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THE ADOPTION OF ICT PROJECT MANAGEMENT SOFTWARE TO FACILITATE THE TRANSITION TO BECOMING A MEDIUM SIZED CONTRACTOR

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A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, 2015

DECLARATION

I declare that this research report submitted by me for the **Master of Science in Engineering** degree to the University of Witwatersrand is my own work and has not been submitted before by me for a degree at another university or higher education institution.

Signed……

Date……

ABSTRACT

The research investigated the practices of some grade 4 contractors registered with the CIDB operating in Johannesburg, with the intention to establish the path they took in order to become a medium-size contractor. The research was based on the assumption that, in order for a small contractor to upgrade to a medium sized contractor and take on more complex projects, they need to upgrade their project management software first, before upgrading their CIDB rating. The research is premised on the supposition that the development of small and medium contractors contribute significantly to the country's employment rate and economy.

It was found that the majority of the respondents upgraded their project management software first before upgrading their CIDB rating, establishing the initial assumption to be true. Other success factors included being able to maintain and develop current staff, sustain adequate cash reserves, maintain good relationships with project stakeholders, ensure good company control, completing projects on time and within budget, and improving the company's project management capabilities.

The recommendations suggest that, as a result of South Africa's weak economic state, it is advisable for grade 3 contractors to grow their respective companies at a consistent rate. Utilizing the project management software effectively, and to its full capabilities, is crucial. Training the staff that will be using the software is just as important.

Keywords: Project Management Software; Small and Medium Contractors; Construction Industry Development Board

DEDICATION

This thesis is devoted to the South African construction industry community, mainly the small as well as medium sized contractors who are determined to work hard and advance within their companies, as well as contributing to the development of the much needed infrastructure in South Africa. It is hoped that the small and medium contractors will make use of the outcome and result from this thesis to advance in their respective companies within this very competitive industry.

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Mr. Michael George Savvides

2014

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ACRONYMS AND ABBREVIATIONS

BEE	Black Economic Empowerment
BIM	Building Information Modelling
CAD	Computer Aided Design
CET	Contracting Entrepreneurial Training
CIDB	Construction Industry Development Board
CPA	Critical Path Analysis
CPM	Critical Path Method
EVA	Earned value Analysis
ICT	Information Communication Technology
ICTs	Information Communication Technologies
LMS	Learning Management System
NDP	National Development Plan
PERT	Program Evaluation Review Technologies
PM	Project Management
RFIs	Request For Information
SEDA	Small Enterprise Development Agency
SMEs	Small and Medium Enterprises
VR	Virtual Reality

1. INTRODUCTION

1.1 Purpose of Study

The way in which construction companies were grouped for the purpose of this investigation is in terms of the grading system implemented by the Construction Industry Development Board (CIDB) of South Africa. There are nine different grades, which designate different contractor sizes in terms of the magnitude of jobs that can be tendered for in Rand value as presented in Table 1.1.

The aim of this research study is to establish the means by which a grade 3 contractor (defined as small contractor) is able to make the upgrade to a grade 4 contractor (defined as a medium contractor), determining what techniques and project management software these contractors have adopted in order to assist them from overcoming the gap in grades.

1.2 Research Background

Globally, there is an abundance of literature available that covers the topic of Information Communication Technology (ICT) adoption in the construction industry, Similarly in the last five to ten years in South Africa there has been a lot more literature available in this area of research as well (Kareem and Bakar, 2011).

The adoption of ICT in the local construction industry lagged for many years when compared to the adoption and uptake in other industries (Kareem and Bakar, 2011). However, in recent years, the adoption levels have increased considerably. As such contractors as small as grade 3 are making use of some sort of technology and specifically project management software (Kareem and Bakar, 2011).

The research that has been conducted in South Africa has focused mainly on the level of adoption amongst the larger contractors Grade 6 to Grade 9), looking at the barriers as well as benefits that are experienced by these contractors in the attempt to successfully implement such technology (Abrahamse, 2008; Arendse, 2013).

Nevertheless, literature as to how and why contractors that are registered with the CIDB Register of Contractors upgrade to a higher rating, is notably scarce. In order

for smaller grade contractors (Grade 1 to Grade 4) to make the leap from one grade to the next, there are various criteria that need to be met, as defined by the CIDB rating system.

In the past, research identified that the larger contractors were adopting various forms of construction software and hardware for the benefit of the company. However, it was found that the smaller contractors operating in the construction industry were not embracing these technologies - a result of numerous barriers hindering the adoption of the various forms of technology available (Peansupap and Walker, 2006).

However, recent studies that have been conducted in the same area have identified that the smaller contractors are now making use of the various forms of construction software technology (Gasa, 2012).

Almost all contractors operating in South Africa are striving to adopt the latest project management software technologies. The implementation and diffusion of the available software is evident but the effective utilization of this software can be questioned (Gasa, 2012).

There are various types of project management software available, where each one offers different features as well as benefits. Literature has shown that project management software is being utilized in South Africa from the large grade 9 contractors right down to small grade 3 contractors in the course of running their businesses. Project management software, amongst other things, improves the way organizations source their information, increasing the efficiency of the actual construction projects and business processes (Rust and Koen, 2011).

This study will particularly focus on grade 3 as well as grade 4 contractors that are registered with the CIDB. The insight gathered from literature as well as consulting with industry personnel is that a grade 3 contractor is considered to be a small sized contractor, and a grade 4 contractor is deemed to be medium sized (Agumba, 2006).

It is very important to note when reading this research study, having categorised a grade 3 contractor as a small contractor whereas a grade 4 contractor is considered to be medium contractor, this may differ with the definition of small and medium sized

companies outlined in the Schedule to Small Business Act (Act 102 of 1996 as amended by Act 26 of 2003).

There is no direct connection between the Small Business Act definition of a contractor, and the CIDB contractor grading system (Aigbavboa & Thwala, 2014). The definition of a medium contractor in the Small Business Act implies that the companies have a larger annual turnover and possibly hire more employees, when compared to medium sized construction contractors discussed in this research study (Aigbavboa & Thwala, 2014).

However, it is crucial to understand that there is somewhat different terminology commonly used as well as loose classification when referring to the size of companies in the construction industry, thus causing some confusion (Fitchett Pers. Com., 2014).

Research done by Thwala and Phaladi (2009) in South Africa who also focused on small and medium contractors, which further supports this this claim. In their research methodolgy they set out to randomly select "One Hundred (100) small and medium contractors" (Thwala and Phaladi, 2009:534) who were registered with other government data bases, including the CIDB.

The selection criteria used to create a sample population for their study included "Contractors from Grade 1 and 4 of the Construction Industry Development Board (CIDB) grading" (Thwala and Phaladi, 2009:534), suggesting that they too deem small contractors to be between grade 1 and grade 3 and a medium contactor to be size 4 and above.

There is a general perception amongst construction professionals in South Africa that the changeover from a grade 3 to a grade 4 effectively marks the transition from an emerging contractor to one that is more recognized and reputable (Thwala and Mofokeng, 2012).

Table 1.1 below identifies the grading sizes from 1 to 9 as well as the estimated tender range of projects that each contractor grade is practically allowed to undertake, considering their size and the resources they have available within the company.

Table 1.1 CIDB contractor grade tender evaluation table (Cidb, 2013)

Contractor Grade:	**Size of Project**
Grade 1	R0 – R200, 000
Grade 2	R200, 000 – R650, 000
Grade 3	R650, 000 – R2, 000, 000
Grade 4	**R2, 000, 000 – R4, 800, 000**
Grade 5	R4, 800, 000 – R6, 500, 000
Grade 6	R6, 500,000 – R13, 000, 000
Grade 7	R13, 000, 000 – R40, 000,000
Grade 8	R40, 000, 000 – R130, 000, 000
Grade 9	R130, 000, 000 – No Limit

Note: It does not mean that if a contractor is of grade 4 medium rating that the company cannot take on a project over the stipulated R4.8 million. The above figures are estimates or guidelines as to what size of project a grade 4 contractor can usually take on in South Africa (Thwala and Mofokeng, 2012).

When grading South African contractors, the CIDB largely evaluates certain conditions amongst other things; the tender value range, the best annual turnover for a minimum of 2 years, the available capital as well as the capabilities of the contractor (Cidb, 2014). The capabilities would involve the experience of the company and level of adoption of certain technologies, like project management software (Thwala & Mofokeng, 2012).

Thwala and Mofokeng (2012) mentioned the capabilities condition, and suggested that the adoption of technologies like project management software will improve and possibly enable contractors to make the leap from a small contractor to a medium contractor.

Although, the CIDB does not specifically mention this condition, for the purpose of this study, this is what the research is setting out to test.

Therefore, for the purpose of this research study and not forgetting the aforementioned evaluation conditions by the CIDB, the necessary conditions this study is researching will be the tender value range and the capabilities of the companies, focusing on the adoption of project management software.

Research demonstrates that projects that are typically available and undertaken by grade 4 contractors are significantly larger and earn a lot more profit when compared to projects undertaken by grade 3 contractors (Thwala & Mofokeng, 2012).

During this research study, literature suggests that the adoption of project management software is apparent amongst all sized contractors, however the effective utilization of the software's full capabilities may be lacking.

This research will try to establish whether these contractors are utilizing their software effectively. Consequently, the main objective of this study is to establish if a small grade 3 contractor has upgraded to a medium sized grade 4 contractor by first upgrading their project management software, which subsequently enables them to make the upgrade in contractor size, or where the small contractor first upgrades to a medium sized contractor with the intention of then upgrading their project management software.

It is clear that the higher the grade a contractor is, the larger the projects they are allowed to undertake and the more profit they can earn. The importance of this study is to provide insight and awareness to the thousands of grade 3 contractors operating in South Africa, particularly if they intend to upgrade to a medium sized contractor, demonstrating the paths and mechanisms that they should follow and implement in order to initiate the upgrade successfully.

1.3 Research Motivation

The motivation behind this research is firstly to look at small and medium contractors operating in the South African construction industry as they contribute towards a significant portion of the South African economy. The vast number of small and

medium enterprises (SMEs) in the country significantly contributes to increasing the amount of employment in South Africa (Greve, 2013).

However, in recent years there has been a significant fall in the amount of registered SMEs due to the volatility of the construction industry, increased competitiveness amongst contractors and the lack of work opportunities available to the smaller size contractors (Lappe and Spang, 2013). Thus, in order for the smaller contractors to stay afloat, they need to upgrade in order to be able to take on larger projects as well as to gain the upper hand on their competitors within the industry.

Research in developing countries similar to South Africa has proven that one of the major contributing factors to smaller contractors making the leap from one grade to the next is the effective implementation of the available construction related technologies (Kareem and Bakar, 2011).

1.4 Research Question

- Does the adoption of project management software enable small contractors to make the transition to becoming a medium sized contractor?

1.5 Assumptions

- Through exploring global as well as local literature, it is presumed that a grade 3 contractor is deemed to be a “small” contractor and a grade 4 contractor is considered to be a “medium” sized contractor.
- In order for a small contractor to upgrade to a medium sized contractor and take on more complex projects, they need to upgrade their project management software first, before upgrading their CIDB rating.
- The abilities and capacity of some of the small contractors is lacking.

1.6 Hypothesis

- The premise of this research is that for a small contractor to make the leap to becoming a medium sized contractor, the effective use of ICT project management software enables a successful transition to grade 4.

1.7 Chapter Overview

1.7.1 Chapter 1

Chapter 1 introduces the thesis to the reader, where the purpose of the research is outlined. A research background and motivation behind the research is presented, where it explains what research has been conducted on this topic already as well as how this research will contribute to previous studies done on this topic and to the South African construction industry. Chapter 1 also speaks about the CIDB, where it explains the grading conditions used to evaluate the size of contractors. The research question, all the assumptions made for the study as well as the hypothesis being tested are all outlined in this chapter.

1.7.2 Chapter 2

Chapter 2 of this thesis consists of the literature review, where literature relevant to the research topic at hand is examined. The literature review establishes the theoretical framework for the research topic, where it defines the relevant key terms, definitions and terminology relating to project management software and the transition from a grade 3 contractor to a grade 4 contractor.

The literature review identifies previous studies relating to the thesis topic and those that contribute to getting a better understanding of the topic at hand. The literature review describes, summarizes, evaluates and clarifies the various topics of research that subsequently contribute to this research study. The literature review justifies why the research was undertaken, demonstrating where it fits into the existing body of knowledge.

It describes how the subject has previously been studied; however it also highlights the gap in the previous research conducted. The literature review explains how this research is adding to the understanding and knowledge of this particular field of study.

1.7.3 Chapter 3

Chapter 3 of this thesis describes the methodology used to collect and analyse the information and data collected through interview questions. In order to collect

information from the selected respondents, a brief pilot test was initially conducted to identify potential participants. This was followed by a combination of semi-structured and open-ended interviews with each of the chosen respondents.

The methodology fully explains how the entire procedure was carried out, from the testing to the selection of the research participants, how the interviews were carried out as well as how the pieces of information collected were analysed.

1.7.4 Chapter 4

Chapter 4 of this thesis consists of the data analysis, where it is fully explained how and why the data collected from the interviews were analysed. This section provides readers with a complete breakdown of the information gathered, highlighting specific and important themes that surfaced from analysing the data, which contributed significantly to the final research conclusions and recommendations. The data from the respondents were analysed and compared using a data collection analysis template, which can be found in Appendix A.

All themes and points highlighted throughout the data analysis were found to be of particular importance, which significantly contributed to answering the main research question.

Chapter 4 offers a combined set of data, analysis as well as discussion on all the information gathered, where it provides an integrated evaluation of the data and discussion, as it is consistent with the interview methodology.

1.7.5 Chapter 5

Chapter 5 is the final chapter of this thesis consisting of conclusions as well as recommendations based on the information and data gathered, where the research question was subsequently answered. However, room has been left to aid in identifying an opportunity for further research that can contribute to this particular field.

1.8 Sources of data

The information and literature used to contribute to this thesis consisted of various journals, articles, books, thesis, dissertations, reports, websites, electronic sources and case studies. All the sources are referenced accordingly throughout the thesis with a concise reference list at the back of the document. All the work has been referenced according to the Harvard Style of referencing.

1.9 Limitations

The limitation of this research was that five respondents were selected to be interviewed, as this was above the minimum requirement of four respondents, which was stipulated in the methodology (Chapter 3).

2. LITERATURE REVIEW

2.1 Introduction

Globally, there is an abundance of literature available that covers the topic of Information Communication Technology (ICT) adoption in the construction industry. Fortunately, South Africa has also experienced an increase in the amount of literature in this area of research over the last five to ten years.

The adoption of ICT in the local construction industry lagged for many years when compared to the adoption and uptake in other industries (Abrahamse, 2008). However, in recent years, the adoption levels have increased considerably, where contractors as small as grade 3 are making use of some sort of technology, specifically directing the attention to the adoption of project management software (Kareem and Bakar, 2011).

The research led in South Africa has focused mainly on the level of adoption amongst building contractors, looking at the barriers as well as benefits that are experienced by these contractors in an attempt to successfully implement ICT (Abrahamse, 2008; Arendse, 2013).

Nevertheless, literature and research as to how and why contractors that are registered with the CIDB Register of Contractors upgrade to a higher rating, is notably falling short. In order for smaller grade contractors to make the leap from one grade to the next, there are various criteria that need to be met.

In the past, research identified that the larger contractors were adopting various forms of construction ICT software and hardware for the benefit of the company. However, it was found that the smaller contractors operating in the construction industry were not adopting these technologies as a result of numerous barriers hindering the various forms of useful technologies available (Peansupap and Walker, 2006).

Recent studies conducted in this area of research have identified that the smaller contractors operating in South Africa are currently making use of the various forms of construction software technology, in order to survive in the very competitive construction industry (Gasa, 2012).

2.2 The State of South African Construction Industry

In comparison to a few years ago, work opportunities within the South African construction industry had seemed to be lacking (Industry Insight, 2013). However, in the turn of the New Year (2014), companies have reported an increase in work opportunities as well as improved financial returns. According to Keith and Windapo (2011) this is primarily an outcome of these companies undertaking a forced restructuring and the adoption of certain mechanisms to improve internal efficiencies, from the larger companies all the way down to the smaller contractors.

The debt levels within the South African economy are significantly high, whilst at the same time the ratio of savings to disposable income is unsatisfactorily low (Greve, 2013).

Furthermore, according to Senatore (2014) there has been an excess supply in the commercial property market over recent years with a surplus of property in the non-residential division, which is a result of the country's property boom, thus disturbing capital and growth income.

Considering theses aspects amongst others, the construction industry in the last few years can be characterised by internal restructuring, where companies have taken it upon themselves to increase operational efficiency as well as subdued margins (Arendse, 2013). Consequently, the increase in the industry's volatility has prompted small and medium contractors to increase their levels of competition by adopting certain techniques and mechanisms (Thwala and Mofokeng, 2012).

According to Rust and Koen (2011) the South African construction industry had grown by an estimated 15% per annum between the period of 2008 and 2010 leading up to the FIFA World Cup. The South African Federation of Civil Engineering Contractors 'SAFCEC' (cited in Rust and Koen, 2011) mentioned that the construction industry slowdown was not a result of the completion of infrastructure built for the Soccer World Cup.

Arendse (2013) in agreement with Rust and Koen (2011) stated that the slowdown in the construction industry after the World Cup is actually down to poor national planning and coordination, which has contributed to the industry's volatility.

Over and above the unsolidified economic situation in the country, the South African construction industry also faces challenges with regard to skills deficiencies, with equivalent emphasis on environmental issues and electricity shortages (Davis, 2013; Rust and Koen, 2011).

Gyulay (2007) further elaborates on this matter mentioning that the South African construction industry is fraught with numerous problems namely: disruptions and time delays; variations in project costs; poor on and off site management in addition to skills shortages and competence issues. Hewage et al. (2007) seemed to agree and also points out that the lack of participation by employees is also one of major industry challenges experienced in the course of performing construction projects.

Eisenhardt and Schoonhven (cited in Keith and Windapo, 2011) explain that the construction industry in the developing economy of South Africa is growing gradually, where opportunities are still presented to new construction firms.

When comparing the South African construction industry to the construction industry in developed countries, it has been found that those in the more mature and developed markets offer little opportunity for new companies mainly because these new companies have little advantage over their more recognized and established competitors (Keith and Windapo, 2011).

Thwala and Phaladi (2009) are in agreement, where they mention the South African economy is a growth market; meaning it can accommodate the entry of new construction companies. However, Keith and Windapo (2011) do suggest that even though the industry is growing, the country's construction industry is cyclical.

They discuss when there is a growth phase in the country, for whatever reason, all companies, established and new, are presented with work opportunities.

2.3 Skills Shortages

There are severe shortages of trained artisans, first level supervisory staff and project managers, consequently impacting on the demands for quality control, training and standard operating measures (Hewage et al., 2007). Hosseini et al. (2012) add that the shortage of skills is further aggravated by the maturing profile of workers in the country (average age of 55), highlighting the issue that in the near future there will be very few people to transfer their skills and mentor the younger generations.

Rust and Koen (2011) agree somewhat in mentioning that the smaller contractors face this problem in particular, as they do not have the necessary resources to address these quality issues. The authors do, however, argue in saying that the larger contractors have tried to implement programs to resolve the skills requirements.

It is important to note that when considering building staff, they are made up of foreman, artisans, and general labourers. When comparing a South African medium scale contractor to a contractor of similar scale in Europe or America, the South African contractor will generally employ more staff due to the cost of labour being significantly cheaper (Turner and Townsend, 2013).

This is confirmed in the three tables provided below, comparing the purchasing parity of labour costs in South Africa, the UK and the US (Turner and Townsend, 2013).

Table 2.1 Comparing SA's purchasing parity of labour costs

South Africa

	ZAR	USD (exchange rate: 9.80)	Purchasing power parity
Labour			
Group 1 tradesman eg plumber/electrician	60	6	11
Group 2 tradesman eg carpenter/bricklayer	48	5	9
Group 3 tradesman eg carpet layer, tiler, plasterer	45	5	8
General labourer	28	3	5
Site foreman	100	10	18

Table 2.1.1 Comparing the UK's purchasing parity of labour costs

United Kingdom	GBP	USD (exchange rate: 0.65)	Purchasing power parity
Labour			
Group 1 tradesman eg plumber/electrician	31	48	57
Group 2 tradesman eg carpenter/bricklayer	26	40	48
Group 3 tradesman eg carpet layer, tiler, plasterer	26	40	48
General labourer	17	25	31
Site foreman	33	50	60

Table 2.1.2 Comparing the USA's purchasing parity of labour costs

United States of America	USD	Purchasing power parity
Labour		
Group 1 tradesman eg plumber/electrician	76	74
Group 2 tradesman eg carpenter/bricklayer	66	64
Group 3 tradesman eg carpet layer, tiler, plasterer	58	56
General labourer	54	52
Site foreman	78	76

2.4 Uniqueness of Construction Industry

What contributes significantly to the volatility and precariousness of the construction industry is the uniqueness of each and every construction project (Gyulay, 2007). Lappe and Spang (2013) as well as Gyulay (2007) explain that every construction project in one way or another is unique, saying that no two projects can be exactly the same.

Kareem and Bakar (2011) discuss that, even if there are two identical construction projects, factors such as the weather, suppliers, and location can significantly alter the process and outcome of the two identical projects Lappe and Spang (2013) further explain that major projects are unique as they often involve different clients, stakeholders, and environments with each construction project having its own aim and objectives as well as external influences.

Gyulay (2007) clarifies that it is imperative to have a good understanding of the various elements that may have an impact throughout the project's processes. Many of the factors that influence a project negatively can be managed, whilst at the same time other influences remain unknown until an undetermined time where they appear and

have a significant impact on the project's success (Gyulay, 2007; Hewage et al., 2007).

As a result of such volatility and uncertainty within the county's economy and political anxiety, conditions within the construction sector have altered (Greve, 2013).

Consequently, a large share of construction as well as engineering companies have expanded and taken on more work abroad, purely to obtain more steadiness and consistency in future earnings (Munshi, 2014). Senatore (2014) reaffirms what Greve (2013) identified, by further explaining that companies seeking to take advantage of infrastructure investment abroad are expected to expand and upgrade.

As a result of the larger contractors looking for work that is more consistent and reliable away from South Africa, it has essentially created a 'vacuum' within the South African construction industry (Thwala and Mofokeng, 2012). Thwala and Mofokeng (2012) explain that the recent phenomenon where the larger contractors are looking for work abroad has fundamentally created an opportunity and incentive for the smaller grade contractors.

The smaller contractors have essentially been given the opportunity to take up the work that would usually be taken up by the larger companies. It has encouraged the smaller grade contractors typically from grade 3 to grade 6 to upgrade to compete amongst the more established contractors in order to capture the projects essentially left behind by the globalising companies (Senatore, 2014; Thwala and Phaladi, 2009).

2.5 Complexity of the Construction Industry

The management of a modern day construction project requires a vast knowledge of contemporary management techniques and technologies in addition to having a full and thorough understanding of the entire construction process (Hendricksen, 1998). Thus, based on the above-mentioned research, the use of project management software will enable project managers to cope with the complexity and demands of a

project whilst providing numerous amounts of benefits at the same time (Hlahla, 2013)

The construction process of a project can be described as an assembly-like process, where the process is complicated, parallel and dynamic (Thwala & Mofokeng, 2012). Complexity of a construction project relates to the complex systems and complex processes involved.

The many different stakeholders involved on a project, the different lines of communication, time and budget constraints, and the uniqueness of every project are amongst the many factors that contribute to making a construction project a complex task to undertake (Hosseini et al., 2012).

Every project is unique in terms of the problems that arise, with different priorities and resources assigned to it (Davis, 2013). However, there are various project management techniques and technologies that are available that can provide efficient planning techniques, maintaining better control and effective communication amongst project stakeholders.

It is the project manager's responsibility to select a project management tool or technique that will best fit their management style in successfully completing a project (Görög, 2011). Program Evaluation Review Techniques (PERT), Gantt charts, Work Breakdown Structures, Risk Management Strategies, budgeting and Critical Path Analysis are some of the techniques that have been developed to assist project managers in managing the complexity that comes along with a construction project (Lappe and Spang, 2013).

Ballan and El-Diraby (2011) explain that the techniques mentioned above are all included in the various project management software, essentially making the life of the person using it a lot easier as all these tools are integrated into one software programme.

2.6 Grading of Contractors in South Africa

A report was undertaken by Keith and Windapo (2011) who investigated and developed a typical road map in which contractors registered with the CIDB would have followed, with regards to contractors moving up the contractor grades. They conducted an analysis of the contractors that recently moved up a grade on the CIDB Register of Contractors. Their in-depth investigation concentrated on the particular instruments and processes that these newly upgraded contractors had implemented in order to obtain and achieve such advancement.

The analysis of these contractors with regards to their significant advancement and transformation was particularly concerned with the company's ownership profile, the time frame taken to achieve such upgrade, the financial status, capacity as well as capabilities of these contractors (Keith and Windapo, 2011). By focusing on these particular mechanisms it aided the study to identify which one was most significant and influential to these contactors in their upgrade transformation.

The main objectives of their work were to:

- "Research the typical various stages to becoming a large contractor (i.e. CIDB Grade 5 to 9 contractor)"
- "Synthesize the factors that would encourage the growth and development of new large contractors – but clearly set out realistic expectations and highlight the dangers of unreasonable expectations" (Keith & Windapo, 2011:2-3).

This study was based on the assumption that the significant growth by emerging contractors owned by black South Africans is in the best interests of the future growth of the country. It was undertaken with the intention to advise the lower grade contractors about the various factors that would enable them to grow into a larger grade contractor, which is where this research will extend on first.

The objectives for the present research are similar, but build on the objectives that were presented in the study conducted by Keith and Windapo (2011). They are comparable in the sense that they both are trying to identify which techniques and

methods contractors should adopt in order to grow further or upgrade, however Keith and Windapo (2011) focused particularly on the ownership profile of the companies (i.e. sex and race of owners) and emphasized the upgrade from a grade 5 contractor to a grade 9 (Keith and Windapo, 2011).

This presents a gap in research, where there is little South African academic literature in the investigation into techniques and mechanisms that grade 3 contractors adopt in making the upgrade to a grade 4 contractor.

2.7 Upgrading to Higher Grading Level in South Africa

The CIDB largely evaluates certain conditions amongst other things when grading contractors, they will look at; the tender value range, the best annual turnover, the available capital as well as the capabilities of the contractor (Cidb, 2014). The capabilities would involve the experience of the company and level of adoption of certain technologies, like project management software (Thwala & Mofokeng, 2012).

Thwala and Mofokeng (2012) mentioned the capabilities condition, and suggested that the adoption of technologies like project management software will improve and possibly enable contractors to make the leap from a small contractor to a medium contractor.

Although, the CIDB does not specifically mention this condition, for the purpose of this study, this is what the research is setting out to test.

Therefore, in order for any contractor to upgrade to a higher grading level regardless of where they fall within the grades of 2 to 9 on the CIDB contractor rating, these contractors are compelled to acquire a greater financial capacity, adopt relevant technologies in addition to successfully completing larger scale projects in time and within the stipulated budget (Arendse, 2013). According to Keith and Windapo (2011) it is significantly more difficult to achieve and complete an upgrade without access to work opportunities.

Through research, information on the pace at which contractors generally upgrade could marginally be determined (Marx, 2012). The time within which contractors upgrade reveals that these contractors take time to grow and improve their financial resources, technical as well as project management abilities and capacity. In addition to this, further factors that one needs to consider are the actual construction experience that these contractors obtain together with process maturity, which includes business related processes (Cidb, 2014).

Keith and Windapo (2011) elaborate by explaining that as the contractors grow and upgrade, they continuously need to adapt the processes they follow. However, Marx (2012) does argue this to a certain degree, emphasizing that even though some contractors do not upgrade and continue to operate on the same grade, these companies can mature over time and in certain instances may find it beneficial to remain in their existing grade for whatever reason.

An investigation undertaken by the CIDB revealed that on average an estimated 1000 or 10% of the general building and civil engineering contractors who are registered with the CIDB between the grades of 2 and 8, will manage to upgrade annually at least by one grade (Cidb, 2012). According to Keith and Windapo (2011), the highest rate of upgrades that usually occurs is within contractor grades 2 to 4.

As such during the period between 2006 and 2010, one of the major reasons why certain contractors (and in particular black-owned contractors) were upgrading with three or more grades was not only due to government policies or mergers and acquisitions (Gasa, 2012). Most authors argue that these exponential leaps are based on having good “internal organic growth” (Gasa, 2012; Keith and Windapo, 2011). In order to authenticate this belief, twelve of the most prosperous contractors were examined by Keith and Windapo (2011) with the intention of identifying factors and monitoring the organic path of growth that effectively resulted in the contractors’ success.

Through monitoring and evaluating the selected candidates, it became apparent that on average, these contractors would upgrade once in every 10 to 12 month period (Keith and Windapo, 2011). According to Arendse (2013) the main reason these

contractors had elevated from one grade to the next in such a short space of time was not only a result of the Government policies that were in place, but also due to numerous other factors that were identified in having a direct influence on the growth advancement of these contractors. Some of these factors are listed below (Arendse, 2013; Davis, 2013):

- A combination of good and shared experience in the construction industry;
- Retaining their best staff members as well as recruiting new personnel who could add value to the company, creating a close-knit workforce;
- Showing great emphasis on maintaining company morals and standards;
- Investing company capital in secured fixed assets;
- Creating good relationships with suppliers, working meticulously with them in order to avoid delays and disputes.

Similar reasons were found in the Malaysian and Brazilian construction industries. However, the factor that stood out as contributing most significantly to the success of contractor upgrades and advancement in those two countries was the effective utilization project management software (Kareem and Bakar, 2011; Michaloski and Costa, 2010).

CIDB (cited in Gasa, 2012) summarises the information gathered from a survey that was conducted shortly after the above-mentioned contractors were monitored:

- Contractors who operate effectively, will mostly be led by a well-experienced construction industry individual. This leader is usually open to new ideas, techniques and mechanisms, which can aid the company and give it a competitive edge. Having a great leader enables the workforce to gain the necessary experience in addition to developing at a faster rate (Gasa, 2012).
- For a company to become successful it essentially needs to develop a strong and reputable track record, creating a robust financial base in addition to consciously investing capital in appropriate fixed assets and technologies (Gasa, 2012).

- Successful companies retain their current employees and attract new staff where it is deemed necessary, in addition to focusing on geographic spread and product diversification.

However, although Government policies did and currently still do contribute significantly to the promotion of contractor development, this does not guarantee immediate or any success at all (Gasa, 2012). Thwala and Mofokeng (2012) further explain that contractors should not be reliant solely on the Government policies in place, but should exploit their own organisational strengths and capabilities in the most efficient and effective way. However, according to Gasa (2012), in order for these small and medium contractors to grow whilst at the same time compete successfully, the effective utilization of the available ICT in project management software is crucial.

2.8 Financial Position

According to Eisenhardt and Schoonhoven (1990) a real characteristic of a successful construction company is to establish a strong cash reserve, allowing them to have a greater financial capacity. For emerging smaller construction companies, one of their largest failure factors is having inadequate financial resources, where a company's development is very reliant on the abundance of this resource (Eisenhardt and Schoonhoven, 1990).

2.9 Importance of Project Management in the Construction Process

In the context of this research, it is important to first define what project management is prior to any discussion and analysis of the benefits of utilizing project management software. Project management can be defined as the process of planning, motivating, organizing and controlling of projects or company resources with the objective of achieving specific predetermined goals (Project Management Institute, 2014).

Project management dates back to the 1950s and today is applied to single projects in addition to being used for the coordination and management of entire project portfolios (Lappe and Spang, 2013). Project management is a proven method for managing not only construction projects but projects in other industries. Increasing

importance of project management has been attributed to the increasing complexity of projects (Görög, 2011).

The complexity of tasks has heightened as tasks must now be completed under more demanding constraints, with regard to pressure on project completion dates, project budgets, and coordination of different project stakeholders (Davis, 2013; Lappe and Spang, 2013). Kerzner (2009) also talks about the complexity of the construction process, explaining that construction projects have become more complex since World War II.

2.10 Evolution of Project Management Software

During the period of 1960 to 1970 the combination of using PERT, CPA and EVA boosted the popularity of project management amongst the private and public sectors (Ballan and El-Diraby, 2011). Initially the larger engineering and construction firms used project management, where the conventional project management tools and methods were applied to various projects for the purpose of managing the large budgets and complex schedules associated with these larger projects (Liu, et al., 2008).

The commitment to using these project management tools and methods during this time coincided with the establishment of the computer and the specific software, which specialized in project management (Liu et al., 2008). Ballan and El-Diraby (2011) further explain that these computer software "packages" were extremely expensive as well as difficult to use as they were only performed on mainframe computers at the time.

DuPont purchased one the first Univac computers in the 1950s and set out to design the first computer software programme that would incorporate planning, estimating and scheduling (EPM, 2011).

In 1959 the company presented the first Critical Path Method (CPM) application, whereby project management became the first commercial software that was run on a computer (EPM, 2011). However, the CPM concept did not succeed as expected and

nearly died out completely. Mauchly and Associates revived the software, by commercialising it and streamlining the process to pay more attention to scheduling as opposed to costing, as well as provided training seminars to popularise the software, but it was still not affordable (EPM, 2011).

Figure 2.1 shows the first CPM analysis diagram in 1957, with a project schedule consisting of 61 activities:

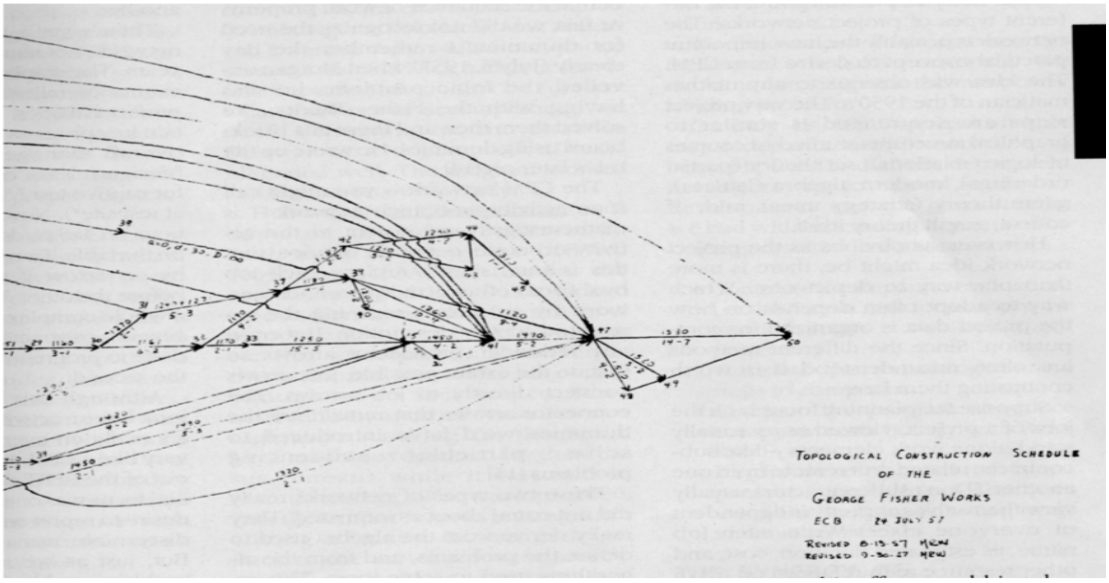


Figure 2.1 The first digital CPM analysis diagram from 1957 (EPM, 2011)

The increased execution of project management tools and methods in the early 1980s was facilitated with the arrival of the personal computer, which subsequently resulted in more affordable project management software (Ballan and El-Diraby, 2011; Liu et al, 2008).

Görög (2011) describes that by the turn of the 1990s, project management tools and techniques were being utilized by other industries along with the engineering and construction organisations. At the end of the 1990s this development resulted in more affordable computers that were able to control and manage projects more effectively. Cheaper project management software for these computers was made available with the intention to assist project managers in running a project (Görög, 2011).

During this period, developments associated with evolution of the Internet notably altered business practices. The Internet offered a quicker, collaborative and customized platform that permitted people to browse and acquire products and services directly online. This progression has essentially made companies more productive, efficient and client oriented (Miranda and Lima, 2012).

2.11 Mainstreaming Computer Applications in Universities

During the early 1980s, the use of project management software on the personal computer, which was designed with the intention to make project management tasks easier and more convenient, became broadly accessible to various organisations (Kwak, 2003).

Table 2.2 Evolution of technology and project management software (Kwak, 2003)

	Technology	Management Science	Project Management & Technology	Major Projects	Project Office
~ 1958	- Telegraph - Telephone - First computer - Automobile - Airplane - First database	- Adam Smith - Frederick W. Taylor - Henry Fayor - Henry Gantt - A McGregor's XY theory	- Parametric Cost Estimating - PERT/CPM - Gantt Chart - Monte Carlo Simulation - Systematic Application	- Inter Continental railroads - Hoover Dam - Polaris - Manhattan project - Panama Canal	- Focal point - "proximity" - Traditional project office functions - Navy Special Project Office (SPO)
1959 ~ 1979	- IBM 7090 - Xerox copier - UNIX - Microsoft Founded	- ISO - Total Quality Management - Globalization - Quality Management	- PMI - Inventory Control - Material requirement planning	- Apollo 11 - ARPANET	- Project Supporting Office
1980 ~ 1994	- Personal Computer - Wireless in-building network - First Internet browser (MOSAIC)	- Manufacturing resource planning - Risk Management	- Matrix organization - PM Software for PC	- Boeing 777 - Space Shuttle Challenger - The English-France Channel project	- Project Headquarter - War Room
1995 ~ Current	- Internet	- Critical chain - Enterprise Resource Planning	- PMBOK (PMI)	- Iridium - Y2K project	- Virtual Project Office - Web-base Project Office

A paper by Brown et al. (2008) discusses the use of ICTs in Higher Education Institutions within South Africa. The use of ICT in Universities was initially for

administration and infrastructure development.

Lippert (cited by Brown et al., 2008:73) mentioned that ICT was only introduced during the mid to late nineties to the mainstream tertiary curriculum. During this time it was taught in certain faculties, particularly in Universities in the two major metropolitan areas of the Western Cape and Johannesburg.

However, it is important to know that only at the turn of the 21st century in South Africa did most Universities fully introduce ICTs into the teaching and learning curriculum (Czerniewicz and Brown, 2006) cited by (Brown et al., 2008:69).

During the study conducted by Brown et al., 2008, it established that the "hard disciplines" like the Engineering and Built Environment, Science and Health Science faculties particularly in Universities from the Western Cape, here where the use of ICT teaching applications was applied at a higher standard as opposed to the Humanities and Business faculties in the early 1990s.

Although, during the 1980s and 1990s in South Africa when forms of e-learning across faculties were introduced, there were still various implementation issues at the time including: absence of resources; adverse perceptions of the ICT systems in place; the technology at the time being very difficult to use and understand as well as being very expensive (Kwak, 2003; Brown et al, 2008).

Learning Management Systems (LMS) were regarded at the time as one of the major inhibitors to the integration of ICT or e-learning within Universities, where the lack of practiced lecturers in the use of ICT software contributed to the deficiency in LMSs (Lippert, 1993). Today e-learning is apparent in various forms and practices, across all faculties in almost all Universities throughout South Africa (EMA, 2013).

It must be noted that students who were not taught ICT programmes during the 1980s and 1990s find it difficult to grasp the latest technologies, as opposed to University students from the last ten years (Brown et al., 2008). Students in recent years are exposed to the latest technology and software programmes throughout their time at University, as well as widespread exposure to the Internet playing a major role in the uptake of Information Communication Technologies amongst the youth (Czerniewicz et al., 2008)

2.12 Driving Forces Behind the Implementation of ICT in Project Management Software

Introducing project management software demands a strong sense of motivation within a company (Hosseini et al., 2012). Consequently, the first step towards the adoption of new, or the improvement of original software, within construction companies relies on the strengthening of the company's motivation (Hosseini et al., 2012).

The majority of the driving forces that promote and encourage the implementation of innovative construction related technology is similar to other industries. Peansupap and Walker's (2006) study of small and medium contractors identified that the driving forces to make effective use of available project management software include:

- Enhancing the levels of productivity in all construction processes;
- Widespread globalization drift in competition has become aggressive and threatening to contractors' survival;
- Ability to cope with tight scheduling;
- The industry as a whole dependence on information and communication transfer;
- The massive competition amongst small and medium contractors;
- The topographical as well as organizational issues with regards to area proximity;
- The project alignment in the construction industry;
- The inherent multi-organisational structure within companies, in order to assemble and gather multi-disciplinary skills. (Peansupap and Walker, 2006)

Thwala and Mofokeng (2012) emphasized that there is a significant difference between utilizing project management software and 'effectively' utilizing the software. Using project management software effectively, essentially means making full use of the integrated features that the software has to offer - using the software to its full capabilities for what it was designed to do (Peansupap and Walker, 2006).

2.13 Level of Adoption of Project Management Software in the Construction Industry

The global construction industry in the last 10 to 15 years has experienced an increase in the availability and use of ICT technologies (Kareem and Bakar, 2011). However, with regard to the adoption of ICT in the construction industry, the overall adoption is still significantly lower when compared to other industries in the marketplace (Hewage, et al., 2007; Peansupap and Walker, 2006). This phenomenon could be attributed to the fact that the construction industry is inherently conservative and has traditionally lagged when compared to other industries with regard to the implementation of new technologies (Hewage et al., 2007).

The running of a construction project includes not only the building of the project but also includes the processes involved prior to the commencement of any actual construction as well as the processes involved post completion of the entire project. This requires effective coordination and collaboration of project budgets, time schedules as well as the communication between multiple project members on a continuous basis (Ahuja, Shanker and Yang, 2008)

This can be achieved more effectively through real time communication flow between all personnel involved with a construction project. To make use of real time communication the adoption of ICTs, particularly project management software, is seen to be highly beneficial (Peansupap and Walker, 2006).

It has been found that ICT adoption in project management software differs in terms of contractor size. Specifically, larger contractors are prone to adopt the more expensive and advanced systems than their smaller counterparts (Ghobakhloo, et al., 2012).

When the phenomenon of the Internet was introduced to the world, it was fundamental in forcing companies to scrutinize their existing business practices and adopt new methods of operation (McIvor et al., 2003). Consequently, it induced an increase in the use of ICT project management software in the global construction industry (Kareem and Bakar, 2011).

As a developing country, the South African construction industry and the contractors who form part of it should be expected to behave in a similar way to that of other developing countries (Abrahamse, 2008). Therefore, studies conducted in developing countries such as India, Malaysia, Brazil and Nigeria will be examined in order to better understand the possible situation in South Africa regarding ICT adoption and implementation, particularly looking at project management software.

Several studies have been done on the aforementioned developing countries, particularly on the subject of identifying the various benefits and barriers to project management software implementation.

2.14 Barriers to Adopting ICT Project Management Software Globally

It has been discovered that there was a slow rate of adoption of ICT project management software in these developing countries mostly due to:

- The complex nature of the construction industry;
- ICT immaturity levels;
- Financial constraints;
- Poor availability of tools for evaluating the benefits of using the relevant technologies;
- A lack of understanding of the implementation process. (Peansupap and Walker, 2005)

In the past it was found that the small and medium contractors were adopting ICT project management software at a very slow rate due to the various factors listed above. The companies believed that the barriers and disadvantages were far greater than the potential benefits. However, as the benefits of implementing the various types of project management software became evident first hand by contractors in the construction industry, this perception rapidly changed (Sun et al., 2008).

Prior to adoption of the software, it became evident that there was a lack of innovation diffusion by senior managers who decided on whether the company would adopt any

software. Experienced managers of construction companies had limited knowledge with regard to project management software usage (Peansupap and Walker, 2006).

Other barriers concerning the integration of the project management software was the lack of training, general conservativeness of the construction industry, a general perception of high economic outlay with unknown benefits (Dehlin and Olofsson, 2008). Some of the trends that were identified include that the construction industry makes ineffective use of currently available project management solutions (Adriaanse and Voordijk, 2005).

In the past the adoption levels tended to vary between the differently sized construction firms. Larger companies tended to adopt technology a lot faster than the smaller contractors, as a result of the smaller companies' resource and financial constraints (Ghobakhloo et al., 2012).

However, recent research conducted by Hosseini et al., (2012) identified that majority of the implementation barriers have been overcome by contractors globally. Kareem and Bakar (2011) are in agreement by further claiming that almost 90% of the Malaysian construction industry contractors have adopted some sort of project management software.

Nevertheless, both authors stress the point that even though there has been a massive uptake of project management software in these developing countries, they maintain that a significant number of these contractors are not effectively utilizing the software to its full capabilities (Kareem and Baker, 2011; Hosseini et al., 2012).

2.15 Barriers to Adopting ICT Project Management Software in South Africa

The use of project management software in the South African construction industry in the last decade has become widespread (Hosseini et al., 2012). The South African construction industry in the past had to compete globally, facing unique problems where half the total software applications sold and distributed in the South African market was from abroad. This had a direct effect on the cost of such technologies,

which deterred construction companies that were interested in investing in project management software (Ballan and El-Diraby, 2011).

Nevertheless, project management software is now readily available, where companies are able to download project management software off the Internet (Hlahla, 2013). In the past some South African contractors, similar to contractors in other developing countries, had executive managers who still did not believe that the use of project management software was important from a strategic point of view. Many of the experienced managers did not appreciate the benefits of such software and how it may contribute to increasing the productivity of their daily function, thereby benefiting the company as a whole (Abrahamse, 2008; Hlahla, 2013).

Previously some of the smaller companies did not have resources available for technological advancement, which in the past led to a slow evolution of construction companies in South Africa (Thwala and Mofokeng, 2012). However, today there are numerous construction software programmes available, where programmes start from being free to download on the Internet, to software that will cost some companies over R80 000 according to Cilliers[1].

Difficulties in adopting project management software in terms of training personnel were identified as a significant barrier (Abrahamse, 2008). Arendse (2013) adds to this by explaining that the older (>50 years), more traditional construction managers in construction companies who never went to University or Technikon have limited knowledge with regard to the latest available technologies and have no interest in utilizing these technologies.

In the past there was a general perception about project management software amongst the smaller contractors about the high economic outlay with unknown benefits (Gasa, 2012). Listed below are additional barriers that in the past deterred contractors from adopting ICT project management software:

[1] Personal Communication with L, Cilliers (2012), Director of Contract Communicator Pty (Ltd).

- A lack of adequate computer literacy amongst potential system users;
- A lack of confidence in reliability of the available systems;
- Time required for fully adopting and understanding the software. Training was necessary as in the past there was a lack of adequate computer literacy skills, which would take up time and resources. Time spent on training was seen to be time lost on the construction site and making money. Due to the unknown benefits it was very difficult to see the necessity of such systems. (Peansupap and Walker, 2006)

However, in the last 10 to 15 years in South Africa, the majority if not almost all the barriers that were mentioned to adopting project management software have been overcome (Gasa, 2012).

Another problem in South Africa was the lack of effective implementation of Government Development Programmes for small contractors (Mukanyima, 2012). Government Development Programmes in the past were accustom to conflict between the various role players as well as operational difficulties, resulted in the programmes not meeting expectations.

However, a study conducted by Mukanyima (2012) discusses how the National Department of Public Works (NDPW) later implemented a programme under the Ekurhuleni Metropolitan Municipality with the intention to improve on the first phase of programmes, which was the subject of Egbeonu's (2004) research.

Mukanyima (2012) explains how the Expanded Public Works Programme (EPWP) introduced the Vuk'uphile learnership programme in Ekurhuleni, where attendees learnt project management skills from the first phase programmes. All the project stakeholders acknowledged the previous inadequacies and subsequently eliminated the previous problems. The programmes have improved and focus on developing technical skills as well as management training whilst also improving the computer literacy skills of the learners.

2.16 Available Project Management Software in SA

This section of the literature review will discuss some of the available project management software that is being used by the various South African contractors. There are various project management programmes available to construction companies, the majority of which can be accessed online or purchased through a software company. Many of the programmes offer a wider range of features to provide a more effective and efficient system. Listed below is a brief description of some of the project management software used by the larger contractors:

2.16.1 Procore

Procore's construction software provides many tools such as creating accurate schedules, storage and management of documents, managing contracts and tracking project communications and time worked. Procore organizes contracts, sub contracts, purchase orders and any changes in orders. It tracks actual amounts committed and paid with the budgeted amounts to help keep the project on track. Procore helps reduce time wasted on transfer of information such as change order requests. Either amount-based contracts or unit/quantity budgets may be used (Procore, 2014).

2.16.2 Microsoft Dynamics NAV

Microsoft Dynamics NAV provides integrated financial, supply-chain, and customer relationship management (CRM) for small to medium companies. This product works very well with Microsoft Office to help integrate more of the business's actions.

A Microsoft Dynamics NAV solution centralizes the critical estimate; permit; sales; project management; labour; and financial information to help the user better manage budgets; schedules; field activities; customer relationship and the bottom line. It is delivered through a network channel of partners and is easy to learn and implement. A link between customer options and selections with contracts is created to track and update contracts through change orders, through to project completion (Microsoft Dynamics, 2014).

2.16.3 Contract Communicator

Contract Communicator is a web-based solution for project management made available to the construction and engineering sectors. It is a 'project aware' system that identifies, manages and communicates the causes and effects of events causing delay or additional expense on projects. It also incorporates risk-identifying functions, which alert users about any risks and provides resulting actions immediately. Contract communicator ensures that users adhere to claims processes and avoid time bars. It reduces dependence on individuals and their level of ability (Contract Communicator, 2014).

The project management software systems mentioned above are available for purchase from the respective companies who develop them. Although, there is free project software available for download off the Internet, they offer less features but may be suitable for the smaller grade contractors.

2.16.4 MS Project

This is a standardised free software program. The program is designed to be able to read project files from Microsoft, which is not common amongst many of the free software packages that are available. The software is able to do project planning, resource management, project scheduling and project review (Open Workbench, 2014).

2.16.5 Open Project

This is a Windows enabled desktop project management software, which is also readily available through free online download. It is furnished with an efficient and effective scheduling instrument. It is very similar to the interface of MS project, where it also enables the user to conduct resource management, task handling as well as project scheduling (OpenProj, 2014).

2.16.6 Primavera Software

This desktop-based project management software is from Enterprise Project Solutions. The software was created to handle large scale, advanced and multi-layered projects.

The software is able to systematically control endless amounts of project activities, whilst providing unrestricted amounts of resources and target plans. The software is unique, where it is tailored to each individual company, depending on what features the company requires out of the software.

Some of the features the software offers amongst other things is integrated document management, email-tracking, construction coordination and project collaboration (Primavera, 2014)

2.16.7 Comparison of the Software

It is clear that there are two forms of project management software, either desktop based or open source. Senatore (2014) discusses the two forms of project management software, where he mentions that many open source free project management software lack support and are not user friendly. One of the biggest concerns of using free open source software is the data security and privacy online, as well as the accesibility of most features (Senatore, 2014)

Many of the sophisticated proprietary desktop project management software are expensive. However, amongst many other features they provide support, security, accessibility and user friendliness.(Senatore, 2014).

It has become clearly evident that even the small and medium sized contractors are making use of some sort of project management software. The questions that may be asked are: why they are using that particular software; are they using it effectively; and are they experiencing cost and time benefits from using the software?

2.17 Benefits of ICT Project Management Software

In the past there were various barriers to the adoption and use of project management software amongst South African contractors and other countries alike. However, once these barriers are overcome, the benefits are considerable (Abrahamse, 2008; Hlahla, 2013).

Project management software provides users with essential tools for improving communication in construction processes and for creating new construction business opportunities (Peansupap and Walker, 2005). Ballan and El-Diraby (2011) state that the effective use of such software could create great opportunities for construction companies to operate globally.

Peansupap and Walker (2005) mention some of the benefits of using project management software, which have been identified in studies done in developing countries and South Africa, and found that if the majority of the available software is used effectively, any form of information integration can be supported. This in turn can help reduce the volume of information processed, can increase the projects' productivity and help reduce avoidable costs.

Michaloski and Costa (2010) add that information integration can essentially reduce data re-entry through the Internet transferring information protocols.

Bowden (cited in Abrahamse, 2008:7) identified some of the benefits that have been experienced by small and medium contractors in South Africa if the project management software being utilized is used effectively to its optimum capacity. These include reduction in defects, reduction in waste, increase in productivity, increase in predictability and the effective reduction in operation and maintenance costs, preventing needless time delays as well as reducing unnecessary costs.

Regardless of the size of contractor operating in the construction industry, a project management software solution fundamentally provides contractors with the structure and organization necessary to accomplish various tasks, as well as managing time and resources (Peansupap and Walker, 2005).

Project management software permits project managers to have clear guidelines and procedures, which allows them to navigate from their current position to their goals (Ballan and El-Diraby, 2011). Brilakis (2007) argues that project management software can essentially become the lifeline for a construction company where a project's time, budget and resources are utilized to optimum capacity.

The following features appear in the majority of the available software packages:

- Communication: Project management software provides networks of communication, with particular reference to projects, tasks and programs, making these more efficient whilst at the same time providing easier modes of communication between project stakeholders (Peansupap and Walker, 2005).
- Budget Control: The way in which the budget of a construction project is managed will subsequently determine the future of the contractor. The project management software enables the project manager to view a project's cost easily, as well as comparing actual budget to the originally planned budget (Ballan and El-Diraby, 2011). Therefore, money is ultimately saved.
- Tracking: Following the project's progress is crucial for the success of a construction company. Project management software provides clear visual data for project managers to determine if the project is running on course according to the original time frame, highlighting what work has been completed and what is still unfinished (Ballan and EL-Diraby, 2011; Michaloski and Costa, 2010).
- Decision Making: The utilization of project management software enables the decision making process to be enhanced for the project, where all the relevant and necessary information is accessible in one place (Michaloski and Costa, 2010).

There are many more benefits from using the software, where it deals with improving the management of risks and quality on a construction project as well. Therefore, by effectively using project management software it can ultimately afford contractors the competitive edge over their industry counterparts where the return on investment will eventually materialise (Michaloski and Costa, 2010; Peansupap and Walker, 2006; and Senatore, 2014).

2.18 Conclusion

In conclusion, the literature review has evaluated the state of the South African construction industry, the uniqueness of construction projects, and has analysed the evolution of project management software. It has also looked at the CIDB contractor

grading system, particularly focusing on grade 4 medium contractors. The implementation of project management software amongst the aforementioned sample group has been investigated.

This study builds on previous literature in South Africa, where the researchers tracked the path in which contractors follow to become a grade 9 contractor, concentrating particularly on the grade 5, 6, 7, and 8 contractors where the research focused predominantly on the ownership profiles and experience of these companies in making an upgrade (Keith and Windapo, 2011). There is a need for a more detailed understanding as to how smaller grade 3 contractors upgrade to medium sized grade 4 contractors.

This research expands on the current research in this field of study as well as answering the proposed research question in determining whether contractors upgrade to level 4 and then upgrade their project management software, or vice versa
(Gyulay, 2007) (Gyulay, 2007)

3. RESEARCH METHOD

Contractors operating within Johannesburg were considered for this research, based on the fact that these contractors have greater access to a significant number of projects on a larger scale as opposed to the work that is available for contractors operating in the other provinces across the country (Marx, 2012). These contractors would typically be more representative of the trends that were identified in the literature review and were more likely to provide further accurate and useful information that would eventually contribute to answering the research question.

Initially to ascertain how accurate and adequate the information gathered would be, a brief study test was conducted. To make the results of the pilot test feasible, ten randomly picked medium grade 4 contractors who are registered with the CIDB were asked to take part in a pilot test over the telephone.

The motivation behind selecting grade 4 contractors as opposed to grade 3 is because this study wants to understand the path they took from a small contractor to becoming a medium sized contractor. The pilot testing was merely intended to test logistics and obtain information prior to the greater study, which fundamentally did improve the quality of the latter (Leedy and Ormrod, 2005).

The pilot testing was based on predetermined interview questions that had been set out. The interview questions each had predetermined answers to each question for the interviewee to select. The benefit of this was that the responses would be uniform in nature, which simplified the analysis of the information (Saunders et al., 2003).

The intention of the pilot testing was to improve the research instrument and to help the detailed collection of the relevant information for the purpose of eventually answering the research question. The technique adopted here was acquired from relevant academic papers.

Agumba (2006) and Abrahamse (2008) initially conducted a pilot test, using the theory derived from their literature review, the purpose was to test the tool that would be utilized during their research.

From the several methods for collecting data that are available, this particular research study made use of the following types of interview methods to gather information and answer the research question:

- Semi-structured interview interviews; and
- Open-ended interview interviews.

Semi-structured and open-ended interviews are largely used in explanatory research about the research topics (Ritchie and Lewis, 2003). Semi-structured interviews are primarily used in explanatory research to fundamentally create an understanding of the relationships between the different variables in information gathered (Newton, 2010). In addition, they are used in exploratory studies to provide further information about the research area.

The reason behind making the decision to utilize the aforementioned interview methods was based on the premise that the effective use of these types of interviews is appropriate for collecting information that is qualitative (Agumba, 2006). In addition to this, the flexibility of the instrument allowed interviews with the sample group to be done telephonically or in person (Leedy and Ormrod, 2005).

The combination of the two methods enabled the researcher of this study to investigate the current situation and gather information that typically cannot be predicted. The use of semi-structured open-ended interviews combined a pre-determined set of open questions.

The structure of the interview questions would prompt further discussion. Agumba (2006) as well as Keith and Windapo (2011) successfully used these techniques in similar research. According to Agumba (2006) the use of semi-structured open-ended interviews does not constrain the respondents to a set of pre-determined answers found in a structured interview.

The semi-structured open-ended interviews turned out to be very useful for collecting the relevant information about the participants' knowledge and experience in the construction industry. It allowed the researcher to gain feedback about project

processes as well as numerous perspectives and project outcomes from the relevant and knowledgeable company personnel (Keith and Windapo, 2011; Ritchie and Lewis, 2003). The interviews were conducted face-to-face with the interviewee, which was appropriate for this type of research, where the focus was on acquiring insight as well as understanding in addition to gaining a better in-depth meaning of the question at hand (Ritchie and Lewis, 2003). The advantage of using the semi-structured open-ended interviews was that the researcher was able to gather rich details as well as new and different insights that otherwise have been able to gather from a structured interview (Newton, 2010).

It must be noted that one of the negative points related to this form of data gathering is that the data analysis would be more laborious as correlations between responses to open ended interview questions would need to be determined, once again without introducing bias into the data (Leedy and Ormrod, 2005; Saunders et al., 2003). In analysing the semi-structured open-ended questions, it was identified through research that the use of descriptive analysis, as well as content analysis methods would be effective in trying to analyse the information gathered (Agumba, 2006; Leedy and Ormrod, 2005).

All the data were collected utilizing hand written notes gathered from the interview. Any information that the interviewee was allowed to disclose that was deemed relevant to the study was examined, in addition to the verbal information and written notes that were gathered.

Specific documentary data were requested from the interviewees to contribute additional information that would be analysed in the attempt to answer the research question, such as:

1. The company end of year financial reports;
2. The budgets allocated to invest in such software (ROI);
3. The amount of projects the company has successfully completed;
4. The size as well as the cost of the projects completed and currently underway;

5. The number of staff employed from the company's inauguration up until current.

3.1 The Sample Interviewed

As mentioned in the literature review (chapter 2), during the last few years in South Africa there has been a notable decline in the number of small and medium sized contractors operating in the construction industry, where several companies fail within the first year of their inauguration (Marx, 2012). For this reason, the medium sized companies (i.e. Grade 4) selected for this study had to have been in operation for a minimum period of two years and have completed at least one project successfully during this time. Moreover, as discussed, they were to be chosen from within the Gauteng province.

The sample group of grade 4 contractors was obtained from the CIDB Register of Contractors, in particular from the General Building (GB) class of works. The contractors registered under the CIDB range from grades 2 to 9, as defined below:

- 2 to 4 - Normally established and emerging contractor that operates locally;
- 5 and 6 - Predominantly working locally and regionally;
- 7 and 8 - Usually contractors that are active at a regional level as well as provincial level; and
- 9 - Contractors that typically will work at a national level in addition to an international level.

3.2 Sample Size

Ten contractors were identified from the CIBD list who met the primary selection requirement, namely of having upgraded from grade 3 to 4 in the last few years. This list was further refined to ensure that the participants would be able to provide the necessary data to address the research question. A minimum of four participants was needed, as determined in consulting the literature on qualitative research methods (Newton, 2010).

Consequently, for this research it was decided that a highly detailed in-depth study on a minimum of four contractors would be adequate enough to make a conclusive decision on the question at hand. Thus, five contractors were identified in case one of them subsequently withdrew or refused permission for their information to be published (Sukhoo, 2009).

3.3 Analysis of data

3.3.1 Pilot Testing

The information gathered from the pilot test was analysed manually. According to Ritchie and Lewis (2003) the benefit of conducting a brief preliminary interview with potential respondents is that it allows for direct counts to be done easily on the responses, eliminating respondents who do not fit the desired contractor description discussed in the literature.

The structured interview consisted of boxes to tick with 'yes' and 'no' answers, as well as a number of other questions containing a set of different answers to be ticked in answering the respective question. The boxes we're ticked by interviewer. If the respondents' answers did not match the requirements of the research, they would be disregarded for any further research. The responses were entered into a spread sheet to facilitate the process on choosing the appropriate respondents for the main interview process.

3.3.2 Semi-Structured interview

In analysing the information gathered for this particular interview process, the use of a descriptive analytical method was adopted. This analysis would be in respect of two or more variables, where it would permit the effective analysis of the contractor profiles and work groups.

The analysis technique selected for this research study was similarly used by Agumba (2006), in analysing the semi-structured interview adopted. The purpose of this technique was to analyse the numerous characteristics of the contractors, such as their composition, size and efficiency (Agumba, 2006).

In this setting it was intended to determine procedures that would expose the size and

shape of distributions in addition to comparing relationships among the different variables identified amongst participants.

3.3.3 Open-ended Interview

Keith and Windapo (2011) as well as Gasa (2012) whose research is in line with this study, made effective use of content analysis for the data captured from their open-ended interviews. A similar data collection and management process was used to store, retrieve and analyse the information and responses gathered from the interviews for this research. An adapted data collection and analysis template was used, similar to Agumba (2006) and Keith and Windapo (2011).

Identifiers were assigned to the participants and their information entered into a modified Excel spread sheet. In order to aid the succeeding analysis, codes were developed and assigned to categorise the responses of the participants. This type of research is qualitative where the results are richly detailed, contextually laden and subjective (Agumba, 2006). The information from the interviews was revised and condensed to signify themes and categories that describe the topic being researched (Fereday and Muir-Cochrane, 2006).

Subsequent to the completion of the interviews, the data were reviewed with the intention of identifying mutual, repeated and emergent themes amongst the participants. An independent person knowledgeable in this area of research was consulted with the information gathered, with the purpose of bringing a fresh perspective on the identification of themes and possible interpretations of the data. At this stage it was possible to abandon data that were not pertinent to the research question, while appropriate information was identified and stored in accordance with their codes in the template.

All the relevant answers were manually entered into the information collection spread sheet, where they were recorded based on question number or question identifier. Each theme was entered in an individual line, which helped in cases where the participants had a response that was positive as well as a negative to a question. To analyse the information gathered, some of the responses obtained were given a code

according to a theme. The responses were recorded in comprehensive themes with sub-categories where it was deemed necessary.

The analysis of the patterns between themes was undertaken to establish if there were comparable traits amongst research subjects with similar responses. Categorizing each column by the question number, by participants and response codes aided in simplifying the analysis.

Analysing the various patterns that emerged from the interviews effectively permitted the evaluation process to change from a descriptive role to a more analytical role. Looking for patterns and trends in the participants' responses aided in providing some sort of conclusions. The results of the analysis are presented in the subsequent chapter, indicating that the necessary data answers the research question and confirms the initial hypothesis.

4. DATA COLLECTION AND EVALUATION

4.1 Introduction

This section of the study contains a full analysis and evaluation of the data collected during the investigation from the participating companies. As stated in the research methodology section, the data collection plan identified construction companies in the Gauteng area. The main discriminatory factor identified was the CIDB grading system, namely that only grade 4 general building contractors were to be studied.

The CIDB register of contractors enables anyone to pinpoint the exact type of company that they are looking for by providing the user with a range of selection criteria in order to narrow the search down. The website allows you to select the type of contractor, the size of the contactor, the tender size these contractors take on as well as the area or region these companies operate in. This search process produced a list of grade 4 general building contractors who operate their business in and around the Gauteng area. The resultant list of contractors comprised of: the contractors name; type of work they do; if they currently are an actively registered company as well as a list of their contact information.

The first phase of the data collection process was the pilot testing. Using the list of contractors identified on the CIDB website the researcher randomly picked contractors to call over the phone with the purpose of inviting them to take part in the pilot test. The researcher explained, if they were selected, a face-to-face interview would need to be arranged and conducted later on for the main data collection process.

As one would expect, many of the potential participants were either too busy or not interested in taking part in the pilot test. In total, 28 companies from the CIDB registry were contacted telephonically in order to obtain the 10 participants that were needed to take part in the pilot test.

4.1.1 Pilot Testing

As discussed in the methodology, in order to ascertain the optimal number of a minimum of four participants that matched the desired characteristics who would be

interviewed for the purpose of answering the research question, the pilot testing was undertaken to sieve out potential participants who would not be able to contribute significantly to the study at hand. Therefore, ten contractors that operate in Gauteng were identified to take part in the first phase of the data collection process.

The pilot testing was necessary to ascertain how adequate the information gathered would be. The motivation behind only selecting grade 4 contractors as opposed to grade 3 was because this study wants to understand the path they took from a small contractor to become a medium sized contractor. The pilot testing was conducted with the intention to test logistics and obtain information prior to the greater study, which effectively did improve the quality of the latter.

Once the respondent within the company agreed to take part in the pilot test, the following predetermined interview questions were asked over the phone with the intention of establishing if each respondent would be suitable to take part in the greater study:

4.1.2 Pilot Test Questions:

Question1: Are you currently a grade 4 general building contractor?

Question 2: Are you currently making use of any type of project management software?

Question 3: What software are you currently using?

Question 4: Who deals with the Project Management Software in the company?

Question 5: How many years has your company been in operation?

Question 6: In which area of Gauteng do you operate?

Question 7: Have you remained the same grade as you entered into the CIDB registry or have you upgraded from a grade 3 contractor or downgraded from a grade 5 or above?

Question 8: Would you be willing to take part in a face-to-face interview for the greater research study?

The information gathered from the pilot testing was analysed manually on the spread sheet provided below:

Table 4.1 Pilot test data collection spread sheet

	Question Answers							
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
Respondent 1	Yes	Yes	Primavera	Project Manager	3	JHB	Upgrade	Yes
Respondent 2	Yes	Yes	Open Project	Project Manager	3	JHB	Upgrade	Yes
Respondent 3	Yes	Yes	MS project	Foreman	5	PTA North	Upgrade	No
Respondent 4	Yes	Yes	Primavera	Project Manager	3	Lenasia	Upgrade	Yes
Respondent 5	Yes	No	NA	NA	3	Midrand	Upgrade	No
Respondent 6	Yes	No	NA	NA	2	Alexandra	As entered	No
Respondent 7	Yes	Yes	Primavera	Project Manager	3	Soweto	Upgrade	Yes
Respondent 8	Yes	Yes	CCS (Candy)	Project Manager	4	Sandton	Upgrade	Yes
Respondent 9	Yes	Yes	Podio	Foreman	1	PTA North	Upgrade	Yes
Respondent 10	Yes	Yes	Microsoft Dynamic	Project Manager	4	PTA North	Downgrade	Yes

The pilot testing effectively aided the researcher in eliminating particular respondents who did not fit the desired contractor description. The two most crucial characteristics

that any potential candidate needed to have was that the company needed to be using some form of project management software and have been in operation for a minimum period of two years.

Out of the ten candidates, only two of the contractors were not making use of any form of project management software, which eliminated them for any further participation in the study.

However, the fact that the affected two out of the ten respondents were able to operate at a grade 4 contractor level without any project management software was very remarkable. On exploring why these two respondents were not making use of any project management software, the respondents' answers revealed similarities to the barriers of implementation identified and confirmed in the literature review.

When speaking to the young project manager within one of the companies, it became apparent that the older, more traditional staff were reluctant to learn about how to use project management software, either because they had a lack of confidence in the reliability of the available systems or just preferred to use more traditional methods of management. So essentially it came down to a lack of adequate computer literacy amongst some of the more conventional staff members, where it was clearly evident that the younger staff members would have preferred adopting project management software within the company.

Respondent 6, the director of the company, acknowledged that the effective use of project management software would benefit the company. The respondent was currently looking at introducing project management software within the company by the end of the 2014, subject to time constraints in training of the relevant staff members.

In trying to get a better understanding as to why these two contractors still had not been using project management software at this stage of their companies' development, the topic of education type and level of the owners of these particular companies was brought into question. A paper covered by Egbeonu (2004) identifies these matters as a significant factor for successful small contractors to grow into larger businesses.

4.1.3 Government Development Programmes

It emerged that the owners of these two companies did not have a tertiary education at all; both had previously worked for construction companies for several years where they gained vital onsite construction experience and knowledge. However, the respondents revealed that they both had attended government development workshops for emerging contractors in the past.

The respondents confirmed the findings of Egbeonu (2004) in the literature review, namely that government development programmes had failed in the past. The respondents explained that they were not taught effectively how to use project management software in these programmes, thus a combination of a poor level of education and the lack of performance by the government programmes in the past, seem to be the contributing factors to why the owners had not adopted any form of project management software into their company.

4.1.4 Selection Criteria

Of the ten selected contractors inclusive of the two that were not using any project management software, respondent 3 who agreed to take part in the initial pilot test, unfortunately opted to not take part any further. Respondent 9 had to be eliminated, having only been in operation for one year. The remaining seven contractors were reduced to the optimal number of five by applying a geographical filter focusing on contractors based in Johannesburg. The benefit of using only Johannesburg based contractors is that they would more than likely have a similar client base and type of project, also having a significant relation to complexity and demands for time and cost performance.

Three of the seven remaining contractors were making use of similar project management software (i.e. Primavera). They all met the minimum requirement of being in operation for a period of at least two years as well as operating within the same geographical area. The fourth and fifth contractors were also situated in the Johannesburg area and met the requirement of being in operation for a minimum of two years.

The remaining respondents were based in Pretoria North and thus could experience different business conditions from the rest of the remaining group. These respondents

were therefore eliminated from the round of interviews.

Following this selection process, a time and date was arranged with each respondent for the purpose of conducting the face-to-face interview. The interview process was conducted and finalized over four weeks as the times and dates were arranged around the respondents' work schedules. It is important to note that the interviews were conducted with a staff member who was either in charge of the project management software implementation or a staff member, usually the project manager, who was making use of the software.

4.2 Interview Process

The information captured throughout the face-to-face interview process was analysed using the methods identified in the previous chapter. A comprehensive write up with the results obtained from the interviews is presented below.

The write up consists of emergent themes that materialized in the responses, which essentially surfaced throughout the interview process. Important themes and categories that have been identified from each respective respondent will be highlighted and discussed, as the various similarities as well as dissimilarities that appeared in the respondents answers that prompted a point for discussion are included in the analysis and discussion.

It is important to note that all five respondents nominated have been in operation for at least three years or more. This resulted in information that was more accurate and comprehensive with the ultimate intention of answering the research question.

From each of the five respondents, the researcher was able to interview one individual who represented the company. The person had to be using the project management software within their respective company and had been at the company during the transition from a small contractor to a medium sized contractor, or was a person who was very knowledgeable about the implementation of the project management software within the company through its transition phase.

Out of the five nominated respondents, the researcher interviewed a project manager from four of the companies, and the director from the remaining company.

Each interview lasted the full length of the allocated 1-hour. The researcher's interview questions prompted highly informative conversations, as had been anticipated, with opportunity of a broader view and outlook on various elements and themes, which essentially would contribute significantly to this analysis of the information gathered.

The data collection spread sheet was formulated after the interviews had been conducted. When analysis started, the researcher went through one question at a time comparing the responses of each participant to that particular question. Using a simple coding system to analyse the spread sheet, the researcher marked the responses that had similarities, variances, as well as if the response represented a positive or negative feedback.

By doing this, the researcher was able to match and group the responses of the participants with the intention of formulating themes and categories that were repeated and which emerged from the interview process amongst the various responses. Provided in Figure 4.1 is the spider diagram used to map out the various themes that will be looked at in detail throughout the analysis and discussion. Refer to Appendix A for the data collection spread sheet.

Figure 4.1 provided below is a list of emergent themes that resulted from the interview process, each theme will be discussed in the following sections (Fereday and Muir-Cochrane, 2006).

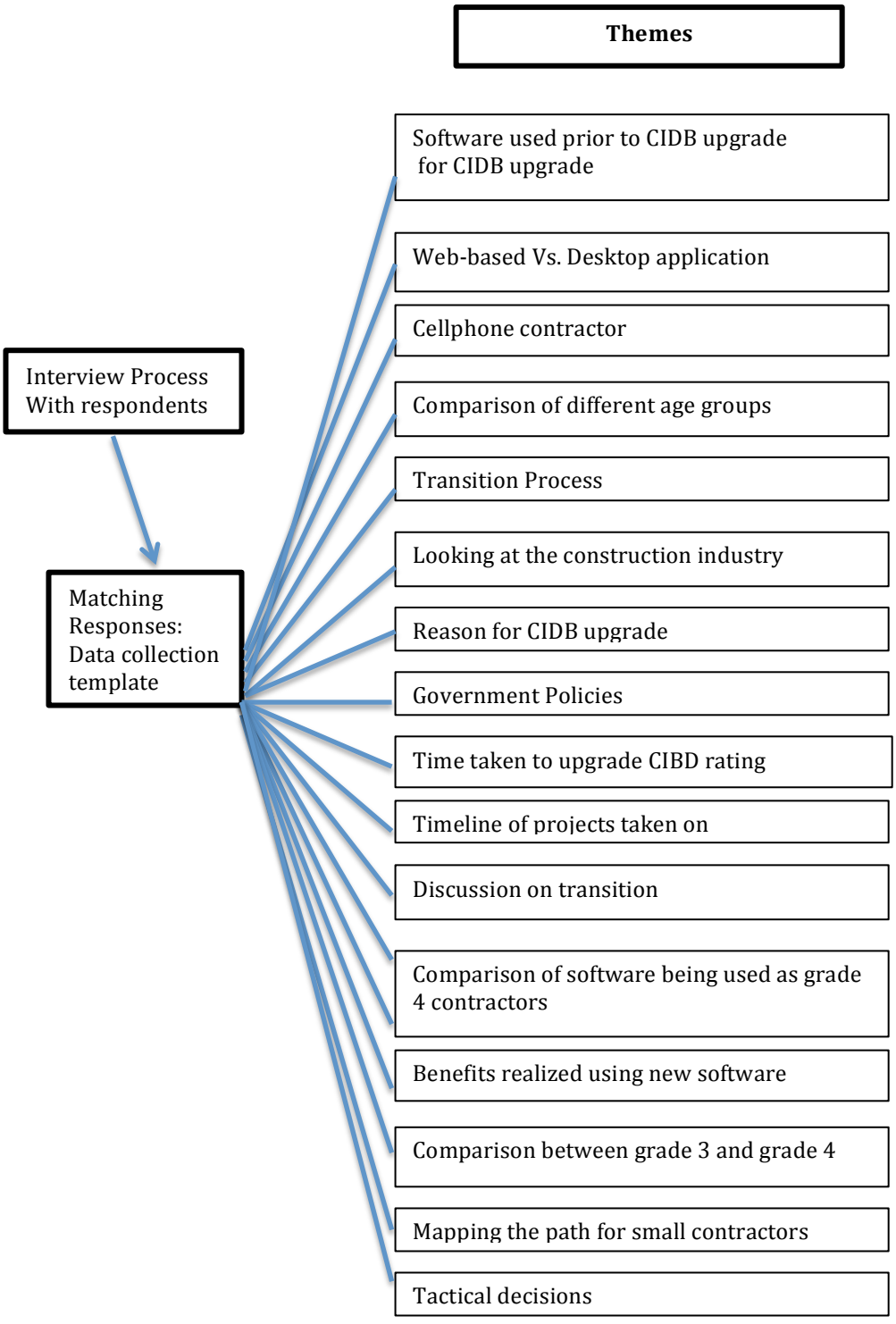


Figure 4.1 List of Emergent Themes

4.3 Software used prior to CIDB grading

For the purpose of this research it was important to have interviewed a person from each company who had been working at the company during its transition process to becoming a medium grade 4 contractor. The reason for this is that such a person would have specific knowledge on how and why the company managed to upgrade, as well as be aware of what project management software was being used prior to the time of transition.

Out of all the five respondents, four of them were making use of some form of project management software when they were still characterized as small grade 3 contractors. Surprisingly one of the respondents had not exploited any form of project management software at all prior to upgrading to a grade 4 medium contractor.

Of the four respondents who used some form of project management software prior to upgrading their CIDB grading, two of the respondents were making use of 'Achievo PM Software' while the remaining pair made use of 'Gantt Project' and 'MS Project'.

The reason behind making use of these particular programmes was a general consensus amongst the respondents that at the time they were free to download; easy to access off the Internet; and that they did not know of many other available software products at the time.

The table below indicates which of the software was web-based or a desktop application:

Table 4.2 Web-based software vs. Desktop application software

Software:	Web-based Open Source:	Desktop Application:	Cost:
Achievo	Yes	No	Free Download
MS Project	No	Yes	Free Download
Gantt Project	No	Yes	Free Download

It is important to note that Peansupap and Walker (2005) described in the literature

review that one of the most common inhibitors for contractors not using any project management software at all in the past was due to the high acquisition cost of the software. However, in the literature review Ballan and El-Diraby (2011) discussed the advancement of the Internet over the last twelve to fourteen years, which has seen applications like project management software becoming readily available for free download off the Internet, which is validated by the responses received by the respondents interviewed.

Out of the three programmes that were used prior to the companies making any upgrade, Achievo got the worst feedback from the two respondents who made use of the software programme. According to both respondents, Achievo at the time was "infuriatingly" and "annoyingly" difficult to install where the prompts to alter the permission changes and changes to the database effectively reduced any eagerness and enthusiasm to use the software. In addition to the programme being difficult to install and set up, the software's functionality, usability and design were "absurd" for any person trying to fully understand how the software worked.

Both respondents mentioned that the software was not only designed for the construction environment but also could be used in the business environment, which may have been the reason why they found it difficult to mould to their specific requirements. At the time, the programme was not designed in such a way to be able to cope with the size of projects that these companies were taking on.

One respondent mentioned that the only way the company was to move forward and take on bigger projects was that they had to look to new project management software that would be more functional, more user friendly, and which integrated the essential project management tools.

The second respondent who made use of the Achievo software in the past made the same observations and further mentioned that based on the fact that this programme was lacking in many areas, the company attempted to combine two different software programmes with the Achievo software with the intention of threading them into one system. However, this procedure required more time and effort to actually find a way to effectively integrate the different software, as opposed to doing the actual work the company had taken on.

In response to this, the two respective project managers admitted that due to the time and cost constraints on their respective projects at the time, it became apparent that both interviewees resorted to managing their projects manually with regards to using the skills and techniques they acquired at University and Technikon.

One respondent made use of critical path analysis, earned value analysis as well as resource levelling manually and only used the software to print Gantt charts. However, the second respondent used critical path analysis as well as earned value analysis manually but did manage to use resource levelling and the design of Gantt charts on the software programme.

The other two respondents, who were also making use of project management software whilst being grade 3 contractors, both revealed that, at the time, MS Project and Gantt Project were both capable of handling the size of projects that these two companies were taking on.

In contrast to the two companies who used the Achievo software, these two respondents were utilizing similar software programmes (MS Project and Gantt Project) where each of the software packages offered almost identical features. They enabled both companies to make effective use of the software programmes, while the use of manual project management techniques was kept to a minimum. It became apparent that both MS Project and Gantt Project offered an integrated set of tools, which was functional for small contractors to use. Both were free to download and were merely alternatives to one another.

The respondent who used MS Project still had the software installed on his laptop although they no longer make use of it, however the interviewee was kind enough to go through the programme very briefly where he demonstrated some of the features the software had when they used it. The software provided and integrated Gantt charts, resource-loading charts, Program Evaluation Review Techniques (PERT) as well as import and export capabilities, which enabled them to share projects amongst company personnel.

The respondent who previously used Gantt Project did not have the software on hand. However, the interviewee was very knowledgeable about the particular software, and was able to reveal what the software incorporated and what it was used for. Gantt

Project offered similar tools to what MS Project provided with very little to differentiate the two.

Below is a graphical illustration of what typical project management tasks were being used by the respondents on their respective software, prior to and after their upgrade to a grade 4 medium contractor. The vertical margin is representative of how many of the five respondents made use of the particular project management tasks on the software before and after their CIDB upgrade.

In order to get a uniform set of answers amongst the respondents, five of the most conventional project management tasks were highlighted:

- Critical Path Analysis;
- Earned Value Analysis;
- Gantt Chart;
- Project Evaluation and Review Techniques;
- Resource Levelling.

The reason for the above mentioned is that 90% of any project management software offers these tools, and even if they do not, the respondents would be knowledgeable on how to do these tasks manually as a result of their tertiary education and work experience.

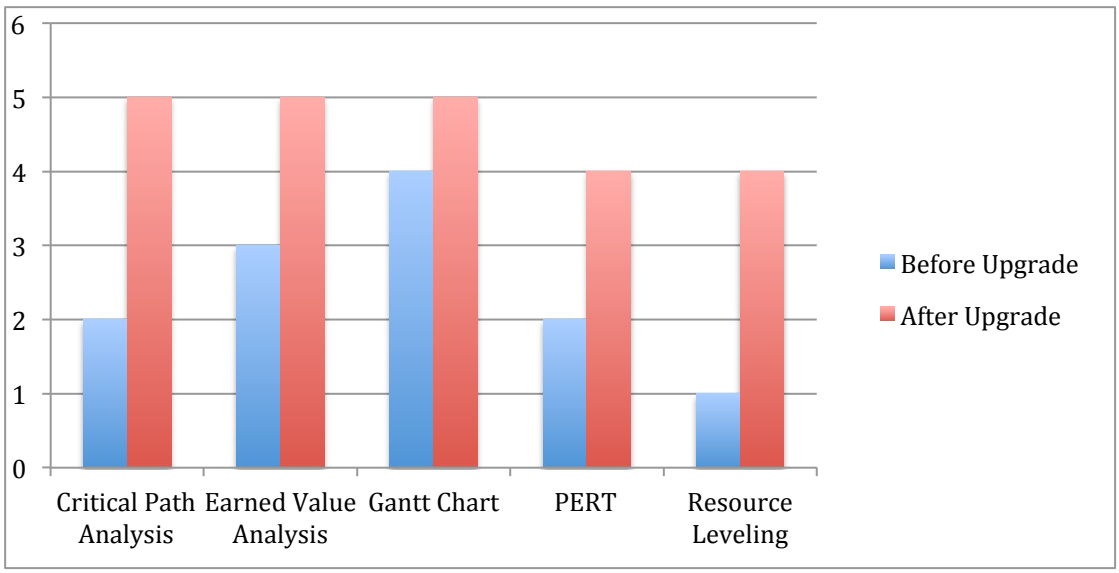


Figure 4.2 Use of project management tools before and after upgrade

Figure 4.2 illustrates that only after all the respondents upgraded to a medium sized contractor did the majority of them make effective use of the typical project management tasks on their respective software.

However, the real reason for this is because four of the five respondents upgraded their software first, which in turn allowed them to upgrade their CIDB rating. By upgrading their software, the respondents were exposed to slightly more advanced software where it allowed the user to carry out the mainstream project management tasks effortlessly, as the new software they acquired was significantly more compatible, functional, integrated and efficient.

Figure 4.2 largely substantiates what was discussed in the literature review, where Lappe and Spang (2013) mention that the majority of the conventional project management tasks, like critical path analysis and Gantt charts for example, although they are old, are still suitable and capable of being successfully applied to small construction projects manually without the use of computer software.

The respondents did describe what tasks they did manually and what tasks they did on their original software before upgrading. Figure 4.2 validates this where it can be seen that very few of the respondents were able to carry out all the tasks together on one project management software when they were at CIDB level 3.

However, even though the conventional project management tasks can still be carried out manually, almost all project management software available, regardless if it is free or not, comes standard with tools to carry out those tasks with ease. Although there is a critical level of complexity that is possible to do manually, beyond this level it becomes too difficult to track all activities manually (Lappe and Spang, 2013).

4.4 Web-based Vs. Desktop Application

From discussing the three different types of project management software with the interviewees, the open source software, namely Achievo, seemed to be a lot more difficult to use (being a web-based open-source product) as opposed to the desktop applications. Li et al. (2011) explain that web-based software has many benefits, but using closed-sourced (desktop applications) sometimes makes far more business sense as they are usually easier to understand and simple to use.

Although web-based software is usually free, Li et al. (2011) explain that there are usually issues with many types of software concerning usability, functionality and ease of installation.

However, Ghapanchi et al. (2014) agree that in the past this may have been the case, where they explain that when the free web-based software was initially introduced there were problems with regard to explaining to users how to utilize the software as well as how to integrate the various features offered, confirming much of what was said about the Achievo software by the respondents. Over the years these issues have been ironed out due to the feedback received from the web-based users, where their problems and concerns with using the web-based open-source software have in many cases been attended to (Ghapanchi et al., 2014).

The Achievo software is a good example of this, where the company has modified and evolved the software over the years, focusing on users' concerns to the point where the software has become very reputable and reliable for any business looking to use ~~a~~ web-based open source software (Achievo, 2014).

Nevertheless, it was three to four years ago when these four companies were registered as small grade 3 contractors and started to make use of this software. In the meantime, the software has been largely improved and upgraded with more integrated features and tools that have led to improvements in task handling and project scheduling to perhaps enable the smaller users to take on larger and more complex projects via a free download.

Table 4.3 illustrates what software the respondents were using when they were grade 3 contractors, as well as the software they are using now as grade 4 medium contractors.

Table 4.3 Comparison of software used before upgrade to after the upgrade

As Grade 3 Small Contractors	As Grade 4 Medium Contractors
Respondent 1: MS Project Software (26 years of age, Project Manager, 4 years working experience, BSC Construction Management)	**Respondent 1**: Primavera Software
Respondent 2: Achievo PM Software (47 years of age, Project Manager, over than 20 years working experience, BSC Building)	**Respondent 2**: Open Project Software
Respondent 4: Achievo Software (46 years of age, Project Manager, over 20 years working experience, BTec Civil Engineering)	**Respondent 4**: Primavera Software
Respondent 7: No Software (57 years of age, Project Manager, nearly 40 years working experience, government development training certification)	**Respondent 7**: Primavera Software
Respondent 8: Gantt Project PM Software (28 years of age, Project Manager, 6 years working experience, BSC Construction Managements	**Respondent 8**: CCS (Candy) Software

The Age, position in the company, working experience and educational qualification of the five respondents has been outlined in Table 4.3, for ease of reference subsequently.

Although all five respondents are currently using ~~a~~ project management software, the respondent who prior to becoming a grade 4 medium contractor was not utilizing any form of project management software explains why this was so.

The interviewee (respondent 7) is the director and founding person of this particular company. He is in his late 50s from a previously disadvantaged group during the Apartheid era. He had no University education and worked as a site foreman for many years for a larger construction firm where he worked his way up gaining vital construction experience.

At the beginning of 2010 he started his own construction company with the experience and knowledge he had gained over 30 years of working in the industry. However, being a site foreman and not having any University education, he was not exposed to any form of project management software. He would run projects in the most conventional way utilizing only his cellular phone as a mode of communication amongst company personnel and project stakeholders.

A study conducted by Keith and Windapo (2011) does in some way validate what respondent 7 said, describing that an entry-level contractor can fundamentally run his business using no more than a cellular phone, an appropriate vehicle and the right connections in the industry.

Abrahamse (2008) described individuals like respondent 7 to be an entrepreneur, and discusses how the South African construction industry tends to invite these entrepreneurs who have practical experience in the industry but lack sufficient technical and business capacity.

4.5 Cellphone Contractor

A ‘cellular’ or ‘mobile contractor’ is one who predominantly makes use of their cellular phone to manage construction projects. However, due to technological advancements, on a modern cellphone many more tools are at the disposal of the user as opposed to cellphones ten years ago (Abrahamse, 2008). Although respondent 7 was not using a smartphone when he started off, but simply used his phone for calls to the various project stakeholders, for the purpose of this study it may be important to discuss what the modern day smart phone can do.

A mobile phone that is capable of executing almost the same functions of a computer, characteristically having a fairly large screen and an operating system proficient enough to run a variety of applications, is considered to be a smartphone (Oxford, 2014). When comparing the phone that respondent 7 used when he first started off, to the smartphones that are available today, there is a considerable difference in their capabilities.

A normal cellphone typically sends and receives texts, photos and videos as well the ability to email, however smartphones have gone a step forward by installing

computer capabilities within the mobile device. Smartphones have far more superior operating systems; web access and most notably have the ability to download applications. Having a smartphone gives one access to thousands of different types of applications, ranging from games and entertainment to education, business and social media (Garcia, 2012).

There is a variety of project management, CAD, engineering and estimating applications that a construction professional can easily download off the "app store", where now a person can effectively run a small construction project by using just the relevant applications on their smartphone (Garcia, 2012).

Many of the software applications are integrated as well as linked to the user's computer; the applications on the smartphone have almost identical features as the equivalent application that one would get on a computer. Therefore, in the last three years the use of smartphone devices for managing projects has significantly increased (EMA, 2013).

A survey conducted by EMA (2013) determined that almost 40% of contactors are using their smartphones for purchasing decisions, checking specifications, comparing products and prices through quick ease of access to information on the Internet. These smartphones have enabled contractors to connect with staff, suppliers, sub-contractors as well as clients, allowing productivity to increase whilst saving time, as they are able to access almost all the information pertaining to the project at the click of a few buttons.

Respondent 7 explained that in his first few projects as a new small company, not being able to carry out simple critical paths, resource levelling or Gantt Charts made it difficult for him to keep projects on time and within budget. He explained that clients were getting disgruntled at the fact there was very little they could refer to in order to see the progress of the projects.

Nevertheless, due to his experience and thorough knowledge of construction, the company was still able to finish the projects that they had taken on within a respectable time and budget. After time, when tendering for projects of medium contractor scale, the company was overlooked on numerous occasions based on the fact that their CIDB rating was still a grade 3 contractor.

Although his company was probably capable of taking on those projects, the clients or principal agents, usually architects, refused to hire them because they were not making use of any reputable project management software, which has almost become mandatory for a contractor in today's construction industry.

An option which was presented to him by one of the clients was that, even though he was registered as a grade 3 contractor, the client would offer him a project of medium contractor scale, however only if he outsourced or hired a consultant recommended by the client to set the project programme.

The contractor subsequently agreed but "utterly regretted" it later on. He indicated that the consultant was too expensive and numerous disputes arose as the consultant showed poor professionalism and attentiveness to the project at hand. The interviewee did reveal that the company made little to no profit on that particular project.

This effectively made the respondent look into adopting project management software within his own company where he would be able to produce project programmes without the need to outsource to a consultant. The respondent admitted although experience comes with age, adopting technology is a lot more difficult if you were not brought up using it.

Of the four respondents who were utilizing project management software when they were registered as small grade 3 contractors, two of the interviewees were young, aged 26 and 28 respectively, both of whom went to University and studied construction project management. The other interviewees, who were also project managers within their respective companies, were in their late 40s, one of whom went to University and the other to a Technikon more than 23 years ago where they both studied construction.

4.5 Comparison of Different Age Groups

On analysing the information gathered from all the interviews conducted, it became apparent that the younger project managers were the catalysts that promoted the upgrading and extensive use of new and improved project management software within their respective companies. For the purpose of this study, the younger respondents are deemed to be below the age of 30, and the older respondents are

deemed to be above the age of 40 years old.

This brings relevance to what was described in the literature review (Brown et al., 2008), where the authors mention that although students during the 1980s and 1990s may have been taught some form of project management software at University, students from the last ten years are much more advanced with regards to making effective use construction related technologies.

The responses from the interviews substantiate what was discussed in the literature review (Czerniewicz et al., 2008), where the inclusion of ICT software for teaching and learning in tertiary education in South Africa did improve tremendously at the turn of the 21st century. It was seen to be lacking during the 1980s and 1990s as a result of its affordability, perceptions, lack of management systems, University resources, and lastly the difficulty in trying to actually use such technologies or software.

The older more experienced project managers who graduated from University and Technikon more than 20 years ago, both worked as foreman for large contracting firms for many years and eventually decided to venture into a partnership or start their own contracting company and run their respective companies as a project manager.

This is where dissimilarities between the two generations of project managers arose. The older interviewees were taught the manual techniques to manage a construction project when they were at University, as project management software was difficult to use, expensive and therefore rarely taught in the University syllabus. Although the younger interviewees were also taught the manual techniques to run a project, they were exposed to some form of project management software at University level.

To authenticate the information gathered from the interviews, the researcher subsequently went to the School of Construction Management at Wits University to find out if the information gathered from the interviews is accurate. After speaking to the relevant staff that had information on the implementation of teaching project management software in the syllabus over the past 15 to 20 years, the information from the interviews matched.

A change in syllabus as well as the expansion of the School's computer facilities in

the last 10 years has seen a more intense use of IT in teaching project and construction management software. 15 to 20 years ago, the computer facilities at the school were small; however, the university did have some form of project management software available on their computers.

Although the use of the software was not taught in the degree's syllabus, students who wanted to, would teach themselves the software in their spare time up until eight or ten years ago, where it was introduced in a third year project management course.

This indicates that, when the older interviewees were at university, if they did not teach themselves how to use project management software, they were not taught how to use project management software effectively. The older interviewees admitted that they were exposed to project management software from working with their previous employers; however, they were not compelled to learn it or, in fact, were not interested in learning the benefits of using such software as they both believed that at the time the more traditional methods were adequate.

This is clearly in line with what was discussed in the literature findings where it was mentioned that the older traditional workers were often more reluctant to adopt ICT project management software due to their experience in conventional approaches to project management (Peansupap and Walker, 2005).

Both of the older interviewees (Respondent 2 and 4) on starting their small contracting companies started without the utilization of project management software, where one interviewee described that his company only introduced the software after 5 months in operation. This particular respondent was introduced to the Achievo PM software by a friend who had been using it in his construction company.

The respondent managed to teach himself the basics of how the software worked, and although this particular software was not the best at the time, he acknowledged that if similar software was used more effectively the benefits on saving time and cost could soon be realized.

The second of the older interviewees discussed that, at the inception of his small contracting company, he went into partnership with another individual who had used project management software exclusively. Subsequently, it was introduced into the

partnership, but the older partner had slight apprehension towards the reliability of the software. He did admit, however, that it was the first step in moving the company forward.

Table 4.4 provides an evaluation of the respective project management software used whilst the respondents were still grade 3 contractors.

Table 4.4 Evaluation of software used prior to upgrade

Participants:	**Software used at grade 3:**	**How did they find out about the particular software:**	**Evaluation, 1 being the lowest and 5 being the highest:**
Interviewee 1: (Young) **(Respondent 1)**	MS Project PM Software	Learnt it at University	Functionality: 5 Ease of Installation: 4 Usability: 5 Design: 5
Interviewee 2: (Older) **(Respondent 2)**	Achievo PM Software	From a friend	Functionality: 2 Ease of Installation: 1 Usability: 2 Design: 2
Interviewee 4: (Older) **(Respondent 4)**	Achievo PM Software	From a partner	Functionality: 1 Ease of Installation: 2 Usability: 3 Design: 3
Interviewee 8: (Young) **(Respondent 8)**	Gantt Project PM Software	Found on the internet	Functionality: 4 Ease of Installation: 4 Usability: 4 Design: 5

It was unexpected that the older, less technological 'savvy' interviewees, had both made use of the Achievo software previously, as this is a more sophisticated and difficult system. However, both gave very negative feedback on the product during their interviews. This is represented above considering all the software functionality, ease of installation, usability and design.

The reason why both of the older interviewees ended up using this particular software may just have been coincidental; however, from discussion, it seems that quite possibly this particular software product was better marketed at the time. Due to the younger respondents actually having used PM software, they would have been more discerning on the ease of use and would have been able to evaluate this across the range of products on offer.

From discussion with the respondents, the researcher was able to get a feel on how they actually went about evaluating the software. It became very clear that the way the respondents evaluated their original software was by comparing it to their new software; particularly when comparing the two by their functionality, ease of installation, usability and design.

The functionality of the software refers to what the software does for the user and its suitability for its intended purpose. The Achievo users explained that the software did not fulfil its expectations. They both discussed that at the time the software did not have the capacity to do what they needed it to do, and it was really hard to understand how the different features were integrated, or to develop a sense of direction on the programme.

The fact that they were only able to make use of one or two of the features on the programmes clearly defined its shortcomings, where its ease of use and learnability was a problem.

However, upon investigation into the current Achievo project management software, it is clear that the software has improved tremendously and is now seen as a more reputable project management software amongst smaller contractors. The simpler yet effective layout provides the business and construction environment with greater tools, as it is now able to fit into any type of organization with its ability to adapt to a client's specific situation with ease of installation and setup.

When correlating the responses, it became apparent that the project management tools the respondents described to be necessary to do through the software are the mainstream tools like: critical path analysis, Gantt charts, resource levelling and Earned Value Analysis. They explained that these tasks are interrelated, whereby a change made on the one task is automatically updated on the other tasks. This allows

for considerable time saving as well as elimination of mistakes that may arise from manual co-ordination.

4.6 Transition Process

The main purpose of this research is to establish what path these companies followed in order to facilitate the transition from being a grade 3 small contractor to upgrade to a medium sized grade 4 contractor.

It was important to first establish why all five of the respondents actually decided to upgrade their CIDB rating. The structure of the interview questions allowed for an open conversation, where each respondent was given the opportunity to speak their mind freely.

All five respondents were very similar in their responses as to why they decided to upgrade their CIDB rating. In each case they discussed that, in order to grow the company to take on larger more complex projects, this would result in greater profits once the projects were completed.

Respondent 4 said, “In order for me to become a more profitable company, I needed to start taking on larger projects, and to prove to clients my company is able to take on projects of medium magnitude, I needed to upgrade my CID rating to do this.” This response was consistent amongst majority of the other interviewees.

Respondent 8 said, “As a business owner, I wanted to make more profit. In order for me to do this and take on projects with larger profit margins, I needed to become a more competitive contractor. In order to do this I needed to grow my company, employ more staff and introduce new technologies like CCS Candy.” The response I received amongst the other respondents was also consistent with respondent 8, adding to the reliability of the data being collected for the study.

All five respondents were in agreement that in order to make the upgrade to a CIDB grade 4 medium contractor, certain requirements needed to be met, which are set out by the Construction Industry Development Board (Cidb, 2013).

In order for any contractor to upgrade to a higher level, regardless of where they fall within the grades of 2 to 9 on CIDB contractor registry, these contractors are

compelled to acquire a greater financial capacity and adoption of technologies, in addition to successfully completing projects in time and within the stipulated budget (Arendse, 2013).

Table 4.5 demonstrates their responses to a set of predetermined questions as to the reason why they upgraded.

Table 4.5 Contractors who upgrade their software first before upgrading their CIDB rating

Respondents:	Reason for upgrade:
Respondent 1: *(Upgraded software AFTER transition)	Take on larger projects: yes To grow the company as a whole: yes To employ more staff: no Earn more money: yes Become more competitive: yes
Respondent 2: (Upgraded software first)	Take on larger projects: yes To grow the company as a whole: yes To employ more staff: yes Earn more money: no Become more competitive: yes
Respondent 4: (Upgraded software first)	Take on larger projects: yes To grow the company as a whole: yes To employ more staff: yes Earn more money: yes Become more competitive: yes
Respondent 7: (Completely introduced a new software)	Take on larger projects: yes To grow the company as a whole: yes To employ more staff: yes Earn more money: yes Become more competitive: yes
Respondent 8: (Upgraded software first)	Take on larger projects: yes To grow the company as a whole: yes To employ more staff: yes Earn more money: yes Become more competitive: yes

4.7 Key Findings

A topic discussed in the interviews was the "volatility" and "unpredictability" of the construction industry in South Africa where all of the respondents were of the opinion that this is primarily because each construction project they encountered was unique in some way. The responses received were similar to what was identified in the

literature: namely that projects have different clients, stakeholders and diverse environments with external influences.

Three of the respondents (Respondents 2,4 and 8) confirmed what has been discussed in the literature (Greve, 2013), when they were asked why they made the upgrade to a medium contractor. All three were aware that a 'vacuum' has effectively been created within the construction industry in South Africa. As a result of the larger contractors looking for work abroad that is more consistent and reliable, consequently creating opportunity for the smaller sized contractors to take up the work that was customarily taken up by the larger firms.

This confirms what Senatore (2014) as well as Thwala and Phaladi (2012) had mentioned. Some of the respondents discussed that the only way to take advantage of this opening in the market, was to upgrade their CIDB rating in order to take on the larger projects left behind by the globalising companies. Question 7 in the semi-structured interview (Refer to Appendix B) turned out to be the most effective question to answer the research question.

The question encapsulated what the research is trying to establish, where it requested the interviewee to discuss whether the company upgraded to a medium sized contractor first and subsequently realised, due to the complexity of the larger projects, that they needed to upgrade their project management software or whether they upgraded their project management software first, which then subsequently allowed them to upgrade their CIDB rating to a medium contractor and handle larger, more complex projects.

The latter was to be the more frequent response from the interviewees; four of the five companies followed the same path in becoming a grade 4 medium contractor, each revealing that, in their pursuit of becoming a medium sized contractor, they first had to upgrade the project management software that they were using amongst other things, including improving their financial resources and project management capabilities.

Of the four respondents who upgraded their software first (Respondents 2,4,7 and 8) outlined in Table 4.5, three of them had to acquire new software, replacing the initial software with a more advanced software. The other respondent, who was not utilizing any project management software, had to introduce a new software within the company with the intention of making the upgrade to a medium contractor.

The remaining respondent did reveal that the company was able to upgrade their CIDB rating to a medium grade 4 contractor prior to upgrading their project management software, however, this particular company was making use of MS Project during its transition process. According to the respondent, MS Project was capable of handling projects on a medium contractor scale.

The respondent did discuss that the software was only used for what was required of the work being carried out at the time; they never expanded further on the programme. They did think of combining it with Microsoft Project Server to improve portfolio management, but never did.

Nevertheless, prior to taking on their first medium scale project that was considerably larger than any project they had taken on before, the company decided to acquire Primavera Project Management Software. This software is seemingly a more professional project management system, in that it integrates all the necessary tools and techniques that one would need to handle a project of medium scale

It is very important to note that in order for the companies to upgrade their CIDB rating, although the capacity of their project management software was a crucial factor, it was not the only aspect that needed to be changed within each company that enabled them to make the upgrade. Some of the other contributing factors are discussed later on.

The respondents were asked to explain why they decided to upgrade their CIDB rating, which generated several similar responses. Four of the five respondents made it clear that, in order to take on larger projects of medium scale, their company was to upgrade its CIDB rating in order to become more reputable in the construction industry.

The one interviewee explains that if there is some sort of confirmation that the contractor is registered on a respectable construction industry platform, where the contractor's capacity is recorded appropriately on the website, clients are likely to feel more at ease.

Four of the respondents discussed that taking on larger projects allows the company to grow, where more staff would need to be employed in order to carry the workload of the new projects. This prompted a follow up question: "In order to upgrade your CIDB rating to take on the bigger projects, did you employ more staff prior to upgrading or did you upgrade first, which prompted the company to employ new staff?"

Four of the five respondents commented that, similar to having to upgrade their project management software first, their companies needed to employ and train new staff prior to applying for an upgrade in their CIDB rating. They discussed that one of the main requirements to upgrade their CIDB rating is to take on and complete larger projects as well as improve project management capabilities.

Some of the respondents mentioned that the additional staff included quantity surveyors, office staff, artisans and general labourers in order to take on the larger work load expected from taking on projects of medium scale. They all discussed that, although during the upgrading phase of adopting the new project management software and employing additional staff, the companies' expenses did rise significantly. However, this enabled them to effectively upgrade their CIDB rating.

Some admitted that it was initially difficult to make a profit because of these additional expenses, however, over time and on completing these larger projects as a result of now having the adequate staff capable of taking on these projects successfully, the return on investment is now being realised.

4.9 Government Policies

Of the five respondents, there was one who had benefitted from Government policies aimed at promoting small contracting companies owned and operated by black entrepreneurs. Respondent 7 stated that due to various Government policies introduced to help previously disadvantaged black entrepreneurs, they were provided

with easier access to finance, management skills as well as support in institutional arrangements. According to the interviewee, the contractor learnership program selected the best candidates within the community according to various criteria. He explained that it was mandatory for each applicant to take part in an aptitude and ability test formulated by the Department of Public Works.

The Department of Public Works introduced a construction management course called CET (Contracting Entrepreneurial Training). According to the interviewee, this course offered by the Government consisted of various modules over a period of two to three years. The reason he was able to attend this nationally recognised course was because he was a new contractor at the time when he applied through an open tender process.

The training program comprised various technical support services, where the selected applicants were exposed to training, materials and construction management. The interviewee explained that the course was very thorough and well executed and he admits that, without the aid of the Government policies and training programmes, his company would not be where it is today.

The interviewee indicated that the objectives of the Small and Emerging Contractor Development Program was to develop small contractors in disadvantaged communities that are active in the South African construction industry.

This is in accordance with what was discussed in the literature review (Hewage et al., 2007) where the government is trying to combat the severe shortages of first level supervisory staff and project managers, which contributes significantly to the issue of poor quality control, training and operating measures amongst the smaller contractors operating in the South African construction industry.

The interviewee does admit he is a prime example of a small contractor who was provided with the necessary training, resources and work opportunities and took it upon himself to develop his company.

However, the interviewee does explain that although the Government policies did sufficiently help him personally, as well as to get his company off the mark, it takes

personal initiative and perseverance to take what they have learnt and create their own opportunities in order to grow.

The interviewee's response is in agreement with what Keith and Windapo (2011), that some of the smaller contractors are too reliant on these Government policies and expect everything to be "spoon fed" to them, explaining why so many of the candidates in these programmes fail when they are left to start on their own.

Although the other four respondents did not take part in these Government Development Programmes for Small Contractors, two of the four who are black owned did explain that the BEE (Black Economic Empowerment) policy introduced officially in 2003 has helped them with regard to having access to more work opportunities. Nevertheless, respondents did stress the issue that in order for them to move forward as a company and acquire more work, relying on the BEE policy solely will be detrimental to a company's continuation.

The BEE respondents did admit that in tendering for a job when competing with white owned companies with no BEE status at all, 60% of the time they would be awarded the tender mainly due to their BEE status. Interestingly enough the white owned respondent, did admit that not having a BEE status at all would be a significant handicap in the construction industry in South Africa, however they did not describe it to be the sole reason why they did not win tenders.

Nevertheless it is important to note that the BEE Government Policy does not in any way hinder a small contractor from upgrading their CIDB rating (Human, 2006). Although the respondents did have mixed responses to the effectiveness of the policy, they do agree in saying that the policy is a good concept, although they did mention that it could possibly have been implemented with a better regulatory strategy.

4.10 Time taken to upgrade CIDB rating

It was useful to determine the time taken for each company to upgrade their CIDB rating to grade 4. It is important to note that all of the respondents entered the industry

as a grade 3 small. The time taken for each contractor to upgrade is provided in the table below.

Table 4.6 Comparison of time taken for each contractor to upgrade

Respondents:	**Year Company was inaugurated:**	**Time taken in months to upgrade to grade 4 medium contractor:**
Respondent 1:	2011	13 Months
Respondent 2:	2010	24 Months
Respondent 4:	2011	22 Months
Respondent 7:	2011	30 Months
Respondent 8:	2012	11 Months

4.10.1 Timeline of Projects Taken on by Each Respondent

Provided below are the company timelines for each respondent, from the year of their inauguration till the date of the interview. The timeline incorporates each of their company milestones, projects and time of upgrade. The "X" marked on each timeline is the month of completion of their respective projects at the time. Projects, which were still underway at the time of the interview, are not marked, as they were not completed as yet.

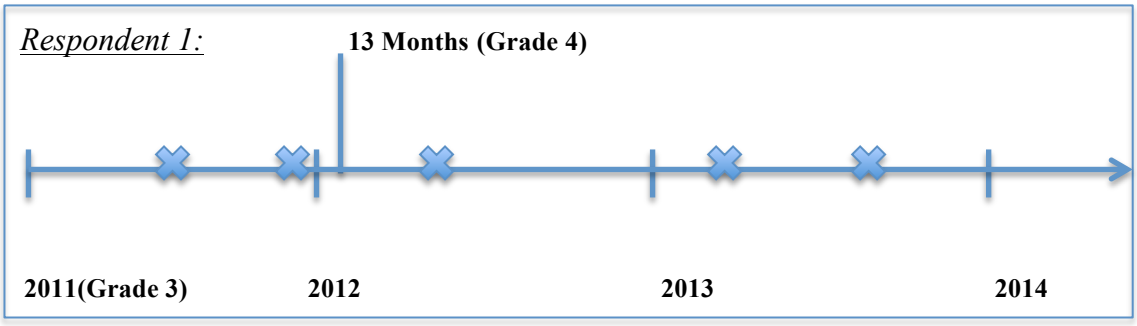


Figure 4.3 Project time line of respondent 1

2011-2012: The respondent mentioned that in their first year the company managed to complete two projects, the one project valued at R900 000, which was a refurbishment to an office block. The second project was valued at R1 million, which was a refurbishment and renovation to a gym.

2012-2013: In February 2012, when the company was registered as a grade 4 medium contractor, the company only purchased the Primavera software after the upgrade. They took on two projects again that year. One project was an extension to a house to the value of R300 000, and the construction of a small used car dealership to the value of R4.4 million.

2013-2014: The car dealership was completed later this year. That year the company renovated and extended a well-known pharmacy to the value of R2.4 Million, as well as in October that year started the construction of a house in the Meyersdal Nature Estate to the value of R4.5 million.

2014-Current: The house in the estate was fully underway, and the company was also waiting for approval to upgrade their CIDB rating to a grade 5 contractor.

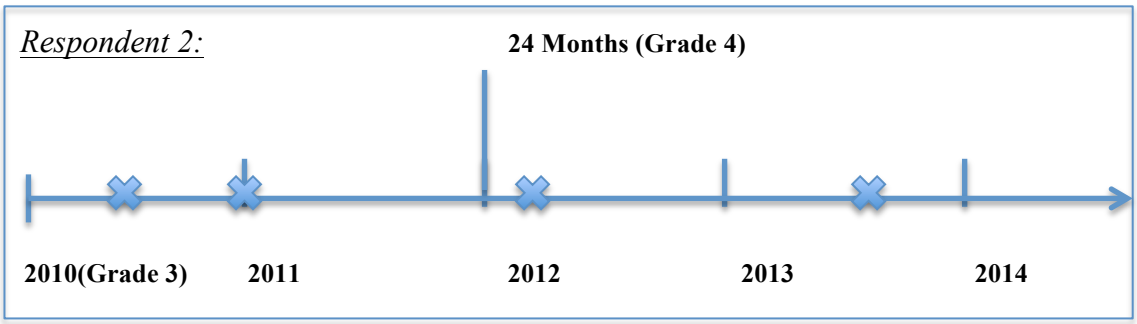


Figure 4.4 Project time line of respondent 2

2010-2011: In the first year as a grade 3 contractor, they only managed to do numerous small jobs. The one was the re-plastering of a small shopping centre to the value of R180 000, the other was the renovation to a house to the value of R1.3 Million.

2011-2012: That year they won a tender to do a municipal building to the value of R2.2 million, as well as managed to upgrade their CIDB rating to a grade 4 on completion of the municipal building at the end of the year/beginning of the next. The

company used the Open Project software for the first time on the Municipal building project.

2012-2013: During that year they started to build a high-end house in Bassonia Estate to the value of R5 Million, with small jobs on the side.

2013-2014: The house in Bassonia Estate was completed that year. In July 2013 the company was awarded the tender to build storage units with offices on a vacant piece of land, with the value of the project estimated to be R3 Million.

2014-Current: The company was still busy on the storage units at the time of the interview, and had just been awarded a tender to build an office space for an estate agency.

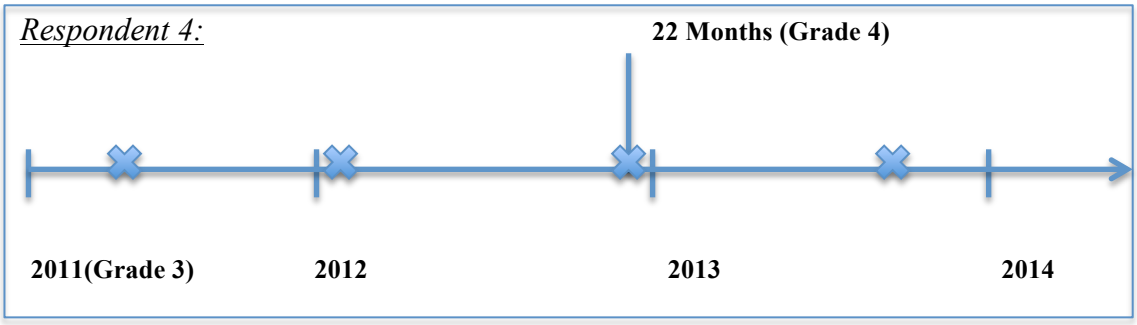


Figure 4.5 Project time line of respondent 4

2011-2012: The company commenced the construction of restaurant to the value of R2.3 million, as well as renovations for a bank in the same shopping complex to the value of R100 000.

2012-2013: At the beginning of 2012, the company purchased the Primavera software. The company took on a project to reinforce an unstable floor slab and restoration to an old, very small block of flats, to the value of an estimated R2.3 million. That year, in October, the company was approved to be registered as a grade 4 medium contractor.

2013-2014: That year the company took on two projects, to build a house as well as a Spa. The Spa was made up of a hairdresser, tanning salon, nail studio and waxing studio. The house was valued at R3.5 million and the salon valued at R2 million.

2014-Current: They were still busy with the house when the interview was taking

place, as well as awaiting approval to be upgraded to a grade 5 contractor.

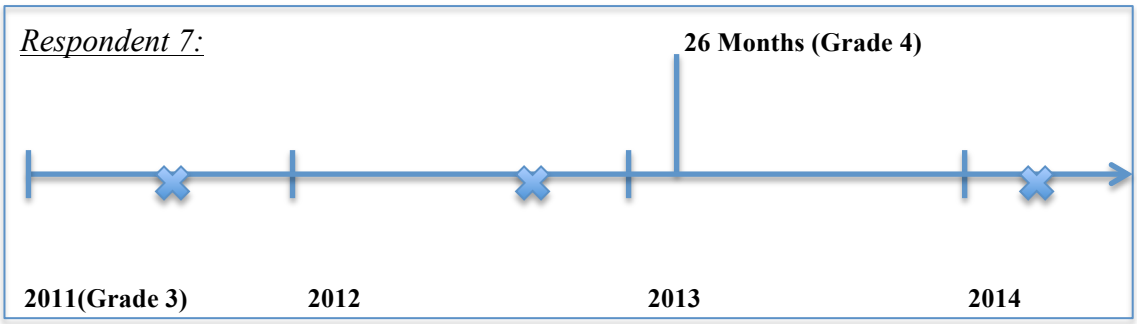


Figure 4.6 Project time line of respondent 7

2011-2012: The respondent who had no project management software at the beginning did numerous small projects that year, the biggest of which was the renovation to a police station to the value of R300 000. During this period the owner/project manager was attending the government-training program, CET (Contracting Entrepreneurial Training).

2012-2013: He continued to attend the program during this time. That year he managed to get a job to build offices, on the basis that he had to use a project management consultant. The project value was R2.5 million, but he admits he made very little profit on the project.

2013-2014: At the beginning of 2013 the company purchased project management software for the first time, as well as hired more staff. In June 2013 the company was upgraded to a medium grade 4 contractor. In February 2013 the company commenced a project to build a very small shopping centre to the value of R4.5 million, which only had eight shops in the centre.

2014-Current: The small centre was still under construction at the time of the interview.

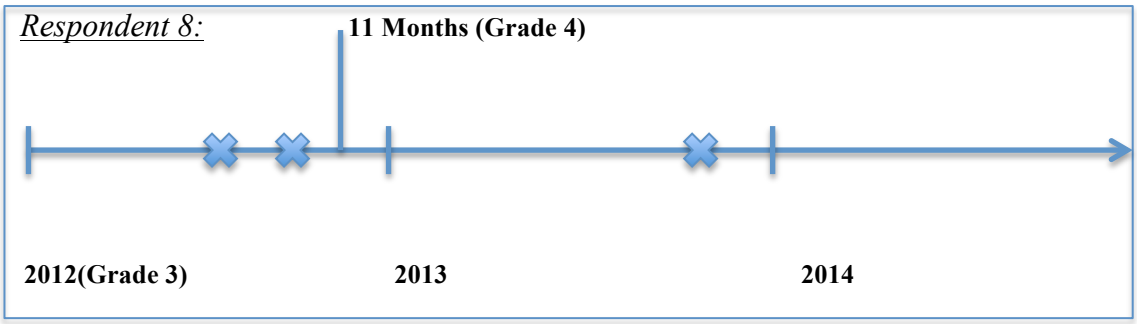


Figure 4.7 Project time line of respondent 8

2012-2013: In the first year of operation the company managed to upgrade their CIDB rating to a medium grade 4 contractor. In that year, prior to upgrading, the company finished two projects simultaneously, a refurbishment to offices in a small office block valued at R250 000 and a fast food outlet to the value of R2.5 million as well as small maintenance jobs along the way. The company acquired the CCS Candy/Build Smart in June that year.

2013-2014: During that year the company took on two medium scale projects: A part renovation to a shopping centre valued at R2.8 million, and construction of a new car dealership valued at R3.9 million.

2014- Current: According to the interviewee, the car dealership at the time of the interview was still under construction.

After a discussion with the respondents on the transition process over the years of taking on the various projects as well as upgrading to a grade 4 contractor during that time, there were some similarities amongst the responses as to what was described in the literature review by Gasa (2012), with regard to the factors that need to be considered that will aid smaller contractors to make a successful upgrade in rating.

Some of the respondents revealed the following factors that could make the transition process much easier. These included capitalising on the construction experience of members; retaining original staff whilst also recruiting new personnel; maintaining good company morale and standards; investing the company capital appropriately, whether it was in plant and equipment, the project management software or staff training; as well as maintaining close-knit relationships with suppliers.

Some respondents mentioned in the discussion that, in order to become successful in

the construction industry, it is important to build a strong and reputable track record of completed projects. The one respondent explained that: “You are only as good as your last project; reputation is what gets you by in this industry”.

4.11 Discussion on Transition

Respondent 1 explained that it took just over 13 months to make the official transition from a small contractor to a grade 4 contractor. This contractor was different to the remaining four respondents, in that he was able to make the upgrade of his CIDB rating using the same software (MS Project) that he initially started off with as opposed to first upgrading the software. He explained that the effective use of MS Project allowed the company to take on larger projects, which essentially sped up the procedure of upgrading their contractor rating.

However, he indicated that the company did have a significantly larger workforce that was usually expected of a small contractor at the time, but the company expenses were higher than they should have been as a result of this. However, he explained that taking on the added risk fundamentally allowed the company to take on greater workloads, which in turn fast tracked his CIDB upgrade process.

When comparing MS Project to the software the remaining companies initially used, MS Project was more functional, user friendly and its simple design allowed the company to handle projects that were more complex.

Respondents 2 and 4 took a similar amount of time to make the upgrade. Similarities in their responses related to the difficulties in finding consistent work of small contractor scale. So in order for them to upgrade their CIDB rating to a medium grade 4 contractor, both acknowledged that they needed to take on more staff and upgrade their project management software.

Of the five respondents, respondent 8 took only 11 months to upgrade their CIDB rating to a grade 4. Though this was somewhat different from the other respondents, it is confirmed by Keith and Windapo (2011), who observe that it takes a contractor on average 10 to 12 months to make an upgrade in CIDB rating, depending on the competency and capabilities of company personnel.

In trying to understand how respondent 8 took such a short period of time to upgrade, various factors came up in the discussion. The fact that the interviewee was young and vibrant played its part, in that he was aware that the software his company was using initially was adequate for what they were doing at the time, but he was looking to the future with the intention of growing the company beyond a grade 4 contractor. He knew that acquiring a more reputable, robust and professional software would allow the company to take on several projects simultaneously, but a significant investment in new project management software would need to be carried out.

The interviewee explained that acquiring the CCS Candy software was an expensive investment but the company would not need to acquire any further project management software if they moved up the CIDB ratings. This was because this particular software is able to facilitate projects of up to grade 9 contractor scale, similar to the Primavera software acquired by some of the other respondents.

During the period of interviewing respondents 1 and 4, they both had applied to the CIDB registry to upgrade their CIDB rating to a grade 5 contractor rating, and were awaiting approval.

4.12 Financial Position of Each Company

It was important to compare each respondent's financial position from the time they started off to where they are now. The financial position of an organisation can be described as the sum of money that the bank holds in an account on behalf of the company (Keith and Windapo, 2011). Establishing a strong financial position is crucial, especially for emerging construction companies, where usually the client will only pay what is owed after a 30-day invoice.

One respondent explained as a general rule of thumb, that whatever sum of money the company is turning over each year for the company to successfully stay afloat, it requires the company to have nearly double that figure as a cash reserve, which will also be dependent on the type of contract that was agreed upon with the client.

Acquiring the actual financial reserve information from the respondents was a difficult task. Only three of the respondents were able to reveal some sort of information to contribute to the research, as provided in the ensuing table 4.7.

Table 4.7 Financial position from inauguration to current year

	Financial Position (NB: figures only estimates)				
Year	**2010**	**2011**	**2012**	**2013**	**2014**
Respondent 1		R 200 000		R 1,700 000	
Respondent 7	R 75 000			R 800 000	
Respondent 8			R 320 000	R 1,000 00	

It is clear from analysing the estimates in the above table that the respondents who started off with larger cash reserves were able to invest sooner in assets like the project management software, staff and equipment. Having strong cash reserves provides a 'financial cushion' giving the companies more confidence to take on larger, more complex projects.

In accordance with what was discussed by Eisenhardt and Schoonhoven, 1990, these three respondents were able to maintain and grow their financial reserves over the years, taking on larger valued projects each time, allowing them to put money back into the company.

Respondents 1 and 8 mentioned that the initial company cash reserve was money saved up among the respective founding owners, whereas respondent 7, as he was the only founding member of the company, had used some of his personal savings.

4.13 Comparison of Software Being Used As Grade 4 Contractors

Amongst the five respondents interviewed, three of them are using software from Enterprise Project Solutions called Primavera, while the remaining two are making use of Open Project and CCS Candy/Built Smart.

In response to question 22 in the semi-structured interview, although the respondents were not able to disclose the exact price, it was clear that the majority of the software costs over R16 000 per annum. The respondents were able to divulge that the pricing

of the software did come with an unlimited annual usage license. The price also includes unrestricted user access, implementation of the software as well as customer support.

A Primavera representative was hesitant to disclose such information, due to the fact that the software is tailored to each individual company, depending on what features the company requires out of the software. However, it did appear that the figures from the respondents interviewed and from the representative of the software company were very similar, thus an estimate could be reached. A similar process was used to obtain a price estimate for the CCS Candy/Build Smart software.

Primavera

Enterprise Project Solutions offers a variety of software programmes. The three respondents who were using the software from Enterprise Project Solutions were all making use of the Primavera P6 Professional Project Management Software.

All pricing includes VAT, the software licenses, 1st year support, a media pack, which includes the installation CDs, training of staff and remote installation. Provided below is an estimated break down of the software cost that the respondents would have paid for the software. (First month's payment includes a once-off license fee and one month's rental. Thereafter billing for rental fees is every month.)

Initial start-up fee for first month:

Description:	**Total:**
Initial license fees @ R 7,000.00 per system	R 7,00.00
Subtotal	**R 7, 000.00**
VAT 14%	R 980.00
Total	**R 7,980.00**

Rental fees from second month and onwards:

Description:	**Total:**
Monthly rental fees for one license @ R 2,000.00	**R 2,000.00**
VAT 14%	R 280.00
Total	**R 2, 280.00**

Therefore the estimated price for the first year's subscription for using the software is: R **7,980.00 + (R 2, 280 x 11 Months) = R 33, 060.00**

CCS Candy/Build Smart

CCS Candy + Build Smart is an integrated cost management solution, of which Build Smart is a cost management solution, while Candy is an estimating solution and provides project control. They tie financial processes to the physical processes for construction projects. All pricing is inclusive of VAT, the software licenses, 1st year support, installation of CDs and delivery. Provided below is an estimated break down of the software cost that the respondents would have paid for the software. (First month's payment includes a once off license fee and one month's rental. Thereafter billing for rental fees is every month.)

Initial start up fee for first month:

Description:	**Total:**
Initial license fees @R 4,000.00 per system	R 4,000.00
Monthly rental fees for a full license @ R 1,300.00 per system	R 1,300.00
Subtotal	**R 5,300.00**
VAT 14%	R 742.00
Total	**R 6,042.00**

Rental fees from second month and onwards:

Description:	**Total:**
Monthly rental fees for one license @ R 1,300.00	**R 1,300.00**
VAT 14%	R 182.00
Total	**R 1,482.00**

Therefore the estimated price for the first year's subscription for using the software is:
R 6, 042.00 + (R 1,482.00 x 11 Months) = R 22, 344.00

However, this price for the CCS Candy/Build Smart does not include any training. The training courses are offered throughout the year, where the price for the different courses ranges from R1 800 to R3 500 per staff member. According to the respondent who is making use of the software, two staff members went on the training course when the software was initially purchased.

Essentially the two purchased software programmes are very similar in price and offer almost identical features.

These companies can use both Primavera and CCS Candy/Build Smart all the way through to becoming grade 9 large contractors, as opposed to the respondent using the free Open Project software who will eventually need to acquire more superior project management software to grow their CIDB rating to a large grade contractor.

Respondent 2, who is currently making use of Open Project, acknowledges that sooner or later if the company has the intention of growing to become a much larger contractor by taking on greater and more complex projects, the company will have to invest in a superior project management software. However, for the time being, he is content that the software is adequate for the type and size of projects the company currently is taking on. The respondent explained that only when it is necessary to upgrade his software would he do so.

When the remaining respondents who have purchased their software were asked why

they did not use free project management software like Open Project, which is capable of handling the work they are currently doing, they all agreed that free software would be a suitable option for their current medium sized projects.

However, all the respondents revealed that their ultimate intention is to grow their respective companies. The respondents felt that by investing in a superior but more expensive software now, the company may not need to make use of all the features the software has to offer for the time being, later on when the company grows and more is expected of them, there will be no need for them to purchase a new software.

The superior software, like CCS and Primavera, offer various features to accommodate the growing requirements expected of a contractor like contract administration concerning all the relevant project stakeholders, smart procurement accounts, time tracking, and reporting.

The respondents could understand why one would be content as a medium grade contractor with free software like Open Project, which did offer a lot more features than some of the other free downloadable software on the Internet. However, they argued that it is better to implement software that can grow with the company and train staff now to be prepared for future projects, as opposed to only upgrading the software each time you need to take on bigger projects.

The main issue the other respondents brought up that went against what respondent 2 believed, was the fact that it will be more time consuming trying to train staff and understand how a new programme operates each time, as well as considering the purchasing costs along the way.

The Primavera and CCS project management software are desktop applications designed specifically for construction project management, the purpose of which is to make project management more manageable. The respondents who make use of these software programmes explained how easy, yet professional, the programmes are.

Similar responses arose when the respondents were asked to discuss what their new software offered when compared to their previous software. A theme that arose was the fact that the software was far superior when compared to their older software, where essentially the software was a lot easier to understand, easier to use and

primarily more functional.

Two of the respondents found out about the software from researching online by reading forums and product reviews. One of the respondents discussed that, in tendering for a specific project, the tender required that they make use of the Primavera software. The respondent explained that Primavera operates as a service model, where he acquired the software on a subscription basis, thus saving time and money.

4.14 Benefits Realised Using New Software

Discussing the benefits of project management software with each of the respondents, resulted in a confirmation of what was discussed in the literature review. All respondents acknowledged that the benefits of project management software can only be realised if the software is used effectively. This means making full use of the capabilities of all the tools provided in each respective software programme.

The majority of the respondents who used project management software prior to upgrading their CIDB rating discussed how the ineffective use of the original software provided very few benefits, based on the fact that for much of the time they were trying to understand how the programme functioned and how they could apply it to their respective projects. The effectiveness of using the software is determined by its functionality, ease of installation, usability and design.

Nevertheless, when discussing the comparison between their original software and the software they are currently using, common responses amongst the respondents who did upgrade their software in order to upgrade their CIDB rating did appear.

As expected, the variation in cost of the respective project management software programmes was the initial differentiating factor amongst the responses. All of the initial project management software used at the time when each respondent was a grade 3 small contractor was free to download off the Internet. The Achievo software used by respondents 2 and 4 is a flexible web-based open source management tool as opposed to MS Project and Gantt Project used by respondent 1 and 8 respectively, which are desktop applications.

When the respondents did decide to upgrade their project management software, much more thought and research went into acquiring a new programme based on the knowledge and experience they had gained from making use of their original software.

Respondent 7, not having used project management software before, could not rely on past experience and knowledge to acquire new software. However, the respondent did reveal that extensive research and consultation with other industry professionals was conducted prior to acquiring their first software.

All the respondents were in agreement that once the implementation of their respective new software within the company was finalized, including training of the staff on how to use the software, the benefits of using the newly acquired project management software were soon realised.

Upon identifying common themes that occurred amongst the responses to question 25 "What are the benefits from utilizing the PM software?" The most common benefits realised by the respondents were identified as:

- Project cost saving;
- Project time constraints;
- Communication;
- Human resource management;
- Tracking of project progress; and
- Multiple projects.

For these smaller contractors, generating a project budget in the past seemed very daunting, especially when taking on their first few projects as a small contractor. However, all the respondents did acknowledge that they were aware that the project budget is an indispensable tool for measuring a project's performance and progress.

They explained that when using their project management software effectively, they were able to create project budgets directly from the project plan or estimates. Cost savings are now really being realized on their projects as they can now accurately monitor the budget of the project, where the actual costs being incurred can be

compared to the initial planned budget. All the respondents admitted that they have saved unnecessary expenditure on projects by using this function on the project management software. It provides a more accurate depiction of the current budget and the future financial forecasts in real time.

It was seen to be common amongst the responses that, although the initial cost of purchasing the software, implementing and training the staff was expensive, the return on investment is far greater through saving costs on projects that may have been incurred before.

There seemed to be consensus amongst the responses in the use of their project management software tools for analysing critical paths and developing Gantt charts, which were used consistently throughout projects, as time is one of the biggest issues to manage on a construction project.

The respondents all emphasized the issue that to be able to track a project's progress is a crucial aspect for managing a project. Each of the different software programmes used by the respondents has a function that provides the users with a clear visual illustration of project milestones and deliverables. The software allows respondents to accurately see the progress of the planned versus the actual, where the software alerts users where there is going to be a clash in activities as the project moves along and the project plan is updated.

Some did discuss that this could be done manually, however being able to refer to the progress schedule at the click of a button is more efficient. The function that provides the user with a timely alert when activities are going to clash causing the project time delays is also highly beneficial.

Project management software allows project managers to manage projects more effectively. The respondents describe how it aids in improving decision making, by being able to have instantaneous access to the company's financial and accounting information.

The automated office operations function, which featured in almost all the software, allocates where one should spend more time on value-added activities. The effective use of the software has also helped the respondents to improve key business processes

as well as enhance company productivity and profitability.

Three of the respondents mentioned how the effective use of the software has streamlined internal communications within their company. They all revealed how communication between the head-office and on-site personnel has been improved, as a result of the efficient transmission of information through the software. Communication between project stakeholders is more effective as they are continuously provided with up to date real-time information.

One thing that stood out amongst all the responses, is where they discussed that having project management software in place will not necessarily help the user to be more effective in what they do. However, it allows project managers to have access to more information and data that may in turn allow them to be more effective as well as efficient.

This is similar to what was discussed in the literature (Ghioca, 2011) where project managers still need to know how to communicate to project heads as well as delegate responsibilities clearly to staff members, apart from also knowing how to use project management software effectively.

4.15 Comparison between Grade 3 and Grade 4

One of the questions the respondents were asked to discuss, was how their company is different today from when the company started out.

The responses received were very similar, and some very interesting. All the respondents were registered as grade 4 medium contractors on the CIDB Registry at the time of the interview. However, it must be noted that during the time of the interviews two of the five respondents were awaiting approval to be officially registered as grade 5 contractors, thus proving that some of the respondents were looking to grow further as a company.

The two respondents who applied for a CIDB upgrade to Grade 5 were making use of the Primavera project management software. This confirms the point made earlier, that having a superior project management software at this stage in the company's life, although it is expensive, allowed them to take on and complete multiple larger

scale projects successfully, which is one of the main criteria that needs to be met in order to move up the CIDB ratings.

The majority of the respondents did mention that, when they started off, the profitability of the company was very small. In order to win tenders, they would have, in some cases, to reduce their profit margin by hiring a project management consultant, as discussed earlier. However, they mentioned that even though they were making very little profit, the benefit was that their company's reputation and exposure within the industry was growing progressively.

Another reason for some of the respondents seeing little profitability in their projects could be attributed to the poor project management software the company was using at the time. Mainly the respondents who used the Achievo software revealed that the lack of profitability initially was due to the fact that they spent a lot of time trying to understand the programme as well as mould it to their project needs.

Comparing the profitability they are currently experiencing, as opposed to when they started off, revealed similar responses. The profit margin of each company is significantly higher as a result of superior project management software, better project management capabilities, experience and robust relationships formed with project stakeholders.

The respondents explain that being able to take on multiple projects as a result of their new software, allows them to have more than one source of income for the company. In addition to having various features on their software that alert the users of any activity and time clashes, communicating any changes to stakeholders and other features, eliminates unnecessary costs that would have been incurred with the old software.

An important factor that did come up amongst some of the responses was the size of the company now as opposed to when the company first started off, with particular reference to the amount of staff employed. In upgrading to a grade 4 contractor, the respondents each employed more staff in different areas of the company, which enabled them to subsequently upgrade.

The staff from each company was divided into the following categories based on the

feedback and data received from the respondents:

- Project managers;
- Office Staff;
- Quantity surveyors;
- Artisans/Plasterers; and
- Labourers.

The following Figures 4.7 and 4.8 are graphical representations comparing the number of staff employed initially, to the amount of staff employed at the date of the interview:

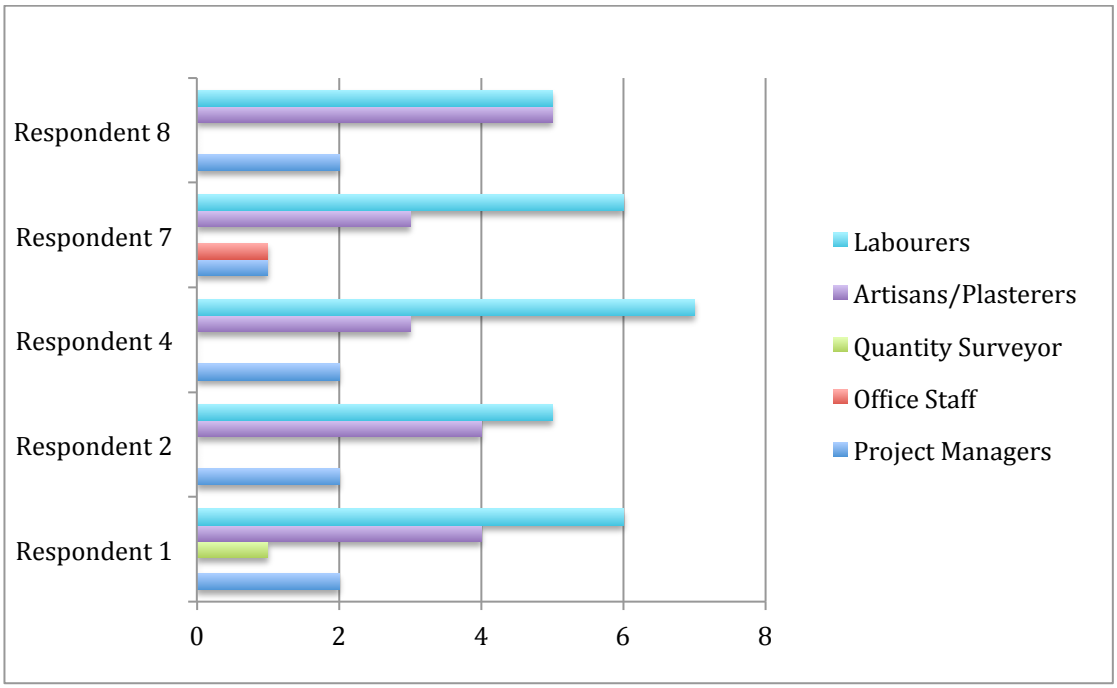


Figure 4.7 Staff Prior to Upgrading CIDB Rating

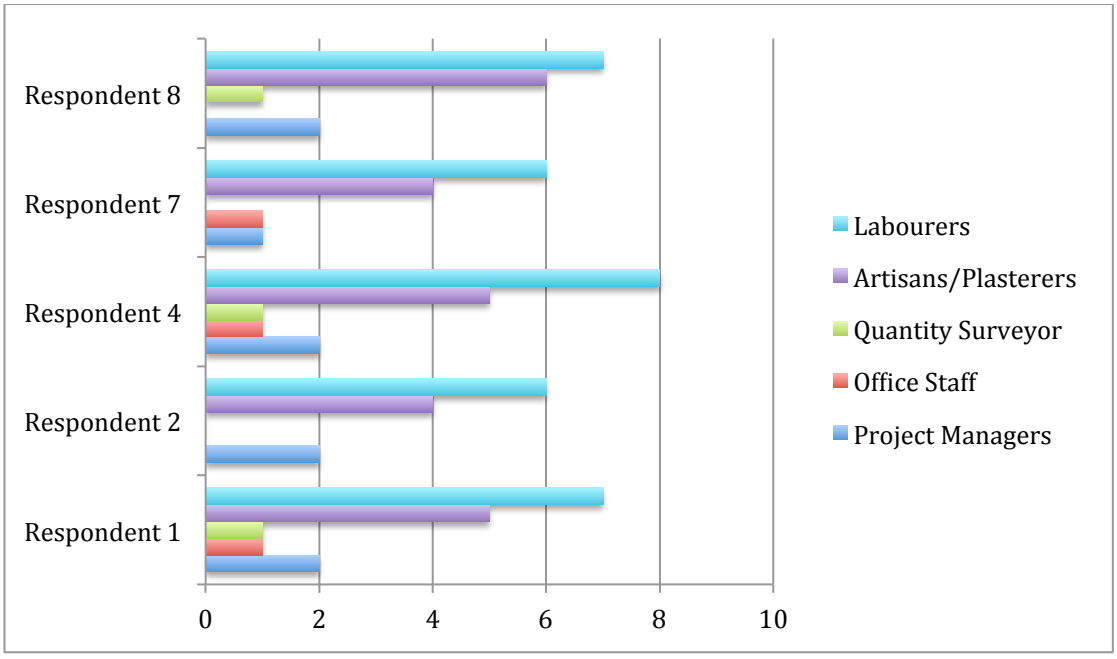


Figure 4.8 Current Staff Employed

On comparison, it can be established that the companies had more staff at the date of the interview than they did when they first started off. All the respondents started off with two project managers except respondent 7 who had one. The project managers were essentially the people who started the company.

As discussed earlier, in order for the majority of the respondents to upgrade their CIDB rating, they had to upgrade their project management software along with employing more staff. It must be noted when comparing the increase in staff, the majority of the respondents increased specialization in particular, by hiring a Quantity Surveyor. They have also employed more artisans to handle the increased complexity of work.

For the size of project a medium grade 4 contractor takes on, according to all the respondents, there is no need to hire more project managers. Their reason is that a project manager is able to run more than one medium scale project, especially with the project management software that the company had introduced. All the project managers were on site for most of the time, therefore also taking on the role as foremen.

Respondent 7 was the only company still employing one project manager, being the

owner himself. He explained that for the amount and type of projects the company is currently taking on, although it is difficult for him, it is manageable on his own, although he did mention that he was looking to hire a new project manager to assist him by the end of the year.

Two of the three respondents who were currently employing quantity surveyors, were the two respondents awaiting approval from the CIDB Registry to upgrade to grade 5. They explained that having a quantity surveyor on board allowed them to distribute the workload of cost estimating and tendering for projects. Although having a quantity surveyor was an additional expense that they could possibly do without, they were looking to have staff grow along with the company in the future and preferred having an internal quantity surveyor as opposed to a consultant, a situation that had led to disputes in the past.

The artisans and labourers are considered to be 'building staff'. As one would expect, to take on larger projects, a company needs to employ more staff with these capabilities. The amount of staff employed by grade 4 medium contractors in South Africa may differ when compared to a contractor of a similar scale in North America or parts of Europe, as discussed in the literature review (Turner and Townsend, 2013). Considering the five respondents interviewed, the average staff employed in total by each company is about 15 people, which is adequate for a grade 4 medium contractor, as deemed by the CIDB registry for a project of value between R2 000 000 to R4 800 000.

Almost all the respondents admitted that with the amount of staff they currently employ, if work had to commence simultaneously for two projects of the above-mentioned size, they would only be able to take on those two projects and no more. They revealed that the software would easily be able to handle numerous projects concurrently; however they acknowledged that they would need to hire more staff to distribute across the various projects. One respondent explained that this is actually a catalyst for these companies to grow further.

An important thing that was interesting coming from a contractor of their size is that, being one of the project managers who run the company, it is crucial for him to take a strategic approach to selecting, authorising and funding projects. He further explained

that in order for the company to grow, one needs to choose the best fit of projects for his company and effectively manage the project till the completion of its lifecycle. To select the right projects and finish them within the stipulated time and budget is difficult; however, he explained that using the CCS Candy/Build Smart project management software provides the user with the right tools and processes, making the task simpler.

The respondent revealed that from years of experience in the industry, to achieve ultimate project success, project managers need to be able to prioritize projects based on the company's tolerance of risk. He further explained that making the best use of limited resources; managing projects with numerous project stakeholders; meeting regulatory requirements; and avoiding unnecessary project claims, whilst enhancing project output and delivery, are some of things a construction company needs to consider at all times.

Almost all the respondents interviewed explained that modern day construction companies simply cannot rely solely on the project delivery techniques used in the past. One of the respondents awaiting grade 5 contractor approval noted that with every new project his company takes on, it is crucial that the project is in line with the company's strategic objectives along with being completed successfully within the stipulated time and project budget each and every time.

The respondents who were making use of the Primavera software also discussed how they have benefited from some of the features the software has to offer. The *Phase Gate Management* feature, allows the respondents to define their company standard methods to direct project phase gates. The *Construction Coordination* feature enables the user to manage notices to ensure RFIs (Request for Information) as well as project related submittals.

The *Design Coordination* feature preserves the latest basis of project design documents with the option of amendment control. One of the respondents admitted that the *Project Collaboration* feature is highly useful to his company, in that it enables him to coordinate with project stakeholders through supplementary orders and design adjustment requests.

Table A5 in Appendix C provides a list of the comprehensive features offered by the

three different project management software programmes that are being used amongst the five respondents. It is clear that, although the Primavera and CCS software are reasonably expensive, they both offer significantly more features than that of the free Open Project software. This confirms what the respondents discussed earlier, where they explained that using the Open Project software for the size of projects they are currently taking on is more than adequate to handle the work required of them.

Nevertheless, if the companies intend to grow in the future (which all of them do), by taking a larger projects, the construction company will have to handle many more tasks related to each project and cope with the complexity of managing several projects simultaneously. This is where the advanced features incorporated in the Primavera and CCS software will be of benefit.

4.16 Summary of Core Findings

4.16.1 Mapping the Path for Small Contractors

The information gathered from the interview process enabled this study to establish what path a small grade 3 contractor would have to take in order to upgrade their CIDB rating on the Construction Industry Development Board register of contractors. As highlighted in the literature, there are certain competencies that a company needs to develop and demonstrate.

The CIDB is the South African government agency that has the responsibility to ensure the development of the construction industry. After analysing the information gathered, it can be established that almost all the contractors interviewed desire to progress to the higher contractor grades because the competition is perceived to be less and the project values are greater (CIDB, 2009).

It became apparent that as these construction companies moved into more complex environments where projects became more complicated, it became necessary to adopt a finer set of capabilities to successfully handle the risks and opportunities that would confront them.

When the respondents were still grade 3 contractors, they matched the characteristics of type 2 firms discussed in the literature review (Rush et al., 2007), where they

defined these contractors to be ‘reactive’. Like type 2 firms, they recognised the task of company transformation as well as the necessity for continuous enhancements in their company’s technical abilities, but some of the respondents were or still are unclear about how to react to this effectively.

When a company advances in the CIDB Register of Contractors, it broadly suggests that the company is able to acquire more profitable projects. The responses received confirmed what was put forward by Keith and Windapo (2011) where a contractor’s turnovers, as well as their greatest project value finished, are some of the criteria used by the CIDB when grading contractors.

There was consensus amongst the responses that in the company’s growth path they needed to exploit company strengths, take opportunities presented to them, improve on company weaknesses and deal with external threats.

One of the respondents confirmed Thwala and Mofokeng (2012), namely that the construction industry in the country is growing, being a developing country, thus there are opportunities for smaller companies who are starting off. When comparing the time taken for small grade 3 contractors to upgrade to a grade 4 contractor, there is a difference between firms who started off within the years 2005 to 2007 to firms who started off within 2009 to 2011.

It seems that companies who started off within the years 2005 to 2007 managed to upgrade their CIDB rating quicker than the companies interviewed for this research, where the majority of them started within the 2009 to 2011 time period. The reason for this is that, during the 2005 to 2007 period, the South African economy was doing relatively well, where a lot more construction was going on especially in preparation for the 2010 FIFA Soccer World Cup.

The following Figure 4.9 illustrates the cyclical demand for construction work in South Africa during this particular period, thus confirming the above-mentioned findings. The smaller construction companies had far more job opportunities, which allowed them to grow much quicker.

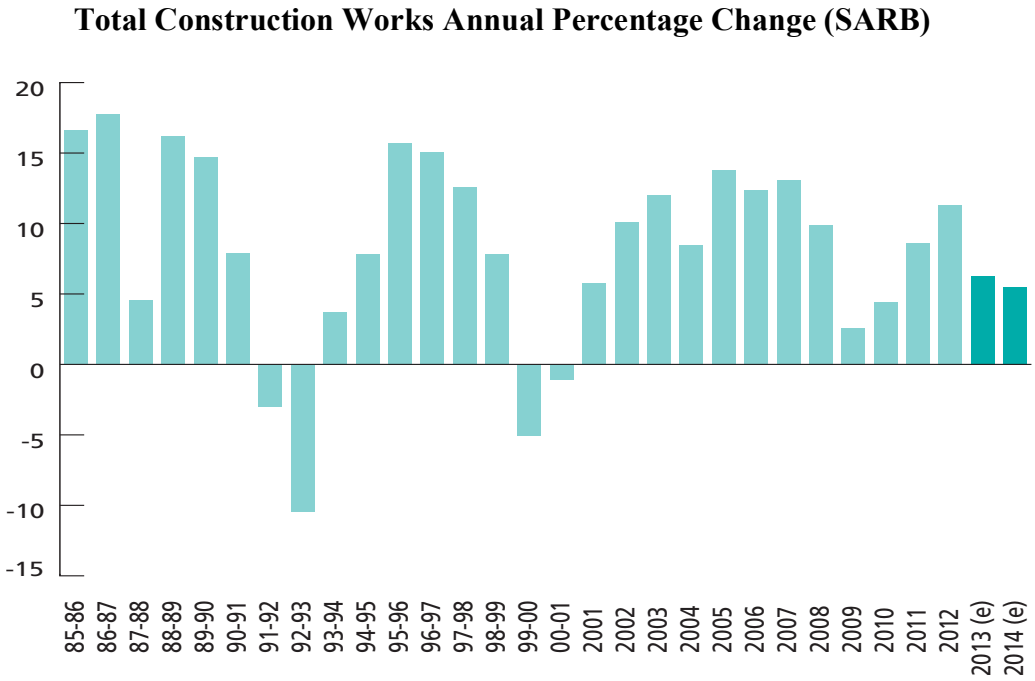


Figure 4.9 Total construction works annual percentage change over the years in South Africa (Industry Insight, 2014)

When comparing the two periods, it is known that the global recession in 2008 affected the South African economy. The responses were consistent with what was described in the literature review by Bohlmann and Van Heerden (2009), who argue that the construction industry was one of the industries that was affected most as a result of the recession

During this period there were less work opportunities for all competitors but especially for the newer small contractors, which resulted in the companies taking a longer period of time to upgrade their CIDB rating. This validates the responses received from the companies interviewed for this research, where it took some of them a lot longer than the estimated 10 to 12 months to upgrade as it was described in the literature review by Keith and Windapo (2011).

Some would argue that to establish a successful construction firm, the company needs the founding owners to have some professional qualification (Egbeonu, 2004). From discussion with the respondents it can be suggested that the founding owners' construction experience individually and as a team seem to be the most significant contributing factors responsible for a company's growth.

Companies with founding owners who have the necessary work experience as well as

a professional qualification, as with some of the respondents, appear to move quicker up the CIDB grading system. It seems as if they get the work done faster with fewer mistakes when compared to companies like respondent 7, where the founding owner had the necessary work experience but had no professional qualification.

This can be observed on the respondents' timeline discussed above, comparing the respondents' time taken to upgrade as well as the amount and size of projects taken on by them over the years. The founding owners of respondent 1 both had construction experience and relevant professional qualifications, and took 13 months to upgrade, compared to respondent 7 who took two and a half years to make the upgrade.

4.16.2 Tactical Decisions

In order to grow the company, the respondents revealed some of their tactical decisions that they have introduced to grow their respective companies. From the responses, some common themes appeared when analysing the information gathered.

Establishing a firm financial foundation seems to be a crucial factor to establish from the outset of their company. The founding owners, when starting their company, had financial reserves saved up over the years from working with their previous employers. They discuss that having no form of financial backing as well as the risk of not being remunerated on time by clients, will threaten the continued existence of a company trying to start off.

One of the respondents admitted that prior to the inception of his company, he ensured that there were adequate cash reserves. He also discussed having cash reserves to allow one to avoid loans from banks. The respondent further explained that on a construction project, the profit margin would not surpass 10% especially for a small contractor. The interest rates can sometimes exceed this and at the end when it is time to get paid by the client and you have to pay the loan back to the bank, the bank essentially takes almost all the profit.

Additional themes arose with regard to factors they did and still do take into account prior to and after upgrading their CIDB rating including:

Leadership: The owners or project managers need to maintain strong leadership

capabilities in order to get the respect and backing not only from company staff but also from other project stakeholders.

Reputation: It was discussed earlier, that without a good reputation within the construction industry for completion of quality work, on time, within budget and at a professional standard, a company will not survive in this very competitive industry.

Forming relationships: Forming good working relationships with suppliers, by paying them on time, can be beneficial. Using the same supplier for several projects can sometimes result in discounts or increases in allowable credit, thus increasing profits made on projects.

Procurement of equipment: Project management software has been discussed extensively above, as one category of equipment that the contractor needs to consider. In some instances, the acquisition of plant and equipment as opposed to renting the equipment will, in the long run, be beneficial to the company.

For these companies, upgrading their project management software and using it effectively was a factor that significantly contributed towards upgrading their CIDB rating. However, if the respondents had not taken the above-mentioned factors into account, the upgrade would more than likely not have happened. It seems that the combination of upgrading their project management software whilst maintaining and improving on the above-mentioned factors is a common theme amongst all the respondents and appears to be the successful blend that enabled them to grow as a company.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

This research study sought to explore one aspect of the transition procedure followed by grade 3 contractors in their attempt to upgrade their CIDB rating to a medium-size grade 4 contractor, namely the adoption of project management software.

This research expanded on the current research in this field of study, with the intention of answering the proposed research question; in determining whether contractors upgrade to level 4 and then upgrade their project management software, or, as their project management capabilities increase through the effective utilization of improved project management software, the contractors subsequently become more confident in making the jump to the next grade.

The research evaluated the current state of the South African construction industry and has analysed the evolution of project management software. It has also investigated the different grades of contractors, particularly focusing on the grade 4 medium contractors, specifically looking at the implementation of project management software amongst this sample group.

From the results of the interview process with five participating contractors who upgraded their CIDB rating from a small grade 3 contractor to a medium grade 4 contractor, along with the information gathered from the literature review, the following conclusions can be made:

- The five respondents interviewed, who all successfully upgraded their CIDB rating to a medium sized grade 4 contactor over the last three years, revealed that as a result of the poor economy in South Africa, it takes a longer time to upgrade when compared to companies upgrading seven or eight years ago. Assessing the growth path of the five respondents, the transition process to a grade 4 medium-sized contractor, including their intentions for future growth, was found to be somewhat gradual, sturdy but consistent.

It took the respondents an average of 18 to 19 months to upgrade their CIDB rating. This is a bit longer than the average 10 to 12 months found by Keith and Windapo (2011), however the results of these authors started from 2006, and the respondents were predominantly grade 7 contractors and above, where the transition process is easier based largely on their financial resources and industry experience.

- From analysing the interviews, the following factors that significantly contributed to the successful upgrade of the five respondents are:
  - Project management software: It was found that acquiring superior and more reliable project management software was one of the most decisive factors that contributed to enabling the respondents to upgrade their rating. Investing in professional software like Primavera or CCS enabled the contractors to grow through the CIDB grades without having to change the software. Using the software to its full capabilities provides users with the project management tools that enable companies to take on more complex projects of greater value, and several projects simultaneously. Project management software provides opportunities as well as benefits if used effectively. It has become common in the tendering stage for projects that the use of project management software is mandatory for a contractor.
  - Financial reserves: Without a strong financial position, very rarely will a contractor of small or medium size succeed. Due to the complexity and volatility of the construction industry, as well as the competition involved at the smaller contractor levels, for companies to stay afloat it is pivotal to have sufficient financial capacity to deal with periods of no work or delayed remuneration from clients. The growth of a construction company is reliant on the availability of cash reserves that are put back into the company. Bank loans are avoided due to the high interest rates charged in comparison to the percentage of profit made on a project.
  - Control: Control over their company and employees is crucial; if there is no control from the start, the company will struggle to move forward. Control signifies the management and leadership responsibilities of the owners and project managers, by leading

effectively with the intention to provide structure and set out a strategy to achieve company objectives. Where these characteristics are evident, the staff as well as project stakeholders will show respect. Exploiting the strengths of the company as well as harnessing the construction experience and knowledge effectively, enables the company to handle the difficulties accompanied with working in this industry.

- Company status: It is crucial to uphold an outstanding project track record, as this will dictate the reputation of the company. Displaying quality and professionalism is of the utmost importance, regardless of the size of company. In order for a company to grow it needs to complete each and every project on time, within budget and at a quality standard. A company's reputation is only as good as their last project; once a company's reputation is ruined it is difficult to win tenders, thereby placing the continuation of the company at risk.
- Relationships: Establishing sound relationships with suppliers and other project stakeholders can be very beneficial to the growth of a company. Paying suppliers on time and using them repeatedly, will usually result in company discounts and better credit ratings. Performing well on a project can provide more work opportunities. It will usually result in the project stakeholders, like the client or architect, using the company again for other projects. By forming these bonds, it provides the company with continuous work.
- Company as a whole: Experience is a vital asset for any company. It was found in the interview process that almost all the respondents' founding owners had construction experience, some more than others. The combination of experience, youth, technical knowledge and professional qualifications enables a company to develop successfully. The companies whose founding owners have the relevant work experience and the essential qualifications were found to have advanced comparatively faster.

5.2 Recommendations for Small Contractors

For small contractors to make the successful transition to becoming grade 4 contractors, owners/project managers of these companies need to consider the following factors.

When possible, purchase a reliable and professional project management software, even though the initial cost of the software may be expensive and the tools offered may be of no use yet on the projects the company is currently undertaking. However, if the company's intention is to grow into a larger firm it is advisable to make the investment now, so that the staff can grow with the software, as well as learn and gain experience from using it.

It is clear from the interview results, that four out of the five contractors adopted superior project management software with the intention of moving their companies forward. The new software provided them with better project management tools and capabilities, which contributed significantly to these companies making the upgrade to a medium sized grade 4 contractor.

The free software available for download off the Internet is capable of handling the small or even medium sized projects. It can be beneficial to use some of them, however companies have to train their staff and eventually will need to acquire superior software.

Utilizing the project management software effectively, and to its full capabilities, is crucial. Training the staff that will be using the software is just as important. The superior software like Primavera and CCS enables the user to handle any project management task required right up to projects of large scale. It is beneficial to acquire these software programmes because the companies who develop them provide full support and on-site training.

As a result of the country's poor economic state, it is advisable for grade 3 contractors to grow their respective companies at a consistent rate. The competitiveness for work is greater at the lower level grades when compared to the higher grades, where the

main companies are fully established in the industry. Nevertheless, if small contractors want to upgrade their CIDB rating, one of the criteria that the company will be evaluated on is the number and value of projects that they have completed successfully in the past. Completing a project successfully means finishing the work on time, within the stipulated budget at the desired quality. The respondents explained that getting involved in too many projects at this stage in the company's lifecycle, where the company's capacity and ability to manage the worked load is inadequate, will inevitably lead to failure.

Developing a strong workforce within the company, by maintaining current staff as well as hiring new staff members who can add value to the company, is crucial. Although, hiring new staff at this level may seem an additional expense, especially if the current staff are capable of coping with the present workload, it is important to employ staff strategically to benefit the company in order for the company to move forward and grow. By doing so, greater work opportunities will arise or broader avenues of work may result. A prime example is both of the respondents who had employed Quantity Surveyors after upgrading, in order to expand the company and take on more projects.

Small contractors who are black owned should take advantage of the opportunities provided by Government policies and the contractor development programmes. These are there to provide previously disadvantaged individuals with greater work opportunities; however companies who are reliant solely on these policies will not succeed. It is the owner's responsibility to take the opportunities and expand on them by taking the initiative to develop the company further.

Considering the conclusions and recommendations, a brief list was subsequently established to make it easier for readers to see the exact points mentioned above; where the distinguishing characteristics a small grade contractor would need to adopt in order to make the upgrade to a medium sized grade 4 contractor is provided below:

- Obtaining a respectable, free project management software off the Internet, where its functionality, usability and design are capable of handling the desired tasks i.e. Open Project, Ms Project or purchase a superior software

from a well-known software support company, e.g. Primavera, CCS Candy/Build Smart, Procore; that will enable the company to use the software beyond medium contractor grade, allowing the company to grow at a quicker rate and take on more complex projects simultaneously;

- Maintaining current staff, as well as employing new staff where and when necessary, where capacity in the company is falling short;
- Having the adequate cash reserves by being able to deal with financial issues as a result of remuneration from clients being delayed;
- Maintaining good relationships with suppliers and clients;
- Completing projects successfully on time, within budget and at the best quality;
- Improving project management capabilities through experience, training and development programmes;
- Good company control, owner/project managers developing a leadership style that suites the company structure, motivating staff by delegating responsibilities to individuals where it provides them with confidence as well as adequately managing and co-ordinating the numerous tasks and project stakeholders;
- Ensuring staff are always aware of the company's goals and objectives to move forward; and
- Ensuring the reputation of the company is upheld at all times.

5.3 Providing Additional Support

It is important to note that the South African economy is struggling in 2014 (the year of these interviews) as a result of various industry strikes, the national elections, major economic challenges and domestic turbulence. In the last ten years the country has attained great levels of economic growth, however the country is currently plagued with large account shortfalls, with a significantly inferior growth rate and fragile currency (Mothiane and Rodrigues, 2014).

Part of the motivation behind this research study was to look at small and medium contractors operating in the South African construction industry, because they contribute a significant portion towards of the South African economy. The vast

number of small and medium contractors significantly contributes to increasing the level of employment in South Africa (Greve, 2013).

However, as mentioned before, in recent years there has been a significant decline in the number of registered SMEs due to the volatility of the industry, increased competitiveness amongst contractors and the lack of work opportunities available to the smaller sized contractors. The current economic situation adds to this difficult environment.

From this research results, it is evident that companies tend to develop faster when effectively utilizing good project management software. As a result of this, the following ideas are being presented to help promote the continued growth and development for the current and emerging small grade contractors:

- Provide monthly seminars in the different geographical regions of the country, where small contractors can bring forward issues they are facing. An organisation like the CIDB could invite industry professionals to provide the attendees with advice;
- In the Government training programmes, provide courses on project management software that is respectable and available for attendees to download; and
- Teaching of project management software has been implemented in some tertiary education organisations over the years in South Africa. However, it should be compulsory for all Universities, Technikons and colleges across the country to incorporate a course in the construction and engineering programmes

It is important to note that the success of a contractor is not only reliant on size or CIDB rating, but also the contractor's actual capacity and ability to become a profitable organisation. This profitability stems in part through the company's internal capacity, of which its project management capability plays a significant role, but is also dependent on external factors, in particular prompt payment for work performed. Government, as a major client of the construction industry, should be leading by example in this regard.

In completion of this research study, the aim set out has been achieved, which was to establish the means by which a grade 3 contractor is able to make the upgrade to a grade 4 contractor, determining what techniques and project management software these contractors have adopted in order to assist them from overcoming the gap in grades.

In answering the research question, it has been established that the adoption of project management software does support and enable small contractors in making the transition to become a medium sized contractor.

The hypothesis for this research study has been proven, where for a small contractor to make the leap to becoming a medium sized contractor, the effective use of project management software did enable a successful transition to grade 4.

5.4 Recommendations for Future Research

Future academic research on the adoption of various project management capabilities and construction related technologies that facilitate the transition for smaller contractors to becoming medium sized contractors in the country's Built Environment is recommended, as a result of the significant role these smaller contractors play in contributing to the infrastructure development and employment in South Africa. This research was limited to medium grade 4 sized contractors who only operate in the Gauteng area, in South Africa.

The findings from this research are based on the information from purely Gauteng based companies. The unique characteristics of construction projects in the South African construction industry indicate that this research topic should be extended to other parts of this country.

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Appendix A: Data Collection Spread Sheet

Table A1. Data collection spread sheet

Code:
Similar Response=S
Varied Response=V
Positive Response=P
Negative Response=N

	Matching Responses				
	Respondent 1	Respondent 2	Respondent 4	Respondent 7	Respondent 8
Question No:					
1	S,P	S,P	S,P	V,N	S,P
2	S,P,N	S,P,N	S,P,N	S,P,N	S,P,N
3	S,P,N	S,P,N	S,P,N	S,P,N	S,P,N
4	S,P	S,P	S,P,N	S,P,N	S,P
5	S,P	S,P	S,P	S,P	S,P
6	V,P	S	S	S	S
7	V,P *	S,P *	S,P *	S,P *	S,P *
8	S, V,P,N	S,V,P,N	S,V,P,N	S,V,P,N	S,V,P,N
9	S,N	S,P	S,P	S,P,N	S,P,N
10	N	N	N	P	N
11	S,P	S,P	S,P	S,P	S,P
12	V,P	S,P	S,P	S,P	V,N
13	V,P	S,N	S,N	-	V,P
14	S	S	S	S	S
15	S,P	V,N	S,P	S,P	S,P
16	S, V,P,N	S, V,P,N	S, V,P,N	S, V,P,N	S, V,P,N
17	V,P	V,P	V,P	V,N	V,P
18	S	S	S	S	S
19	V,P	V,P	V,P	V,P	V,P
20	S,P	V,P	S,P	S,P	S,P
21	S,P	V,P,N	S,P	S,P	V,P
22	S	V	S	S	S
23	S, V,P,N	S, V,P,N	S, V,P,N	S, V,P,N	S, V,P,N
24	V	V	V	V	V
25	S,P	S,P	S,P	S,P	S,P
Question No:					
26	V,N	S,N	S,N	V,P	S,N
27	S,N	S,N	S,N	S,N	S,N
28	S,P	V,P,N	S,P	S,P	S,P
29	S,V,P	S,V,P	S,V,P	S,V,P	S,V,P
30	S	S	S,V	S,V	S
31	V,P	V,P	V,P	V,P	V,P
32	V,P	V,P	V,P	V,P,N	V,P,N
33	V	V	V	V	V
34	S,P	S,P	S,P	S,P	S,P
35	S,V,P	S,V,P	V,P	V,P	S,V,P

Appendix B: Interview Questions

Name: Michael Savvides

Student Number: 308370

Date: April-May 2014

Supervisor: Dr. Anne Fitchett

Course: CIVN 7019

Degree: MSc Civil Engineering

Research Interview

Ethical Considerations

The ethical considerations for this research cannot be ignored. Thus, in accordance with the governing principles of research ethics set out by the University of Witwatersrand, the research carried out will follow those principles with the intention of safeguarding your rights, upholding the ethical standards of the University. Your participation in this research study will be voluntary. The information shared and obtained through the interview process will not be made available to any person who is not directly involved in this research.

This study will respect all moral and legal issues in relation to you. Your names and responses will be kept anonymous. This interview is designed to elicit information relevant to this research study. Any data and information for research publication purposes will be treated with anonymity unless permission is granted for it to be used otherwise by you. In addition, the information obtained will not be used for either commercial purposes or made available to third parties without express written your consent by you. By participating in this survey, you express your consent to use the data for research as stated. You also confirm that you are not below the age of 18 and also acknowledge your right to discontinue participation in this research at any time without reason. The information emerging from the study will be made available to all participants on request.

Section A: Semi-Structured interview

Semi-structured Interview:

Question 1: Do you utilize in house project management, or do you employ a consultant to set the project programme for you?

Question 2: When you were a grade 3 small contractor, did you manage the project using tools from PM software, manually, or no specific tools at all?

Question 3: Which of the following tools did you use manually to manage your projects before you upgraded to a medium sized contractor and why?

- Critical path analysis CPA;
- Earned value analysis;
- Gantt charts;
- Program Evaluation Review Techniques (PERT);
- Resource levelling;

Question 4: Which of the following tools do you use manually to manage your projects since you upgraded to medium sized contractor and why?

- Critical path analysis CPA;
- Earned value analysis;
- Gantt charts;
- Program Evaluation Review Techniques (PERT);
- Resource levelling;
- None.

Question 5: Which of the following tools do you use through the PM software and why?

- Critical path analysis CPA;
- Earned value analysis;
- Gantt charts;
- Program Evaluation Review Techniques (PERT);
- Resource levelling;
- Other.

Question 6: Did your company upgrade its PM software before, after, or not at all at the time of upgrading its CIDB grading to becoming a medium sized contractor?

Question 7: When did you upgrade your software – before or after you applied to upgrade your CIDB grading? (Prompt: Was is it when you upgraded to a medium sized contractor that you realized in order to take on larger more complex projects you needed to upgrade your PM software to handle the tasks involved, or did you upgrade your software first which subsequently allowed you to upgrade contractor size and take on larger projects?)

Completing a project successfully essentially means the project was finished within time, within budget where no variables were changed. However we all know in construction that this is hardly ever the case, leading to the questions:

Question 8.1: Have you ever not completed a project within budget, explain why?

Question 8.2: Have you ever not completed a project within time, explain why?

Question 8.3: Does the use of the PM software help you stay closer to the original time and budget that was stipulated at the beginning of the project? Explain?

Question 9: Is the use of PM software a tendering requirement for the projects you undertake? Do clients request specific PM software to be used? If so, which one?

Question 10: Have you made use of any government development training programs that are available to teach contractors how to use different PM software, if yes explain where and if it was beneficial, if no explain why?

Question 11: What was the main reason for the upgrade? Keeping the following topics in mind:

- Take on larger projects;
- To grow the company as a whole;
- To employ more staff;
- Earn more money;
- Become more competitive;
- Other.

Question 12: Did the implementation of Government policies favouring small contractor development help in the upgrade to a medium sized contractor, if yes elaborate?

Question 13: What PM software were you using before the upgrade and why that specific one?

Question 14: Who in your company is responsible for implementing PM software?

- Owners;
- Project managers;
- General staff.

Question 15: Did you have to train the staff to use the software? Keeping the following topics in mind:

- The time taken;
- Costs involved;
- Technical capacity of staff.

Question 16: Are the older employees more reluctant to using the software as opposed to the younger more technology 'savvy' employees, elaborate?

Question 17: How long did it take to make the upgrade to a medium sized contractor?

Question 18: How many employees did the company have prior to the company upgrade, and how many employees does it have now?

Question 19: What is the average size and value of your current project(s)?

Question 20: Are you able to now have more than one project running simultaneously using PM software since you upgraded? Explain why?

Question 21: What project management software are you currently using and why?

Question 22: If possible please select the price range of the software you are using:

- Free;
- R1000- R5 000
- R6000- R10 000
- R11 000- R15 000
- R16 000 and above

Question 23: What is the difference between the software you use now compared to the previous software? Keeping in mind:

- Cost of the software;
- Integrated tools available;
- User friendliness;
- Types of projects it can handle;
- Ability to make a profit.

Question 24: How did you find out about PM software?

- From studying at University;
- Government development programs;
- The internet;
- Word of mouth;
- Self-research;
- Other.

Question 25: What are the benefits from utilizing the PM software? Keeping in mind:

- Project cost saving;
- Project time constraints;
- Communication;
- Human resource management;
- Tracking of project progress;
- Multiple projects;
- Any other benefits

Section B: Open-ended interview

Question 26: What are the internal factors that hamper the implementation of project management software within your company?

Question 27: What are the external factors that hinder the implementation of project management software within your company?

Question 28: Will you be able to upgrade further with the current software you are using, elaborate?

Question 29: Which of the following do you consider to be the key strengths that enabled the company to upgrade, explain why?

- Technical Ability/ Technological Advantage;
- Financial strength;
- Knowledgeable and qualified employees;
- Project management capabilities;
- Others.

Question 30: What were the threats to the company's survival at the beginning, and how were they over come? Keeping the following topics in mind:

- Lack of adequate financial resources by project clients;
- Lack of technological skills;
- Competitors;
- Access to capital;
- Cultural differences;
- Bribery and corruption;
- Others.

Question 31: Would you like to talk about your company's history and underline any significant milestones from the company's inception to where it is now.

Question 32: Briefly explain what the growth path was like from grade 3 contractor to a grade 4.

Question 33: Did the path in which the company grew match the initial vision set out by the company creators?

Question 34: Please discuss the differences between where the company is today and where it was at the beginning, keeping the following topics in mind:

- CIDB grade of registration;
- Company's Profitability;
- Annual Turnover;
- Size of projects;
- Availability of work.

Question 35: Finally, please would you give an indication of what keeps the company going and where is it going next?

(**Note:** During these open ended questions the central topic of the use of PM software may be revisited with the respondent)

Appendix C: Comparison of PM software features

Table A2. Comparison of PM software features

	Comparison of price and features between the software currently being used by the grade 4 contractors		
Software	**Open Project**	**Primavera**	**CCS Candy/Build smart**
Main Features Offered	-Project management and milestones; -Issue management; -Bug tracking; -Project timelines -Document management -Forum -Wiki -Time tracking -Project news	-Project dashboard -Document management -Drawing management -RFIs -Daily log -Scheduling -Bidding -Email tracking -Reporting -Submittals -Timecard -Planning -Valuations -Construction coordination -Phase gate management -Project collaboration -Design coordination	-Estimating -Planning -Valuations -Cost allowable with EV analysis -Project cash flow -Build smart procurement and accounts -Forecasting -Subcontract management -Electronic take-off linked to BOQ -Payroll and labour costing -Plant and equipment costing -Human resource management -Contract costing reports -Time and attendance systems -Procurement and controls

Appendix D: Participant Information Sheet and The Consent Form

Participation Information Sheet

Good morning/afternoon Sir/Madam thank you so much for your time. My name is Michael Savvides and I am a Wits University student currently doing my Masters in Civil Engineering. I am conducting research for my thesis on medium sized contractors operating in the Johannesburg area. My role as a researcher is to obtain information and data from you, which will contribute to my research.

The intention of this study is to answer my research question, which is to establish the means by which a small grade 3 contractor is able to make the upgrade to a medium sized grade 4 contractor, determining what techniques and PM software these contractors have adopted in order to assist them from overcoming the bridge in grades. A gap exists in South African literature, where there is a need for a more detailed understanding as to how smaller grade 3 contractors upgrade to medium sized grade 4 contractors. The benefit of this study is to provide insight and awareness to the thousands of grade 3 contractors currently operating in the very volatile South African construction industry, particularly if they intend to upgrade to a medium sized contractor, demonstrating the paths and mechanisms that they should follow and implement in order to initiate the upgrade successfully.

I, Michael Savvides, am inviting you to take part in my research study. Your company was selected based on your CIDB grading, particularly the fact that you have upgraded from a grade 3 contractor to a grade 4 contractor in the last 3 years, you operate in Johannesburg and the fact that you are making use of a PM software.

You will be involved in an interview process where you will be asked numerous questions regarding your company with regards to the upgrade path from a grade 3 contractor to a grade 4 contractor as well as the PM software you previously used and are currently using. The interview will be face-to-face at your offices to make it more convenient for you, once you have agreed to take part we can arrange a time and date that best suits you. An audio recording device will be used as well as written notes to gather as much relevant information as possible. Only one interview will be conducted and will be limited to a time no longer than 1hr 30min.

Your refusal to participate once agreeing to take part in the study is allowed at anytime, prior to the interview and even after the interview has taken place, where it is assured that the information gathered from the interview will be returned to you or discarded completely. You may refuse to answer questions, which you feel uncomfortable about, and you may withdraw from the study at any time you like. All efforts will be made to ensure the anonymity of yourself and your company, keeping any information you divulge confidential if so requested by you.

The research findings will be reported in my final thesis document, which will be made available through Wits University on the world-wide-web. If you have any questions or issues that you are unsure of please feel free to contact me at anytime and I will willingly help explain anything you are uncertain about. I can provide you with a summary of my research before and after the interviews if you would like.

Contact details of researcher:

Name: Michael Savvides (308370)

Email: michaelsavvides89@gmail.com

Number: 082 711 6201

Contact details of supervisor:

Name: Dr. Anne Fitchett

Email: Anne.Fitchett@wits.ac.za

Consent Form

The research that will be conducted by Michael Savvides has been clearly explained to me, after discussion with Michael, I now have a clear and knowledgeable understanding of what the research is about, what my involvement is and what Michael is setting out to achieve.

I've been told that:

- My company has been selected based on our CIDB rating upgrade from a grade 3 contractor to a grade 4 contractor, we make use of PM software, and because we operate in Johannesburg;
- An interview will be conducted by Michael with the relevant staff in the company who deal with the implementation and use of the PM software;
- The interviews will be face-to-face at our offices at a date and time once we have agreed;
- The interview will be no longer than 1hr 30min, where an audio recording device will be used to aid in gathering the information from the interview;
- My name and the company's name will remain anonymous in the write up of the research;
- I can withdraw prior to or after the interview has taken place, and may have the information gathered from the interview returned;
- Any information I deem confidential will be secured;
- I am allowed to request a summary of the work done by Michael;
- The information gathered will be reported in Michael's final thesis; and
- If I have any queries or issues I am freely allowed to contact Michael or his supervisor for clarification.

I am giving my full consent to take part and contribute information to this research study, where I agree to take part in the interview process.

I agree/disagree to the use of an audio recording device that will be used to record the information gathered from the interview process.

Signature of participant:

……

Date:

……..

Appendix E: Ethics Application Form

University of the Witwatersrand, Johannesburg

Ethics Application Form* for *Human Research Ethics Committee (HREC Non-Medical)

(Revised December 2012)

Use this form in applying for clearance of research involving human participants

Instructions

1. Completed applications must be submitted to the Research Office approximately three weeks before each of the monthly meetings. The deadlines are available on the Wits Research website http://www.wits.ac.za/academic/research/ethics.htm/7075/ethics.html
2. Applications must be submitted as hard copies, one of which must be an original (see checklist below for numbers of copies required). Electronic submissions will not be accepted.
3. All submissions and materials must be typed. Handwritten submissions are **NOT** acceptable.
4. Incomplete applications will **NOT** be considered.
5. Applications will **NOT** be processed if signatures from applicant or supervisor are missing.
6. Photocopying should be done 'back-to-back' to save paper.
7. Glossy and fancy binding is **NOT** necessary.
8. Necessary supporting documents (e.g. *Participant Information Sheet, Consent Form*, copies of instruments), must be stapled to the *Ethics Application Form.*

Complete this checklist to show what documents you have submitted.

☑	**Check list**	**No. of copies required**
For all research:		
X	Completed *Ethics Application Form*	**15**
X	Copies of the research proposal	**4**
X	Copies of proposed research instruments (e.g. questionnaires/interview schedules)	**4**
X	*Participant Information Sheet* (for each different sample group)	**4**
X	*Consent Form* [*Assent Form* for under 18s] (for participant's signature) (for each different sample group)	**4**
Where applicable (Attach to this form):		
	Relevant permissions (from, e.g. company's HR department, National authorities such as Education, Correctional Services, etc.) or other legally required consent	**4**
	Any other appropriate consent forms (e.g. consent forms for members of focus groups, consent forms (for video or photography), etc.	**4**
	Guardian *Consent Form* (for participants under the age of 18)	**4**
	Other (please specify)	**4**

1. Researcher's personal data

Surname: Savvides	Name: Michael

Title:		Prof		Dr	x	Mr		Ms		Mrs		Other:
School: Civil Engineering											
Staff / Student number: 308370							x	Full time		Part time		Staff
Your telephone(s): 0827116201											
Your Email: michaelsavvides89@gmail.com											
Name of Supervisor (if applicable):	Dr. Anne Fitchett										
Supervisor's email address:	Anne.fitchett@wits .ac.za										
Supervisor's tel. number(s):	+27 11 717 7107.										

2. Specifics about the research project

Title of research project

The adoption of ICT project management software to facilitate the transition to becoming a medium sized contractor.

Is this research for degree purposes?			x	**Yes**		**No**	
If so, for what degree?		**Honours**		**Masters (dissertation)**	x	**Masters (research report)**	
		PhD		**Other (specify):**			
Has it been approved by the relevant higher degrees committee or other relevant unit?				**Yes**		**No**	x **Submitted & pending**

List the names and affiliations of any *additional* researchers who will be covered by this ethics protocol

Where will the research be carried out?

The offices of the respondents.

What are the aims and objectives of the research? (Please list; be brief)

- Evaluate the path a small contractor takes to becoming a medium sized contractor.
- Does the use of PM software enable them to make the upgrade to a higher CIDB grading.
- Do they upgrade their software first then upgrade their CIDB grading or the other way around.

Do you have any financial or material interest associated with your research participants or with the organisations that you will work with during your research?		
☐ Yes	☐ No	☐ Potential conflicts of interest may exist
P**lease explain how you will manage any existing or potential conflicts of interest, if applicable.**		

INFORMATION RELATING TO ETHICAL MATTERS
Protocols submitted to the Committee must have sufficient information to enable the committee to judge the ethical implications of the proposed research. Please be brief and concise but also as specific and informative as possible

3. Formal permission					
Has appropriate formal permission been obtained, if required (e.g. employer, government department, land owner, etc.)?					
	Yes (attached)	x	Not required		Pending (must be supplied before permission is granted)
Obtaining permission is necessary when conducting research *within the premises* of a particular site such as an ethnography of the functioning of a supermarket or a school, or the way staff interact with clients in a clinic, or of how the HIV Unit in the City of Johannesburg functions. Please read the detailed guidelines on the Ethics website http://web.wits.ac.za/Academic/Research/Applications.htm					

	4. How will data on human research participants be collected (instruments, methods, procedures)? (Attach instruments as an appendix)
	In written format (e.g. questionnaires, diagnostic tests, etc.)
	Completion of on-line instruments (e.g. questionnaires)
x	Individual interviews (e.g. structured, semi-structured, etc.)
	Group interviews (e.g. seminar/discussion groups, focus groups, etc.)
	Ethnographic observation, participant observation, other informal descriptive, and/ or interactive methods
	Community-based methods or techniques such as drama workshops, community theatre, training workshops, participant rural appraisal (PRA), rapid rural appraisal (RRA), etc.
	Research on/in therapeutic or counselling contexts
	Observation of public performance, and/or public behaviour observation
	Photography, video and/or audio recording (**specific separate consent forms may be required**)
	Other research methods or techniques (specify in this line).
Brief details of instruments to be used (attach instrument or draft to this application) - -structured and open-ended interviews	

5. Who will the research participants be?				
Brief description of human participants, including age range and sample size, for each sample: - Company Project Managers (1 person for each compay will be interviewed) - Five companies will be identified to take part in the research.				
Does this research expose either the participant or the researcher to any potential risks or harm that they would not otherwise be exposed to?		Yes	x	No
If 'yes', explain:				

Will research involve vulnerable categories?		Yes	x	No
If so, state which ones:				
How will any existing vulnerabilities among research participants be addressed?				

NB: The term 'vulnerable categories' includes, among others, children under 18, orphans, prisoners, persons with cognitive or communication disorders, people who are traumatised or currently in traumatic situations.

Where necessary, include details of steps to be taken to facilitate data collection across language barriers (e.g. interpretation or translation).

6. How will informed consent be obtained?

How will potential participants be identified / selected / recruited?

- From 10 participants 5 will be selected from a simple telephone call, to ensure they are medium sized contractor and they use Pm software and operate in JHB.
- Once 5 have contractors have been nominated an invitation by email will be sent to the relevant Projecy Managers asking them to take part and explaining what the research will entail and their involvement.

What will participants be told about the research (including the promises to be made)?

- Their names and the companies name will be kept anonymous.
- They can pull out at any time.
- They are being interviewed because they are a medium sized contractor, they use PM software and operate in JHB.
- The information gathered from the interview will contribute to my final write up.
- They will be provided with the information gathered prior to any publication.

How will informed consent be obtained?

x	Formal (Signed form)		Informal (e.g. verbal)		Other

Briefly explain your strategy for ensuring informed consent

- A formal written consent form has been developed in accordance with the wits ethics department, stipultaing what their involvement in the research will be, how the research will be conducted and what the information will be used for in a list format. At the bottom of the page will be a space for the participants signature consenting to take part in the interview process.

Attach *Participant Information Sheets* and *Consent Forms* for each sample group, and/or other related materials

NB*: Consent* in social science and humanities research involving human participants: Where informal ethnographic or participant observation methods are used, or where signed *Consent Forms* are not possible, or for research involving group contexts (focus group, Participant Rapid Assessment, Rapid Rural Appraisal, public performance, workshops) **state how the quality of informed consent will be assured**. It is essential that participants in research be fully informed and agree, on this basis, to participate in the research.

7. Protecting participant identities

Can **confidentiality** be guaranteed?	x	Yes		No
Can **anonymity** be guaranteed in resulting reports, theses	x	Yes		No

and/or publications?			

Explain how this will be done? (What will participants be told in this regard?)
- No where in the interview questionaire does it allow for the interviewees name or the companys name to be attatched to it. There are no questions asking them such details and the respondents will be provided with the final write up from the research information gathered prior to submission if required, ensuring they have been kept anonymous and the information they have divulged has been kept confidential. The interviews will be done at their offices not allowing any confidential information to leave the premises without their consent.

NB: While confidentiality may be desirable, it cannot be guaranteed in, for example, focus groups, or ethnographic observation. Similarly anonymity should be preserved in questionnaires, but cannot be offered in workshop methodologies, focus group research, etc. Participants should have the right to remain anonymous in the final report, and this must be respected in handling of all data relating to them. Participants need to be informed about these issues.

8. Protection of data during and after the research

How will the data be protected while the research is in progress? (This includes how the identities of participants will be protected).
- The information gathered from the interviews will only be discussed between myself and my supervisor. All the information gathered will be kept safely in my personal possession storing it on my laptop and in my own office space where no one will be able to access the information.

What is to be **done with the research data** after completion of the project?

	Stored in archives (specify)		Stored in on-line data base (specify)
x	Stored in password protected computer		Stored in digital form with all identifying feature removed
	Destroyed after … years (insert numbers of years)		

Explain how the data will be securely stored during this time
- Will be kept on a folder on my laptop where a password is required to open the document.

NB: 'Raw' or unprocessed data, especially **where the identity or personal data of research participants is included, must be safeguarded** and preserved from unauthorised access. Data may be destroyed after use, but **preservation in an archive or personal collection** may also be appropriate, desirable or even essential. For instance, data sets that contain **historically important information** or information that relates to **national heritage** must be preserved and should be placed in a public archive where possible and appropriate.

All data should be preserved in a way that **respects the nature of the original participants' consent**. If you are unsure about the procedure of data management and storage, please contact Nina Lewin (ninalewin@gmail.com)

9. Access to the research results / reports
How will the results be **reported**? - Published online
Who will have access? - People using the world-wide-web

Note: All Wits Masters and PhDs are stored in the main library as well being made available on the www.

SIGNATURES (REQUIRED)

In signing this form, the researcher and supervisor (if any) of this project undertake to ensure that any amendments to this project that are required by the Human Research Ethics Committee are made before the project commences.

Declaration: We, the signatories, declare that all information on this form is correct and that we will strive to maintain the highest ethical standards in this research at all times, according to disciplinary and university expectations, recognising that ethical practice in research is always a continuing process.

	Date	Name	Signature
Applicant			
Supervisor			