, particularly with respect to addressing unemployment and stimulating labour-intensive forms of production (Andre, 2004). Furthermore, exclusive emphasis on the 'high skills' strategy ignores the tough conditions and constraints that developing economies face in their attempts to move up the value chain (Andre, 2004). According to Patel (2007), this shortage of artisans exists alongside a massive expansion of FET college enrolments in engineering studies (in the FET context Artisan related skills are clustered under engineering). According to Patel (2007), a total of 280 000 graduated in engineering studies in 2000 but only 34% found jobs in industry. It is primarily because most of these engineering students are not employer sponsored and that FET courses are not aligned to industry requirements. The surplus of unemployed FET college engineering graduates is exacerbated by the increase in the number of learners who have enrolled in learnerships since April 2001.

### **2.6.1 Learner Choices Matriculates Do**

Cosser and du Toit (2002) analysed the factors that affected the choices of Grade 12 learners in their transition to higher education. South Africa's higher education participation rate of between 15-18 per cent was below the 20 per cent benchmark given for middle income developing countries, and the National Plan for Higher Education was designed to reduce income inequality and poverty by creating opportunities for young people and adults to further their education and consequently become employable. To encourage the on-the-job sector in South Africa is consequently touted as a major contributor to the reduction of intermediate skills shortages in South Africa. Gamble (2004, 173-175) discusses the characteristics of intermediate level knowledge and skills in terms of how it differs from low or high-level skills:

Intermediate level knowledge and skills are best described as skills held by workers in the craft and artisanal trades, where knowledge is a combination of theory and practice, and the emphasis is on the practical rather than the conceptual. Low- level skills perform particular routines and procedures without understanding the entire process. Those ones are typically present in mass production enterprises. High-level skills can be characterized by 'principle through procedure', where engineers for example have complete knowledge about a particular process. At this level, however, the emphasis is on the conceptual rather than the practical, as there is usually a managerial component to the work of the engineer (ibid, 175).

### **2.6.2 Business Approach to Training**

A literature review reveals that business has sought to get rid of the expense for training and more importantly, the implied cost of paying for skills. It has appeared to be shortsighted when it comes to training and during boom periods resorted to importing skills as a stopgap. In the future, this option might prove increasingly more difficult in view of the global demand for artisans. It should be noted that whilst in the past, South Africa was only an importer of skills; this is no longer the case. South Africa artisans are currently working on projects in Russia, China and the Middle East while thousands have immigrated to Australia and elsewhere. These developments could impact on the costs of doing business in South Africa.

This increased global competition for artisans has resulted in unpredictable and shorter contract cycles. This has introduced uncertainty about the future, which makes employers reluctant to enter into the 3-4 year contracts involved in the employment of apprentices.

Apart from not having the capacity to carry the additional costs, they do not want to have to put them off if contracts do not eventuate (Marshman 1996).

The move to shorter contract cycles (for example in the case of the new learnership contracts) reflects the introduction of 'lean production' techniques aimed at reducing a firm's cost and risk (Harrison 1997). A key element in lean production is the Just in Time (JIT) production method. JIT offers employers considerable competitive advantage through cost savings. It is also a method for shifting the risk of market fluctuations from the purchaser of a good or a service onto the supplier, as the purchaser is not locked into a fixed long term contract.

However, JIT production methods make it difficult to provide the continuity of work required for an apprenticeship and they are a factor in the growth of labour hire.

### **2.6.3 Image of the Artisan:**

Over the years various discussions have taken place on how to build the image of the artisan. Some years ago Eskom attempted to set up an Institute of Artisans to raise the image of artisans within the public arena. This issue has also been taken up during JIPSA discussions. It is clear that during different periods in history, the artisan was considered a valued skill within the workplace. In the post-apartheid era, the artisan became less appreciated and valued.

In a newspaper article (Cape Times Insight May 15, 2007), Merseta CEO Dr Raymond Patel pointed that the dire shortage of artisans is not unique to South Africa but a global phenomenon that permeates the Western world because young people are afraid to get their hands dirty.



Young people would rather work with computers than to for engineering and its associated professions. If the country is to increase the supply of artisans some measures will have to be implemented to encourage people to become artisans. A similar process might have to occur if learnerships are to be taken seriously. It is questionable whether the marketing around the end product of a learnership has been properly done. Most companies are sceptical about learnerships and have questioned the quality from learnership programmes.

#### **2.6.4 Loss of Focus on Intermediate Skill**

The current artisan shortage has been exacerbated by the fact that a large number of the learner ships that were initiated from 2001 were at the lower (NQF 1) rather than intermediary skills levels. This might partly be a result of a drive by government to meet specific targets to employ unemployed youth and for redress. The NQF 1 learner ships were bridging learner ships, which is critical if workers, previously denied access to training, could have the opportunity of moving up the skills ladder. This did not however, address scarce or critical skills needs. A balance needs to be achieved between redress learner ships and skills interventions at the intermediary and higher end of the skills spectrum. It should however, be noted, that according to some research, the introduction of learner ships, for example, at the higher end of the skills spectrum has proved to be problematic because of the costs involved and other related problems.

#### **2.7 How to implore Skills**

The former Deputy President of the Republic of South Africa Phumzile Mlambo-Ngcuka in her foreword on the introduction of the ASGiSA maintains that, there is overwhelming evidence that addressing skills shortages is one of the most critical interventions that will make a major difference in achieving the remaining objectives. Through improved skills, the economy can absorb more youth who can be rescued from both poverty and other social ills. The massive infrastructure programme of over R400 billion and sectors earmarked for growth will prosper if appropriate and adequate skills can be attainable. Gross Domestic Product (GDP) growth, increased numbers of people with skills that the growth demands will work in favour of creating jobs and ending poverty, ASGISA report (2007: 7).

### **2.7.1 The Joint Initiative on Priority Skills Acquisition (Jipsa)**

The Joint Initiative on Priority Skills Acquisition (JIPSA) – a multi-stakeholder driven process – was established in March 2006 and was tasked with the responsibility of addressing the supply of scarce and critical skills so as to meet the objectives of the Accelerated and Shared Growth Initiative (ASGISA).

JIPSA faced a rather daunting task of having to almost coerce various constituencies, especially government departments, to begin to work together to address the delivery of skills. In view of various sensitivities around its establishment, JIPSA was careful to argue that its mandate was not to usurp the authority of existing institutions or replace them but to begin to assist them in unblocking the logjams. One of the interviewees for this case study commented that JIPSA initially faced a less than warm reception from those institutions and government departments who felt that their authority was being undermined.

JIPSA's most critical challenge has been to create a sense of common purpose and partnership between the key players and within and between different institutions. Key to this has been to ensure some level of coordination within and between government departments such as education and labour, which has been decidedly lacking. JIPSA was a desperate attempt to raise the profile of the skills shortage in the country.

More than anything however, JIPSA has put skills higher up on the political radar with an attempt being made to provide focus and play a co-coordinating and convening role.

It has achieved this as well as ensuring the reprioritization of funding for the delivery of skills such as in relation to artisans. Some progress is being made but in view of the fact that JIPSA is not an implementation agency, it is only able to give guidance on how departments and other structures and institutions should proceed. JIPSA's target on artisans is to increase training output to 50 000 between then and 2011, meaning that the country has to train about 12 500 artisans per year, or an additional 7 500 new artisans each year.

To put this figure into perspective, a total of 36 703 apprenticeships were registered in the period from April 2000 to March 2005.

For this to be a reality there should be a common ground and understanding on creating coherence and certainty on the four routes to artisan development proposed by the Department of Labour. For example, a lot can still come from the further education and training (FET) college route through an internship or skills programme.

It is well understood that colleges are not producing the quality of artisans that industry requires, which is why so few graduates are absorbed immediately into the labour market. Steel and Engineering Industry Federation of South Africa (Seifsa) has developed the accelerated artisan training model at the Fundi training centre since 2005. The Fundi accelerated artisan-training model targets apprentices who have completed theoretical training at FET colleges. After 80 weeks of training, the apprentices are ready to undergo their trade test. Under this accelerated programme a total of 69 artisans have been trained to date.

Although the figure is still low, it is a pointer in the right direction. Opening up other underutilized training facilities around the country might help and be used for skills training programmes. Based on the success achieved by the Seifa initiative, the Manufacturing Engineering and Related Services education and training authority (Merseta) has approved the accelerated training model, and is funding a pilot project to train 650 artisans in 14 metal engineering trades and 650 artisans in automotive trades (Engineering News, 11 October 2007).

This project was capable of increasing the number of artisans in South Africa to between 3 000 and 4 000 in 18 to 36 months if additional funds were available. Meeting the target of training 50 000 artisans by 2010 was not unrealistic provided the SETAs had the financial resources to fund that training. A literature review has confirmed that a target of 12 500 new apprentices per year has been reached before.

### **2.7.2 The Use of Expanded Public Works Programmes**

Bentall et al. (1999) defined a 'labour-intensive approach' as an approach where labour is the dominant resource for carrying out works, and where the share of the total project cost spent on labour is high (typically 25 to 60%). The term 'labour-intensive approach' indicates that optimal use is made of labour as the predominant resource in infrastructure projects, while ensuring cost effectiveness and safeguarding quality. Through employment-intensive infrastructural works, a few countries have tried to create relatively small 'functional economic areas' in the countryside. This has been done in an attempt to stem rural-urban migration and to retain more people on the land. An example is the Djoliba Pilot Project in Mali, the conversion of a swollen rural village into an agro-urban community, which called for several layers of investment in infrastructure. This project was to test the feasibility of establishing some 150 rural centres that would service Mali's more than 10 000 villages (Thwala, 2001). The Volta River Settlement Programme of Ghana, involving the creation of a network of rural towns and access roads, is another example of rural spatial planning.

Three times as many workers were employed in these resettlement preparations than were involved in building the Volta Dam, showing the employment-generating potential of employment-intensive infrastructural investment. Several opportunities covering a range of skills were available to the young workers, ranging from site supervisor; bricklaying; site foremen; shuttering and formwork; plumbers; painters; carpenters; and tillers. Many of the youth who worked under the different programmes were self-employed on completion of the various programmes. Those who were not self-employed were able to find other job opportunities and employment in the construction sector. The public works programmes were significant in that they were able to expose the unemployed youth to various work opportunities and the skills required (Thwala, 2001).

Most of the working-age young people in developing countries have a low skills level and it is important to plan infrastructure programmes using labour-intensive methods in order to absorb the unemployed youth. Infrastructure programmes such as the public works programmes provide opportunities to unskilled and semi-skilled youth who cannot be absorbed by the other sectors which require specialised skills. Thus, within various institutional and organizational frameworks, a wide range of techniques of labour intensive road construction has been extensively tried and tested over the past 25 years.

(Barker, 1986; Abedian and Standish, 1986; Ligthelm and Van Niekerk, 1986; McCutcheon, 1994a; 2001; McCutcheon and Taylor-Parkins, 2003; Thwala, 2001). The Expanded Public Works Programme (EPWP) in South Africa is an on-going government initiative aimed at generating a million temporary employment opportunities for the currently unemployed by the year 2009 within four sectors; namely the infrastructure, economic, social and environment sectors. The programme aims to generate seven hundred and fifty thousand (750,000) of these employment opportunities within the infrastructure sector (Phillips, 2004:9).

The infrastructure work covers four main categories within the civil construction industry. These categories are namely low-volume roads, trenching, storm water, and sidewalks. Task rates have been prescribed for the activities involved in the construction of these categories of projects. In order to promote the sustainability of emerging/small contractors, the EPWP has established a contractor learnership programme which provides managerial and technical skills amongst others to emerging contractors through classroom and on-the-job (project) training (EPWP, 2005:10). It is the intention of the EPWP to expand into other construction related operations such as building work.

The building industry has been traditionally labour-intensive. However, several authorities have noted that skills and productivity levels in the industry are lower than those achieved fifty years ago, which means that building is now labour-extensive. It is generally accepted that managerial inefficiencies and the lack of adequate formal training for apprentices have contributed to the low productivity (Phillips, 2004:9). The building industry in South Africa prescribes productivity norms for building activities rather than task rates. The EPWP is currently considering a framework that will enable it to set task rates for building activities. The past and present state of artisanship must influence the nature of this framework.

The current state of artisanship in the building industry differs significantly from what existed in the 1950s and 1960s. Apprenticeship at present is mostly done through informal training which is in contrast to the formal training administered during the apartheid era. The average number of artisans being trained on a yearly basis in post-apartheid South Africa is lower than what existed in the apartheid era; in 1970, there were over 40,000 skilled trade workers in the building industry. as against the trend depicted.

### **2.7.3 Skills and Experience through Learning**

Walker and Shen (2000) point out that skills gaps which are labour-related, negatively affect project delivery. Wahab *et al.* (2008) declare that, despite the wide spectrum of factors affecting construction productivity, it is notable that workforce skills development and training featured as a commonly cited factor that affects timely project delivery (Naoum, 2001).

Conti (2005) found that training has a positive and significant effect on productivity. Brown et al. (2004) conclude from a study titled „The Relationship between Human Capital and Time Performance in Project Management: a path analysis’ that performance will improve with increased investment in human capital. Training helps workers to be abreast of modern technology.

### **2.7.4 The Impact of Hiv/Aids on Skills Availability**

According to Bollinger (1999), the two major economic impacts of HIV/AIDS are the reduction in labour supply and the increase in labour cost. Bollinger (1999) further states that South African companies stand to lose revenue due to high absenteeism as a result of illness, time off to attend funerals, time spent in training of new labour, and high labour turn-over. Such a turn of events is likely to affect all labour intensive industries (van Aardt, 2004).

The Mining Industry employed 442 911 people in 2005 (Chamber of Mines, 2006). In that year it was believed that a third of South African miners were HIV-positive, resulting in regular absenteeism and loss in productivity. The high infection rates of HIV/AIDS in mine workers together with the related incidence of illness and death means that mines will lose between 5-10% of their workforce each year (Fourie, 2006; Davies et al, 2002). In 2005 the South African coal mining sector alone generated R36 billion in revenue sales. This was the second largest component of the South African mining industry. The coal produced by the coal mining sector is used to generate 93% of South Africa's electricity. It is also used to produce approximately 30% of the country's liquid fuel production. The coal mining sector directly accounted for 1,2% of South Africa's Gross Domestic Product (GDP) and directly employed 56 971 people in 2005 (Chamber of Mines, 2006).

It is therefore reasonable to assume that, if AIDS has a significant impact on the availability of skills in the coal mining industry, the effect will be very damaging to the industry as a whole (Davies et al, 2002). Mining companies will be required to provide pecuniary resources to cope with mine health. By 2015 it is estimated that for every single normal death on a mine there will be eight mine workers dead or dying from AIDS related diseases (Fourier, 2006: 37).

It is estimated that in the next five years South African mines will require about 20% more mine workers to maintain normal production levels and to replace workers in key positions that suddenly become ill and die (Fourier, 2006: 37).

### **2.7.5 Attracting and Developing Young Talent**

These challenges need to be addressed with concerted effort. Globally engineering has had an image problem among the young (e.g. O'Donnell *et al.*, 2008). The same is true in South Africa where in recent years industries such as banking and information communications technology (ICT) have been more fashionable options for graduates and school leavers. This is a global concern. The conclusion of a seminar series in the East Midlands region of the United Kingdom, for example, reported by Dainty *et al.* (2005), would ring true in South Africa and elsewhere:

It was argued that efforts to create a sustainable future supply of indigenous skills must begin with a robust campaign to promote the industry, its occupations and its careers.

As a responsible employer, Murray & Roberts is addressing this in an extensive process of collaboration with schools, colleges and universities, including promoting the development of skills in mathematics. It is a process that includes bursary payments and job experience that is not just confined to the South African home market (Murray & Roberts, 2009, p. 23).

Murray & Roberts is not immune to the engineering and technology global skills deficit, which is experienced across all our businesses and projects globally. It has increased bursary intake at universities and on-the-job training programs are making a significant contribution to building the skills pool in South Africa, Canada and Australia. The development of “learnerships” has been important. These are not just aimed at the young – people from 16 – 60 are encouraged to join one (Schussler, 2006). These programmes combine theory with practice and, focusing on learning outcomes, ensure substantive exposure and practical grounding in the world of work for school leavers, new graduates and others.

The Medupi and Kusile projects provide substantive opportunities for learnerships to be completed on one project, together with the transition into qualified craft roles. Too often experiences have been fragmented given the nature of the industry.

The attitudes towards the industry among the young will continue to need to be addressed, but these projects have provided a higher profile for the sector and generated interest accordingly. The Gautrain transportation project in Gauteng Province has had a similar effect. Engaging the young will be crucial to the future of the industry. Their discipline and attitudes at work, which can manifest itself in absenteeism, will need ongoing attention.

## **2.8 Organisational Behaviour**

### **2.8.1 Leadership and Commitment**

This section initially examines some viewpoints of leadership and then concludes with a review of commitment. Steenkamp and Van Schoor (2002), define leadership as “influencing the people so that all of them do the right things, the right way at the right time willingly, on their own, so that the organization grows and the purpose is fulfilled”.

All the ingredients for successfully achieving quality superiority, one stands out: active leadership by upper management.

Leadership is essential in the implementation of ISO 9000 and that the complete involvement of the management level in their capacity of leadership is essential for the success of a quality project. However leadership must be supported by training as managers must have a good understanding of the ISO 9000 standards and also view it as a tool for total quality if they want to obtain maximum benefit from it.

Steenkamp and Van Schoor (2002), refer to charismatic leadership as leadership that transforms employees to pursue organizational goals over self-interests. These leaders set high performance expectations and standards because they are aware that challenging, attainable goals lead to greater productivity. In the context of total quality management (TQM), this style of leadership is important to the success of any TQM initiative within an organization. Steenkamp and Van Schoor (2002), state that transformational leadership refers to the process of influencing major changes in the attitudes and assumptions of employees in an organization. TQM literature has stressed the importance of transformational leadership in the creation and maintenance of a quality culture.

Finally the interpretative approach asserts that leadership concepts and theories are subjective efforts by social scientists to interpret ambiguous events in a more meaningful way. Thus, sometimes it is convenient to blame TQM failure on leadership and when TQM is a success, leadership is seen to be most important contributor.

### **2.8.2 Communication**

This section offers a brief review of communication and its importance to this study. Schermerhorn, et al (2004:285) define organizational communication as the specific process through which information moves and is exchanged throughout a company. This information can flow through formal and informal structures and upward, downward or laterally in an organisation. Besterfield, et al (2003:47) state that communication delivers “the organization’s values, expectations and directions”. Effective communication requires feedback. In this regard barriers to communication must be removed. Some barriers include hierarchical aspects such as managers prohibiting employees from communicating to upper management and not allowing feedback to occur in the workplace. Barke (2006) asserts that communication is exchanging information in such a way that it creates a common basis of understanding and feeling. It can also be the transfer of messages between a business and its external environment as well as within the business itself.



Barke (2006) classifies communication into two types. They are formal and informal communication, which could be verbal or written. Formal communication is normally endorsed while informal is not endorsed.

Barke (2006) enumerates several methods / mediums of communication in the construction industry. These include: verbal; written; graphical: electronic - the use of e-mail; radio; GSM; video conferencing, and diagrams. In any form of communication, there is upward, downward and horizontal communication. Upward communication is that communication that emanates from a subordinate to a superior officer. Downward communication is that initiated by a superior officer to a subordinate and horizontal communication occurs between colleagues and friends.

Besterfield, et al (2003:47) states that improving quality will be hampered if poor communication impedes the flow of information to and from the employees. Periodic surveys can be done to assess if communication is effective and whether the communication message was understood and if behaviours and attitudes were changed. Ross (1993:48) refers to communication as “the mortar that binds TQM processes together”.

As top management communicate the vision of quality into the organisation, each recipient's perception of the quality message can lead to misunderstanding and even misdirection of their effort. Besterfield, et al (2003:47) states that, it is further mentioned that a person can only communicate in terms of the recipient's language and perception and therefore the message must be in terms of their own experience. If the employee's perception of quality is to perform a better job or retain the customer, the message of TQM is unlikely to be understood. A suggestion for TQM is to ensure that measures of quality should be set and agreed upon.

## **2.9 Conclusion**

The available evidence indicates that there is indeed a significant demand for people with skills, which is not matched by their availability. Factors such as economic growth, sectoral levels of labour intensity, age profile projections of net migration, the business cycle, government expenditure decisions, projections of HIV/AIDS morbidity rates, industrial policy and foreign direct investment, all affect this supply and demand dynamic. Without an understanding of the dynamics of the skills environment, it is not possible to plan appropriately, and the consequences of skills imbalances are undoubtedly negative (Schnetler, 1989:148).

The use of expanded public works programmes can be of a great help to try and minimize the shortages of artisan skills. Through employment-intensive infrastructural works, a few countries have tried to create relatively small 'functional economic areas' in the countryside. This has been done in an attempt to stem rural-urban migration and to retain more people on the land. An example is the Djoliba Pilot Project in Mali, the conversion of a swollen rural village into an agro-urban community, which called for several layers of investment in infrastructure. This project was to test the feasibility of establishing some 150 rural centres that would service Mali's more than 10 000 villages (Thwala, 2001).

The encouragement of the students from matric level can reduce the problem of the shortages of the artisan's skills. South Africa's higher education participation rate of between 15-18 per cent was below the 20 per cent benchmark given for middle income developing countries. The National Plan for Higher Education was designed to reduce income inequality and poverty by creating opportunities for young people and adults to further their education and consequently become employable, to encourage on-the-job sector in South Africa is consequently touted as a major contributor to the reduction of intermediate skills shortages in South Africa. Gamble (2004, 173-175) discusses the characteristics of intermediate level knowledge and skills in terms of how it differs from low or high-level skills.

In a newspaper article (Cape Times Insight May 15, 2007), Merseta CEO Dr Raymond Patel pointed out that the dire shortage of artisans is not unique to South Africa but a global phenomenon that permeates the Western world because young people are afraid to get their hands dirty. Young people would rather work with computers than to for engineering and its associated professions. If the country is to increase the supply of artisans some measures will have to be implemented to encourage people to become artisans.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter provides an explanation regarding the methodologies and procedures employed for the study. These include data collection, sampling (populations used), questionnaire design, and the data analysis methodology.

Chapter Three discusses the qualitative and quantitative approach inquiry in detail and explains how it was employed in this research, the rationale for the case study research strategy and the methods used for data collection. The mixed approach was used to explore the underlying causes and effects of the artisan skills shortages. However the core methodology approach of this research was more on the quantitative approach. Then the data analysis methodology is discussed, followed by the important issues of reliability and validity and the measures that were taken to ensure these.

According to Goddard and Melville (2001), research is the study of problems through the use of scientific methods and principles. It implies exhaustive study, investigation or experiments following some logical sequence. They further add that research involves a critical analysis of existing conclusions or theories with regard to newly discovered facts. They indicate that advances in technology as well as an ever-changing society demand a continued search for new knowledge and understanding of the world. It is also important to note that studies differ; therefore the methodology that is appropriate for each study must be carefully selected.

In Chapter Two, a review of the literature on skills shortages was presented. The chapter served to create a basic understanding of what skills shortages are, and why their interpretation is important if firms are to respond appropriately to shortage situations. In order to gain a full understanding of the problem of the shortage of artisan's skills in the construction sector in South Africa particularly in the Western Cape Province, the research study was conducted on the basis of a phenomenological paradigm.

According to Collis and Hussey (2003:55), the phenomenological paradigm tends to produce qualitative data; uses small samples; and is concerned with generating theories which produce data that are rich and subjective and has a natural location; low reliability; and has high validity. Hammond, Howarth and Keat (1991) view the phenomenological paradigm as aiming to identify and describe the subjective experiences of respondents in a research study. For this study, the phenomenological paradigm was adopted because of the depth and richness of detail it can provide.

Research, according to Welman and Kruger (2001), involves the application of various methods and techniques in order to create scientifically developed knowledge by using objective methods and procedures. Mutai (2000) defines research as a “systematic search for pertinent information which leads to new knowledge.” It encompasses investigations into relationships among different factors operating in a given situation.

### **3.2 There are Various Types of Research Available**

There are various kinds of research. Research could be descriptive, correlative or exploratory. When choosing the correct type of research to employ when attempting to solve a problem, researchers should be guided by the characteristics of the problem, the initial level of knowledge, the properties of the variables, as well as the purpose of the investigation. Research design is a plan or blue-print of how a researcher intends to conduct the research (Kumar, 2005).

### **3.3 Validity and Reliability**

Studies in general should be conducted in a valid and logical manner. The basis of the argument and evidence that supports the study should be logical and valid. Mouton (2001) says that, in order to collect data, some form of measuring instruments have to be used. These could be sophisticated instruments ranging from high resolution microscopes to gas spectrometers, or instruments such as questionnaires, observation schedules, interviewing schedules and psychological tests.

Leedy *et al.* (2005) highlight validity and reliability as two factors that are vitally important when considering the measurement of data: Validity is the soundness and the effectiveness of the measuring instrument. This refers to the functionality of the instrument and accuracy of the reading by the instrument, and Reliability deals with the accuracy of the measuring instrument and how dependable the data read or taken from the instrument are.

There are many ways in which the validity of a measurement can be tested. These include: Face validity: This is a subjective judgment and is given by the researcher; Criterion related validity: Judgment is made of the measurement based on the standards that have been set; Content validity: This is the accuracy with which an instrument measures the factors or situations under study; Construct validity: This is the extent to which the conclusions reached in a study are free from bias, and External validity: This is the extent to which the conclusions reached in a study are generalised and applied to samples in other cases. Reliability is the extent of power not to fail of a result or theory. It is concerned about accuracy.

Leedy *et al.* (2005) state that; it is the consistency of a measuring instrument to yield certain results in repeated measuring. Reliability reflects the extent of error of a result. Therefore, reliability is about the question: with what accuracy does the measurement, test inventory or questionnaire measure what it is intended to measure?

### **3.4 The Case Study Methods**

According to Collis and Hussey (2003:68) case studies are often described as exploratory research, and used in areas where there are few theories or a deficient body of knowledge. Scapens (in Collis and Hussey, 2003:68) adds the following types of case studies:

- Descriptive case studies where the objective is restricted to describing current practice
- Illustrative case studies where the research attempts to illustrate new and possibly innovative practices adopted by particular companies
- Experimental case studies where the research examines the difficulties in implementing new procedures and techniques in an organisation and evaluating the benefits
- Explanatory case studies where on existing theory is used to understand and explain what is happening.

Yin (2003:9) argues that a case study strategy is preferred when the researcher seeks answers to “how” and “why” questions, when the researcher has little control over events being studied, when the object of study is a contemporary phenomenon in a real-life context, when boundaries between the phenomenon and the context are not clear, and when it is desirable to use multiple sources of evidence. Stake (1995:3) acknowledges that cases can be chosen and studied because they are thought to be instrumentally useful in furthering understanding of a particular problem, issue, concept, and so on. Yin (1994:13) identifies the following characteristics of case study research:

- The research aims not only to explore certain phenomena, but to understand them within a particular context
- The research does not commence with a set of questions and notions about the limits within which the study will take place
- The research uses multiple methods for collecting data which may be both qualitative and quantitative.

### **3.5 Methods of Data Analysis**

A case study is suited to data triangulation, where data are collected from different sources in the study of a phenomenon (Collis and Hussey, 2003). Jick (in Collis and Hussey, 2003:78) contends that triangulation has vital strengths, encourages productive research, enhances qualitative methods and allows the complementary use of quantitative methods. Yin (1993:32) reinforces this view by observing that an important aspect of case study data collection is the use of multiple sources of evidence in order to converge on the same set of issues.

Cooper and Schindler (in Froom, 2007:36) acknowledge that the communication approach does have weaknesses. They cite the quality and quantity of information gathered being dependent on the ability and willingness of respondents to cooperate. The unwillingness to cooperate may be due to people failing to see any value in participation, they may fear the interview experience for some personal reason, or they may view the topic as too sensitive and thus the interview as potentially embarrassing or intrusive.

According to Cooper and Schindler (in Froon, 2007:35), there are two basic approaches to data collection, and these being observation and communication. Froon (2007:35) notes that if the research questions and objectives are concerned with what people do, then an obvious way in which to discover this is to watch the people do it. This is what observation involves. The communication approach, on the other hand, involves questioning or surveying people and recording their responses for analysis (Froon, 2007:35). Froon (2007) contends that questioning is more economical and efficient than observation, and that a few well-chosen questions can yield information that would take much more time and effort to gather by observation.

### **3.5.1 Communication Approach to Data Collection**

The close and open ended questionnaires were an approach adopted as the main mean of collecting data at source. Document study was used during the literature review to also collect primary data. Henning, van Rensburg and Smit (2004:100) argue that if documents and other modes of data collection are omitted from a study there could be gaps that are left unfilled. They further argue that it is useful to practice data collection in as many modes as possible, and then select a specific method in a specific design that may capture data optimally and purposefully.

### **3.5.2 Interviews**

Collis and Hussey (2003:167) state that interviews are a method of collecting data in which selected participants are asked questions in order to find out what they do, think or feel. They acknowledge that interviews are associated with both positivist and phenomenological methodologies. Schwandt (2007: 163) classifies interviews as either structured (closed, forced-choice responses) or unstructured (open-ended responses). Collis and Hussey (2003) suggest unstructured interviews are suitable for a phenomenological (qualitative) approach.

According to Easterby-Smith, Thorpe and Lowe (1991), unstructured or an important step in qualitative research is identifying the parameters for data collection. According to Creswell (1994:148), the idea of qualitative research is to purposefully select informants (or documents or visual material) that will best answer the research question, and no attempt is made to select informants randomly.

### **3.5.3 Questionnaire**

According to Collis and Hussey (2003), questionnaires are associated with both positivistic and phenomenological methodologies. They also describe a questionnaire as a list of carefully structured questions, chosen after considerable testing, with a view to eliciting reliable responses from a chosen sample. The main aim of a questionnaire, according to Collis and Hussey (2003:173), is to find out what a selected group of participants do, think or feel. Delport (2005:166) concurs with Collis and Hussey (2003) in that the basic objective of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on the particular issue.

A self-administered questionnaire is handed to the respondent, who completes it on his own, but the researcher is available in case problems arise. Questionnaires are sometimes delivered by hand, so that respondents can complete them in their own time, and then are collected later by fieldworkers. The last type is the group-administered questionnaire in which case respondents who are present in a group would each complete a questionnaire on their own without discussion with the other members of the group. There is also a telephonic questionnaire which, from a methodological point of view, is more a type of structured interview schedule whereby the researcher asks the questions telephonically through a person-to-person interview. The questionnaire is divided into two sections, with the first section requiring the respondent's biographical information while the second section is the actual opinion survey.

The questionnaire was emailed and also delivered by hand because, the time was also limited to wait for the response via email, so the questionnaires were distributed to a number of individuals within various departments of NMC group that utilise artisans or work very closely with artisans. Individuals in these departments would be quite close to occupations that utilise artisans, and would therefore be able to perceive any problems that arise because of a shortage of artisan's skills and are also more likely to know what the cause of the shortage is. The questionnaire was also distributed among training and human resource departments within the NMC group.



## **3.6 Qualitative and Quantitative Research Methodology**

### **3.6.1 The quantitative approach**

A quantitative approach was chosen as the methodology best appropriate for the study because the purpose of the research concerns explanation and prediction of time. Furthermore the quantitative approach was chosen as appropriate as it involves numerical data. In terms of the availability of literature for the study, its availability could be assumed to be largely one of the criteria suggested. Therefore, the quantitative approach was chosen, according to Leedy *et al.* (2005). The time for the field work of the research is relatively short. Leedy *et al.* (2005) posit that when the time available for the research is short, the quantitative approach is appropriate. Based on this the quantitative approach was chosen. The target population for the study is learned (educated). They are mainly graduates and are familiar with quantitative studies. The characteristics of the data for the study are that they are numeric, representative and consist of large samples. Data will be analysed statistically and findings communicated in numbers. Based on these considerations, the quantitative approach is considered appropriate as a method for conducting the research.

### **3.6.2 Qualitative approach**

A qualitative approach has also been used in this research. To illustrate the purpose, descriptive and explanatory methods were used and part of the findings will be expressed qualitatively.

### **3.6.3 Triangulation**

Triangulation is used because it is a method that employs the use of qualitative and quantitative data to address a single research question or problem (Kumar, 2005). Fellows and Liu (2003) describe triangulation as the means of using both qualitative and quantitative techniques together. Further, they said that such a combination can be very powerful to gain insights and results. Love *et al.* (2002) suggest that triangulation could be influential in espousing multi-level research within construction management research to embrace both ontological and epistemological viewpoints.

### **3.7 Data Analysis**

The data analysis approach adopted in this case study was both descriptive as well as interpretational. Descriptive statistics were used in the analysis of the responses to the questionnaire. Translating the responses to each of the questions in the questionnaire into the number of times a certain answer appeared has helped in the understanding of the nature of the shortages of artisan's skills in the construction sector.

According to Henning et al (2004), analysing qualitative data literally means taking words, sentences and paragraphs apart, which is an important act in the research project in order to make sense of, interpret and theorise, the data. Schwandt (2007:6) advises that in organising, reducing and describing the data, an analysis ought to be rigorous, systematic, disciplined, carefully documented, and methodical.

Quantitative analysis involves mathematical operations which quantifies the results in numerical values. Quantitative data extracted from closed ended questionnaires was encoded using the Statistical Package for the Social Science (SPSS) and results were carefully analysed statistically using both the descriptive and inferential statistics.

#### **3.7.1 Descriptive statistics**

Descriptive analysis make use of measures of central tendency, which provide a single value which can be said to typify broadly the way the cases are split between the categories of a variable. There are three measures of central tendency namely; mode, mean and median (Henn, Weinstein and Foard, 2006).

Struwig and Stead (2001) maintained that descriptive statistics provide statistical summaries of data. Descriptive statistics provide an overall, coherent and straightforward picture of a large amount of data.

#### **3.7.2 Inferential statistics**

Inferential statistics use samples of observations to infer observation probably found in a population. They assist in generalising the findings from the sample to the larger population (Struwig and Stead, 2001).

## **CHAPTER FOUR**

### **DATA ANALYSIS AND DISCUSSION**

#### **4.1 Introduction**

This chapter presents the analysis of the data gathered in the survey using the questionnaire. The chapter will also present the description of cases based on different sites of Neil Muller Construction group (NMC) and observations. This section also presents the interpretation and discussion of the results pertaining to the causes and effects of shortages of skilled artisans and its impact on the contractor production. This study will also present the response rate of the questionnaire survey and the profile of respondents in the study.

#### **4.2 Observations on site**

Observations were done on different sites of NMC during the time the researcher was working with them and the time the researcher visited their sites for research study done for the purpose of fulfilling the requirements of Bachelor Technology Degree (BTech). The site visits and also working on sites led to realization of the study presented in this chapter. Observations were carried out in October 2010 and November 2010, of which on November 2010 the researcher was working with them as the construction technician student. Attached is the confirmation letter from NMC qualifying the research question that the study seeks to analyse and indeed exists in the Construction industry.

#### **4.3 Response rate of questionnaire survey**

The data was gathered via questionnaire surveys from a total of 209 questionnaires distributed to Neil Muller Construction sites (NMC) in the Cape Peninsula area in the Western Cape Province. Respondents included contracts managers, senior site managers, junior site managers, construction technicians, contractor project managers, foremen/leading hands, trainee carpenters / trainee artisans, site clerks and other site personnel. Questionnaires of about two hundred and nine (209) were sent on various sites via email and some were physically handed to the respondents.

Of the 209 delivered questionnaires, 65 were duly completed and returned, representing a response rate of 31.1% the majority of the questionnaires were collected in person while the minority of the respondents returned the questionnaires via fax and email.

The following steps were taken in order to improve the response rate:

- The covering letter made a humane appeal to the respondents;
- The length of the questionnaire was kept to a minimum for a study of this magnitude.

#### 4.4 Profile of respondents

##### 4.4.1 Departments of participants

This section presents types of the participant departments, the current positions, gender, age, highest qualification of respondents, status in the organisation and work experience of respondents. As seen in Figure 4.1, participants of departments included procurement (12%), quantity surveyors (11%), project management (16%), buying department (6%), and site management (46%), human resource management (3%) and others (6%).

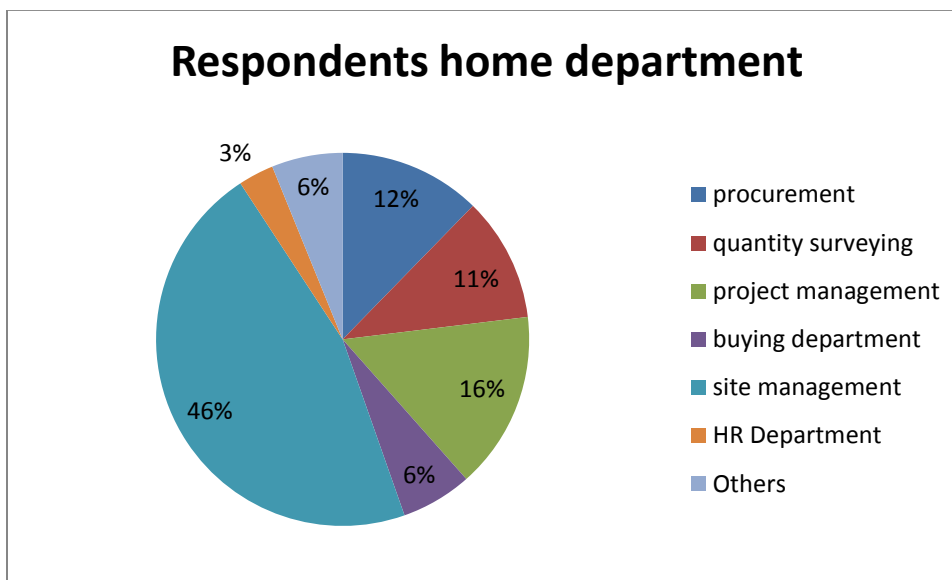
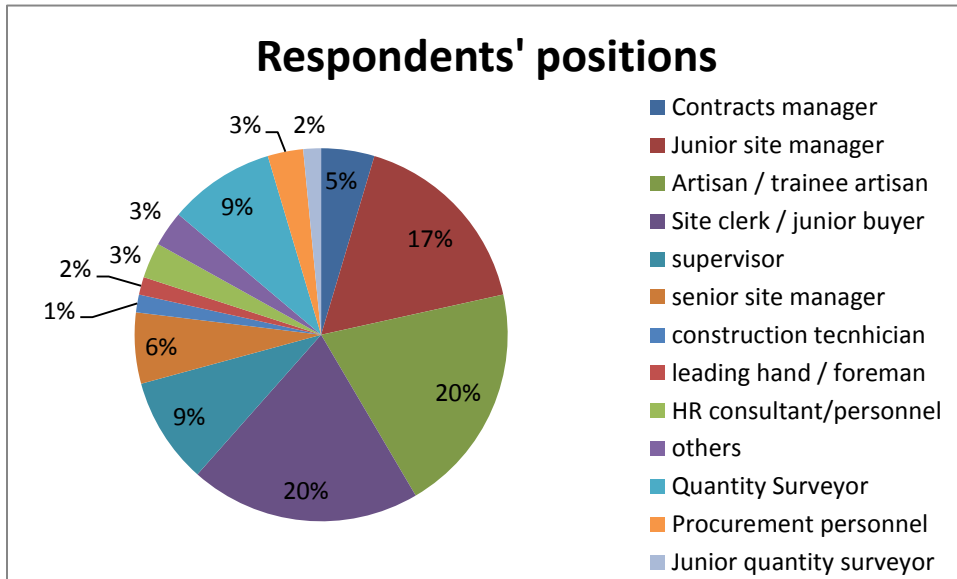


Figure 4.1: Respondents of departments

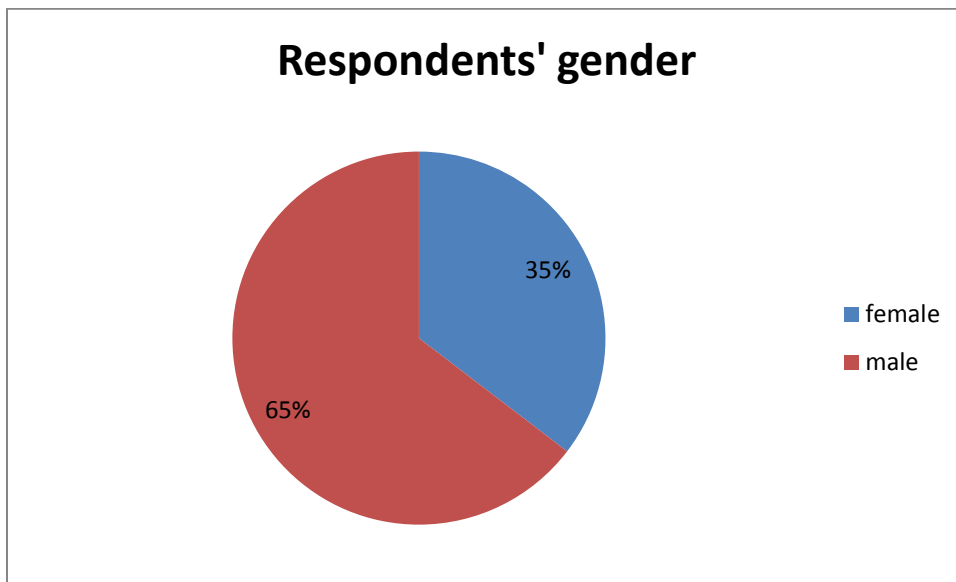
Figure 5.2 depicts the current position of the respondents. The survey population included site management team, which the site management team is made up of mostly direct and indirect personnel, indirect personnel would be for example the HR consultant , procurement and buying personnel and the direct personnel would be site management team, quantity surveying and project management team. Following is the rate of respondents in percentage of each department showing the current position of respondents: contracts manager (5%), Junior site managers (17%), artisan / trainee artisan (20%), site clerk / junior buyer (20%), supervisor (9%), senior site manager (6%), construction technicians (2%), leading hand (2%), human resource consultant (3%), others (3%), quantity surveying (9%), procurement personnel (3%) and junior quantity surveyor (2%).



**Figure 4.2:** Current positions of the respondents

#### 4.4.2 Gender of the respondents

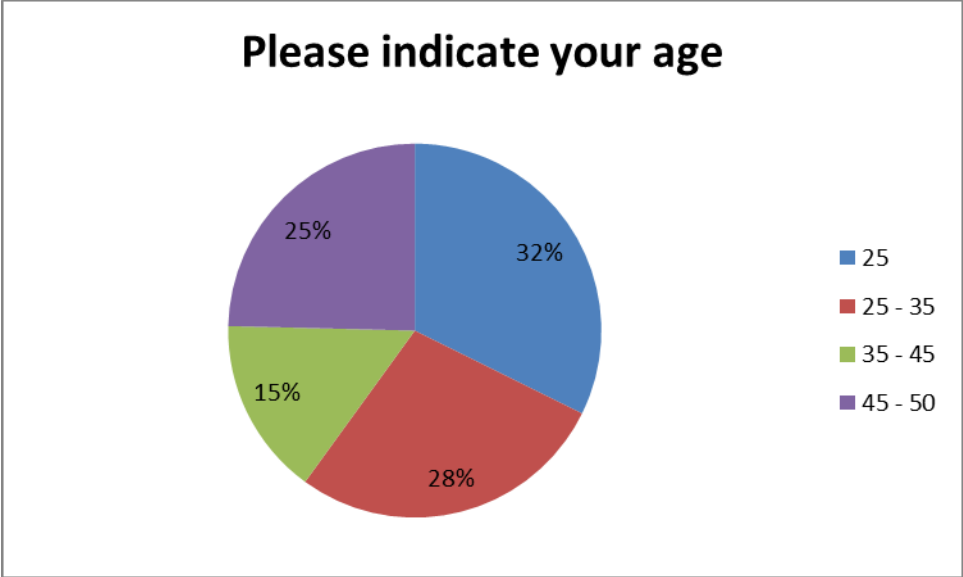
Figure 5.3 indicate the rate of respondents of genders in percentage. 65% that participated on the survey was men and only 35% was women, refer to figure 5.3 below for confirmation of the data presented. This gives evidence to the statement that says the industry is masculine - inclined.



**Figure 4.3:** gender of the respondents

#### 4.4.3 Age distribution of respondents

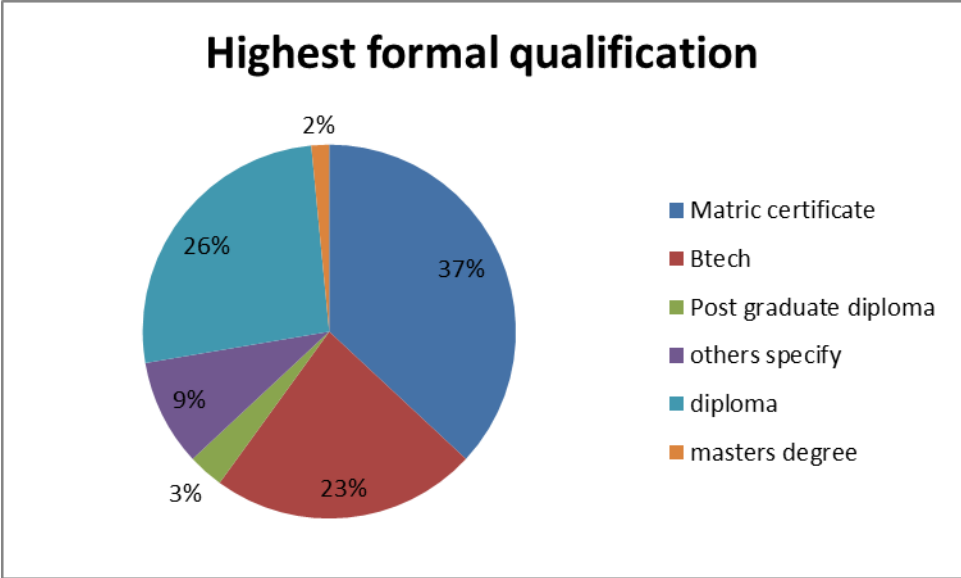
Figure 5.4 depicts the age category of the respondents. 32% of the respondents are about 25 years of age, 28% of the respondents are between the ages 25 to 35 years, and 15% of respondents are between the ages of 35 to 45 year, while on the other hand 25% of the respondents are between the ages of 45 to 50 years. The age of the respondents gives confidence with regards to the outcome of the data presented because the participants are mature enough to give sound quality of information required to achieve the objectives of this study. The age categories from 35 to 45 and from 45 to 50 are participants and /or respondents that have sound knowledge of the construction industry.



**Figure 4.4:** Age distribution of respondents

**4.4.4 Highest formal qualification of respondents**

Figure 5.5 indicates the highest academic qualification of the respondents. 37% of the respondents have matric certificate, and they predominate sample. Following closely are respondents with national diploma's, totalling 26%, and 23% of the respondents hold bachelor's degree, 9% of respondents fall under the category of others specify, 3% of the respondents are those with post graduate diploma and lastly 2% of the respondents are those with master's degrees .This analysis reveals that well qualified personnel are employed in the industry but they are the minority as opposed to the respondents with matric certificate. Therefore performance could be affected because the level of formal training is very low according to the sample presented in this study compared to the level of informal training. It also indicates that those without the necessary formal training have perceptions are not always reliable.

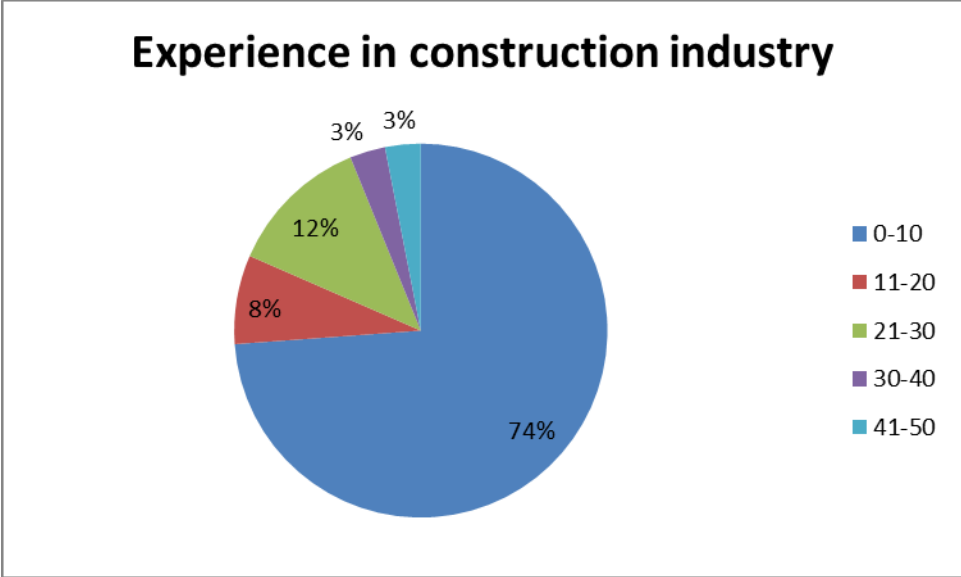


**Figure 4.5:** Highest formal qualification

**4.4.5 Experience in Construction Industry**

Figure 5.6 indicates the experience of the respondents in the Construction Industry. 74% of the respondents are between zero to ten (0-10) years of working experience in construction industry, of which they are the predominant of this sample. 8% of the respondents are between the eleven to twenty (11-20) years of working experience in the construction industry, 12% of the respondents are between twenty one to thirty (21-30) years of working experience in the construction industry, however 3% of the respondents are between the thirty one to forty (31-40) years of working experience in the construction industry, and of course lastly the other 3% of the respondents are between eleven to twenty (41-50) years of working experience in the construction industry and this category of the sample is well informed about all the challenges of the construction industry. So that implies that their response to the survey will give the valid information with regard to the objectives that the study seeks to determine. However the predominant category which is about 74% of this sample does not have enough experience that could help them to deal with any challenges coming their way.





**Figure 4.6:** Experience in Construction Industry

**4.5 Main questionnaire analysis**

**4.5.1 Training structures**

**4.5.1.1. Personnel responsible for managing skills training**

Respondents were requested to indicate their perception concerning the personnel responsible for managing skills training using a 5-point Likert Scale where 1= minor; 2 = semi-minor; 3 = neutral; 4 = major; and 5 = strong major; 6= unsure. From Table 5.1, it was possible to rank the personnel responsible for managing skills using their means. Human resource personnel were ranked first with a mean score of (3.83), contracts management was ranked second with the mean score of (3.77), senior management was ranked on third with the mean score of (3.71), site managers was ranked on the fourth place with the mean score of (3.48) and supervisor / foreman was ranked on the fifth place with the mean score of (3.18). Since all of means of the responses were greater than 3, respondents tended to agree that personnel responsible for managing skills training were important. Comparative to other aspects not cited in the questionnaire, one of the respondents added that skills management was one of the key areas that any firms that want to be successful must take into consideration at all times throughout all levels of employment within the organisation and/or a firm.

**Table 4.1: Personnel responsible for managing skills training**

Skill training	Minor		Semi minor		Neutral		Major		Strong major		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
human resource personnel	10	15.4	1	1.5	12	18.5	12	18.5	27	41.5	3	4.6	65	3.83	1.50	1
contracts management	5	7.7	2	3.1	18	27.7	22	33.8	14	21.5	4	6.2	65	3.77	1.24	2
senior management	5	7.7	6	9.2	16	24.6	17	26.2	18	27.7	3	4.6	65	3.71	1.31	3
Site managers	6	9.2	7	10.8	16	24.6	25	38.5	8	12.3	3	4.6	65	3.48	1.25	4
supervisors/foreman	13	20.0	6	9.2	16	24.6	20	30.8	6	9.2	4	6.2	65	3.18	1.50	5

#### 4.5.1.2 Reliability test

The outcomes of the item study conducted to determine the steadfastness of the summated scores calculated for the various factor categories are stated in this section. The Item analysis was engaged for the seven items (statements) in the questionnaire that were summated into scores for the 7 factor categories. For each factor Cronbach's coefficient  $\alpha$  was calculated and a factor analysis specifying a one factor model was conducted.

Table 5.2 shows the summary of the reliability test for the questions. Gomm (2008) indicated that the closer the coefficient is to 1, the more reliable the instrument item; an optimal Cronbach's co-efficient alpha value should be above 0.7. It is evident that the questions satisfy the reliability test, however there is one question that was below 0.7, it showed the results of 0.675 but very close to 0.7. Tests for the internal reliability of the factors in each category were conducted by determining their Cronbach's coefficient  $\alpha$  value. Table 5.2 presents the results:

**Table 4.2: summary of the reliability test**

<b>Question No</b>	<b>Statement</b>	<b>No. of questions</b>	<b>Cronbach's alpha coefficient</b>
9	Employees responsible for managing skills training in your company	5	0.822
11	site related factors which might be the causes of reworks due to shortages of skills or lack of skills which could result to low productivity	8	0.929
12	use of the following training methods when developing skills on your labour force	3	0.792
16	to what extent do you agree with the following statements	4	0.675
17	to what extent Sub-contractors are used to perform activities on your Construction site	4	0.943
19	The extent to which of the following learning mechanisms are implemented.	8	0.893
20	Sub-contractors related factors which might be caused by rework due to lack of skilled artisan and miscommunication.	6	0.916
	Total questions	38	5.97

#### **4.5.1.3 Reworks due to shortages of skills and / or lack of skills which could result to low productivity**

Respondents were asked to show their insight concerning the reworks due to shortages of skills and / or lack of skills which could result to low productivity using a 5-point Likert Scale where 1= minor; 2 = semi-minor; 3 = neutral; 4 = major; and 5 = strong major; 6= unsure. From Table 5.3, it was possible to rank the personnel responsible for managing skills using their means. Ineffective use of quality management practice was ranked first with a mean score of 3.40, lack of training and practises with mean score of (3.20) was rank second, setting out errors with mean score of (3.09) was rank on third place, constructability problems with mean score of (3.09) was ranked on the forth place, poor planning resources with mean score of (3.06), was also ranked on the firth place, poor co-ordination of resources with mean score of (2.92) was ranked on the sixth place followed by, failure to provide protection to works with mean score of (2.74) was ranked as the second last and the last one was the Lack of safety with mean score of (2.68) respectively. Since most of means of the responses were greater than 3, respondents tended to agree that personnel responsible for managing skills training were important.

**Table 4.3: Reworks due to shortages of skills and / or lack of skills which could result to low productivity**

Site management (mgt)	Minor		Semi minor		Neutral		Major		Strong major		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
Ineffective use of quality mgt. practise	11	16.9	7	10.8	11	16.9	18	27.7	17	26.2	1	1.5	65	3.40	1.46	1
Lack of training and practises	11	16.9	7	10.8	11	16.9	18	27.7	17	26.2	1	1.5	65	3.20	1.34	2
Setting out errors	13	20.0	7	10.8	18	27.7	16	24.6	10	15.4	1	1.5	65	3.09	1.49	3
Constructability problems	11	16.9	13	20.0	24	36.9	6	9.2	9	13.8	2	3.1	65	3.09	1.39	4
Poor planning resources	16	24.6	5	7.7	18	27.7	11	16.9	15	23.1	0	0	65	3.06	1.48	5
Poor co-ordination of resources	16	24.6	5	7.7	18	27.7	11	16.9	15	23.1	0	0	65	2.92	1.35	6
Failure to provide protection to works	19	29.2	17	26.2	5	7.7	14	21.5	10	15.4	0	0	65	2.74	1.50	7
Lack of safety	19	29.2	12	18.5	14	21.5	8	12.3	11	16.9	1	1.5	65	2.68	1.48	8

#### 4.5.1.4 Training methods when developing skills on your labour force

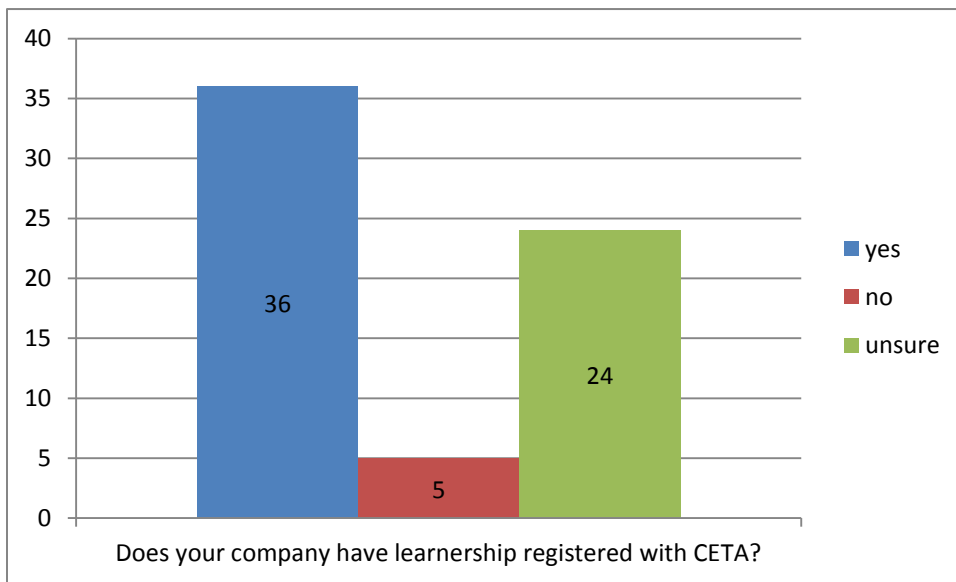
The execution of training methods mechanisms was examined. The ranking by means of the answers relating to training methodology of learning mechanisms is shown in Table 5.4. Formal training was ranked first with a mean score of 4.38, followed by on-site training with a mean score of (4.23) and off-site training with a mean score of (4.12). These findings shown above indicate that learning mechanisms that were employed to transfer skills and knowledge were implemented to some extent.

**Table 4.4: Training methods when developing skills on your labour force**

Training mechanism	Always		Often		Sometimes		Rarely		Never		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
Formal training (e.g.FET College)	15	23.1	19	29.2	14	21.5	7	10.8	3	4.6	7	10.8	65	4.38	1.50	1
On-site training	17	26.2	19	29.2	16	24.6	2	3.1	7	10.8	4	6.2	65	4.23	1.57	2
Off-site training	14	21.5	13	20.0	21	32.3	7	10.8	4	6.2	6	9.2	65	4.12	1.51	3

#### 4.5.1.5 The company have a registered learner-ship with CETA

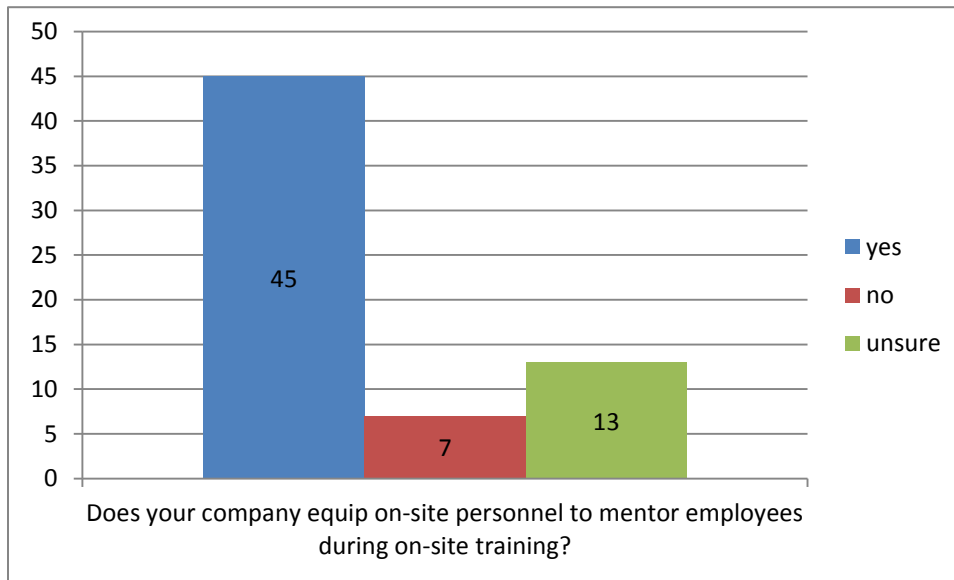
Respondents were requested through the questionnaire survey to indicate if the company that they are working for have a registered learner-ship programme with the Construction Education Training Association (CETA). The options that were given to them as criteria to measure their knowledge was yes, no and unsure option. Ranking by the number of respondents that answered the questions, Figure 5.7 shows the response of the respondents. The YES option was ranked first with 36 respondents out of 65 respondents answered, followed by an UNSURE option ranked second with 24 respondents who have no evidence if the company is registered with CETA or not and the last option was a NO option where only about 5 respondents did not know anything about learner ship programme.



**Figure 4.7:** Company have a registered learner-ship with CETA.

#### 4.5.1.6 The company equip on-site personnel to mentor employees during the on-site training

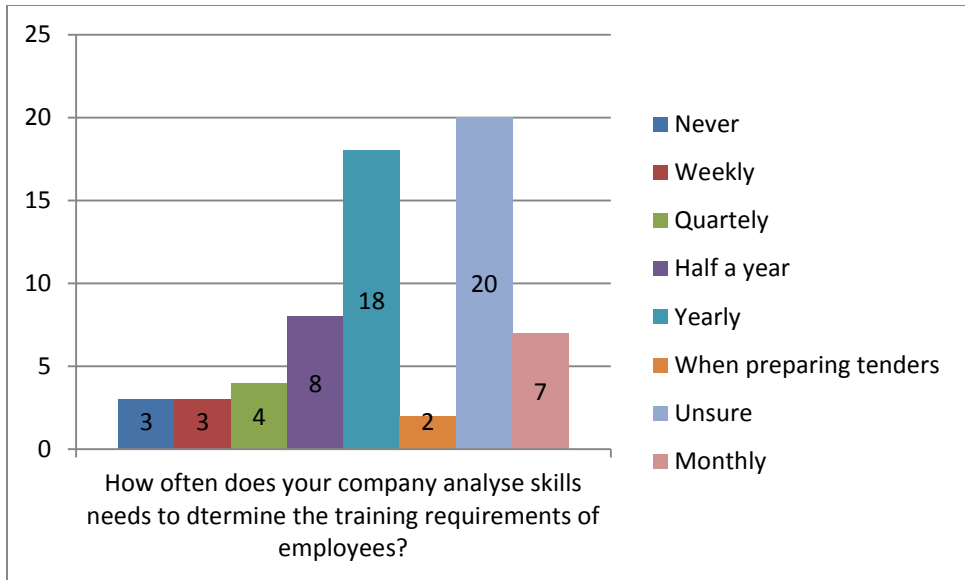
Figure 5.8 shows the response of the respondents. The YES option was ranked first with 45 respondents out of 65 respondents answered, followed by an UNSURE option ranked in a second position with 13 respondents unsure if the Company does equip on-site personnel to mentor employees during the an on-site training and the last option was a NO option where only about 7 respondents that did not know anything if the Company does equip on-site personnel to mentor employees during the an on-site training.



**Figure 4.8:** The Company equip on-site personnel to mentor employees during the on-site training

#### **4.5.1.7 Company analyses of the skills need to determine the training requirement of employees**

Respondents were requested to indicate their view regarding the company analyses of the skills needs to determine the training requirements of employees using a 8-point Likert Scale where 1= never; 2 = weekly; 3 = quarterly; 4 = half a year; 5 = yearly; 6 = when preparing tenders; 7 = unsure and 8 = monthly. Figure 5.9 shows the results from all the respondents participated on the questionnaire survey. 209 questionnaires were distributed, but only 65 respondents contributed on the questionnaire survey distributed. Never ranked first with a frequency score of 3; followed by weekly with a score of 3; quarterly with a score of 4; half a year with a score of 8; yearly with a score of 18; when preparing tenders with a score of 2; unsure with a score of 20 and lastly monthly with a score of 7. The results shown on the figure 5.9 below gives an evidence that most of the respondents about 20 of them are not sure how often does a company analyses skills need to determine the training requirements, however on the other about 18 respondents in number clearly answered that yearly the company do the review of the skills analyses to determine the training requirements. Few of the respondents in other Likert scale options disagree with the above mentioned respondents, for example 8 respondents say the skills analyses to determine training requirements is only done in the mid of the year, whereas on the other side 7 of the respondents believes that skills analyses are only done for the purpose of submitting tenders. Therefore according to the evidence presented in figure 5.9, most of the respondents do not really know the exact time that the company analyses the skills need for training requirements.



**Figure 4.9:** Company analyses of the skills need to determine the training requirement of employees

**4.5.1.8 Employees less likely to receive the training practise**

The employees that are less likely to receive the training practice were identified. The results in Table 5.5 show the insight of respondents with regard to employees that are less likely to receive training practice. By ranking the means of the responses, casual employees are less likely to receive skills training with a means score of (3.18). The next most less likely category to receive training skills was non-permanent employees with a mean score of (3.06); the second last category that is also most less likely to receive training skills was employees that are made permanent before formal training with a mean score of (3.05); and last category that is permanency of employment is pre-requisition for training with a mean score of (2.95). Evidently, respondents agreed that the first three factors were the major since their means are between 3.18 to 3.05. However according to the percentage displayed on table 5.9 many of the respondents were at the neutral status by 29% which that proves that many respondents did not have a clue with regard to the employees that are less likely to receive training.



**Table 4.5: Employees less likely to receive the training practise**

Statements	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
Casual employees are less likely to receive skills training	11	16.9	12	18.5	19	29.2	10	15.4	12	18.5	1	1.5	65	3.18	1.52	1
Non-permanent employees receive skills training within your company	14	21.5	10	15.4	16	24.6	11	16.9	11	16.9	3	4.6	65	3.06	1.52	2
Employees are made permanent before formal training	12	18.5	11	16.9	14	21.5	12	18.5	13	20.0	3	4.6	65	3.05	1.39	3
Permanency of employment is pre-requisite for training	15	23.1	15	23.1	13	20.0	8	12.3	8	12.3	6	9.2	65	2.95	1.62	4

#### **4.5.1.9 Trades of work sub-contracted**

Respondents were asked to indicate the extent to which subcontractors are used to perform the trades listed below in table 5.6. The following trades are performed by sub-contractors on behalf of the main contractor. Table 5.6 indicates that support work and formwork was ranked first with a mean score of (5.34). Brickwork trade was ranked second with a mean score of (4.69); followed by plastering trade with a mean score of (4.68) and lastly concrete work with a mean score of (4.17).

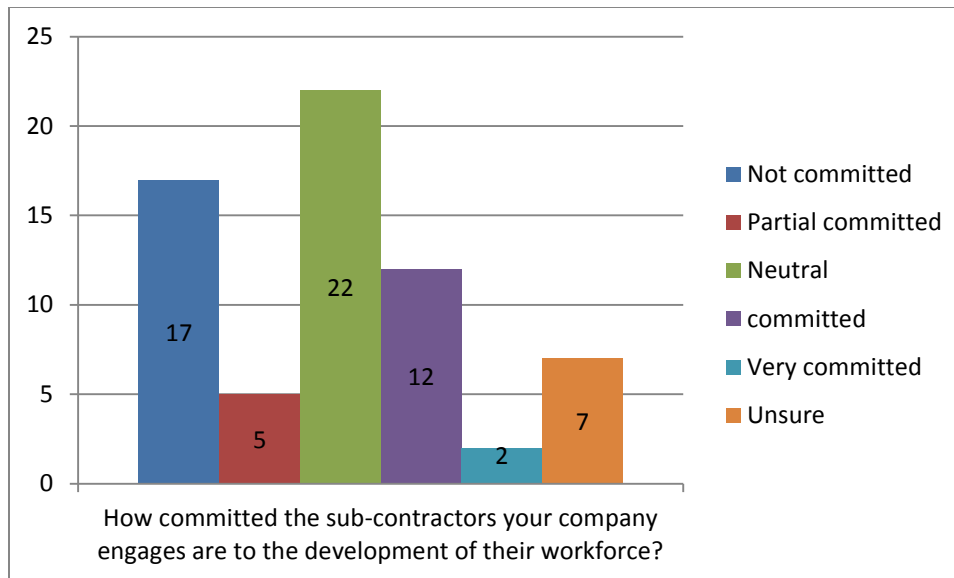
According to the results presented on table 5.6 below, most of the respondents tended to agree that the total work of all the trades listed on table 5.6 are always performed by sub-contractors on behalf of the main contractor. Table 5.6 clearly show in percentage that support work and formwork about 38.5% of the respondents tended to agree that this trade of work is always performed by a sub-contractor for the main contractor. For brick work and plastering about 47.7% percent of respondents tended to agree as well that these trades are also performed by the sub-contractor on behalf of the main contractor and lastly 26.2 % of the respondents are of the opinion that this trade is also always performed by a subcontractor on behalf of the main contractor.

**Table 4.6: Trades of work sub-contracted**

Trades Sub-contracted	Always		Often		Sometimes		Rarely		Never		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
Support work and formwork	25	38.5	20	30.8	6	9.2	3	4.6	3	4.6	8	12.3	65	5.34	6.48	1
Brickwork	31	47.7	15	23.1	5	7.7	3	4.6	4	6.2	7	10.8	65	4.69	1.72	2
Plastering	31	47.7	14	21.5	6	9.2	3	4.6	4	6.2	7	10.8	65	4.68	1.72	3
Concrete work	17	26.2	16	24.6	14	21.5	5	7.7	5	7.7	8	12.3	65	4.17	1.67	4

**4.5.1.10 Sub-contractors commitment to the development of their workforce**

Respondents were asked to indicate their view regarding sub-contractor’s commitment to the development of their workforce using a 6-point Likert Scale where 1= not committed; 2 = partial committed; 3 = neutral; 4 = committed; 5 = very committed and 6 = unsure. Figure 5.10 shows the results from all the respondents participated on the questionnaire survey. The total number of 209 questionnaires was distributed, but only 65 respondents participated on the questionnaire survey distributed. Neutral option ranked first with a frequency score of 22 which this clearly shows that most participates that participated on the survey did not know much about the involvement of the sub-contractors to the development of their workforce; followed by not committed with a score of 17; on the other hand about twelve (12) participates believes that sub-contractors are committed to the development of their workforce ; again about seven (7) participates are not really informed if subcontractors are committed to the development of their workforce or not; the second last group of participates about five (5) of them believes that sub-contractors are partial committed to the development of their workforce and the last group of participates only two (2) strongly believes that sub-contractors are very committed to the development of their workforce. Therefore according to the findings presented below on figure 5.10 it is then evident that most of the respondents did not have a clue if sub-contractors are really committed to the development of their workforce or not.



**Figure 4.10:** Sub-contractors commitment to the development of their workforce

#### 4.5.1.11 The extents to which of the following learning mechanisms are implemented

Respondents were requested to show their knowledge about the extents to which learning mechanisms were implemented using a 5-point Likert Scale where 1= not at all; 2 = not well; 3 = neutral; 4 = well implemented; and 5 = very well implemented. From Table 5.7, it was possible to rank the extents to which the learning mechanisms were used using their means. Training programmes for staff was ranked first with a mean score of (3.28), Project reviews was ranked second with mean score of (3.23), Self-learning of individuals (e.g. trades man on site) with a mean score of (3.14) was rank on the third place, Internal seminars on new development with a mean score of (3.05) was ranked on the fourth place, Research and Development with a mean score of (2.94), was also ranked on the fifth place, Internal benchmarking with mean score of (2.91) was ranked on the sixth place and the last one was the external benchmarking with a mean score of (2.85) respectively. Since most of means of the responses were greater than 3, respondents tended to agree that learning mechanisms was well implemented, although on the other hand most of the respondents participated were neutral according to table 5.11 looking at percentages. However, the last few factors recorded a mean score less than 3 implying that respondents disagreed that learning mechanisms was well implemented.

**Table 4.7: The extents to which of the following learning mechanisms are implemented**

Learning	Not at all		Not well		Neutral		Well implemented		Very implemented		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%				
Training programs for staff	7	10.8	8	12.3	19	29.2	22	33.8	9	13.8	65	3.28	1.18	1
Project reviews	7	10.8	13	20.0	14	21.5	20	30.8	11	16.9	65	3.23	1.26	2
Self-learning of individuals (e.g. trades man on site)	3	4.6	9	13.8	35	53.8	12	18.5	6	9.2	65	3.14	0.93	3
Internal seminars on new development	7	10.8	10	15.4	26	40.0	17	26.2	5	7.7	65	3.05	1.08	4
Research and Development	6	9.2	16	24.6	26	40.0	10	15.4	7	10.8	65	2.94	1.10	5
Internal benchmarking	8	12.3	16	24.6	23	35.4	10	15.4	8	12.3	65	2.91	1.18	6
External benchmarking	8	12.3	14	21.5	29	44.6	8	12.3	6	9.2	65	2.85	1.09	7

**4.5.1.12 Sub-contractor’s related factors which might be caused by rework due to lack of skilled artisan and miscommunication**

Subcontractor-related factors were examined and Table 5.8 shows the results. The means of the responses were ranked, Inadequate supervisor/foreman/tradesmen ratios was regarded as the most dominant subcontractor-related factor that might be one of the causes of reworks with a mean score = (3.20), and the standard deviation was used to distinguish sub-contract-related factor ranking number one = (1.51), followed by low labour skill level with a mean score = (3.20), followed by Shortages of skilled labours with a mean score = (3.23), followed by Shortages of skilled supervisors with a mean score = (3.11), second last factor is unclear instruction to workers with a mean score =(2.97) and the last factor is non-compliance with specifications with a mean = (2.91). According to table 5.12 below, it is evident that most of the means were greater than 3 then that imply that respondents tended to agree that most of the factors were considered to be subcontractor-related factors which had a lot of influence to reworks encountered. However the last two factors recorded a mean score less than 3 implying that respondents disagreed those subcontractor-related factors had a lot of influence to reworks

encountered. Therefore it is evident that sub-contractor related factors are the most predominant factors that lead to reworks.

**Table 4.8: Sub-contractor’s related factors which might be caused by rework due to lack of skilled artisan and miscommunication**

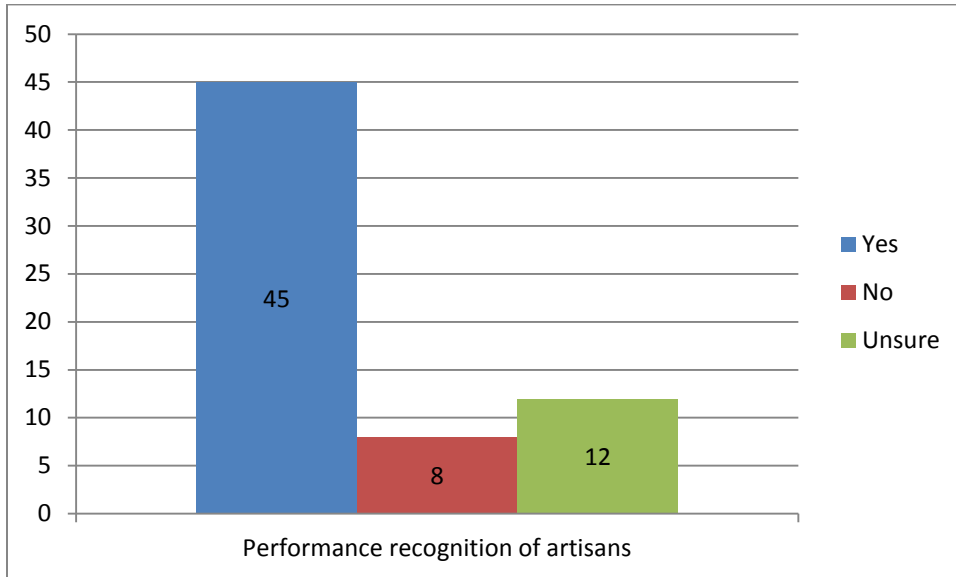
Statements	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Unsure		Total	Mean	Std Dev	Rank
	N	%	N	%	N	%	N	%	N	%	N	%				
Inadequate supervisor/foreman/tradesmen ratios	14	21.5	7	10.8	12	18.5	19	29.2	10	15.4	3	4.6	65	3.20	1.51	1
Low labour skilled level	13	20.0	7	10.8	14	21.5	17	26.2	13	20.0	1	1.5	65	3.20	1.45	2
Shortages of skilled labours	12	18.5	8	12.3	12	18.5	19	29.2	14	21.5	0	0	65	3.23	1.41	3
Shortages of skilled supervisors	15	23.1	8	12.3	13	20.0	14	21.5	14	21.5	1	1.5	65	3.11	1.51	4
Unclear instruction to workers	14	21.5	7	10.8	20	30.8	14	21.5	8	12.3	2	3.0	65	2.97	1.37	5
Non-compliance with specifications	14	21.5	14	21.5	11	16.9	17	26.2	8	12.3	1	1.5	65	2.91	1.41	6

#### 4.5.2 Causes and effects of shortages in artisan skills

##### 4.5.2.1. (a) Performance recognition of artisans

Respondents who participated on the survey distributed were asked to indicate their views regarding performance recognition of artisans in the company that they are working for using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.11 shows the results from all the respondents participated on the questionnaire survey. The yes option ranked first with a frequency score of 45 in number, which this clearly shows that most respondents that participated on the survey agreed that indeed artisans who do not get recognition for their performance are more likely to be less productive than artisans that do get performance recognition. However other respondents felt that recognition of the performance of artisans does not really have a negative impact on their daily productivity, about eight (8) respondents in

number replied with a NO answer on this options raking number three, and lastly on the other hand about twelve (12) respondents were not sure if artisans who do not get recognise for the performance at work are more likely to be less productive than the artisans who do get recognise ranking number two. Therefore according to the results presented on figure 5.11 below. It is clear that artisans who do not get recognised are more likely to be less productive than the artisans that does get recognise.



**Figure 4.11: Performance recognition of artisans**

#### **4.5.2.1. (b) Performance recognition of artisans – respondents were asked to elaborate on the option that they chose on the above question**

Following are some of the response from the respondents; please bear in mind that only few responses are used below from the respondents for discussion purposes:

- Artisans who are not getting proper recognition on their work performance are more likely to be less motivated to do their very best to achieve the highest daily productivity targets.

- When employees and / or artisans are recognised of their performance they are motivated to go an extra mile and to do their best which that will bring about to productivity at the end of the day.
- When artisan's work is not recognised, they do not feel appreciated and therefore they would not do any extra work or make on effort to work hard.
- My answer is yes because each and every employee/artisan likes effort to be appreciated and be recognised for what they do. Recognition gets employees to be motivated, a lack of recognition results in resigning of the employees or carelessly becoming less productive. Recognition pushes performance and productivity far beyond expectations.
- Recognition motivates one's inner-self and often causes a high productivity due to work being recognised.

Therefore according to the above given responses from the respondents, it is evident then that if artisans are recognised for the performance of their work done then they are more likely to be motivated and inspired to do their very best to achieve the highest production due to the fact that their performance is recognised. A definition of motivation is the set of processes that determine the choices people make about their behaviours.

Laufer and Moore (1983) advocated the use of financial incentive programmes to improve construction labour productivity, reinforcing Maloney's (1982) thesis of driving forces that led to productivity improvements.

According to Wilbert Scheer (1979), motivation is an abstract term. It imparts incentives that require a response on the part of someone else to achieve a defined goal. In business, motivation is not synonymous with salaries; money is a means for accommodating the economic needs of workers. Motivation means an inner wholesome desire to exert effort without the external stimulus of money. Smithers and Walker (2000) also cite this with the statement that says motivation plays a part in enhancing construction labour productivity and forms the basis for identification of the work environment factors.

#### 4.5.2.2. (a) Motivation plays vital role in artisan's production

Respondents were asked to show their views regarding motivation plays vital role in artisan's production using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.12 shows the results from all the respondents participated on the questionnaire survey. The yes option ranked first with a score of 45 in number, showing that most respondents agreed that indeed artisans who do not get motivated for their performance are more likely to be less productive than artisans that do get motivated by their supervisors and / or managers. On the other hand some of the respondents felt that motivation does not really have a negative impact on their daily productivity, about two (2) respondents in number replied with a NO answer on this options raking number three, and lastly about twelve (18) respondents were not sure if artisans who do not get motivated at work are more likely to be less productive than the artisans who do get motivated. Therefore based on the outcomes presented on figure 5.12 below, it is clear that artisans who do not get motivated are more likely to be less productive than the artisans that do get motivated of the work that they are doing.

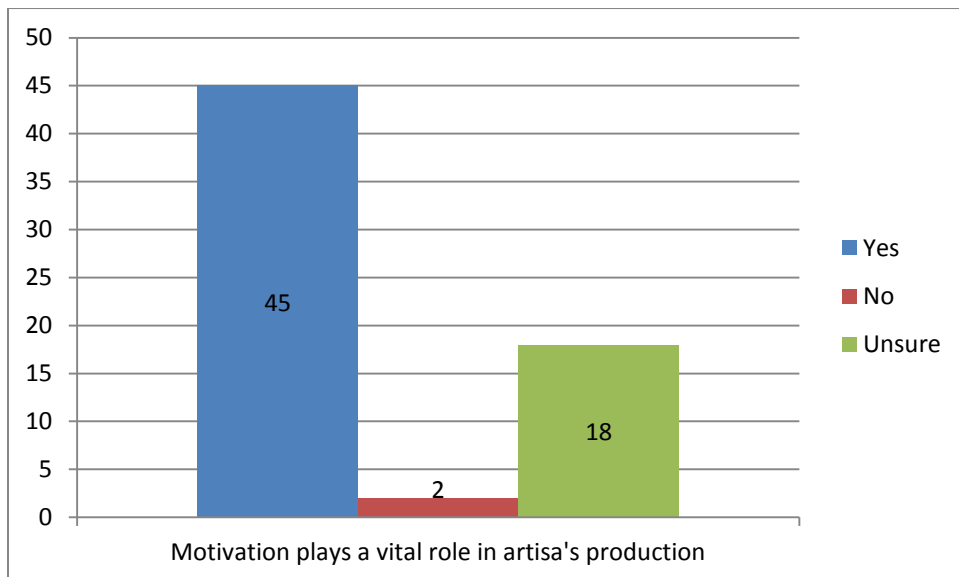


Figure 4.12: Motivation plays vital role in artisan's production



#### **4.5.2.2. (b) Motivation plays vital role in artisan's production – respondents were asked to elaborate on the option that they chose on the above question**

Following are some of the responses from the respondents; please bear in mind that only few responses are used below from the respondents for discussion purposes:

- When the employee is motivated there is a tendency to work harder to achieve greater results.
- When artisans are motivated they work much more effectively than when they are not motivated.
- Motivation plays a big role and when artisans/employees are motivated they are more productive and faster at the same time.
- Positive motivation breeds a positive attitude, happy workers work harder than expected.
- Motivation makes the employees want to give more than they are expected to give-going the extra mile.
- If employees know that there is some kind of incentive for their hard work it will motivate them to work harder.
- Motivation drives people to perform their duties even greater than they were expected to.

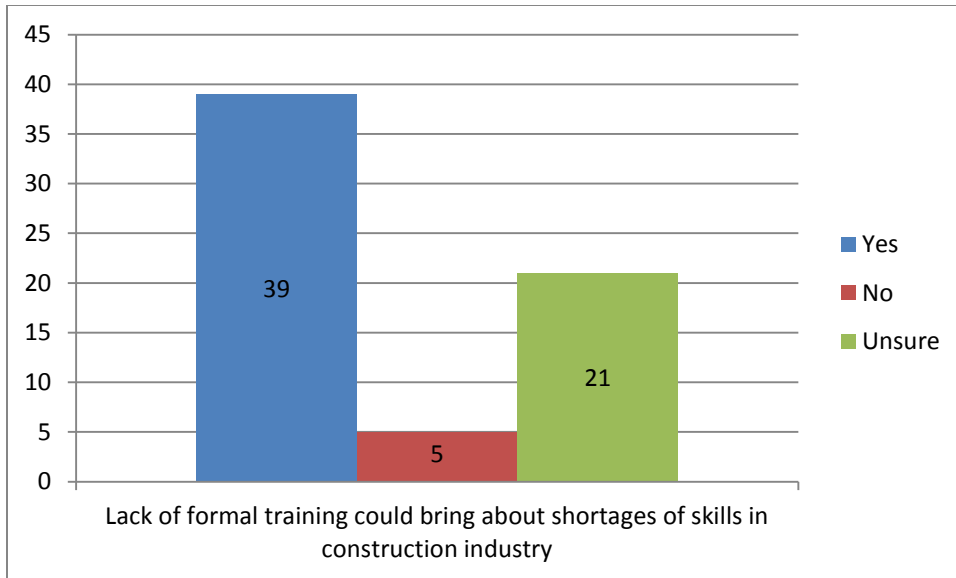
According to the above given responses from the respondents, it is clear that if artisans are motivated for the work that they have performed, they are more likely to be more productive and achieve greater results than expected. A definition of motivation is the set of processes that determine the choices people make about their behaviours.

Smithers and Walker (2000) also cite this with the statement that says motivation plays a part in enhancing construction labour productivity and forms the basis for identification of the work environment factors.

According to Wilbert Scheer (1979), motivation is an abstract term. It imparts incentives that require a response on the part of someone else to achieve a defined goal. In business, motivation is not synonymous with salaries; money is a means for accommodating the economic needs of workers.

#### **4.5.2.3. (a) Lack of formal training to artisans brings about shortages of skills**

Respondents who took part on the survey were asked to indicate their opinions with regard to Lack of formal training to artisans bring about shortages of skills using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.13 displays the results from all the respondents participated on the questionnaire survey. The yes option ranked first with a frequency score of 39 in number, which this clearly shows that most of the respondents that contributed on the survey agreed that lack of formal training to artisans does bring about shortages of skills and / or even lack of skills in the construction sector in the Western Cape Province. Other respondents felt that lack of formal training to artisans does not have a negative impact on the construction sector at least about five (5) respondents in number replied with a NO answer on this category raking number three, and lastly about twenty one (21) respondents were not sure if lack of formal training does bring about shortages of skills in the construction industry. Therefore according to the results presented on figure 5.13 below. It is clear that lack of formal training to artisans does have a negative impact on the shortages of skills artisans in the construction sector because about 39 respondents in number agreed that lack of formal training have a negative impact on the skills shortages in the construction industry in the western Cape Province of South Africa.



**Figure 4.13: Lack of formal training to artisans bring about shortages of skills**

**4.5.2.3. (b) Lack of formal training to artisans bring about shortages of skills - respondents were asked to elaborate on the option that they chose on the above question**

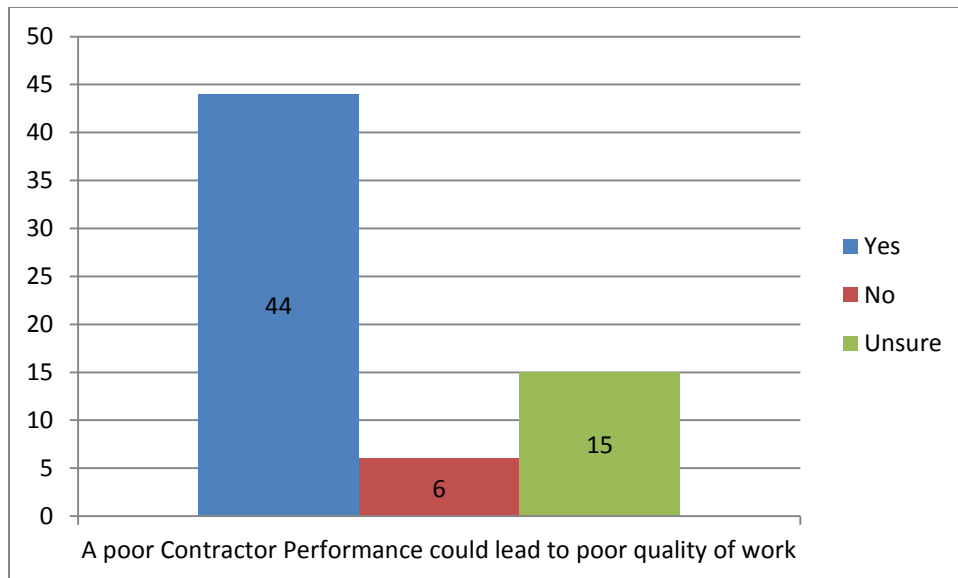
Following are some of the responses from the respondents; please bear in mind that only few responses are used below from the respondents for discussion purposes:

- Many workers and / or artisans know how to do bricklaying. Because they do not have a formal certificate or diploma through formal training, they will not be recognised for their skills or even given the opportunity to further up their level, therefore this discourages them in such a way that they would end up leaving construction industry to look for green pastures in other industries.
- Construction is the technical field that has a short programme these days, therefore skills training is essential as that monitors whether the employee/artisan is competent or not.
- Untrained staff wastes money and time. Lack of formal training causes a lot of incidents, e.g. an artisan has to cut boards to prepare for the formwork and this artisan was never taught how to cut the boards.
- Lack of skilled artisans could be the results of a number of factors, one of which is the lack formal training.

Regarding the above listed responses from some of the respondents; it is then evident that lack of formal training for artisans does bring about the skills shortages in the construction industry. Informal skilling has weaknesses that stem mainly from its characteristics. These challenges have been identified through a number of studies (Franklin, 1973; Middleton *et al.*, 1991; Kent and Mushi, 1995; McGrath *et al.*, 1995; Barasa and Kaabwe, 2001; Ziderman, 2003) and include: The narrow and static range of skills offered. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets. This limits the marketability of the graduates as existing techniques become obsolete, serves to perpetuate traditional techniques that may not be optimal and demands high levels of supervision (see Cattell, 1997).

#### **4.5.2.4. (a) Poor contractor performance leads to poor quality of work**

Respondents who took part on the survey were asked to indicate their views with regard to poor contractor performance which could lead to poor quality of work using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.14 shows the results from all the respondents. The yes option ranked first with a frequency score of 44 in number, which this clearly shows that most of the respondents that contributed on the survey agreed that poor contractor performance could be the results of the poor quality of works produced by the contractor. On the other hand at least about six (6) respondents felt that poor contractor performance does not have a negative impact on the poor quality of works performed by the contractor, the respondents showed their views on this category by choosing a NO option. And lastly about fifteen (15) respondents were not sure if poor contractor performance could be the results of the poor quality of work. Therefore according to the outcomes presented on figure 5.14 below. It is evident poor contractor performance leads to poor quality because about 44 respondents in number out of 65 respondents contributing to this survey agreed that poor contractor performance have a negative impact on the poor quality of works performed by the contractor.



**Figure 4.14: Poor contractor performance leads to poor quality of work**

**4.5.2.4. (b) Poor contractor performance leads to poor quality of work – respondents were asked to elaborate on the option that they chose on the above question**

Following are some of the responses from the respondents; please bear in mind that only few responses are used below from the respondents for discussion purposes:

- Poor contractor works leads to poor quality works.
- When production has to be accelerated without the correct resources the quality of work will be compromised.
- The performance of the contractor is the number one factor to determine quality of work, and the poor performance from the contractor can lead to poor quality of work.
- Poor contractor performance is the result of unskilled workers.
- The contractor has a direct effect on the construction process.
- Good quality is a product of good performance, therefore if the contractor performs poorly that leads to the rework which at some stage will compromise the originality of the product. For good quality of work, we need to follow the artisan rule that says you measure twice and cut once.
- Poor performance leads to poor results and the results determine the overall quality.

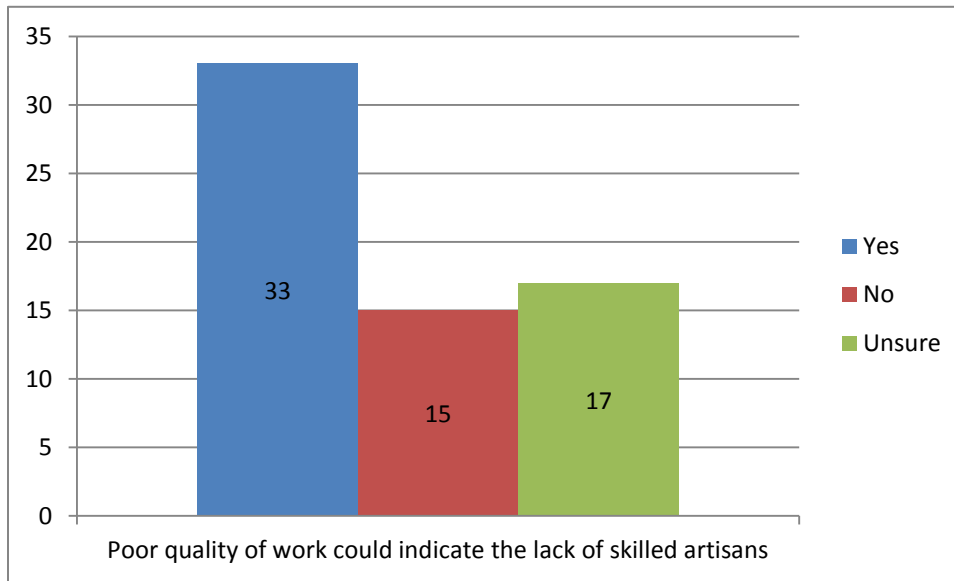
- Most inadequate performances of contractors are due to untrained, less experienced and unqualified artisans who perform certain duties. Poor performance is equal to poor quality of works.

Concerning the above listed responses from some of the respondents; it is evident that poor contractor performance leads to poor quality of work. One of the respondents said that good quality is the product of good performance, therefore if the contractor gives poor performance that leads to the reworks of some work which at some stage will compromise the originality of the product. The statement given above proves that if the contractor does not have enough and / or good skilled artisans to perform the work that means the outcomes of the work performed will reflect the quality of work done. Therefore good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance on behalf of the contractor. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets.

This limits the marketability of the graduates as existing techniques become obsolete and serves to perpetuate traditional techniques that may not be optimal and demands high levels of supervision (see Cattell, 1997).

#### **4.5.2.5. (a) Poor quality works indicate lack of skilled artisans**

Respondents who took part on the survey were asked to indicate their views with regard to poor quality of work which might indicate lack of skilled artisans using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.14 shows the results from all the respondents. The yes option ranked first with a frequency score of 33 in number, which this clearly shows that most of the respondents that contributed on the survey agreed that poor quality of works could be the results of the lack of skilled artisans. On the other hand at least about fifteen (15) respondents felt that poor quality of works does not really indicate lack of skilled artisans, the respondents showed their views on this category by choosing a NO option. And lastly about seventeen (17) respondents were not sure if poor quality of works could be the results of the lack of skilled artisans. Therefore according to the results presented on figure 5.15 below. It is evident poor quality of works could be the results of the lack of skilled artisans in the construction sector because about 33 respondents in number out of 65 respondents contributing to this survey agreed that poor quality of works could be the results of the lack of skilled artisans.



**Figure 4.15: poor quality works indicate lack of skilled artisans.**

**4.5.2.5. (b) Poor quality works indicate lack of skilled – respondents were asked to elaborate on the option that they chose on the above question.**

Following are some of the responses from the respondents; please bear in mind that only few responses are used below from the respondents for discussion purposes:

- Yes it does but sometimes when people are not happy quality drops.
- Building trades request skilled artisans have received the correct training to execute specialist work.
- Skills are always shown in the quality of work; if one does not possess skills one cannot do a job.
- Artisans are of utmost importance in construction, because they are the ones who do the actual setting out and putting together of the building. One can have the best management in place but if there are not enough skilled artisans, the quality of work will be poor.
- Unskilled artisans will obviously produce poor quality of works.
- Some of the artisans do not exhibit the necessary skills to perform the work acquired of them to do.

Regarding the above recorded responses from some of the respondents; it is evident that poor quality of works could be one of the potential factors that are caused by the lack of skilled

artisans. One of the respondents said that good quality is the product of good performance, therefore if there a lack of skilled artisans then that could potentially lead to the poor quality of works. The statement given above proves that if the contractor does not have enough and / or good skilled artisans to perform the work that means the outcomes of the work performed will reflect the quality of work done. Therefore good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance. According to Patel (2007), this shortage of artisans exists alongside a massive expansion of FET college enrolments in engineering studies (in the FET context Artisan related skills are clustered under engineering). According to Patel (2007), a total of 280 000 graduated in engineering studies in 2000 but only 34% found jobs in industry. It is primarily because most of these engineering students are not employer sponsored and that FET courses are not aligned to industry requirements. The surplus of unemployed FET college engineering graduates is exacerbated by the increase in the number of learners who have enrolled in learnerships since April 2001.

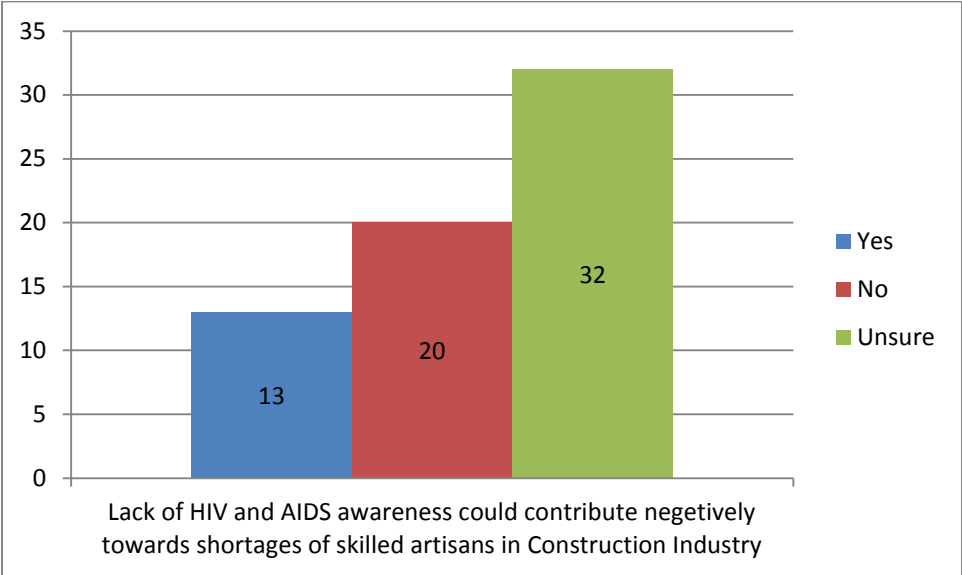
Walker and Shen (2000) point out that skills gaps which are labour related, negatively affect project delivery. Wahab *et al.* (2008) declare that, despite the wide spectrum of factors affecting construction productivity, it is notable that workforce skills development and training featured as a commonly cited factor that affects timely project delivery (Naoum, 2001).

#### **4.5.2.6. (a) Lack of HIV and AIDS awareness contributes negatively towards shortages of skilled artisans in Construction industry**

Respondents were asked to show their views about the Lack of HIV and AIDS awareness which could contribute negatively towards shortages of skilled artisans in Construction industry using a 3-point Likert Scale where 1= yes; 2 = no and 3 = unsure. Figure 5.16 shows the results from all the respondents participated on the questionnaire survey. NO option ranked first with a frequency score of 20 respondents in number, which this clearly shows that most of the respondents that contributed on the survey disagreed with the fact that lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in the construction industry in the Western Cape Province. Other respondents felt that lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in construction industry. At least about thirteen (13) respondents in number replied with a Yes answer to this category raking number three, and lastly about thirty two (32) respondents were not sure if lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in the construction industry in the Western Cape Province.



Therefore according to the results presented on figure 5.16 below. It is clear that the majority of the employees that participated on the survey are not informed about the importance of HIV and AIDS awareness campaign which is why most of the respondents are not sure whether the lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in construction industry or not. Therefore about 32 respondents are not sure, and about 20 respondents disagreed with the fact that lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in Construction industry and lastly only 13 respondents in number agreed with the fact that lack of HIV and AIDS awareness could contribute negatively towards shortages of skilled artisans in construction industry. Therefore to conclude, from the findings presented on the above lines, it clearly shows that there is still a need for HIV and AIDS awareness campaign to educate employees about the importance of their health for both their families and the firms that they are working for, because that has a direct impact on gross domestic product (GDP) of our nation.



**Figure 4.16: Lack of HIV and AIDS awareness contributes negatively towards shortages of skilled artisans in Construction industry**

### **4.5.3 Discussion of findings**

This chapter discussed the findings of the study and the suggested strategies comparative to the reviewed literature. SPSS model was employed in this chapter. The findings revealed that the causes and effects of shortages of skilled artisans during the construction phase of a project (a contractor's perspective) are really applicable as the respondents gave their views with regard to the shortages of skilled artisans. This chapter will further focus on causes, effects, ways to deal with causes and / or ways on how to reduce or eliminate the above mentioned challenges of shortages of skilled artisan in the construction industry in the Cape Town, in the Western Cape Province.

#### **4.5.3.1 Causes of the shortages of skilled artisans**

The literature revealed that the core causes of the shortages of the skilled artisans can be characterized into different sets such as the lack of motivation, dissatisfaction, choices matriculates do, image of the artisans, business approach to training. Therefore, the causes of the lack and / or shortages of skilled artisans were surveyed based on the above mentioned statements. The findings of the study revealed that the lack of formal training to the artisans, performance recognition of artisans and the lack of motivation were the major factors contributing to the shortages of skilled artisans.

Therefore according to the results presented on figure 5.11 above. It is clear that artisans who do not get recognised are more likely to be less productive than the artisans that do get recognised. A definition of motivation is the set of processes that determine the choices people make about their behaviours. Laufer and Moore (1983) advocated the use of financial incentive programmes to improve construction labour productivity, reinforcing Maloney's (1982) thesis of driving forces that led to productivity improvements. Therefore also based on the outcomes presented on figure 5.12 above, it is clear that artisans who do not get motivated are more likely to be less productive than the artisans that do get motivated of the work that they are doing. Smithers and Walker (2000) also cite this with the statement that says motivation plays a part in enhancing construction labour productivity and forms the basis for identification of the work environment factors.

This may imply that there is not much attention given to artisans in terms of providing formal training that will stir up motivation within the artisans and also on the other side according to the findings presented on figure 5.11, it is evident that the lack of performance recognition for the work performed by artisans does contribute to the shortages of skilled artisans as a lot of artisans get discouraged and lack the focus to their work and that results in rework being encountered more special during the construction stage of a project. This statement is supported by Palaneeswaran (2006) who suggested that lack of experience and knowledge of design and construction processes contributed to rework. Walker and Shen (2000) point out those skills gaps which are labour-related and negatively affect project delivery.

#### **4.5.3.2 Effects of the shortages of skilled artisans in a progress of a construction project**

The literature established that effects of the rework which might be caused by the lack of skilled artisans in construction projects have an adverse effect on general project performance. It was important, therefore, to examine the impact of rework of the effects of the lack of skilled artisans on project performance in construction projects in the Western Cape Province.

The respondents revealed their insight with regard to effects of the lack of skilled artisans in the Construction industry. The results presented on figure 5.14 and the discussion from the respondents further revealed that it is then evident that poor contractor performance leads to poor quality of work. One of the respondents said that good quality is the product of good performance, therefore if the contractor gives poor performance, that leads to the reworks of some work which at some stage compromises the originality of the product. The statement given above proves that if the contractor does not have enough and / or good skilled artisans to perform the work that means the outcomes of the work performed will reflect the quality of work done. Therefore good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance on behalf of the contractor. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets.

Relative to sub-contractor related factors, respondents identified supervision / foreman / tradesman as the major factor contributing to rework. This was intensified by the poor supervision and management skills due to inexperience and the inability to communicate effectively with subcontractors.

It was reported by respondents that low-skilled labour employed by subcontractors resulted in rework. Indirectly, the human resource support structures such as education, training, motivation, and improved skills level provided by employees' organisations so that they could perform their jobs more effectively and productively, is lacking. Besides, skill shortage is one of the crucial problems facing the South African construction industry. This is supported by Loxton (2004) who reported that the South African construction industry is under pressure due to a combination of factors, one of which is skills shortages.

#### **4.5.3.3 Ways of dealing with shortages of skilled artisans when they happen and how best the shortages of skilled artisans could be reduced and / or eliminated**

The literature review indicated some of the ways of dealing with shortages of skilled artisans when they happen and how best shortages of skilled artisans could be reduced and / or eliminated. Poorly skilled Artisans in construction projects have an adverse effect on general project performance. It was important, therefore, to establish ways in which to deal with shortages of skilled artisans when they happen during construction phase of the project. And it was also important to find ways of how to deal with the shortages of skilled artisans when they occur during the construction stage of the project.

Therefore according to the results presented on figure 5.13 It is clear that lack of formal training for artisans does have a negative impact on the shortages of skilled artisans in the construction sector because about 39 respondents in number agreed that lack of formal training have a negative impact on the skills shortages in the construction industry in the Western Cape Province of South Africa. Also the outcomes presented on figure 5.12, clearly show that artisans who do not get motivated are more likely to be less productive than the artisans that do get motivated of the work that they are doing. Also the majority of the respondents felt that recognition of the performance artisans does have a positive impact on their daily productivity.

According to the responses from the respondents, it is clear that if artisans are motivated for the work that they have performed then they are more likely to be more productive and achieve greater results than expected.

Smithers and Walker (2000) also cite this with the statement that says motivation plays a part in enhancing construction labour productivity and forms the basis for identification of the work environment factors. Performance recognition also plays a vital role in motivating employees to want to achieve all targets set out before them.

Conti (2005) found that training has a positive and significant effect on productivity. Brown *et al.* (2004) conclude from a study titled the Relationship between Human Capital and Time Performance in Project Management: a path analyses that performance will improve with increased investment in human capital. Training helps workers to be abreast of modern technology. An employee is prompted to work harder with modern types of equipment and tools. Couto and Teixeira (2005) conclude that learning increases productivity by 15%.

Walker and Shen (2000) point out that skills gaps which are labour related, negatively affect project delivery. Wahab *et al.* (2008) declare that, despite the wide spectrum of factors affecting construction productivity, it is notable that workforce skills development and training featured as a commonly cited factor that affects timely project delivery (Naoum, 2001). It is therefore very important for artisans to be acquainted with the technological changes so that productivity will not be compromised.

### 4.5.3 Chapter summary

In this chapter, results originating from the questionnaire survey were discussed. The analysis was done using the Statistical Package for the Social Sciences (SPSS) program and data were interpreted by means of frequencies and descriptive statistics. The Cronbach's alpha coefficient for scaled questions was 0.9, signifying that the answers to scaled questions were dependable. Concerning the causes of the shortages of the skilled artisans, it was found that the lack of formal training for artisans, performance recognition of artisans and the lack of motivation were the major factors contributing to the shortages of skill.

In the case of sub-contractor related factors, respondents identified supervision / foreman / tradesman as the major factor contributing to rework. Relative to site management related-factors, setting out errors were identified as one of the major factors that contributed to rework. It was evident that low labour skills level used by subcontractors resulted in rework on site. It was reported by respondents that low-skilled labour employed by subcontractors resulted in rework. Indirectly, the human resource support structures such as education, training, motivation, and improved skills level provided by employees' organisations so that they could perform their jobs more effectively and productively, is lacking. Besides, skills shortages are one of the crucial problems facing the South African construction industry.

With regard to the skilled artisans, the survey of the study revealed that if the contractor does not have enough and / or good skilled artisans to perform the work that means the outcomes of the work performed by the contractor will reflect the quality of work done. Therefore good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance on behalf of the contractor. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter concludes the study, highlights the restrictions that were encountered during the study and makes recommendations based on the findings. The conclusions are comprised of the findings from the analysis of the questionnaire survey. The recommendation section discusses the outcomes and implications of the study.

#### **Aim and objectives**

The aim of this study was to determine the impact of the causes and effects of shortages of artisan skills on contractor production. Specific objectives included:

- To identify causes of shortages of skills during the construction phase;
- To define the effects of shortages of skills in a progress of a project;
- To determine how to deal with shortages of skills when they happen;
- To determine ways in which shortage of skills may be reduced
- To determine whether delays due to the shortages of skills are the results of poor contractor performance

#### **5.2 Conclusions**

##### **5.2.1 Causes of the shortages of skilled artisans**

The findings of the study revealed that the lack of formal training to the artisans, performance recognition of artisans and the lack of motivation were the major factors contributing to the shortages of skilled artisans. It is evident that poor contractor performance leads to poor quality of work because respondents participated on this survey agreed that poor contractor performance have a negative impact on the quality of works performed by the contractor. This is influenced largely by artisan performance.

According to the results presented on the findings of the study, it is clear that artisans who do not get recognised are more likely to be less productive than the artisans that do get recognised. The literature also revealed that the core causes of the shortages of the skilled artisans can be characterized into different sets such as the lack of motivation, dissatisfaction, choices matriculates make, image of the artisans, business approach to the training, and the loss of focus to intermediary skills. Therefore, the causes of the lack and / or shortages of skilled artisans were surveyed based on the above mentioned statements.

Furthermore, setting out errors, due to lack of coordination between the main contractor and subcontractors and the lack of skills on the part of the artisans, were identified. In addition, inexperience on the side of the leading hand and / or supervisor and trades foremen and their inability to interpret the drawings properly contributed to rework during construction. Also, the analysis of the research instrument found that the most predominant source of rework included low labour skill levels. In a newspaper article (Cape Times Insight May 15, 2007), Merseta CEO Dr Raymond Patel pointed that the dire shortage of artisans is not unique to South Africa but a global phenomenon that permeates the Western world because young people are afraid to get their hands dirty. Young people would rather work with computers than in engineering and its associated professions. If the country is to increase the supply of artisans some measures will have to be implemented to encourage people to become artisans.

### **5.2.2 Effects of the shortages of skilled artisans in a progress of a construction project**

The findings of the study revealed that the effects of the rework which might be caused by the lack of skilled artisans in construction projects have an adverse effect on general project performance. It was important, therefore, to examine the impact of rework of the effects of the lack of skilled artisans on project performance in construction projects in the Western Cape Province.

It was reported by respondents that low-skilled labour employed by subcontractors resulted in rework. Indirectly, the human resource support structures such as education, training, motivation, and improved skill level provided by employees' organisations so that they could perform their jobs more effectively and productively is lacking. Besides, the lack of appropriately skilled artisans is one of the crucial problems facing the South African construction industry.



The results presented on figure 5.14 and the discussion from the respondents further revealed that it is then evident that poor contractor performance leads to poor quality of work. One of the respondents said that good quality is the product of good performance, therefore if the contractor gives poor performance that leads to the reworks of some work which at some stage compromises the originality of the product. The statement given above proves that if the contractor does not have enough and / or good skilled artisans to perform the work that means the outcomes of the work performed will reflect the quality of work done. Therefore good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance on behalf of the contractor. This is supported by Loxton (2004) who reported that the South African construction industry is under pressure due to a combination of factors, one of which is skills shortages.

### **5.2.3 Ways of dealing with shortages of skilled artisans when they happen and how best the shortages of skilled artisans could be reduced and / or eliminated**

The available evidence indicates that there is indeed a significant demand for people with skills, which is not matched by their availability. Factors such as economic growth, sectoral levels of labour intensity, projections of net migration, sectoral age profiles, the business cycle, government expenditure decisions, projections of HIV/AIDS morbidity rates, industrial policy and foreign direct investment, all affect this supply and demand dynamic. Without an understanding of the dynamics of the skills environment, it is not possible to plan appropriately, and the consequences of skills imbalances are undoubtedly negative (Schnetler, 1989:148).

Conti (2005) found that training has a positive and significant effect on productivity. Brown *et al.* (2004) conclude from a study titled „*The Relationship between Human Capital and Time Performance in Project Management: a path analysis*’ that performance will improve with increased investment in human capital. Training helps workers to be abreast of modern technology. An employee is prompted to work harder with modern types of equipment and tools.

The literature reviewed indicated some of the ways of dealing with shortages of skilled artisans when they happen and how best shortages of skilled artisans could be reduced and / or eliminated. Poorly skilled artisans in construction projects have an adverse effect on general project performance. It was important, therefore, to establish ways in which to deal with shortages of skilled artisans when they happen during construction phase of the project.

And it was also important to find ways of how to deal with the shortages of skilled artisans when they occur during the construction stage of the project. According to the responses from the respondents, it is clear that if artisans are motivated for the work that they have performed then they are more likely to be more productive and achieve greater results than expected. Smithers and Walker (2000) also cite this with the statement that says motivation plays a part in enhancing construction labour productivity and forms the basis for identification of the work environment factors. Performance recognition also plays a vital role in motivating employees to want to achieve all targets set out before them.

#### **5.2.4 Limitation**

The literature reviewed established that limited research, relative to the impact of causes and effects of the shortages of skilled artisans has been conducted well in the South African construction industry. Previous studies have focused on defects, variation orders, health and safety, reworks and quality management issues in the industry. This study was limited to the Cape Town area in the Western Cape Province of South Africa. One of the biggest challenges faced during the research was to get respondents to participate in the study. For example, during the case studies, the respondents were not willing to provide answers to the questions and they were complaining that they do not have time to sit down and answer all the question detailed in the questionnaires.

It was also difficult to get respondents to complete the questionnaire, as some were not interested in taking part of the survey at all. The questionnaire survey was structured to address these specific occurrences. Questionnaires were distributed to the various sites of the construction firm who is in the general building category with a grade ranging 9, and is registered and in good standing with the Construction Industry Development Board (CIDB).

#### **5.2.5 Recommendations**

The reduction of the impact of causes and effects of shortages of skilled artisans can be developed only if a clear distinction is made between what creates shortages of skilled artisans and what does not. Also, the construction industry must adjust its mind-set that shortage of skills is unavoidable. The shortages of skilled artisans would be dealt with only if the construction industry could launch marketing methods that would attract the young people to join the industry.

The study proposes a combination of interventions based on the literature reviewed and the findings of the data analysed. Robbins (2001) concurs that employees tend to prefer jobs that give them opportunities to use their skills and abilities and offer a variety of tasks. Bassioni *et al.* (2005) say that leaders creating an environment for empowerment, innovation, learning and support will drive performance. Empowerment, innovation, learning and support are factors that drive performance in organisations. Couto and Teixeira (2005) conclude that learning increases productivity by 15%.

South Africa's higher education participation rate of between 15-18 per cent was below the 20 per cent benchmark given for middle income developing countries, and the National Plan for Higher Education was designed to reduce income inequality and poverty by creating opportunities for young people and adults to further their education and consequently become employable, to encourage on-the-job sector in South Africa is consequently touted as a major contributor to the reduction of intermediate skills shortages in South Africa. In a newspaper article (Cape Times Insight May 15, 2007), Merseta CEO Dr Raymond Patel pointed that the dire shortage of artisans is not unique to South Africa but a global phenomenon that permeates the Western world because young people are afraid to get their hands dirty.

Young people would rather work with computers than to for engineering and its associated professions. If the country is to increase the supply of artisans some measures will have to be implemented to encourage people to become artisans. A similar process might have to occur if learnerships are to be taken seriously. It is questionable whether the marketing around the end product of a learnership has been properly done. Therefore effort needs to be made to improve skills and knowledge; otherwise the loss of reputation, interruptions and disturbances to construction and loss of profit will become products of rework that arise on-site.

From the findings, respondents suggested that good skilled artisans will produce good quality of work; however poor quality of work executed will indeed reflect poor performance on behalf of the contractor. The informal training system has difficulty coping with technological changes, and the need for skills enhancement to widen geographical markets.

### **5.2.5.1 Areas recommended for further research**

The findings of the study revealed that the lack of formal training to the artisans, performance recognition of artisans and the lack of motivation were the major factors contributing to the shortages of skilled artisans. It is evident that poor contractor performance leads to poor quality of work because respondents who participated on the survey agreed that poor contractor performance have a negative impact on the quality of works performed by the contractor. Furthermore, there has been limited research that has sought to determine the direct impact of the lack of motivation and performance recognition to employees has a direct negative impact on the production outputs of an organisation and / or firm. Further investigation into the costs and impact of reworks, especially the costs associated with the lack of motivation and performance recognition to the employees, is needed to ascertain the hidden costs associated with undertaken rework.

The above proposed further research studies could help the construction industry to have a good returns from their human resources because the success of any project depends on the good human resource skills that the organisation have in order undertake any project at their disposal. Therefore it is of utmost importance to keep employees happy and motivated for the work that they are performing. Adequately skilled artisan performance adds value to construction projects and will continue to be the yardstick by which the industry will be judged. Their path of continual improvement will bode well for a healthy industry.

## APPENDICES

### APPENDIX A – QUESTIONNAIRE FOR THE MAIN STUDY

#### **Aims and Scope of this survey**

The aim of this survey is to obtain information from NMC Construction group from their various sites that they have within the Cape Town area and its surroundings in the Western Cape Province. The topic is about the causes and effects of shortages of artisan skills during the construction phase of a project (a contractor's perspective). This is the research study taken by the M-Tech Student towards fulfilling a master's degree within the built environment department situated at the Cape Peninsula University of Technology.

#### **To fulfill the research purpose and to complete the survey**

For the purpose of the survey shortages of skills will be defined generally as meaning shortages that exist when employers are unable to fill or have considerable difficulty in filling vacancies for an occupation, or specialized skill needs within that occupation, at current levels of remuneration and conditions of employment, and reasonably accessible location (DEST, 2002). **Skill:** In the report on the Skills Development Strategy for Economic and Employment Growth in South Africa (2001), skill is defined as applied competence. Applied competence is the overarching term for three kinds of competence.

#### **NMC group as the case study is approached**

The survey is distributed to random selected departments and sites. You are assured that the information obtained from this survey will be kept strictly **CONFIDENTIAL** and will be only used for the research purpose. Data collection will not be made available to any third party or used in any published material, except as a component in aggregated statistics.

Please complete the survey and return to:

Sisa Mbeki

Cape Peninsula University of Technology

Email: [sisambk@gmail.com](mailto:sisambk@gmail.com)

Tel: 021 953 8621

Mobile: 078 6820060

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

**Please indicate your response by ticking with an (X) in the appropriate column per item**

**SECTION A: GENERAL INFORMATION**

1. Which of the following best describe your department?

Procurement		Quantity Surveying		Project management		Buying department		Site Management	
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Other (Please specify).....

2. How long have you worked in the construction industry? .....

3. What is your current position in the Company? .....

4. How long have you been working in your position? .....

**SECTION B: PERSONAL INFORMATION**

5. Please indicate your gender

Female	
Male	

6. Please indicate your age:

Under 25 years		25-35 years		35-45 years		45 -50 years		And over 50 years	
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**7. Please indicate your highest formal qualification:**

Matric Certificate		Diploma	
B Tech		Bsc Degree	
Post graduate diploma		Honours degree	
Bachelors degree		Masters degree	
Other please specify		Other please specify	

**8. Please indicate your status in the organisation:**

Contracts Manager		Senior Site Manager	
Junior Site Manager		Construction Technician	
Trainee carpenter / trainee Artisan		Project Manager	
Senior/ junior Buyer		Procurement Manager or Planner	
Supervisor		Foreman / leading hand	

**SECTION B: TRAINING STRUCTURES**

**9. On a Scale of 1 (Monro) to 5 (Major), Please indicate the extent to which the following employees in your Company are responsible for managing skills training ( Please note the unsure)**

Responsibility for skills training		Minor.....Major				
		1	2	3	4	5
Senior Management	unsure	1	2	3	4	5
Contracts Management	unsure	1	2	3	4	5
Site Managers / Agents	unsure	1	2	3	4	5
Supervisors / foreman	unsure	1	2	3	4	5
Human resource Personnel	unsure	1	2	3	4	5

**Please Mark your answer with an (X)**

**10.** Does your Organisation have the documented skills training system in place?

Yes		No		Unsure	
-----	--	----	--	--------	--

**11.** The following examples are site related factors which might be the causes of reworks due to shortages of skills or lack of skills which could result to low productivity, on a Scale of **1 ( Minor)** to **5 (Major)**, Please indicate with an **X** next to the answer of your choice :

Site Management		Minor .....Major				
		1	2	3	4	5
Ineffective use of quality management practices	unsure	1	2	3	4	5
Lack of training and experience	unsure	1	2	3	4	5
setting out errors	unsure	1	2	3	4	5
Constructability problems	unsure	1	2	3	4	5
Poor planning resources	unsure	1	2	3	4	5
Poor co-ordination of resources (e.g Sub-contractors)	unsure	1	2	3	4	5
Failure to provide protection to construction works	unsure	1	2	3	4	5
Lack of safety	Unsure	1	2	3	4	5



12. To what extent does your company make use of the following training methods when developing skills on your labour force ( please note the **unsure** option)

Training mechanism	Unsure	Never	Rarely	sometimes	often	always
Formal training (institutionalized training e.g. FET college)						
On-site training						
Off site training ( Own training centre)						

13. Does your company have learnership register with CETA?

Yes	No	Unsure
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14. Does your company equip on–site personnel to mentor employees during the on-site training?

Yes	No	Unsure
-----	----	--------

15. How often does your company analyse the skills need to determine the training requirement of employees? Please tick with an **X** ( **Please note Unsure option**)

Never	weekly	Monthly	Quarterly
Half year	Yearly	When preparing tenders	Unsure

16. On a scale of 1 (**Strongly disagree**) to 5 (**Strongly agree**), to what extent do you agree with the following statements ( **Please note Unsure**) and please not **that Strongly disagree = 1, disagree = 2, Neutral = 3, Agree = 4 and Strongly agree = 5**

Statements		Strongly disagree.....Strongly agree				
		1	2	3	4	5
Non-permanent employees receive skills training within your company	<b>unsure</b>	1	2	3	4	5
Casual employees are less likely to receive skills training on your company than permanent employees	<b>unsure</b>	1	2	3	4	5
Employees are made permanent before formal training commence	<b>unsure</b>	1	2	3	4	5
Permanency of employment is pre-requisite for training	<b>unsure</b>	1	2	3	4	5

17. Please indicate to what extent Sub-contractors are used to perform the following activities on your Construction site?

Trades Sub-contracted	Unsure	Never	Rarely	sometimes	often	always
Brick work						
Plastering						
Support work and formwork						
Concrete work						

**18.** On a scale of **1 (Not)** to **5 (Very)**, please indicate how committed the sub-contractors your company engages are to the development of their workforce ( **please note the unsure option**)

<b>Unsure</b>	<b>Not .....Very</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

**19.** Please indicate the extent to which of the following learning mechanisms are implemented. Please note the following, **Not at all = 1, not well = 2, Neutral = 3, well implemented = 4, and very implemented = 5**

<b>Learning</b>	<b>Not all .....To a Very extent</b>				
Training programs for staff	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Self-learning of individuals (e.g. tradesmen on site)	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Research and development	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
External benchmarking	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Internal benchmarking	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Project reviews	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Internal seminars on new development	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Others (please specify)	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

20. The following are sub-contractors related factors which might be caused by rework due to lack of skilled artisan and miscommunication. ( **Please note Unsure**) and please not that **Strong disagree = 1, disagree = 2, Neutral = 3, Agree = 4 and Strong agree = 5**

Statements		Strong disagree.....Strong agree				
		1	2	3	4	5
	<b>unsure</b>					
Unclear instruction to workers	<b>unsure</b>	1	2	3	4	5
Non-compliance with specification	<b>unsure</b>	1	2	3	4	5
Shortages of skilled supervisors	<b>unsure</b>	1	2	3	4	5
Shortages of skilled Labour	<b>unsure</b>	1	2	3	4	5
Low labour skill level	<b>unsure</b>	1	2	3	4	5
Inadequate supervisor/foreman/tradesmen ratios	<b>Unsure</b>	1	2	3	4	5

**SECTION C: CAUSES OF SHORTAGES IN ARTISAN SKILLS**

21. Would you say that an artisan who does not get recognition for their performance is likely to be less productive than artisans that do get performance recognition?

Yes	No	Unsure
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22. Reference to the above statement, if your answer is yes, would you please elaborate why?

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**23.** Would you say that motivation plays vital role in artisan's production?

Yes	No	Unsure
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**24.** Reference to the above statement, if your answer is either yes or no, would you please elaborate why?

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**25.** Would you say that lack of formal training of artisans bring about shortages of skills or even lack of skills to artisans in Construction industry?

Yes	No	Unsure
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**26.** Reference to the above statement, if your answer is either yes or no, would you please elaborate how?

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**27.** Does a poor contractor performance leads to poor quality work?

Yes	No	Unsure
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**28.** If your answer is either yes or no, would you please elaborate how?

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**29.** Does poor quality work indicate lack of skilled artisans?

Yes	No	Unsure
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**30.** If your answer is either yes or no, would you please elaborate how?

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**31.** Does a lack of HIV and AIDS awareness contribute negatively towards shortages of skilled artisans in Construction industry?

Yes	No	Unsure
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**32.** If your answer is either yes or no, would you please elaborate how?

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## APPENDIX B – PUBLICATIONS AND CONFERENCE PAPERS MADE DURING THE COURSE OF STUDY

### THE IMPACT OF CAUSES AND EFFECTS OF SHORTAGES OF ARTISAN SKILLS ON CONTRACTOR PRODUCTION

1 Department of Construction Management, Nelson Mandela Metropolitan University,  
[Winston.shakantu@nmmu.ac.za](mailto:Winston.shakantu@nmmu.ac.za) , Tel No. 041-504 2394

2 Department of Quantity Surveying and Construction Management, Cape Peninsula University  
of Technology, [Crowel@cput.ac.za](mailto:Crowel@cput.ac.za), 021 – 959 6631

3 Department of Quantity Surveying and Construction Management, Cape Peninsula University  
of Technology, [sisambk@gmail.com](mailto:sisambk@gmail.com) , 021 – 940 1912

#### ABSTRACT

**Purpose of this paper** - The purpose of this research study is to establish the causes skills shortages during the construction phase of projects and the effects of resultant inadequate skills base on the progress of projects.

**Design** - The focus is on the causes, impact, effects that the lack of skilled artisans has on the productivity of constructors, with special reference to the construction phase of projects. Data were collected via in-person surveys using structured and semi-structured questionnaires. The questionnaires were administered to artisans, general workers, site managers and project managers on construction sites.

**Findings** - The findings reveal that the causes and effects of shortages and / or lack of skilled artisans during the construction phase is that there not enough skilled people to spread around the projects. It was found that only a very small number of artisans attend formal training, that performance is not well recognised and there is rampant lack of motivation among the few available skilled artisans. **Practical implications** - The causes and effects of shortages is a serious problem that the industry needs to address holistically. A workable solution can only be developed if a clear distinction is made between what causes shortages of skilled artisans and what does not.

**Value** - The findings of the study will be useful in developing viable policy interventions into the training regimen of construction artisans. The interventions could assist counter the crippling skill shortages.



**Limitation** - This study was limited to the Cape Town area in the Western Cape province of South Africa.

**APPENDIX C – LETTER OF CONFIRMATION OF SISA MBEKI’S RESEARCH CASE  
STUDY DONE USING NMC GROUP**



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