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The role of coaching in facilitating the transition from engineer to manager

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in Business Executive Coaching

Wits Business School

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ABSTRACT

The extensive training that goes into developing engineering professionals is part of the price society pays for infrastructure development. Yet when it comes to developing young engineering managers, their education is often left to chance. Organisations rely on a combination of manager's intuition and chance to recognise potential new managers and then they are expected to find their own way through the maze of policies, financial reporting, and stakeholder management politics after their appointment. This study was based in a State Owned Company where a group of new engineering managers were interviewed on their experiences as they moved into management in order to identify the challenges they experienced during the transition. The findings in the course of this research contribute to the understanding of the managerial competencies needed in a multi-cultural and multi-disciplinary engineering environment in order to guide new managers and the way in which coaching can contribute to their successful transition into engineering management.

This study used a deductive approach to establish the transition challenges based on selected literature and compared the themes to the data from thematic analysis of qualitative interviews with 16 engineering professionals working in a State Owned Company engineering company.

The role of new managers as talent trustees and containers of corporate memory is an essential part of skills retention strategy. This implies that dysfunctional behaviour at this level will affect future engineering skills retention and development. The cost of coaching should be offset by the risk of management failure when the new managers do not negotiate the transition challenges successfully.

South African companies integrate coaching with the talent or business strategy and they use internal coaches to coach up-and-coming talent and graduates (Steenkamp, 2013). There is an urgent and important need to develop engineers into managers and therefore the assistance given to new managers would be an advantage not just in terms of the general management competencies but also the transition competencies needed in the developing countries, such as South Africa (Denton & Vloeberghs, 2003). The challenges of the transition are exacerbated by the heterogeneous nature of the business world where multiple cultures and generations complicate information exchange in the engineering labour environment.

This research uses some of the insights gained from the international management competencies and applies the differences found the South African context to identify transition management competencies for the developing world. The research goes on to determine how organisations and coaches can facilitate the transition of managers in South Africa.

DECLARATION

I, Esther Rene Wallace, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management (Business and Executive Coaching) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Esther Rene Wallace

Signed at Parktown on the 31st day of March 2015

DEDICATION

This research is dedicated to engineers who design and build the telecommunications, cars, roads, dams, and power stations to provide the everyday conveniences that enable people to have more time to create beautiful art.

ACKNOWLEDGEMENTS

To everyone who has supported me in my lifelong pursuit of knowledge: thank you. You, who provided opportunities, assistance, and friendship to enable me to pursue engineering on the one hand and the humanities on the other; your faith made me strong; when I was weak your hearts carried me.

I would like to thank all the participating engineers. Your willingness to share your experiences made this study possible.

To Dr Hilary Geber, my supervisor; a true coach whose guidance and encouragement throughout this research study will be part of me forever.

To my Father, for always believing in me

To Jenni Croll - for proofreading my report, I thank you

To Edelweiss - for your presence during this course, I can never thank you enough

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1. INTRODUCTION

The first few months after an engineer is promoted to a managerial position is characterised by a massive change in work load, management of delivery and the skilful leadership of people. It means an increased requirement for people skills to engage and motivate the team. The successful negotiation of this transition is the topic of this research and exploring the potential aids available to a new manager is the goal of this work. It requires determination and focus to engage in management and for engineers that is a given. However success is neither due to brute force intelligence nor devious manipulation but to those who adapt with grace and elegance, as this transition is the negotiation of a new environment where the rules are many and some are never documented.

1.1 PURPOSE

These new managers become part of the face of the company and for many young engineers, they are the company. The ‘sink or swim’ approach to engineering education and development has been observed in the development of managers as well. This research explored the experiences of a number of engineers who were promoted to management to determine whether there were better ways to develop relevant managerial skills. The purpose of the research was to determine how coaching could augment traditional management development and so contribute to the improvement of engineering management.

For the purposes of the study a sample of recently promoted engineering managers were interviewed to elicit information about their experiences. The context in this research is engineering management in a developing country. A number of core themes related to the increase in managerial responsibilities were identified and compared to accepted management competency models in the literature. The core themes were analysed and evaluated with reference to management development strategies to discover whether some form of coaching would facilitate the transition of engineers into management.

1.2 CONTEXT OF THE STUDY

In "*Motives for transition: an exploratory study of engineering managers*", Johnson and Sargeant (1998) provide some insights into why engineers move into management. Some years have passed since that study, but the core themes mentioned in the article have not changed. The typical engineering career path leads to management which is considered a natural progression to higher status, better salaries and more responsibility (Tang, 1999).

Some engineers resisted becoming managers and the "dual ladder system" or technical leadership path described by T. J. Allen and Katz (1986, p. 1) was developed out of a need to retain engineering skills by providing recognition and financial rewards in the alternative technical track (Johnson & Sargeant, 1998). There is a perception that engineers on a technical path are not rewarded financially in the same way as managers are. While some engineers see management as the only viable career option, some organisations invest in retaining their engineering skills by other means (Martinich & Polito, 2010).

In another article, Ashley (1993) indicated that some engineers do not necessarily make the leap to management successfully. Some technically proficient engineers are trained to solve problems and take pride in their ability, resist the change required to be successful in management. This sentiment is confirmed by Johnson and Sargeant (1998) when they identify the three reasons why engineers may prefer not to apply for a managerial position. Sithole (2012) agrees that engineers prefer "doing things themselves rather than motivating others" (Sithole, 2012, p12). The reasons she gives, includes the view that engineers a) see management as a waste of engineering technical skills; b) prefer more technical work and c) lack the managerial skills or the inclination to gain new skills in management. At this stage, the literature does not provide quantitative evidence that this principle can be generalised to the majority of engineers but the opinion is pervasive.

The transition into management requires a change in mind-set from individual contributor to managing other individual contributors, as well as a need to manage across multiple disciplines (Charan, Drotter, & Noel, 2010). This change in mind-set may be difficult for many engineers if they want to maintain their engineering skills and at the same time increase their ability to operate in a multi-disciplinary

environment that includes not only various engineering disciplines, but also finance, sales and human resources (Ashley, 1993; Meyler, 2013). In the South African context the environment is characterised by multilingualism and multiculturalism.

Whereas competency in the technical aspects of the job may have been sufficient in the technical role, there is a greater requirement to enable others in the new role (Charan et al., 2010). The management role demands more intra- and interpersonal relationship skills and in various studies, managers have indicated that these relationship skills are amongst the challenges to be faced in the transition to new positions (Hood, 1990; Howard, 2003; Liu, Englar-Carlson & Minichiello, 2011; Sithole, 2012) The steps to success are often not well understood and, as Charan et al., (2010) described it, the transition up the leadership pipeline requires the development of a different set of values, an understanding of which is an essential component of successful progression up the leadership ladder (Hogan, Hogan, & Kaiser, 2010).

The demand for good management increases when companies grow quickly or during periods of expansion when there is a need to appoint new, sometimes less experienced, people (Dolan, García, Diegoli, & Auerbach, 2000). In South Africa, there are additional factors that challenge managers' people management skills such as the cultural diversity and demands of affirmative action (Denton & Vloeberghs, 2003).

The political history in South Africa was marked by Apartheid and related structural discrimination against the Black, Coloured and Indian population. The concept of a previously disadvantaged individual (PDI) has become part of the fabric of societal discourse and employment equity is one of the processes instituted by government to redress the persistent economic structural discrimination (Bielikowski, 2012; Denton & Vloeberghs, 2003; C. Du Toit & Van Tonder, 2009). Post-apartheid graduates are finding that opportunity alone is not the panacea to all the ills of apartheid discrimination. The engineers who have graduated since 1994 experienced the multiple changes in education policy while, in many cases, being the first generation to go to college or university (Booysen, 2013; Dienga, 2012; Human, 1991). Their cultural heritage may not provide a sufficiently technologically rich foundation for the engineering environment which is often experienced as hostile, competitive and intellect driven with low social interaction. In the literature there are many initiatives to

attract the women to engineering as they do not often choose engineering as a profession (Frail, 2012; Hersh, 2000)When an engineer becomes a manager he is expected to embrace the new management role not only in terms of growing his own skills but also in terms of specific organisational constraints and governmental policies, such as employment equity, affirmative action, and labour law (Booysen, 2013). So the new manager must learn to develop previously disadvantaged individuals so that they can use their opportunities and become managers as well.

When managers are not able to lead in the South African environment and develop their subordinates as required by their leadership role, they would have failed in their mission to nurture the next generation of engineers. Managers can fail to manage due to various reasons that range from inadequate staffing to lack of strategic thinking; but seven out of ten reasons are related to the inability to manage and adapt their own behaviour towards others so that they react inappropriately under stress (Hogan et al., 2010). Inappropriate managerial behaviour may include unjustified risk taking as well as blind spots in the area of human interaction (Berglas, 2002; Passmore & Fillery-Travis, 2011). This need for skilful adaptability is also borne out in another study by Morrison, White and Van Velsor (1992). The new manager not only needs to learn new skills but more than that, he needs to learn a new way of relating; a new value set that includes the success of others (Charan et al., 2010). In South Africa, as in the rest of the world, there is a need for more and better managers but this is complicated by the paradox of high unemployment at certain skill levels and skills shortage at other levels according to Hall and Sandelands (2009) .

While there is some difference of opinion on the issue of shortage of managers, there is no doubt about the need for quality management or the high cost of leadership failure Hall, Munson, and Posner (1992). There is a large body of literature on engineering transitions based in Europe and America that provide insight into the challenges of developing the managerial skills of engineers in the First World (Hood, 1990; Howard, 2003; Johnson & Sargeant, 1998; Roberts, 1994; Thamhain, 1986, 1991; Wilde, 2009; Younts, 2006).

The question was then whether there were factors in the emerging or developing countries that modified the engineering management skills requirement as defined in the developed world literature considering that there are some unique influences in

Africa in general and South Africa in particular that could affect managers' behaviour. These influences on managerial transition included political history, language, and cultural heterogeneity amongst others. A search for literature on the engineering management transition based in the developing world returned some, although fewer, results (Baloyi, Van Waveren, & Chan, 2014; Hall & Sandelands, 2009; Human, 1991; Mahlangu, 2014; Sithole, 2012). The World Bank (2011) classifies South Africa as an upper-middle income economy along with countries such as Brazil, Mexico, Thailand, Argentina, Portugal, Malaysia, Chile, Panama, Russian Federation, and Portugal, to mention a few. The International Monetary Fund classifies South Africa as an emerging market country or alternatively as a newly industrialised country.

Given multi-cultural communities and the economic challenges in Africa, what assistance could be provided to assist new engineering managers to be effective in this environment? Some of the possible interventions are linked to training, mentoring, and coaching as part of a human resources strategy.

Coaching has been described as a process to enable individuals to develop the skills, knowledge, and options to become effective (Peterson & Hicks, 1996). Executive coaching emerged in the 1990s and was directed specifically at providing a way to improve the managers' interpersonal skills (Hogan et al., 2010). As a result, coaching was originally seen as a corrective measure and therefore may have conveyed some negative connotations (Peterson, 1996). However, as coaching gained more acceptance as a management intervention, it was seen as enabling employees to develop a new range of skills that could not be obtained in a standard classroom setting (Feldman & Lankau, 2005). This trend in executive coaching has grown in the last ten years with a surge in coaching offerings to business, promising improvement in people skills and performance (Kilburg, 2000; Passmore, 2010).

While coaching and mentoring provide a personal investment in the engineer-manager in South Africa, the successful transition requires more than just a short term investment in emotional intelligence and performance management skills. The multi-cultural environment is host to affirmative action, multi-language barriers, and pressure of production under conditions of dropping profits and rising unemployment. At the very least, this is a boot camp for life in a developing economy with changing

social demands and the pressure to provide infrastructure regardless of energy constraints and reducing financial certainty and foreign investment.

1.3 PROBLEM STATEMENT

The research problem is to determine what role coaching can play to assist engineers to transition to manager. The process will be to explore the challenges experienced by engineers in a developing country during their transition into management and to develop an understanding of the contribution that coaching can make to facilitate that transition.

The career transition is bounded on the one side by the previous engineering role and on the other by the managerial role. As Van Maanen and Schein (1977) describe it: a career represents a sequence of positions representing lateral, upward or downward adjustments of various intensities. This study focuses on the upward progression and the skills development required in the transition (Charan et al., 2010).

The context of this study sets the stage for a comparison between traditional management theory of transition in the Western management paradigm and the unique features of the South African management experience post 1994, given that the country, after 20 years of democracy, is still grappling with correcting structural discrimination and the effects of years of educational disparity.

1.4 SIGNIFICANCE OF THE STUDY

The extensive existing management research has covered a large area of knowledge as defined by the transition by engineers to management and is described in the literature review in Chapter 2.

This study proposes to fill a specific gap in the existing research as it will use research done by Howard (2003) with five participants in New York and apply it in a developing country. The difference is that this study is based at a parastatal company in South Africa; with specific attention to the diverse population represented in the sample to test or confirm the findings in Europe and the USA in the local context and to note the differences relating to political, social, and individual aspects.

The second differentiator is that this qualitative study aims to develop not only an understanding of the engineer's experiences in transitioning into management but to use that information to determine whether coaching can a play a role in facilitating the change and to define some critical requirements for such coaching.

In South Africa, the growing need to develop infrastructure means that more engineers are required to work on multiple projects located all over the country; from coal power stations in the North and East, Gautrain in Gauteng to commissioning wind farms in the Cape. The increasing need for engineers is created in part by the low number of engineers graduating and further exacerbated when engineers are also delegated to perform technologists' work and artisans' work as they are also in short supply. Alternatively, qualified black engineers may leave the industry for lucrative offers in the financial sector and white engineers may follow work opportunities in the Middle East when they are excluded from work opportunities in South Africa as a result of Affirmative Action.

This study may go some way to assist engineering businesses to create a better working environment for engineers who find it difficult to make the transition to management; to enable previously disadvantaged engineers to utilise their opportunities better; and to create a more attractive environment for women engineers in engineering management.

1.5 DELIMITATIONS OF THE STUDY

The study focuses on a number of managers, who were recently promoted from the ranks of engineers in the engineering function of an energy generating State Owned Company (SOC). The preferred employees were registered engineering practitioners including technologists who are moving into management roles. As the SOC management structure is not universal, the title of manager may include project manager and operational manager and even project engineer. This definition may be different in other companies so the principle applied is that this study has focused on the manager who is increasing his span of control or level of responsibility and it excludes first-line supervisors or team leaders.

Within the structural limitations of this study, the conclusions are limited by the size of the sample and the fact that all the participants are currently working for one

company. The findings may be limited to engineers in a parastatal engineering company as the sample constrains generalisability across industries. However, it should be replicable within the Engineering profession across engineering disciplines. The study refers to previous research as it is relevant but does not apply a longitudinal approach and only current perceptions of the engineers are included in this study.

The researcher is the instrument and as such, is part of the research methodology. This is recognised to be an advantage and a weakness. As such, the researcher has to identify the limitation and bracket her experiences and opinions clearly (Creswell, 2012).

1.6 DEFINITION OF TERMS

Various terms are used in the literature and some are defined here to ensure consistency and to create a pragmatic foundation for the structure of further arguments.

Term	Definition
Coaching	An on-going non-judgemental partnership between two people based on dialogue focussed on improving one or more aspects of personal experience and behaviour (Boyce, Jackson, & Neal, 2010). It relies on a contextual relationship and is based on confidentiality (Knight, 2009). This definition is general and has to be confirmed in the specific organisational context.
Derailment	A negative outcome as a result of unsuccessful navigation of the gap from engineer to manager (Hogan et al., 2010).
Developing Managerial skills	The skill set derived as a result of this research based in a South African company
Engineering Professional	Includes professional engineers, professional technologists registered with the Engineering Council of South Africa
International engineering management competencies	The managerial competencies that enable managers to manage deliverables and lead people in developed world environments. The skill set is based on European and American literature
A manager	A person, who plans, organises, directs, and controls the work of others; who has discretionary judgement on the application of resources such as funds, people, and materials and has a certain delegation of authority, depending on his position in the organisation hierarchy.

Term	Definition
Mentoring	The intervention whereby a senior and more experienced person provides guidance to a neophyte. This definition is general and has to be confirmed in the specific organisational context.
Phenomenological study	The research into experience or an aspect of life by collecting data about those experiences and extracting the essential themes or common meaning into abstract descriptions in order to capture a sense of the person's perceptions (Moustakas, 1994).
Phenomenon	The concept or experience that is being studied (Creswell, 2012).
A Professional engineer	Person who is required to have obtained a degree in engineering which is recognized for professional status by the Engineering Council of South Africa and has a minimum of three years postgraduate appropriate experience (Engineering Council of South Africa, 2012).
A Professional Technologist	A person who is required to have obtained a degree in engineering at a University of Technology which is recognized for professional technologist status by the Engineering Council of South Africa and has a minimum of three years postgraduate appropriate experience (Engineering Council of South Africa, 2012).
A Project manager	A person assigned by the organization to achieve the project objectives by the application of knowledge, skills, tools, and techniques to project activities to meet the project requirement, which is a condition or capability that must be met or possessed by a system, product, service, result, or component to satisfy a contract, standard, specification, or other legally imposed documents.
Receiving manager	The manager who identifies and appoints the new manager.
Transitionery engineering management competencies	A list of the management competencies that enable managers to manage deliverables and lead engineers in a developing country like South Africa. The skill set is based on available literature and research in progress in South Africa. The word transitionery is defined in the Collins English Dictionary (2011) as an adjective form of *transition* (Latin *transitio*) meaning 'to cross over' or 'change state from one to another'. The more common form is *transitionery* however this uncommon form is also accepted. It is used in this report to avoid possible confusion.

Note on professional status of engineering professionals

As the statutory professional body, the Engineering Council of South Africa specifies that professional engineers are involved with the progress of technology through innovation, creativity, and change. They apply a range of fundamental principles, to develop and apply new technologies, promote advanced designs and design methods; introduce new efficient production techniques, marketing and construction concepts, in order to pioneer new engineering services and management methods. They may be involved with the management and direction of high risk and resource intensive projects. Professional Engineers undertake and lead varied work that is essentially intellectual in nature, requiring discretion and judgement. Such work is based in proficiencies and competencies derived from experience and research. In the interests of society this work is required to provide cost effective, timely, reliable, safe, aesthetically pleasing, and environmentally sustainable outcomes. The Engineering professional defines, investigates and analyses complex engineering problems and is described in detail in the competency standard provide on the website of the Engineering Council of South Africa (ECSA) . ECSA was established in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000).

A professional technologist attains a level of competence through a combination of education, training, and experience. As the statutory professional body, ECSA requires that a technologist is able to apply engineering principles and techniques to solve engineering problems of varying complexity as defined in the particular industry. Their work may include a combination of, but not necessarily all, the engineering functions of design, research and development, commissioning, project or construction management, measurement and testing, planning, quality assurance, production, maintenance, management and any other activities which require a high level of competence.

The Project Management Institute (PMI) is the international body for Project Management best practice, training and owns the Project Management Body of Knowledge (PMBOK). Requirements include the quantified and documented needs, wants, and expectations of the sponsor, customer, and other stakeholders. It is important to take note of the contractual nature of this activity (PMI, 2012).

In this document in the interests of readability, when referring to an engineer or a manager the word ‘he’ includes ‘she’ and ‘him’ would include ‘her’. When referring to

an engineer or technologist, the words ‘engineering professional’ is understood to include both.

1.7 ASSUMPTIONS

The participants in the purposive sample are recently promoted engineering managers. The preferred period is between 12 to 30 months. Using a small sample limits generalisability across industries but the methodology should enable replicability. The final number of respondents of 16 was adequate to achieve saturation and derive meaningful themes.

Individuals show integrity and contribute meaningful data in the interviews. The study includes managers of both genders, selected from various population groups. The constraints may relate to the willingness of these managers to discuss their experiences at the right level to reveal the stress inherent in the transition.

Although the confidentiality of the participants is safeguarded, the loss of participants’ anonymity could place the validity of the study in jeopardy as they may not be prepared to share sensitive information.

The difference between the engineering role and the managerial role outweighs the differences between engineering disciplines. If this proves inaccurate so that one discipline provides highly contrasting information, the researcher shows the differences in the results and probes the issue specifically.

1.8 OUTLINE OF RESEARCH

The chapter outline begins with the background and context of the study which includes the objectives the research questions importance of the study and an overview of the study. Chapter two covers the theoretical and empirical literature on issues under investigation and provides an overview of the SA labour market for engineering professionals; including the need for engineers to develop infrastructure and the effort involved with producing qualified and competent engineers. Research methodology follows and includes the choice of sample and data collection. An overview of the analysis and thematic structure closes the chapter.

The research findings that agree with the main points covered in the proposed model are contrasted with the findings that were determined from the interviews. The main

variables and the analytical model are applied to this data. It deals with the findings revealed in the research that are not part of the model determined through the literature. It provides a view into the unique features revealed by this research. The discussion of the findings and recommendations based on the findings complete the report.

2. LITERATURE REVIEW

This chapter provides the context to the study on management and transition to management by engineers. A short overview of the engineering labour market provides context to the media statements regarding shortage of engineering skills as well as some background on engineering and managerial competencies as these relate to the research question. In order to explore the challenges faced by engineers during the transition to management, this chapter will consider the existing research that informed the study and then expand to include additional articles and literature on transitions. The last section provides the link to coaching.

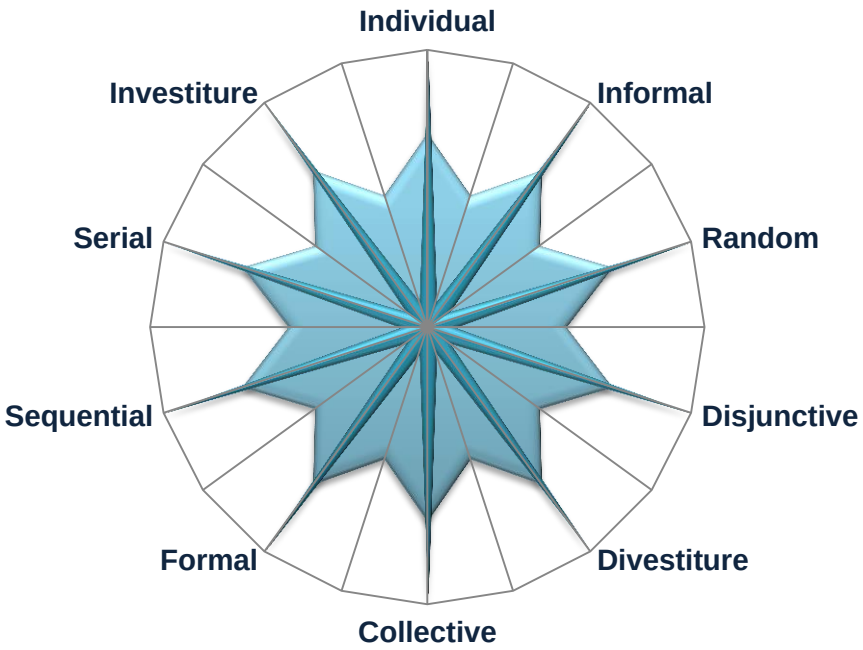
The academic preference is usually for articles and research done recently or at least in the 10 years before a thesis. In researching engineering management the articles aimed specifically at new managers and transition challenges were clustered in the 1980s and 1990s. The surge in research into the transition of engineers into management appears to be linked to years of economic growth and infrastructure development between 1980 and 2000. This is not a coincidence as engineering, like architecture is vulnerable to economic cycles. The significance of an economic upturn in the demand for engineering labour will be discussed later in the chapter. In recent years the articles on engineering careers often refer to research done during the 1980-1990's. Where the older research articles were more relevant to this study I preferred using these articles and they will be found in the citations. Along with the trends in management research the later articles will be cited in preference to the earlier literature where applicable. As most engineering management research was done overseas, the literature review will refer to the articles set in Europe and the United States. This study focusses on the nature and challenge of the engineering management in a developing country and so the references that refer to the African and South African context will be identified clearly as such.

2.1 ORGANISATION AND SOCIALISATION

Organisation and functional differentiation in a complex social system are designed to stabilise the production processes in order to benefit from learning and repetitive actions (Greiner, 1972). In times when the business environment was less dynamic

an organisation could continue in the same manner for a longer time period (Crawford & Nahmias, 2010; Kotter & Schlesinger, 2008). A role or structure change represents a particular challenge for the person(s) involved, as they have to learn new skills; for the organisation the challenge includes having to accommodate the new learning and the period of adjustment.

The literature on organisational socialisation explores how to integrate employees into the new role when they are appointed to enable them to become effective as soon as possible. Socialisation involves building personal bonds, attachments, and problem solving opportunities that may help in improving communication and establishing ties between employees with the view of providing mentorship to employees and enabling productivity (Deshopande & Golhar, 1994; Dworkin, Goldstein, & Drozdenko, 2006; Golhar & Deshpande, 1997). The theory of organisational socialisation as suggested by Van Van Maanen and Schein (1979) defined dimensions to describe collective-individual, formal-informal, sequential-random, fixed-variable, serial-disjunctive and investiture-divestiture. The theory was expanded to include context, content or social aspects of socialisation as explored by Milligan, Margaryan, and Littlejohn (2013).



Source: Adapted from Allen (2006, p. 5)

Figure 1: Aspects of Socialisation

Colleagues play an essential role in the process of socialisation as they know the unwritten rules in a group and they provide the interaction through which learning can take place. Learning can be seen through discussions with others, vicarious learning, coaching and mentoring, learning by teaching and also through trial and error. New managers and new engineers alike, learn fast when they have to solve problems.

In the beginning a group with diverse membership experiences conflict whereas it can contribute to better decision making when the different individuals stop judging differences, adjust and build trust, and learn to appreciate the variety of contributions (Human, 1996; Kokt, 2003; Shen, Chanda, D'Netto, & Monga, 2009).

In Sub-Saharan Africa, language and culture diversity presents at all levels of management. In Western literature on engineering management, diversity is mostly discussed in the context of minorities where African-Americans, Hispanics and other groups are small percentage of the population. On the continent of Africa, the many language and cultural differences cannot be viewed as a minority concern as they are in the majority. As Feely and Harzing (2003) note, a language barrier contributes to negative consequences, undermines trust, and affects understanding. Management must be prepared to deal with the consequences as productivity suffers immediately when the cohesion in a group is low.

The literature review provides a context for the study into engineers when they become managers and the challenges they face during the process.

2.2 POST-APARTHEID SOUTH AFRICA

After the democratic election in in 1994, the writers of the constitution acknowledged 11 official languages in South Africa where each language represented a unique cultural group with their own customs and values. Earlier in the 1990s Hofstede (1993, 1994, 1996; 2004; 2011) explained in theory how diversity manifests through the relationship to power, managing risk, communalism amongst other factors; and it took 12 years for South African researchers to report on the theory as applied to the

cultural diversity in the post-apartheid business melting pot (Meiring, Van de Vijver, Rothmann, & Barrick, 2005; Nel et al., 2012).

The diversity is not reducing as immigration brings work seekers from Zimbabwe, and from other African countries as far North as Cameroon and Senegal. In addition the local populations in South Africa, especially in urban settings, are currently in transition from communalistic to more individualistic and competitive expressions as the links to the rural areas weaken or break down (Donaldson, Mehlomakhulu, Darkey, Dyssel, & Siyongwana, 2013).

2.3 MANAGEMENT IN THE DEVELOPED WORLD

Socialisation involves building personal bonds, attachments, and problem solving opportunities that may help in improving communication and establishing ties between employees with the view of providing mentorship to employees and enabling productivity (Deshopande & Golhar, 1994; Dworkin et al., 2006; Golhar & Deshpande, 1997).

2.4 LABOUR MARKET FOR ENGINEERS

The economic factors influencing the market for engineering services should be mentioned. Ryoo and Rosen (2004) confirmed that the market for engineering skills market reflects economic forces and the demand for engineering skills is elastic with respect to the price of engineering services. With regard to skills supply, the student applications to university engineering courses increase with a positive perception of career prospects in the industry. The engineering courses are amongst the more challenging at university and the actual graduate throughput is as low as 1% (Centre on Higher Education, 2009). In a free market environment one would expect the price of engineering services to rise during a time where there was skills shortage (Aiman-Smith, Bergey, Cantwell, & Doran, 2006; Clarke & Herrmann, 2007; Rasool & Botha, 2011; Wolff, Callahan, & Spencer, 2009). The increase is not uniform across all engineering disciplines.

Since engineering is not a monolithic study discipline, this would explain, at least in part, why there are unemployed engineers in one area of engineering at the same time as there is a shortage of engineering skills in another discipline. Consider the

market for software engineers during development of networking and the issue with Y2K late in the 1999s a case in point.

2.5 BACKGROUND TO ENGINEERING MANAGEMENT CAREERS

The need for engineers is part of a greater skills shortage in South Africa. Price Waterhouse Coopers (2011, p12) identified skills shortages through many years aggravated by the changing demographics of the labour force and the ever-increasing diversity of the workforce. Simultaneously the call for, work–life balance and the effect of recent recession means that the inelastic labour market is fuelling increased competition between organisations for high potential individuals who are capable of making significant differences in organisational performance.

Minister of Science and Technology, Dr Naledi Pandor refers to the lack of graduates in Engineering and Science as one of the most worrying (South African Press Association, 2015). The lack of throughput is evidenced by a 42% to 65% graduation rate of engineering students depending on the year and the discipline (Centre on Higher Education, 2009). While infrastructure development is essential for economic growth in developing countries like South Africa and the demand for technically trained engineers and competent engineering managers has been acknowledged by researchers the inability of education initiatives to change the direction of graduate performance can be as a result of a symptomatic approach to a systemic problem (Hall & Sandelands, 2009; South African Institute of Electrical Engineers, 2014).

Specifically the engineering career tends towards management and managerial skills are required in addition to technical engineering skills. The technical part of engineering education receives regular attention and reviews in industry according to Grimson (2002) and the call to augment engineering education with management skills and indeed more non-technical skills in order to provide engineers with the required foundation to be effective in business, is increasing (Cordova-Wentling, Champaign, & Price, 2007; Grimson, 2002). Engineering had to move from the rarefied confines of the laboratory to be subject to the push-pull of market forces and the politics of the boardroom.

Although training and development has been seen to be a priority business strategy in organisations; the central issue is that Black advancement and integration has not

been fast enough to meet the political transformation agenda The shortage of competently skilled Black managers and compounded further by a lack of suitably qualified and trained personnel from skilled entry point to executive level

Current surveys indicate that there are only 11 percent Blacks in key occupational groupings both in the private and public sectors According to the FSA-Contact's fifth annual affirmative action monitor among corporations, 6.2 percent of employed professionals in 1994 were black, while for 1997, the figure increased by 9.1 percent to 15.3 percent. At 2000 projections the indications were that it would show a further jump to 33 percent. Thus at that stage, there was a need to train and develop, some 10,000 black managers per year. A further concern was that companies were prepared to pay a premium for competent Black managers so the market is skewed by the race preference.

Training and developing Black professionals to fill managerial positions can be complicated by the concern to avoid tokenism and compounded by the shortage of skilled Black managers. Some organizations have adopted a proactive stance to accelerate the advancement of blacks into supervisory and managerial roles. The importance of training and development of black managers is part of the human strategy. The quality of an organization's human resources contributes in part to the improved productivity and performance and diversity. The turbulent environment creates fundamental change posing new challenges and requiring organisations to become more market ware and responsive. These challenges include affirmative action organisational transformation, employment black advancement, and redress.

These issues face corporate organisations as well as parastatals or State Owned Companies (SOC) such as SA Airways, SABC, and Eskom. The practice of management is no longer just a matter of developing a person individually as a leader but includes *leadership* as a social construct. The winds of political change and the aggregation of major challenges have obliged organisations to fast-track management transformation interventions. It is widely accepted that the supply of Black managers for South African organizations will not be adequate to support the desired growth rate needed by the growing economy to manage job creation. The situation in engineering companies is exacerbated by the shortage of black engineering graduates.

Once in senior management, organisations do support managers with development interventions and a personal executive coach at R4000 per hour is considered an additional benefit to accompany the corner office. A few examples indicate that Corporate Executive programs are priced at about 10 % of executive's salary for a yearlong coaching programme (20/20 Executive Coaching, 2014).

Senior managers started out as new managers. There are indications are that there may be benefit in supporting engineering managers earlier in their careers to avoid loss of productivity, motivation and the expense of recruiting new managers (Hogan et al., 2010; Kaiser, Hogan, & Craig, 2008).

The step-change in managerial demands during the early part of the transition is acknowledged as a watershed in engineering career development (Benjamin & O'Reilly, 2011).This view is supported in a number of studies set in Europe and America (Bland, 1996; Hood, 1990; MacTavish, 2007; Younts, 2006). Bland (1996) examined the transition from engineer to manager and focussed on role of education in a study set in the USA; he identified that a planned developmental experience through many varied business functions contributed to successful general management. His research focussed more on first line managers or team leads.

Local studies by Mahlangu (2014) and Sithole (2012) indicate that the new managers in South Africa need similar interventions. In a study, Booysens (2000, p34-38) highlighted the dilemma that South Africa female managers experience in a traditionally male dominant environment. In his study males scored higher in cultural dimensions such as performance orientation, collectiveness, assertiveness and future orientation while females placed social equality significantly higher than the men. Typically, the issue of management skills and organisational policies and procedures become part of the discussion on efficiency and effectiveness.

Dr Ramphele (2008) commented that the South African society has a strong sexist, racist, and authoritarian culture. The redefinition of power away from the control model to an enabling model would be more sustainable in the long term as good leadership seen in this context then becomes empowering for all to rise to their full potential for the greater good of the institution and society as a whole.

The definition of engineering as a male profession and management as a role where males are preferred creates an unstated assumption underpinning much of the

discourse in engineering management (Hall & Sandelands, 2009; Hersh, 2000; Lawless, 2008; Ryoo & Rosen, 2004; Srour, Abdul-Malak, Itani, Bakshan, & Sidani, 2013). Issues relating to structured discrimination, role of language in education and power distance point to this unstated assumption. In the International management model there is a tacit understanding that the manager is white and male, is respected as part of a social class; he talks English as a first language; grew up in an English-speaking home and was educated in engineering technology through an academic school environment and is rooted culturally in an individualist business milieu. This study starts at the International Management model but focusses on the uniquely different aspects of the transition from Engineer to manager in a developing country. Here the manager is not White, not necessarily male and from a different social class; who did not grow up in an English-speaking home was not educated in engineering technology or an academic school environment and is rooted culturally in a collective social milieu in one of more than 20 languages and dialects.

In South Africa the context of transition contains a few added dimensions. These dimensions include culture diversity, language barriers, power distance, as well as the historical legacy of structural discrimination and measures like affirmative action (Coetzee, 2008; Coetzee & Gunz, 2012; Coetzee, Mitonga-Monga, & Swart, 2014; Potgieter, 2013). There are more previously disadvantaged managers fast tracked to senior management and promoted into roles without the benefit of learning through first-hand experience and developing an own experiential basis for decision making. The result is that some managers may be unprepared to deal with long term decision making and risk management. In addition their receiving managers may be equally unprepared to face the new manager who is so different from the assumed engineering profile. Through no fault of their own; they have never had to deal with the intricacies of engineering decision under the two umbrellas, consequential failure when the languages in the tower of babel creating misunderstandings, and correcting the inevitable financial cost implications with the accompanying blame game.

The question is what can be done to assist engineers as they become new managers given that the situation is so complex? What can be done to assist receiving managers as they are called upon to coach new managers to succeed them? Considering the possible interventions that can be used to assist new managers

there is training, job shadowing, mentoring, and coaching amongst many others. The question is in what way support can be provided to new managers and how to contain costs and improve the return on management since these managers are still untested and the organisation may not be willing to invest in the manager until there some confidence that the return will be worth the investment in the new manager. (Jinabhai, 2004)

What really changes with a change in managerial levels? The main change at this level is that the engineer has to become a leader of people who are doing engineering work instead of an individual contributor; he now becomes the motivator and leader of a group of people like himself. Charan et al. (2010) provided the framework to discuss the change in levels of management. At this level the individual contributor becomes responsible to work through others and instead of producing work enables others to work

In summary: the literature review highlights the need for senior engineering managers to become coaching managers to new engineering managers.

2.6 DEFINING THE TRANSITION TO MANAGEMENT

Many engineers view a promotion to management as an ideal (Aucoin, 2002).As a manager they will be able to exert more control over a project and be able to manage the variables in the environment. Johnson and Sargeant (1998) refer to the engineers' reasons for moving into management as the need for recognition, increase in monetary reward. They soon discover that effective operational control of a volatile environment requires them to upgrade their managerial skills. Where previously they could resent a manager for some action, they now find themselves facing the same situation that necessitated the manager to act in the unwanted way and they have to behave in a similar fashion.

The transition from engineer to manager is characterised by a massive change in workload, increased demands from senior managers, and more responsibility for deliverables. Firstly the workload changes as the engineer who was previously responsible for his own engineering design and project leadership is now accountable for the delivery of the project or product not just one design. He has to lead, motivate, and control a group of other engineers to produce work. Some

engineers have expressed this as “herding cats”. The engineers that report to the new manager may also resist managerial control from someone who used to be an equal. Other administrative demands increase and financial reporting to senior management on the performance of the department under his command adds to the daily task list. Where before he could work for most of the day as he planned he now has to attend meetings and arrive at the end of day not having done his own design work and with an even longer action list. The responsibilities and reporting structure expand and deepen as the new manager becomes part of other groupings in the organisation. These changes require that the manager develop an ability to adapt to change, to stay calm under pressure, and to develop new skills.

The structured and methodical engineering mentality also has to start dealing with a very unstructured and chaotic human interaction environment. It is as if two worlds collide. Left brain structure collides with right brain creativity. The new manager and the receiving manager will both need to accommodate more crisis and creative thinking in an unstructured environment

As described in Hood (1990) the preparation and development of an engineer prior to the transition will be instrumental in the successful completion of the process. In a qualitative study, Howard (2003) interviewed five aerospace engineers in Long Island, New York to determine “the experiences, challenges, and individual transitions for engineering managers” (p. iii). He found that engineers typically experienced the overload of demands, significant changes in relationships to peers and difficulties with delegation.

Engineering attracts people who by nature are “driven by achievement” and they are more inclined to solve technical problems as opposed to people problems (Ashley, 1993; p62) (Aucoin, 2002). If the engineer is unaware of his own disposition and also not sensitised to the need for additional people skills, his natural inclination to view any issue as problem to be solved may create conflict in the workplace, making it difficult to delegate. The volume of work will then lead to overload before the engineer realises that he is not able to do everything himself as he did before.

While most engineers do see the promotion to management as a positive reinforcement of their leadership capability and potential it is not an undiluted advantage. There are many view points on this issue. Roberts (1994) disagrees and

asks whether promotion to management is not a misallocation of resources. So the question is: Do we use people in their strength or do we ask them to adapt to the operational requirements in the organisation? The question has been asked whether promoting engineers into management is even a good idea given that engineers are often perceived as being ineffective managers (Johnson & Sargeant, 1998). The organisation loses twice: firstly by gaining an ineffective manager and secondly by losing the technical skills that originally initiated the promotion; skills South Africa cannot afford to lose as Minister of Science and Technology, Dr Naledi Pandor noted at the opening of Africa Engineering Week in August 26, 2014 (South African Institute of Electrical Engineers, 2014). She believes South Africa needs a 400% increase in the number of engineers and that the current increase in student numbers is not enough to ensure the future of South Africa. “The future of our country lies in engineering. South Africans especially our youth need to understand the extent to which Engineering, Science, and Technology have benefited the economy” (p1). The last thing we need is to lose engineers through carelessness.

Becoming a competent engineer takes time. The course is difficult and many students do not complete it as the throughput figures show (Centre on Higher Education, 2009). The process to become a professional engineer is illustrated in the diagram from the Engineering Council of South Africa in Figure 2 (ECSA, 2014)



Figure 2: Professional Engineering Development

Source: Adapted from Engineering Council of South Africa (2014)

This model illustrates the critical milestones completed by a person on the path from school to professional engineering registration. Once qualified the engineer is required to register with ECSA as a candidate engineer, he will gain experience in his chosen discipline and the registration requirements are onerous to ensure that only engineers who are competent will be registered and allowed to perform the work The aspirant engineer has to follow a programme with an accredited institution. After graduation he has to register as a candidate engineer and be trained to gain experience and training so that the structured work allows him to develop engineering judgment. Many companies offer the required training but this is not guaranteed and many engineers have complained that they were doing administrative work and not exposed to actual engineering and find it difficult to register.

If they meet the standard for professional competency they are granted professional registration and the responsibility to work as an engineer and approve work that is in their experience. ECSA is very clear that an engineer is not allowed to do work he is not competent to do; if he does so he is liable for legal and professional sanction. Every five years the registration requirements include that the continuous professional development be proven to include working, mentoring, and retraining. The definition of competence includes the five areas listed below:

1. Group A: Knowledge-based engineering problem solving
    a. Outcome 1: Define, investigate and analyse *engineering problems*
    b. Outcome 2: Design or develop solutions to *engineering problems*
    c. Outcome 3: Comprehend and apply knowledge: principles, specialist knowledge, jurisdictional and local knowledge
2. Group B: Manage Engineering Activities
    a. Outcome 4: Manage part or all of one or more engineering activities
    b. Outcome 5: Communicate clearly with others in the course of his or her engineering activities
3. Group C: Impacts of Engineering Activity
    a. Outcome 6: Recognise and address the reasonably foreseeable social, cultural and environmental effects of engineering activities

b. Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her [level] engineering activities

4. Group D: Exercise judgement, take responsibility, and act ethically
    a. Outcome 8:Conduct engineering activities ethically
    b. Outcome 9:- Exercise sound judgement in the course of *engineering activities*
    c. Outcome 10:- Be responsible for making decisions on part or all of *engineering activities*
5. Group E: Continuing Professional Development
    a. Outcome 11:- Undertake professional development activities sufficient to maintain and extend his or her competence

Source: (Engineering Council of South Africa, 2011, p. 3)

Using knowledge to solve problems entails defining the engineering problems, investigating options and analysing the potential solutions. Initially this work will be done under supervision until the engineer becomes confident to perform the work independently. As experience grows and as the reader will see later, the more the trainee engineer is exposed to real world projects the quicker they gain experience. It is expressed in a statement often directed at new engineers to say “increase in your failure rate”.

This statement that the engineer should increase the level of risk taking so that he can learn what works and what does not. The learning is stepped up to include the application of principles, specialist knowledge, jurisdictional and local knowledge. At some stage the engineer has to develop an ability to predict if there will be unintended consequences or effects as a result of a design or construction. He should recognise and address the reasonably foreseeable social, cultural, and environmental effects of engineering activities while meeting all legal and regulatory requirements. His first requirement is to ensure the Health and Safety of all those who work and operate the site as well as those who will occupy it. Finally he is expected to act ethically with due care and diligence and exercise sound judgement in the course of engineering activities. He accepts responsibility for decisions on part or all of *engineering activities.* After all that he is required to take care of his

education and continued professional development as prescribed by the Engineering Council. These competencies can be visualised using a radar diagram as Figure 3.

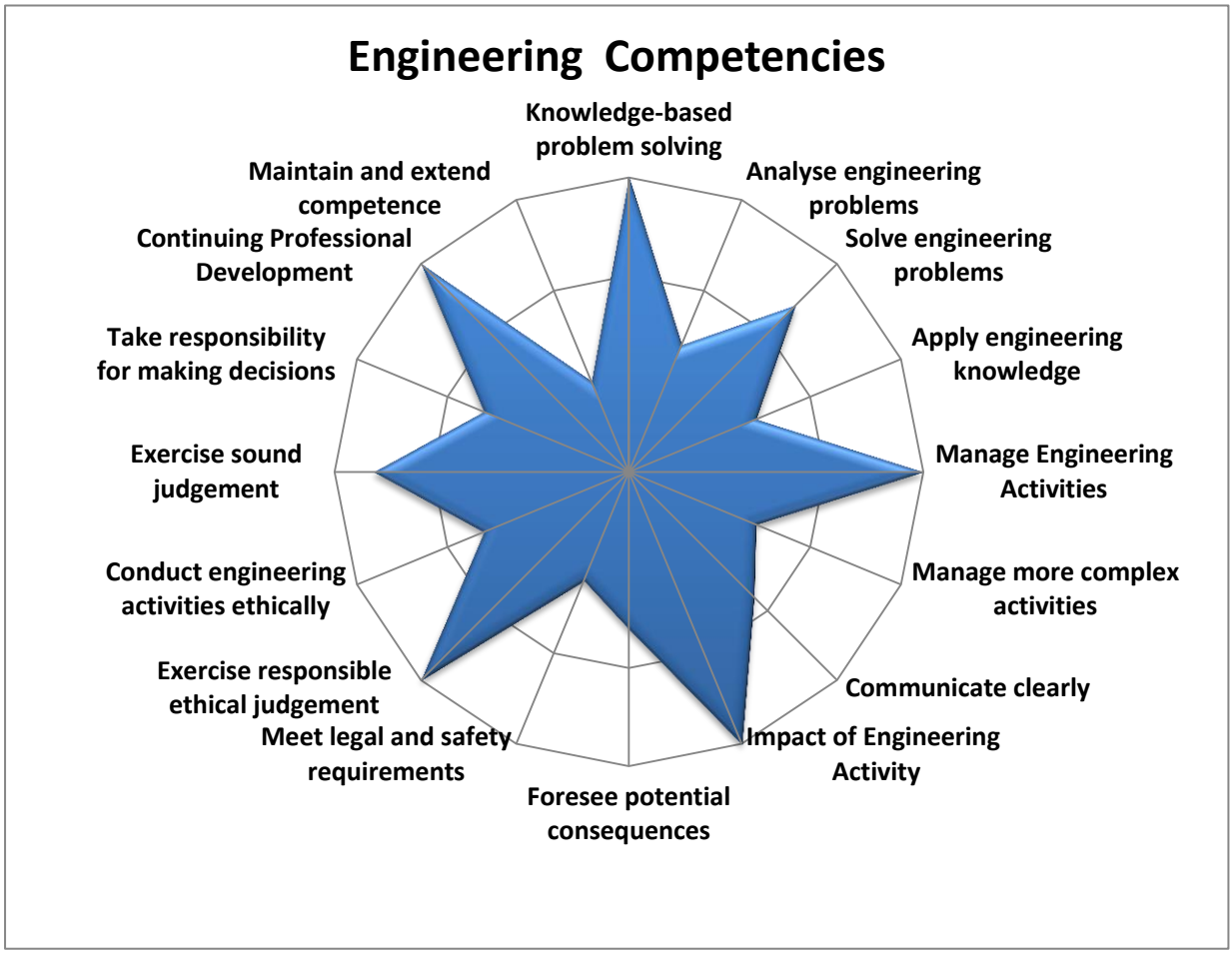


Figure 3: Engineering Competencies

Source: Engineering Council of South Africa (2011)

The scale on this diagram is not significant as it should indicate some strengths and areas for improvement. This picture is important nonetheless, because it shows why engineers tend to management. The words *manage, communicate* and *exercise judgement* appear in the competency list of the candidate engineers development and these same words will be noted in the manager's competency diagram later in the document.

As the engineer works in a regulated industry he has to learn the regulations and legal compliance rules of the business in order to manage engineering activities without exposing himself and the organisation to legal sanction. During the first three years the training process should ideally be structured and prepare the engineer-in-

training to register as a professional engineer or technologist. The engineer is required to take on increasing management responsibility of delivery of designs on projects. It is impossible to play this role without a good command of technical language as well as interpersonal communication. Engineers are often the interface between the client and the contractor and without communication skills the consequences of loss of meaning can be expensive.

Minister of Department of Science and Technology 4 Dr Naledi Pandor urged the improvement of student throughput in the engineering pipeline – from school to graduate professional. She mentioned that there is no Intel manufacturing facility in Africa as there are not enough engineers to support high technology required (Botha, 2014, p1).. She appealed for the transformation of curricula to consider the humanities and the need for social innovation (Botha, 2014). This point is significant as the developing world expects engineers to be part of a social structure and not ivory tower academics. The needs of the people in rural areas cannot be met by expensive third world solutions.

The premise of this study is that the transition of engineers into managers in the South Africa context should be conducted with due consideration of all contributing factors including personality type, situation, organisational and social culture and business environment to ensure that the person, the organisation, society, and the industry all benefit.

2.7 THE ENGINEER'S POINT OF VIEW

The next question is what makes engineers happy? Why do they do what they do? And how does that affect the transition to management? Engineers derive satisfaction from the level of challenge they perceive in their daily tasks and the personal satisfaction of doing the work (Johnson & Sargeant, 1998). In the article the authors compare the level of satisfaction experienced by engineers when doing technical work as opposed to they execute routine administration expected of managers and comment that managers are motivated by more extrinsic motivations in entering management such as remuneration and status. Ashley (1993) explores the importance of motivation further in that engineers need to feel relevant and significant to the organisation and responsible to their fellow engineers for the quality

of creative design and that the recognition from supervisors may be less important than recognition from respected experts.

2.7.1 Shortages in the Engineering Labour market

The discourse around skills shortage in engineering presents some conflicting parts to the picture as discussed by du Toit and Roodt (2009) . In order to make sense of the meaning of *shortage* a concise discussion of the engineering labour market may serve to provide some clarity.

All engineering disciplines are not valued the same way and the demand for engineering services varies with skill and experience. There are many disciplines and new directions are opening as human requirements change. The major disciplines: Civil, Electronics/Software, Electrical, and Mechanical Engineering account for more than 66% of all engineering bachelor's degrees. The next set of disciplines includes Aerospace, Biomedical, Chemical, and Industrial -Manufacturing Engineering and account for 20% of all engineering bachelor's degrees. The less popular disciplines such as Agricultural, Architectural, Engineering Management, Engineering Physics/Engineering Science, Environmental, General Engineering Studies, Materials, Mining, Nuclear, and Petroleum Engineering account for less than 10% of all engineering bachelor's degrees. The Specialty Disciplines (such as Ocean Engineering) make up less than 5% of all engineering bachelor's degrees.

The engineering labour market as described in Dienga (2012) lies in the economic balance between of the supply of hours and the demand for production. This means that different engineering disciplines can be in demand at different times and students need to understand the demand cycles when selecting a direction. In the late 1990s with the Information Technology bubble many engineers diverted into software development. With the 2010 World Cup and 2013 infrastructure projects Civil engineers are in high demand.

The market for engineering labour is made visible in the premium that employers are willing to pay for engineering staff. The list of engineering salaries in provided by The Salary Explorer (2014) shows that the average salaries of engineers are spread wide across discipline and vary with experience and age. The complex nature of engineering is highlighted in the salary distribution where an engineering technician

can expect to earn R170, 000 per year; a Mechanical engineer expects R300, 000 and an Electrical engineer R380, 000 per year. The exponential increase is visible as engineers go into management with an engineering manager earning over R550, 000 and as the responsibility, experience, and scarcity rises a company would expect to pay R1, 150,000 per year for a project director. These figures are not unique. Some senior project engineers' salaries vary between R 503 000 and R1 440 000. (The Career Junction, 2014) compare that to a senior construction project manager in the Western Cape who could expect between R855 372 to R1 337 153 and on paper the salaries are comparable (The Western Cape, 2014). A labour shortage as indicated by an increase in demand and premium salary can be seen in the salary surveys of 2014. According to the Career Junction Index in 2013 mechanical engineers received the highest salary increases as well as Safety & Health managers and production managers. In 2014 the expected increase would be between 10 and 15% (The Career Junction, 2014).

According to the South African Graduate Employers Association (SAGEA) Candidate Survey 2014 of employers showed a complex picture where the competition at the top meant that good candidates could select positions although the number of openings had not increased. The largest employers were banks and investment companies. There is competition for the best graduates and most employers receive more than 1,500 applications for open positions. There is still a shortage of the right employability skills and degree mix. The highest starting salaries in 2014 included civil engineering, chemical engineering, mechanical engineering, and mining engineering.

Another aspect of the shortage lies within the group of engineers with 10 to 15 years' experience. These engineers would have been born in the 1980s and seen the first wave of Affirmative Action in 2006. If the engineer progressed according to the model they would have been the mentors and chief engineers to guide the new engineers and the new managers. But this is where the shortage is. The chief engineers and managers with 10 to 15 years' experience are working to do the design work, manage, and mentor a group of new engineers about 3 or 4 times the preferred number (Private conversation with Senior Manager).

Considering the age distribution of civil engineering professionals in South Africa, there is a large group of experienced engineers in their late forties and older, while in contrast there are insufficient numbers of mid-career staff to carry out the bulk of production (Lawless, 2008). As long as vacancies persist at management level, entry-level (graduate) recruitment will be restricted since there will be no one to train new staff members or conversely some of the new engineers will fill those positions before building the wide experience required to make good managers (Private conversation with Senior Manager)..

Factors that influence an engineer's career are training, experience, and progression. In the state owned enterprises progressions have been put on hold for financial reasons and this is very short sighted as these careers can never catch up the development and the time needed for experience. The unintended consequences can be that these engineers move to other fields. Engineers will look at the labour market and migrate to the better rewarded positions. From 1996 to 2005 most engineers worked in manufacturing, financial and management consulting (Kraak, 2004). Many consulting engineers joined large financial and management consulting companies or smaller engineering companies. A significant 25.2 percent worked outside the engineering sector in finance. These skills are not lost in the full sense as their insight and abstract conceptual skills are contributing to risk management and long term planning but they are lost to the crucial development of infrastructure and training the next generation,

Given that the engineering profession has complexities similar to some other professions and a few ones unique to itself, what influences a person to consider engineering as a profession? The factors that contribute to choosing engineering as a profession is generally having exposure to a person who is an engineer; good mathematics and science marks at school and stimulating home environment According to the Royal Holloway survey for instance, having a family member in the industry was an important factor in choosing engineering as a career (Ansari et al., 2002). One can expect that for lawyers and doctors as well. Studies in America indicated that 59% of White people surveyed and for 48% of those from other ethnic groups this aspect contributed significantly to exposure and familiarity with what engineers really do. However, compared with other ethnic groups, White people had

influences from a greater range of sources, such as careers advice or teacher encouragement (Ansari et al., 2002; Royal Holloway, 2002). Here is where this study has to take a detour to see if the same applies in a developing country such as South Africa

According to Rasool and Botha (2011) the shortage of technical graduates is largely the result of the poor quality of schooling for Black learners in the past. Currently the lack of competent teachers and supportive school environment leading to poor results in mathematics and science, contribute to the systemic problem. The school system, financial difficulties are amongst the main reasons that many Black students who do enter tertiary institutions either drop out or pursue careers outside the science and technology fields (Pandor, 2008).

Many potential students still remain marginalised because they lack the specialised skills wanted by the industry. This concept is referred to as employability. If only 58% of African youth between 15 and 24 qualify to apply at university and 28% of students are in the Science Engineering and Mathematics fields and only 35% graduate; the 1, 500 engineers registering per year are not enough to support the technological and infrastructure requirements of a developing country (Ray, 2009, p. 11).

Mathematics educators have questioned the standard of the mathematics examination papers. A well regarded politician, medical doctor and former anti-apartheid activist, Dr Mamphela Ramphele expressed her concern saying that if the standard for the future was not good enough, then students would not be able to pursue mathematics related careers like engineering, business science, and architecture (Ramphele, 2009, p. 19). As a former Vice-Chancellor at the University of Cape Town and a one-time Managing Director at the World Bank she appreciates the importance of education in uplifting people from poverty.

Political controversy around White skilled labour and the need to match National Demographics obliged skilled Whites to explore alternative labour markets and according to Barker (1997), some graduates leave Africa for work in the Middle East and Europe while some leave the field to work in investment companies. Affirmative action is a large concern of White people according to Mattes and Richmond (2000) and many White South Africans have left because of affirmative action to find work overseas as noted by Ramphele (2008).

Once we accept that there is a shortage, how big is the shortage? MacKenzie-Hoy (2008) calculated we needed 16 times more engineers than we had at during 2008. According to McKechnie (2008), the shortage of engineers, quantity surveyors, technicians, and architects in the construction industry placed great pressure on infrastructural growth. Seven hundred engineers join the economy every year from universities. By 2010 the need was about 11, 000 engineers per year and aggravated by large projects in transport and power generation the need was only going to increase.

One way to address the shortage was to encourage more school leavers to sign up for engineering and then the issue of mathematics literacy reared its head. The inadequacies in the previous and present education system, together with the poor results in mathematics and science, make it worse. Furthermore, the apprenticeship system is underutilised. The levels of artisan training have dropped from about 300 000 registered artisan apprentices in 1975 to an estimated 3000 in 2006 – a tenfold reduction and that contributes to the misapplication of engineers in more technical roles.

Shortages of experienced technical skills are partly explained by declining enrolment in engineering sciences at tertiary institutions during the 1990s. As Kraak (2006, 2012) noted, enrolments at institutions of technology are declining in technology field such as engineering, while graduations in non-technical subjects (e.g. business studies) increase. It appears that the students are not assessing the market for their qualifications.

The next question could be if there is a discernible pattern in the choices of potential graduates. Engineering lies at the far end of an extended education path. In South Africa, Mlatsheni (2005) noted poor language ability in primary school pupils and the declining numbers of matric exemptions. The issue of language in the Western management model is considered a minority or expat problem.

Casale (2011) noted that financial returns on education are also reduced if English language proficiency is considered, which means that to benefit from higher education a graduate requires proficiency in English. In the South African context, the results may also indicate that English language skills act as a signal to employers about the quality of higher education that individuals have received (Casale & Posel,

2011). The importance of language skills is underlined by Marschan-Piekkari, Welch, and Welch (1999) when they say language acts as a facilitator. The possession of the required language skills, such as business English, can be a powerful facilitator of inter-disciplinary business communication flows, especially when one considers the role of personal relationships important communication channels.

According to the Minister of Science and Technology, Dr Naledi Pandor only half of the 1,500 Engineering students graduating with degrees from South African universities practise as engineers as reported in Business Report via South African Press Association (2014). The infrastructure sector feels it keenly. In the Department of Water Affairs loss of technical skills means that where the previously managers were experienced engineers Infrastructure News (2013) noted that only 7 senior management roles are filled by qualified engineers. Dr Blade Nzimande gazetted the National Scarce Skills List: Top 100 Occupations in Demand on 30 May 2014 (Skills Portal, 2014) He explained that engineers are in short supply in South Africa and Electrical engineers are first on the skills list.

The next question would be how to retain engineers given that their skills are in demand and the engineering labour market is not uniform (Kraak, 2009). Prior literature, however, suggests that some unique factors add to the engineering context (Robinson et al., 2005). Engineers need to be challenged (T. J. Allen & Katz, 1986; James-Gordon & Bal, 2001). As a result of changes in economic, social, and technological conditions, engineering managers are face problems in retaining engineers in the current market. The reduced headcount means everyone works harder and there is pressure on productivity and results in tension and conflict between managers and engineers. The result is that engineering managers are called to maintain motivation and productivity. This suggests that in order to encourage engineers to be both organizationally and professionally committed organisations should invest in a development process for planning and enhancing the engineers' professional and managerial development. Thus, the concept of *organizational socialisation* might contribute to reduction in turnover among engineers.

2.8 ENGINEERS CHOOSE MANAGEMENT

The next question would be to stablish the factors that indicate a preference for management. In studies female participants with higher levels of self-esteem, emotional literacy and social connectivity showed confidence to form meaningful social connections and this could explain their preference for managerial career opportunities. Brown, George-Curran, and Smith (2003) showed that emotional literacy is related to the confidence to complete career-related tasks and agreed with Dries and Pepermans (2007) agrees that high emotional intelligence is related to high performing managers career development opportunities. Coetzee (2008) provide results to suggest that the African participants seem to have a significantly stronger need for managerial positions that expose them to a variety of growth and development opportunities and jobs in which they can express their talents and abilities creatively. Affirmative Action policies have given more Black people the opportunity to articulate their competencies, potential and abilities. Positive self-esteem has been found to enable people to become proactive agents and to increase their openness to, and need for, new learning as noted by Coetzee and Bergh (2009). Employers look for employees who are capable of initiative, proactive adjustment, and action-orientation. However, it remains a challenge to describe the exact personal characteristics and competencies that relates to the art of management (Coetzee, 2008; Coetzee & De Villiers, 2010; Coetzee et al., 2014; Coetzee & Schreuder, 2011)

The importance of employability as a driver for the labour market may explain why a graduate while qualified and is yet unable to get a job. The concept of employability may be seen as an agreement or relationship. (Schreuder & Coetzee, 2002; Venter, Coetzee, & Basson, 2013) sees employability as a psychosocial construct explains why some employees are able to adapt to the demands of the organisation and the role so that the organisation can adapt to the market (Dacre Pool & Sewell, 2007). The illustration in Figure 4 shows the contributors to employability such as subject knowledge, generic and transferable skills career development, and emotional intelligence self-confidence which all together makes up adaptability in various contexts. Where an engineer does not exhibit these skills he can find himself in a career dead end.

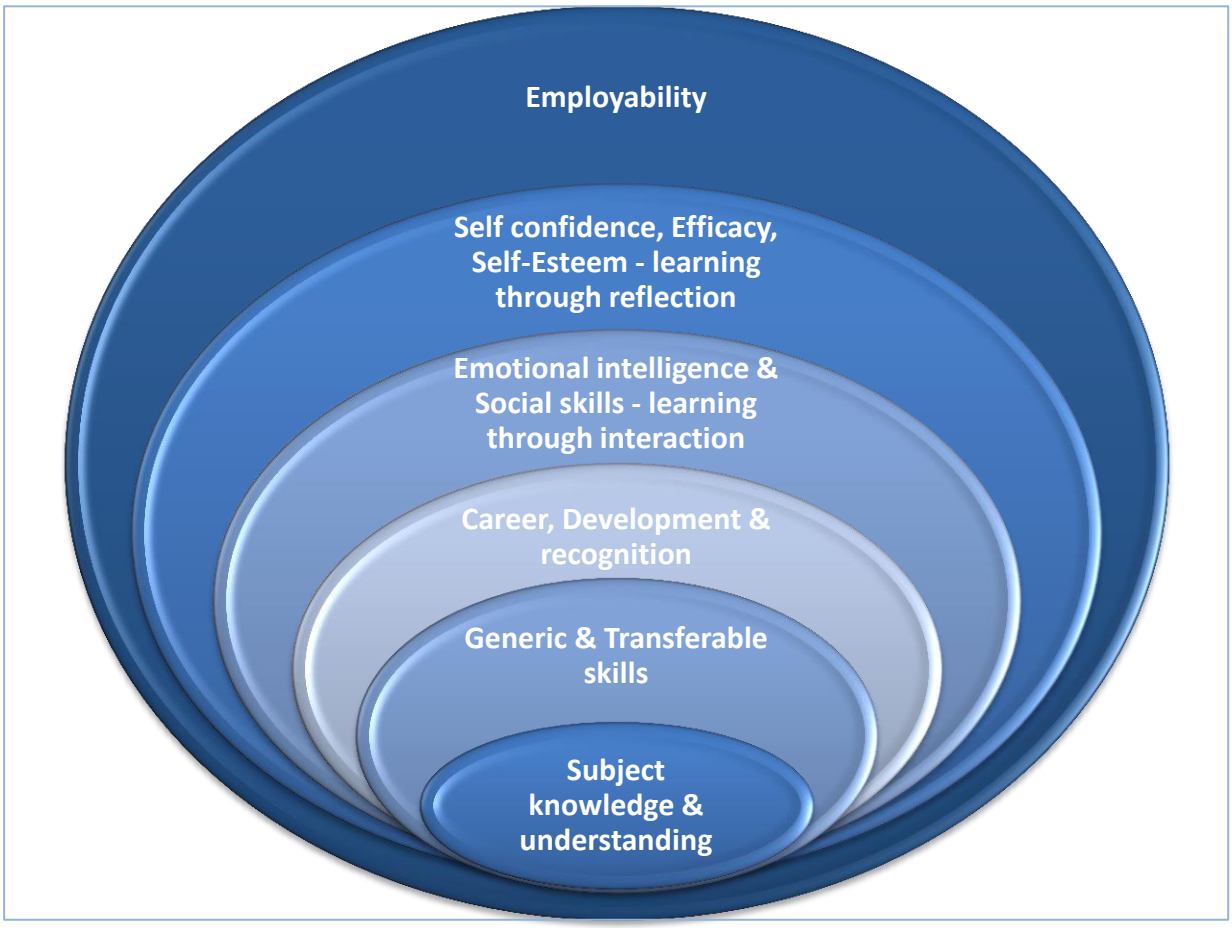


Figure 4: Aspects of employability

Source: Adapted from Dacre Pool and Sewell (2007)

This figure is important as the same factors that contribute to employability also contribute the good management techniques. The significance of this concept makes the difference between a career that stagnates or flourishes uncertain market conditions

According to Furnham (2000), insufficient natural resources, globalisation, the growing demand for corporate social responsibility and ethical governance, as well as the increasing vulnerability of the business world to economic and political steadiness is creating a very uncomfortable future workplace. Full-time employment may be replaced in time by part-time employment or reduced hours per day for certain employees. The job security of previous years is no longer possible. Engineers are also advised to take responsibility for their careers and future financial security. Employability may just be the key to utilising the volatile market (Furnham, 2000). Employability will be an essential skill for all graduates to enable the skills

gained in education and their natural talents to navigate the work environment (Ehiyazaryan & Barraclough, 2009).

Considering the previous argument, this study contributes to research in the South African context, indicating that cultural competence and sociability of individuals contribute to management skills and that while race groups differ significantly regarding these attributes according to (Potgieter & Coetzee, 2013) the difference between individuals may even be larger when compared to exposure to International managerial styles.

The question is then how do we address employability? Organisations that wish to enhance the employability attributes of valuable employees should attempt to provide career development plans which could assist individuals to increase their levels of personality attributes. ECSA also expects that as a responsibility of the employer of a candidate engineer. In order to optimise individuals' sustained employability, organisations should employ people with not only the correct qualifications and technical skills, but also the necessary career meta-competencies. Organisations can promote career development and career counselling interventions on a cognitive, conative, affective, and interpersonal level in order to enhance their career meta-competencies as identified by Potgieter (2013).

Organisations using a career development counselling framework will aid employees in developing their personality attributes. This framework would help employees to develop their employability attributes and career meta-competencies by identifying the relationship between their self-esteem, emotional intelligence and employability attributes. The role of both the manager and the industrial psychologist is that of a career counsellor. To successfully fill this role as a career counsellor, one should gain a holistic image of an individual's self-esteem and emotional intelligence. This enables the career counsellor to help individuals to increase their career meta-competencies. This could potentially assist individuals to obtain and sustain suitable career opportunities.

Human resource practitioners can also play a role using 360 degree feedback in a more sustainable manner. Individuals could engage in self-reflection upon receiving feedback with regard to their personality attributes. Individuals could engage in

personal therapy in order to enhance low levels of self-esteem and low emotional intelligence (Potgieter, 2013 P 359).

2.8.1 Career Anchors

The concept of career anchor, as defined by Schein (1978) and expanded in Schein (1996), is one way to explain the pattern of self-perceived talents, motives and values that direct and integrate careers of engineers in a work context (Sithole, 2012). When faced with a career shift such a promotion to management an engineer may in time become aware of motivations that are explicit or others that are hidden. Career anchors reflect basic motives and needs and provide one lens through which to look at the aspects influencing employability as well as drive (Bigliardi, Petroni, & Dormio, 2005; Igbaria, Kassicieh, & Silver, 1999) . According to Schein (1996), a “career anchor” is a strong self-concept that helps an individual to stabilise their internal career in the midst of dramatic external changes. The concept of career anchors can assist in understanding how people make career choices. A person’s career anchor includes self-perceived talents and abilities, values, and, the sense of motive as it applies to the career. Career anchors only evolve with occupational and life experience. The self-concept provides stability as it is the foundation of the construct of values and motives that directs decisions. The career anchor is revealed in career choices, career changes, career aspirations, and hope for the future; it tends to colour work experiences. The career orientations of an employee show up in the career anchors (Schein & Schein, 1978). In engineering we note the importance of the following anchors a) autonomy/independence: to make own decisions and act accordingly b) job security: to organize career to maximise security or control over security, c) geographical stability: to choose the location of work d) technical-functional competence as an expert in a specific field e) general managerial competence to be a manager. In the engineering management work environment expert power and managerial authority play a large role.

Links between career anchors and occupations have, however, been substantiated by other researchers, e.g. Igbaria et al (1999), who demonstrated links between engineers and technologists, and certain career anchors. In the study by Nordvik (1996), with Norwegian workers, he also showed links between certain career anchors and occupations.

There are three main types of engineering professional in South Africa, depending on their degree or diploma. A four year Bachelor of Science (BSc Eng) or Bachelor of Engineering (BEng) degree from a university is required to register as a candidate profession engineer.

A bachelor of technology (BTech) degree from a university of technology is required to register as an engineering technologist. A person with a national diploma (NDip) from a university of technology can apply for engineering technician status. Some engineers do not complete their formal qualifications and do not eligible register with the Engineering council and they can still work in some technical capacity.

Engineers mostly work in organisations of varying sizes from small consultancy boutique companies or partnership to large conglomerates and public enterprises. It is therefore important that engineers become competent at negotiating their way in the organisational politics and are able to deliver engineering work, sometimes in spite of bureaucracy. The participants in this research study are working in the public sector and the environment has a few unique characteristics of its own.

2.8.1.1 Development of the manager career path

The development of a new manager is designed to expand their influence, power, and capability to manage complexity. Therefore an engineer will be asked to manage a small project under supervision and then another until he can do so unassisted. After that he will be able to lead a small team. As his leadership and managerial skills develop he will become part of a bigger project until he is able to manage larger projects successfully. During this time an engineer can decide to become a project manager or a line manager. If he chooses to become a line manager of a specialist engineering department or ‘Centre of Excellence’, he takes accountability for the people, their training as well as the technical quality, contractual and performance delivery of the specialist system designs. The line manager role will include general management tasks such as managing skills, providing expert resources for projects and financial management.

2.9 THE NATURE OF ORGANISATIONS

How do public organisations differ from private organisations? According to Van der Heijden (2006), a complicating factor in the public sector is its different operating environment, which is characterized by ill-structured and wicked problems complicated by bureaucracy. A distinct difference between the public and the private sectors noted by Flynn (1993) is that the public sector is not usually required to make a profit, and therefore, there is no competition in the market sense. With respect to measuring organizational and individual performance, Flynn (1993) pointed out that politicians may have direct or indirect influence on performance evaluations. These politicians may be held accountable for the services that the public sector provides. As a result, many of the principles of management, equitable treatment and allocation of resources according to need as applied in the public sector encompass the processes of decision-making and management (Flynn, 1993). Consequently, this affects individual objectives and subjective career success.

2.9.1 Organisational Structure and Roles

In companies with extensive hierarchies the promotion on the ladder progresses based on years' service and performance ratings. However in the matrix companies these progressions are less obvious. The importance of the Matrix organisation lies in the complex reporting lines. It started in the Aerospace industry to enable the running of multiple projects utilising the technical skills available (Ford & Randolph, 1992).

The reporting lines can become complicated as the engineer still reports to the line manager in Engineering in terms of standards and procedures while the project manager imposes time and financial controls in terms of the contract.

The roles in Table 1 show how it could work if there are enough resources for every project. But what if one engineer is working on all three projects? Then the issue of multitasking becomes the engineers' juggling act and any conflict amongst the managers will filter down to the engineers.

Table 1: Reporting Lines in Matrix organisation

		Projects Division Project Director		
		Project A	**Project B**	**Project C**
General Manager	**Senior Manager**	**Project Manager A**	**Project Manager B**	**Project Manager B**
Engineering Division	Civil Engineering Department	Chief engineer CA (Civil)	Chief engineer CB (Civil)	Chief engineer CC (Civil)
		Engineer CA (Civil)	Engineer CB (Civil)	Engineer CC (Civil)
	Mechanical Engineering Department	Chief engineer MA (Mechanical)	Chief engineer MB (Mechanical)	Chief engineer MC (Mechanical)
		Engineer MA (Mechanical)	Engineer MB (Mechanical)	Engineer MC (Mechanical)
	Electrical Engineering Department	Chief engineer EA (Electrical)	Chief engineer EB (Electrical)	Chief engineer EC (Electrical)
		Engineer EA (Electrical)	Engineer EB (Electrical)	Engineer EC (Electrical)

The importance of this table lies in the fact that when engineers become managers their first task is to resource projects. Project managers compete with each other for good resources so if a good resource becomes a manager his first job is to replace himself. If the project manager is responsible for functional scope the line manager is responsible that the work is still complies with standards then conflict can arise naturally.

Since we are talking mainly about managers the following discussion is used to illustrate how closely the competencies tie in. And why engineers are often asked to take leadership roles. Leaders have a vision for a future that may not yet be evident. A leader can communicate and motivate a group of followers to make sacrifices for such a desirable future. Since a design is often not well known or understood one of the first things an engineer has to learn is to explain a technical idea to non-technical people in order to secure funding. This means the engineer has to act as a leader by explaining a vision and creating enthusiasm for the reality. The diagram in Figure 5 shows how the leader's competencies are applicable when an engineer has to use influence to sell his ideas. He has to communicate across the entire range of

expertise to explain his ideas to get buy-in from financial managers to technical experts with analytical filters.

The managerial communication competencies are about double when compared to engineers. While managers concentrate on planning and administration, engineers concentrate on technical competencies. . If the role of management is to create an environment where things get done then leadership is needed to make sure that the right things get done. Both are essential in an engineering environment. It serves no purpose to have a cubic metre of cement with consistency accurate to the third decimal, if it is cast in the wrong place.

The illustration in Figure 5 provides a model of the Managers' Competency Clusters as discussed by Wu, Lee, and Tzeng (2005). It provides a starting point to evaluate the managerial competencies we want to have in engineering managers who will in time move into general management.



Figure 5: General Manager's Competency Cluster Model

Source: Adapted from Condition Attributes in Wu et al., 2005; p 488)

This diagram shows that administration and planning forms one of the larger parts of the required management competencies. From Wu's (2005) competency cluster

model the three main skills are planning, self-management, and communication. This is interesting because it highlights the importance of the non-technical or relational skills in the execution of work.

Table 2 provides a summary of the Competency attributes and decision attributes to show how the competency clusters are deconstructed into detail attributes. As an example the communication competencies include informal and formal communication as well as the ability to negotiate.

Table 2: Comparison of management attributes

Condition Attributes and Decision Attributes		
1	Communications competency cluster	Informal communication Formal communication Negotiation
2	Planning and Administration competency cluster	Information gathering Planning and organising Time management Budgeting and financial management
3	Teamwork competency cluster	Designing Teams Creating Supportive environment Team dynamics
4	Technical competency cluster	Knowledge Innovation Design
5	Strategic Action competency cluster	Understanding the industry Understanding the organisation Taking strategic actions
6	Global awareness competency cluster	Integrity and Ethical conduct Cultural openness and sensitivity
7	Self-Management competency cluster	Personal drive and resilience Self-awareness and development
8	Social awareness	Cultural knowledge and understanding Balancing work and life demands
9	Decision attributes	Senior manager Middle manager First line manager Engineer

(Adapted from Condition Attributes in Wu et al., (2005; p 488)

In this table it is interesting to note that the competencies related to engineering work match up with individual leader capabilities and managerial competencies are more in line with leadership skills as defined in a social context. Although these competencies are not the only way of defining a managerial skill set they provide a starting point to compare how engineering competencies and managerial competencies link up and change during the transition..

These competencies may be prioritised depending on the life stage the business or project is in (Greiner, 1972). At the beginning communications is critical but soon planning will become important and then strategic alignment will be an issue. All the skills are required. In the beginning they show up as separate skills which while it starts out that way will need to be integrated and contextualised during the transition to management.

In developing countries, the clan culture may be more or less dominant depending on the degree to which the people have close links with the rural village. Generally in a more international management model the rules of engagement are accepted and mostly tacit. In a South African context this agreement is no longer true. Every person comes to work with their cultural and social rules in a bag next to their computer.

When we identify potential managers through their willingness to interact with people and their ability to lead and motivate others, and their high energy as described by Male, Bush, and Chapman (2011) as well as Dreyfus (2008); Silzer and Church (2009) we are looking for leaders. When we see if these leaders are part of the social fabric we enable them to act as managers.

In preparing managers we need to consider the preparation of the new manager, the situation, the receiving manager, training, skills, coaching and on-going development. When we compare leaders and managers we find that leaders have a vision and the managers enable the implementation of that vision

2.9.2 Engineering manager career path

The career paths of engineers follow a typical path as illustrated in Figure 6 but it may be different in various organisations. It does illustrate some of the career anchors exemplified by a known career ladder and steps in that ladder.

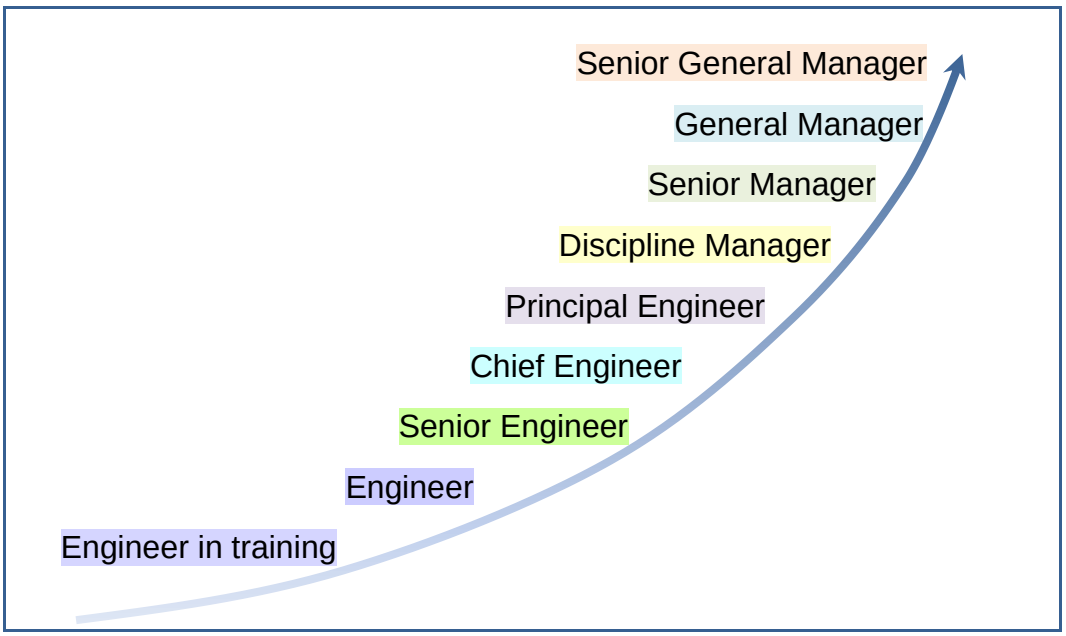


Figure 6: Typical Engineering management career path

The new manager is being groomed to manage other engineers who will provide the essential pipeline of training for the next generation of technical professionals. There is a need to identify engineering competencies not only for the present but also for the future. Not only is it necessary to understand the new manager but also to prepare him or her to motivate the new engineering subordinates. In the figures below, the competency clusters defined by Wu et al. (2005) are adapted to provide a basic framework to show how competencies change in relative importance between Engineering roles and Engineering Manager roles. This is just an indication of one of the methods that can be used to show the difference in skills required when an Engineer is promoted to management.

The engineering competencies according to ECSA are illustrated in Figure 3 on page 33.

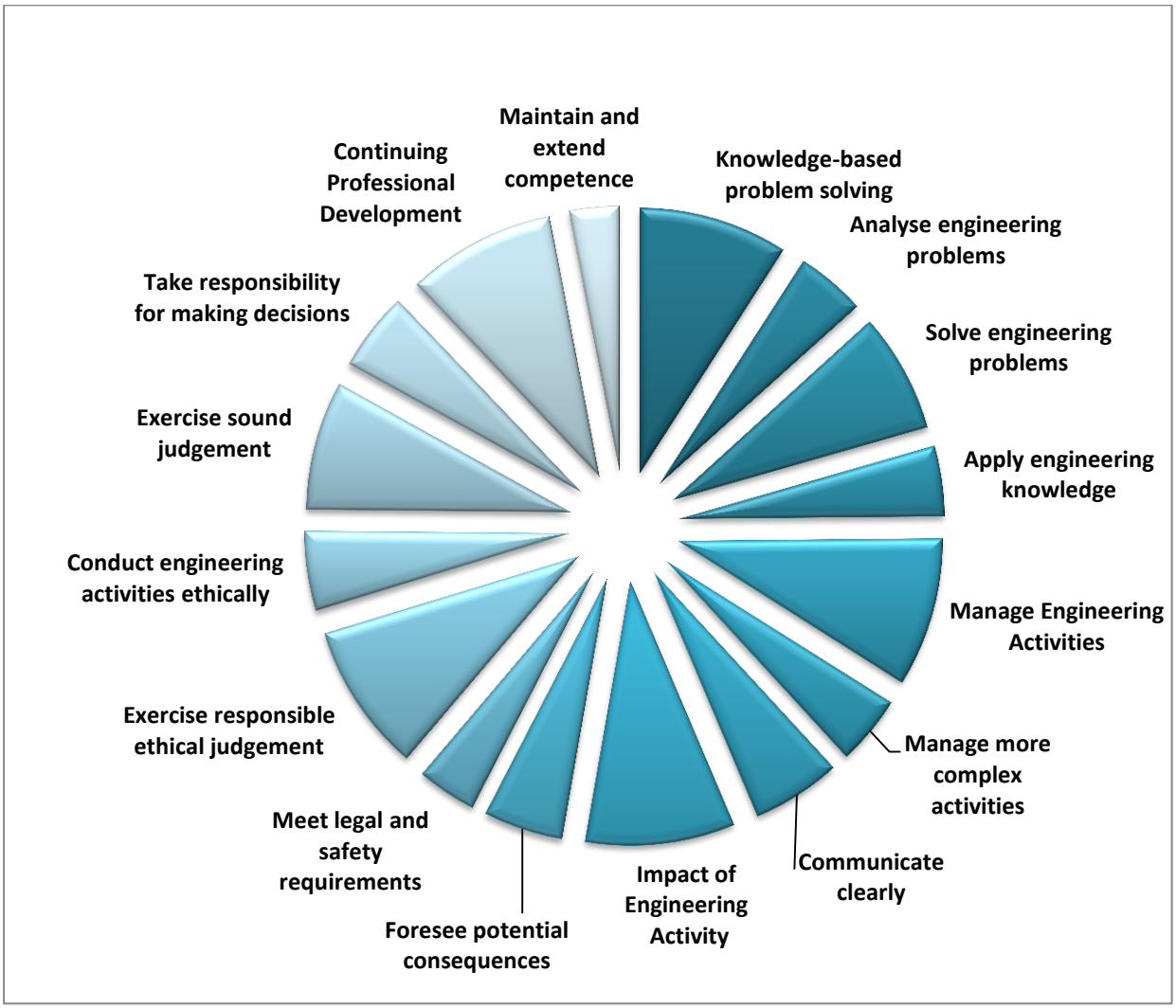


Figure 7: Engineering Competency Cluster model (detail)

Source: Engineering Council of South Africa (2011)

In comparing the managerial competencies and the engineering competencies there is an overlap in the communication cluster and difference in the technical cluster of the role. The list of competencies spells out how engineers need to behave to be good managers. In South Africa a good manager requires more than just the drive to produce design; he has to have a skilful approach to diversity which leads to the first research question:

Research Question 1

What are the challenges facing engineers during the transition to management?

The question covers issues such the nature of the labour market, the intrinsic issues related to the adjustment to the work environment and the responsibility for performance in engineering that is assigned to the new manager.

The appointment of a new employee is often marked by an induction into the company values and key policies. Human Resource departments acknowledge the necessity to provide some form of on-boarding to new appointees. On-boarding can be seen as the socialisation of individuals in organizations through which individuals learn and recognise organisational and department values, behavioural expectations in the role, and what is expected of them in the new role. The organisational socialisation process can include training, coaching, mentoring, and communication of expectations related to the new role (Chao et al., 1994; Taormina, 1997). It can be seen that such a process may be useful to facilitate the transition of an engineer to manager.

2.9.3 Nature of engineering management

Engineering management contains aspects of business management and project management (Shaw, 2002). The standard business management literature does not contain the full spectrum of managerial tasks required of Engineering managers and therefore traditional training may not be sufficient to provide engineers with the kind of management skills that they have to acquire (Ashley, 1993).

At the same time the skills shortage in South Africa, the transformation of the labour market and the employment equity requirement means that there is additional pressure to promote previously disadvantaged Black, Asian and Coloured employees into management (Commission for Employment Equity, 2013). There are a number of approaches to developing engineering managers including on-the-job training, active mentoring, self-directed study, and formal training (Aster, 2008; Badawy, 1995). Business management courses provide fundamental courses in Marketing, Strategy, and Finance but engineering management includes the requirement of multi-project management or programme management. The nature of engineering management is a combination of project management, technical management, people management and business management. The definitions are wide ranging. They range from the definition according to the American Society of Engineering Management that

"Engineering Management is the art and science of planning, organising, allocating resources, and directing and controlling activities that have a technological component" in Dow and Daughton (2011, p. 2) to Badawy (2009, p. 224) who defined Technology Management as a "process of effective integration and utilization of innovation, strategic, operational, and commercial mission of an enterprise for gaining competitive advantage". For the purposes of this study the definition by Shaw (2002, p. 504) that reads "the process of envisioning, designing developing, and supporting new products and services to a set of requirements, within budget, and to a schedule with acceptable levels of risk" will be used. In reality, any organisation will select people and appoint managers to meet their particular requirements according to their chosen definition and competency in engineering is often recognised as an ability to deliver results.

There is a need to develop managers as coaches (Horne, 2008). Coaching remains a neglected management function in many organisations in South Africa. Meyer and Fourie (2004:26) assert that the consultants are claiming ownership of coaching because managers have not been doing their jobs as coaches.

The difference between leader and leadership cannot be avoided in the multitude of cultures manifesting in the South African work environment, From leader focussed on human capital to leadership focused on social capital will make the difference between an effective work place and one fraught with labour unrest. While the leader's self-awareness, self-regulation, and self-motivation provide the basis, it is the social awareness that provides the lubrication for the processes to move according to Day (2000).

The diagram in Figure 8 provides a graphic representation of managerial development. An engineer develops skills to manage a small project; then a small team then a part of a bigger project until he is the manager of a discipline and takes responsibility for the contractual accountability and performance of that sub system.

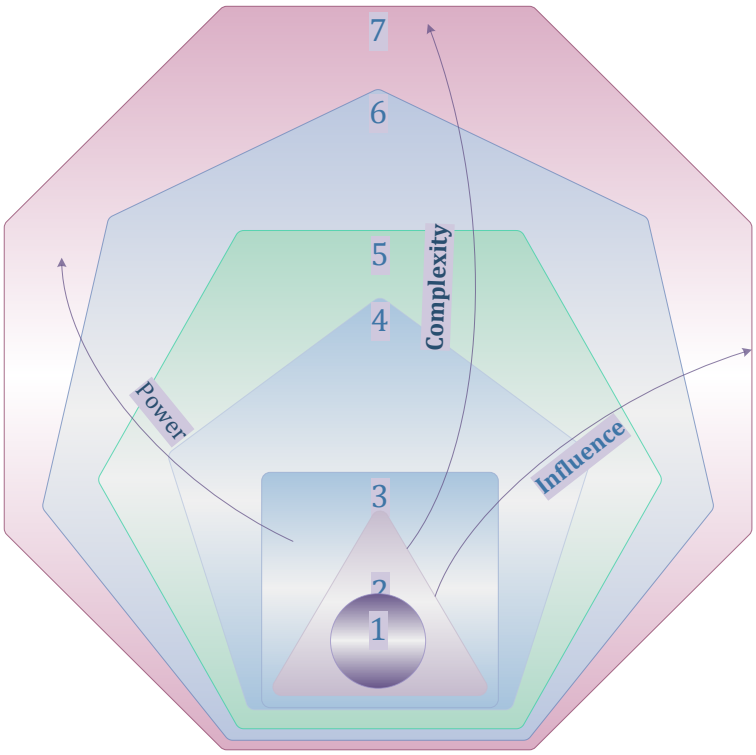


Figure 8: Expanding managerial influence and power

The number of interfaces expands exponentially as the manager's experience and responsibility increases so that finally every interface represents a stakeholder or interface to a client.

2.9.4 Nature of engineering leadership

The concept of career anchor, as defined by Schein (1978) and expanded in Schein (1996), is one way to explain the pattern of self-perceived talents, motives and values that direct and integrate careers of engineers in a work context (Sithole, 2012). When faced with a career shift such a promotion to management an engineer may in time become aware of motivations that are explicit or others that are hidden. Managerial competence is publically espoused and that is where the financial and status rewards are; the inherent skill set and emotional make up of an intrinsically motivated engineer is "fundamentally different" to that of a manager (Schein. 1996, p. 30). In order to be an effective manager the engineer requires a high level of motivation to operate in political environment as Schein (1996) explains. He continues to explain that a manager must also have good analytical and financial skills with high levels of

interpersonal competence to function in teams and in negotiations while being comfortable making highly consequential decisions with only partial information.

As organisation structures are being flattened and decision-making is being pushed down to lower levels of management the skills of general management will be needed at all levels (Sithole, 2012). Engineers by nature are individualistic and focussed on achieving personal goals through application of energy and intelligence. Therefore the engineering manager may be required to forego the satisfaction of own achievement and take pride in the achievement of his team (MacTavish, 2007).

2.9.5 Engineering disciplines

The research on Myers-Briggs Type Indicator in relation to engineering students' preferences provides some basis for constructs to support differentiation between the various disciplines (Felder & Brent, 2005; Jensen, Murphy, & Wood, 1998; Rosati, 1997). Felder (2005) concludes that while the MBTI provides some indication of preferences, there is no evidence that it determines how a person will perform. The adaptability of the student is related a large number of factors including motivation, understanding, attitude, native intelligence, physical and emotional states, self-confidence, concurrent demands on their time, personal rapport with the instructor and compatibility between own learning style and the lecturer's teaching style (p.13). The MBTI is used to measure preferences along a continuum as described below:

Table 3: Myers Briggs Type Indicator (MBTI) Summary

Function	Continuum of Type	
Interacting with others	Extraversion	Introversion
	Obtains energy from communicating with others	Obtains energy from ideas and concepts
Processing information	Sensing	Intuition
	Focus on senses and experience	Focus on big picture and future use

Function	Continuum of Type	
Evaluating information	Thinking	Feeling
	Focus on objective facts, causes and effect	Focus on subjective values and feelings
Arriving at conclusions	Judgement	Perception
	Focus on timely, planned conclusions and decisions	Focus on adaptive process of decision making

Source:Jensen et al. (1998, p. 7)

This short table provides a summary of the different approaches seen in the business environment and if the new managers and their employees do not know about these differences they will merely see the other person as being obstructive and the result can be an escalation of conflict and reduction of trust.

In terms of coaching preferences that Rosati (1997) showed that most successful engineers were judging, introverted thinkers or I_TJ and students who passed in the minimum time were mostly intuitive thinkers or INTJ. The sensitivity to time management is a prerequisite to completing the course on time and ___J types are skilled at managing deadlines as confirmed in Aucoin (2002). In another study, Brock (2008) describes project managers and concludes that they tend towards the _NT_ profile similar to engineers.

The management competencies were derived from themes in the selected literature on management published in the United States and Europe. Management is required to improve operational efficiency and to ensure consistency of administrative control through planning and structural organisation (Fowler, 2015). The i*nternational management* competencies are part of existing management theory according to Wu and de Meuse (De Meuse, Dai, & Wu, 2011; Wu et al., 2005). Managerial competencies include communication, planning, and administration, teamwork, strategic action amongst other. The emphasis on the planning and administration underlines the need for operational efficiency.

2.10 SOUTH AFRICAN CONTEXT

Hutton describes engineering as hard science (Hutton-Wilson, 2006, p. 1) As a “hard science” country with agricultural, mining, manufacturing and beneficiating sectors. South Africa needs a leadership culture to encourage school leavers and students to enter the hard science fields. Just as the economy of South Africa is taking off it has seven scientists in place for every 10 000 members of its work force. So Minister Pandor is correct when she asks for attention in this field of study.

Education of Scientists and Engineers has lagged during the past 15 to 20 years to reach this state. As Kraak (2004) notes, “it is ironic that institutions of technology … are currently witnessing a dramatic decline in a key ‘hard’ technology field (engineering), while graduations in ‘softer’ non-technical subjects (such as business studies) expand” (2004). It took ten years up to 2004 for black engineering students started to graduate and four years for women engineering students to graduate in significant numbers. According to the Engineering Council of South Africa (ECSA) the number of engineers registering is increasing between 7 and 11% per year since 2011 with black coloured and Indian registrations increasing by 20%. At this rate we will not reach the critical level of engineers to support the infrastructure requires.

Traditionally women have been slow to enter the engineering disciplines (Male et al., 2011). In the years up to 2009 there were few black engineers according to the Department of Labour (2013); the percentage of women in management started at a very low base. In Amelink and Creamer (2011) the underrepresentation of females in engineering is linked to traditional views on their mathematical capabilities, the lack of self-efficacy of females in the engineering faculty and how female styles of collaboration may work against them in an engineering environment. Male et al., (2011) agree when they conclude that an improvement in the peer-interaction in the educational setting will go some way to improve the interest of females in pursuing an engineering career.

The challenges in the South African environment identified by Denton & Vloeberghs (2002) include a number of additional factors such as an adversarial culture between White management and Black workers and the role of affirmative action. In terms of the act companies have to present work skills plans (WSP) to show how they intend to improve participation of previously disadvantaged groups in the workplace

(Denton & Vloeberghs, 2003). This means that engineers have to be skilled in industrial relations soon after taking a managerial role. In an environment of downsizing, organisations require employees to develop multi-disciplinary skills, also called multiskilling, which creates additional anxiety in engineering managers, who know that their acquired engineering skills have a use-by date and that they need to upgrade their skills to stay relevant (Ashley, 1993; Meyler, 2013). However their efforts have to be redirected at developing the technical skills of their employees and improving their own managerial skills.

There are a number of historical factors that have contributed to this state of affairs as discussed in Denton and Vloeberghs (2003) and in order to address this situation the Employment Act, No. 55 of 1998, as amended, was enacted to drive Affirmative Action and promote the employment of previously disadvantaged individuals; “Black people, women and disabled people” (Denton & Vloeberghs, 2003, p. 89).

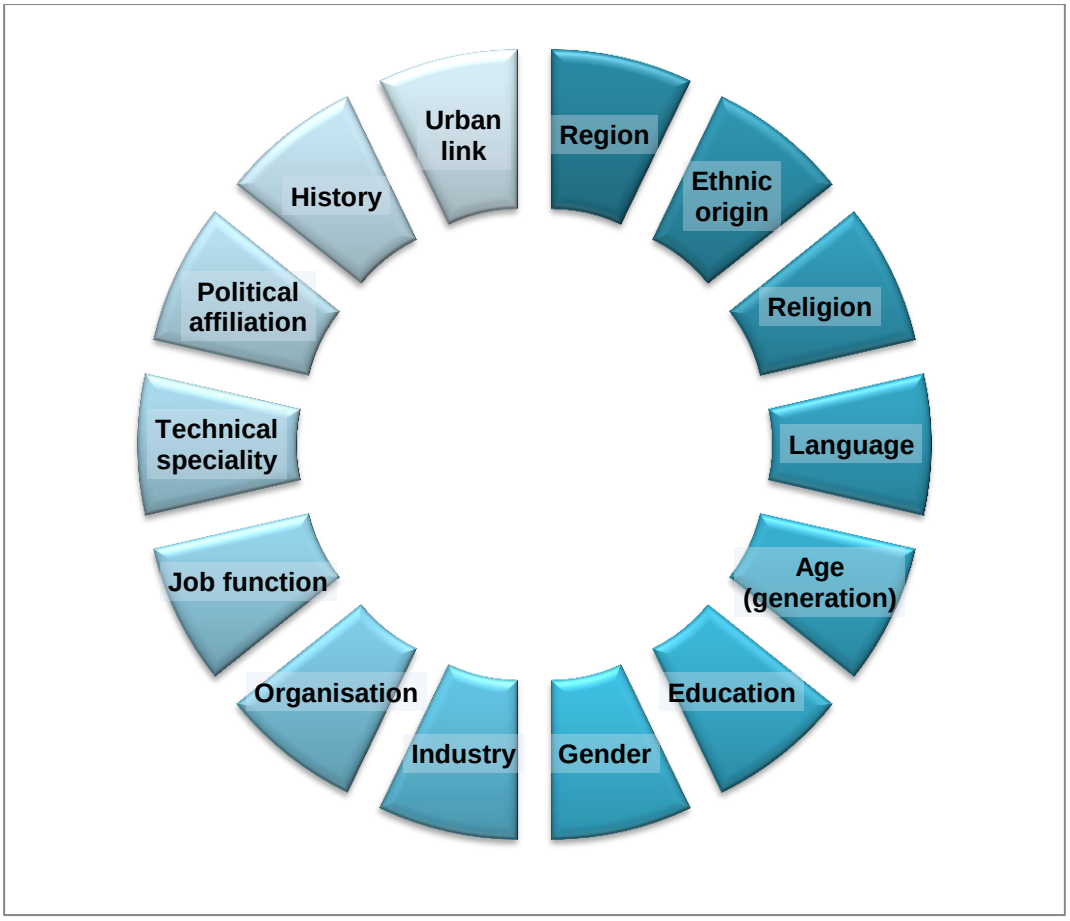


Figure 9: Aspects of Diversity

Source: Adapted from Elena (2010)

This graphic serves the purpose of making explicit the various competing interests when a multi-cultural, multi-disciplinary team is formed to resolve a wicked problem (Conklin & Weil, 1997; Head & Alford, 2013; Jordan, 2011; Rittel & Webber, 1973).The aspects of diversity are often described in research on global project management but not so often in the context of the International management model. My view is that in a developing country every project is a complex interplay of these dynamic and the new manager may not be aware of the importance of managing the variety with elegance.

There is a need to change the way managers manage and research indicates that engineers must make the transition from control to teamwork and leadership that includes coaching others, self-management, boundary management and interfacing with stakeholders (Ashley, 1993; Charan et al., 2010).

Van Hoek and Schulz did research in a mining company and determined that the kind of questions would highlight differences and reduce the conflict of unstated expectations.

> What is the protocol in this company?
>
> Who is allowed to address whom?
>
> What are the unstated rules in the company? And who sets the rules?
>
> Are these rules negotiable? Who will be promoted in the company and what do they have to do to be promoted? (Van Hoek & Schultz, 2014, p. p4).

Employee engagement is part of the organisation's strategic plan, and HR has to be involved; take responsibility and implement an effective engagement programme. Part of the human resource plan should provide for: increasing employee confidence by ensuring that employees can do their jobs properly and that they will be supported if they need training and development; and in stressful or tedious jobs, employers should connect with staff in a manner that will meet employees' needs.

Managers need to let staff know that they appreciate their efforts and that coaching and counselling are available if necessary. On-going communication and feedback to workers are critical. Managers need to tell workers what they need to know and give

them feedback on their performance. Recognition should be given in public, and negative feedback in private. Organisational leaders have to develop trust in the company's integrity and brand and the leader's authenticity.

At management level, the highest level of integrity should be maintained and managers should lead by example and reach out to employees to show them how valuable they are to the organisation. The top management HR team should become aware of the vital role that coaches play at different levels in the organisation. Firstly, the management team needs to determine the readiness of the organisation for coaching and how it will fit into the company's personnel strategies. Then, potential coaches should then be identified and trained and the difference between coaching and counselling addressed. Lastly, the role of coaches should be clarified and communicated to all parties involved. The company could investigate the following guidelines to encourage better manager– employee relationships:

- prioritise contact between managers and employees;
- be accessible
- double the time to explain changes in structure and policy
- allow and empower employees to make decisions about issues that affect them;
- communicate a vision; and
- give employees responsibility and authority, not instructions.

These questions were adapted from Van Hoek and Schultz (2014)

It would be unreasonable to omit the issue of unemployment in the current economy. With formal employment growing very slowly at the same time we have the skills shortage seems anomalous.

This is not what we would expect if there was a skills shortage and a free labour market. The unemployment rate amongst graduates aged 24-29 years is less than 10% depending on the calculation methods, a rate which comparable many OECD states according to van der Berg and van Broekhuizen (2012) and Altbeker and Storme (2013). While according to some authors we are training people for the wrong economy and should include more practical, skills, and vocational training (Bhorat, Mayet, & Visser, 2012; Poitras & Poitras, 2011); the other indicators are that

further education and higher skills level results in lower unemployment (Altbeker & Storme, 2013). While the two opinions may both be correct it is not easy to reconcile the two pictures unless we recognise that education alone is not the answer. Initiative plays a crucial part in navigating the workplace hazards and the way to get experience is being ignored.

This leads us to the first research question:

Research Question 1

What are the challenges facing engineers during the transition to management?

The question covers issues such the nature of the labour market, the intrinsic issues related to the adjustment to the work environment and the responsibility for performance in engineering that is assigned to the new manager.

Research Question 2

What organisational initiatives assist the engineer to navigate the transition?

When comparing the Western management model to the experiences in a developing country are there factors that are noticeably absent?

2.11 COACHING

What does coaching really do? There can be coaching for career development; performance and management. The point is to address coaching of engineers knowing that they have certain strengths and technical skills and other non-technical skills will be required to manage other engineers in the current business environment

Savickas et al., (2009) recommends that “research should be conducted to identify and describe the processes underlying life-designing interventions, particularly related to the work role” (p10). He continues to explain that during these interventions clients will tell their stories and then reflect upon those narratives as a way making sense of the experiences, to form new goals and to plan actions to implement those goals. This process aligns with the Coaching paradigm (Taylor, 2011). He refers to Kilburg (2000) and explains that the coaching process develops a one-on-one situation between the client and coach in which sequences of “single-loop, double-loop and triple-loop” learning occur so that the client is able to develop an

understanding of the current organisational context, the social situation and the response to their internal experience (p.7). The process of reflexive learning, according to Kilburg (2000), means that the client:

- develops self-awareness,
- creates various options within the available responses,
- expands perception in a situation to include awareness of the complexity, paradox and interplay of personalities, and
- develops new ways of dealing with situations.

Many universities and professional bodies throughout the world have recognized the challenges that have been identified in this paper and are engaged in major over-hauls of the way in which they educate their engineers, including the UK (Engineering Council 1997), Australia (Institution of Engineers of Australia 1996), the USA (Accreditation Board for Engineering and Technology 2000). This is also the basis for the South African education model. The engineering science approach provided graduates of high technical ability for the last 50 years need to be reviewed in context of the 3rd world and sustainability of earth's resources. The cost of burning coal and exhausting unrenewable resources will add up for generations to come (Grimson, 2002). In addition according to Grimson (2002), if engineers are to appreciate fully their role in society as a whole then we need more than a one semester course on the engineer in society. Engineering education must come home to the community.

Courses should promote environmental, economic global awareness, problem solving ability, engagement with information technology, self-directed learning and lifelong learning communication, management and teamwork skills, but on a sound base of Mathematics and engineering technology. For engineering graduates to take a more effective societal role they must be better communicators. This means that, in addition to having the ability to explain technical content to engineers they also have to relate the importance of the technical content to people who will use the technology (Grimson, 2002).

Managerial coaching will be breakthrough skill in time to come as learning moves from the classroom to life. Organisational learning should be situated in the real

world, experts will be in the back office represented by a marketing intelligent person; Learning will not be condensed into an arbitrary time slot but will be integral to the business and the community will learn together as opposed to one person at a time (Dixon, 1993).

Learning skills is just one part of the problem. Development means changing frameworks (Dixon, 1993). This explains why managerial behaviour change is not sustainable. According to Elwood the transfer system needs to be managed to ensure that organisational learning can happen and grow organically (Broad, 2003; Holton III & Baldwin, 2003; Naquin & Holton, 2002). Learning how to cope in a dysfunctional system will not change by learning functional behaviours because the system will drive the behaviour back to coping with dysfunction. Chapman explains how the integrated learning model in Figure 10 can be an example of a changed framework (Chapman & Cilliers, 2008).

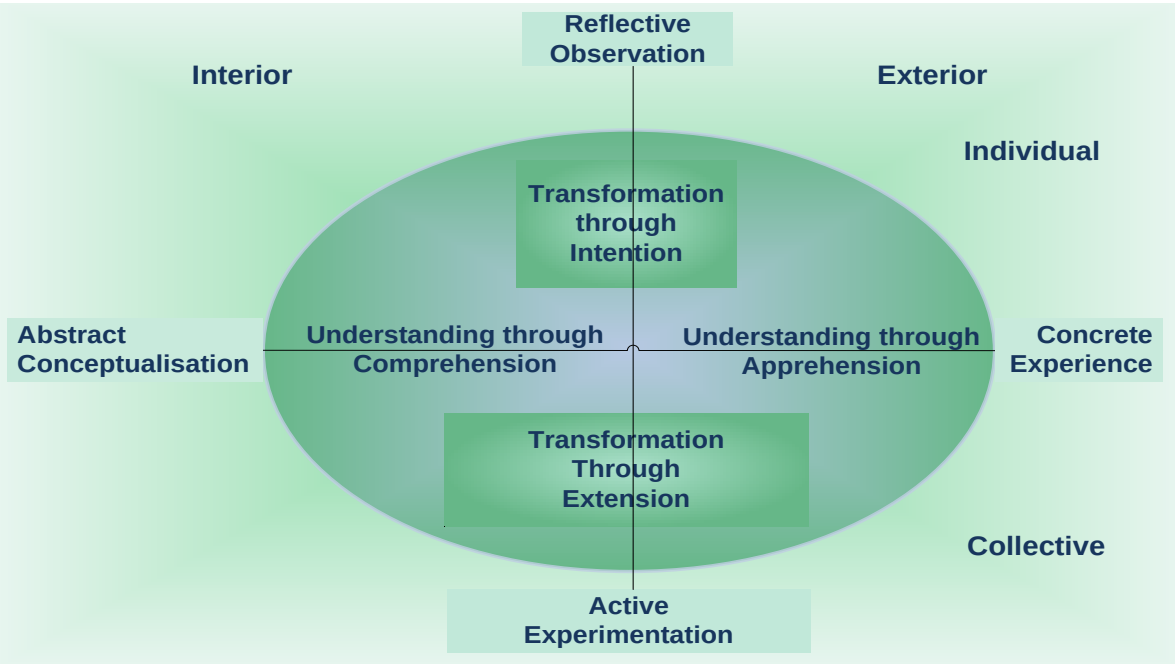


Figure 10: Integrating individual and organisational learning

Source: adapted from Kolb (2012) and Pauchant (2005)

The organisation learning as described above could be integrated into a coaching programme and then executive coaching is viewed as a formal, relatively long-term relationship between a number of individuals with collective responsibility for

executive (including managerial and leadership) authority and responsibility. Most executives understand the concept of strategy formulation and organisational design, but not its actual implementation. Dixon (1993) explains that management development is a gamble as one cannot predict of guarantee the desired outcome. And the timing of the development is not predictable and if the framework needs to be changed one person cannot learn alone as the group inertia will reinforce the old behaviour. The answer to this issue may be found in the work of Jaques on stratified systems theory, which refers to the level of complexity of the task (Jaques & Cason 1994; Jaques & Clement 1997).

Thus, the complexity lies not solely in the formulation of the strategy but only succeeds in the implementation. The strategy has to be implemented and adapted in a continuously changing environment and it has to be a 'real-time strategy' (p13). It is hypothesised that executives find designed strategies difficult to realise because they do not recognise the various levels of complexity and the complexity of translating these levels to their managers who have to implement the strategy. They become overwhelmed by the conflict between their roles as executives and modern, transformational leaders. According to Jaques and Clement (Jaques, 1989) the following competencies are required to manage the levels of complexity involved i.e. Cognitive power, Values, Knowledge/skills, Wisdom, and Traits.

Cognitive power refers to the potential strength of cognitive processes in an individual and the maximum level of task complexity that the individual can handle at any given point in his or her development. This concept represents the maximum number, ambiguity, rate of change, and interweaving of variables that an individual can process in a given time. It is the required cognitive complexity the person can apply to a managerial task of given complexity.

Where a strong sense of values is required for managerial work, and for the leadership of others an individual with the required cognitive complexity must also want to do and value the work at hand. Personal values have to be aligned with the work people do so that their mental energy can be focused and unleashed. If the individual believes in what they are doing, more energy will be available to do the work. Sadly, the converse is also true, even if the individual is cognitively gifted, lack of meaning results in low energy. In certain areas appropriate knowledge and skills

are only the ticket to the game and more experience is needed to avoid costly mistakes.

Wisdom applies to people and things and is related to the soundness of the individual's judgment about the world and people - the ability to make good judgments about people and how they are likely to react in various situations. While, experience is necessary wisdom is required to utilise concrete experience and abstract conceptualisation. The acquisition of wisdom involves the comprehension dimension of experiential learning (Kolb & Kolb, 2012).

The presence of leadership traits and qualities or the absence of temperamental or emotional characteristics in the individual can disrupt the ability to work in teams. This aspect can be seen in the work of coaches who specialise working in this area with emphasis on the weaknesses. Jaques and Clement (1994) conclude that effective managerial leadership in highly complex environments demands three basic conditions. Firstly, the individual must have the necessary level of cognitive competence to sustain the required role and must strongly value the work and responsibility associated with that role (Chapman & Cilliers, 2008). This leads to the third research question.

Research Question 3

How can coaching assist the engineer in negotiating the challenges experienced during the transition to management?

2.12 CONCLUSION OF LITERATURE REVIEW

In review the literature provides a backdrop of an emotionally charged environment where an engineer is expected to develop new skills, to manage a complex non-technical environment at a time when the requirements are unclear, there is no universally correct answer and the key to success lies in motivating other people to achieve the desired goals.

The contribution of coaching will be to assist the new manager to close the gap between engineering success and managerial success. There will be similarities and differences between individuals' experience of level and kind of challenge during the transition. The study will explore those similarities and differences. It is understood

that Coaching is often presented as a panacea to problems in transitions. This research study will attempt to outline how coaching can facilitate engineers' transition to become effective and motivated managers by providing requirements as identified in the research.

Finally this chapter considered the existing research that informed the study of the challenges faced by engineers during the transition to management, the next part reviewed literature on transitions. The link to coaching as method to address transition challenges completed the chapter. In the following chapter the research methodology will be described

3. RESEARCH METHODOLOGY

In this chapter, the methodology used to study the research question is described. The discussion includes the data collection procedures, the research data used and thematic analysis used to develop the data

A brief overview of research methodology theory provides the introduction and the context for the rest of the report which contains the research design process, population, sampling and the research instrument. The sampling selection is discussed and motivated and the procedure for data collection and analysis is explained. The research methodology connects to the research problem and determines the outcome.

The chapter concludes with the procedure for data collection, data analysis, and interpretation. As with all research the limitations, validity, and reliability have to be reviewed critically to assess the implications for generalisability and repeatability. Finally, I consider the ethical issues as they apply in this research and issues of reliability and validity.

3.1 RESEARCH METHODOLOGY / PARADIGM

The use of qualitative methods is appropriate where the study explores the human experience from the individual's perspective (Maxwell, 2012; Ponterotto, 2005; Ulrich, 2003). The context of the person's philosophy and world view is closely interwoven with the data and the research question is based in the philosophical viewpoint and experience of the researcher (Bliss & Rocco, 2003). As Creswell (2007) explains, qualitative methods provide for the possibility of revealing unknown phenomena and the results are then interpreted to provide new knowledge. The quantitative methodology provides a means to measure variables previously identified in a model whereas research using the qualitative method is predominantly inductive and extracts the common threads from the experiences of the participants (Creswell et al., 2007). He goes further to explain that the researcher identifies an observable event, sequence of perceptions or phenomenon in the human experience and gathers data about that phenomenon from the people who can provide first-hand information. Each participant may, on reflection, bring some interpretations or greater dimensions that may not have been evident at the time of the event (Willis, 2004).

Qualitative methodologies are used to listen to how different people express their own experiences. By allowing the participant to speak the perspective emerges in their own words (Orbe, 2000). As phenomenology is the study of the essence of experience, it is suitable for this study. Phenomenology provides a way to focus on the conscious experience of how a person relates to his own worldview as described by van Manen (1990). It is important that this is done before the interpretation occurs and the naming of a phenomenon contaminates the meaning. Phenomenological research is involved in exploring the phenomenon as it is presented (van Manen, 1990).

The researcher may or may not be aware of some interpretation or experience that will influence the research process as Creswell (2012) mentions, quoting Moustakas (1994). He refers to “bracketing” as the process where the researcher, being aware of the possibility of intrusion of his/her own ideas, makes special effort to see the evidence as for the first time (Creswell, 2012, p80). The next part of the process was to develop a description or word-picture of the essential parts or some composite of all the various experiences through rigorous data analysis (Creswell, 2012).

If coaching research agrees on one thing it is the ability to listen without introducing additional interpretations. The art in research is then to present the participant’s experience as directly as possible. Compared to the positivist approach The Phenomenologist researcher is aware that she is part of the measurement and that her beliefs, values, and attitudes are acknowledged. (Fouche, 1993),

Mouton and Marais (1990, p. 12) state that individual researchers “hold explicit beliefs”. The intent of this research was to hear the perspectives of the new managers about the phenomenon of their challenges during the transition to management (Groenewald, 2004).

The clusters of meaning covered many topics from economics, psychology to anthropology and finance. The clusters of meaning covered the whole range of human experience. A review of the clusters eliminated overlap between the clusters. The result was that the data were as close to the meaning as possible.

3.2 RESEARCH DESIGN

The research design is qualitative and the proposed method of gathering the data will be through semi-structured interviews. The process may be more time intensive than a questionnaire but the purpose of the study is to elicit new information and the assumption is that, on reflection, the participants may be able to reveal information and interpretations that will expand the current understanding. The questionnaire does not facilitate this level of interaction. The process of semi-structured interviews allows for some structure in that the same questions are asked but that they are sufficiently open ended to allow reflection to take place. Since the researcher's intent is to create an informal atmosphere and to establish credibility, it should enable the participant to share personal experiences and interpretation. The questions were adapted where necessary, to explore the personal experience as it is revealed during the interview.

This qualitative research is intended to contribute to the body of knowledge in the study of coaching as is relevant to the field of engineering management. In order to compare the results, 4 coaches and 4 managers were interviewed. These coaches and managers were chosen to provide an alternative view on the challenges faced by new managers and would have been involved with manager development.

3.2.1 Population and sample

The population resides in the South African engineering professionals who have recently been promoted into a management role. The sample includes a range of disciplines from Electrical to Civil and Mechanical engineering who are currently working in the Engineering department of a State Owned Company.

3.2.1.1 Population

The study focused on a group of professional engineers registered with the Engineering Council of South Africa and who have been promoted to management in the previous twelve to eighteen months. The reason is that the individuals should be in the transition phase between the engineer role and the managerial role. If they have been successful, the experience will still be vivid and if they are in a stressful situation they should be able to articulate the stressful aspects of the situation. The

population includes all disciplines such as Electrical, Civil and Mechanical engineering. Typically the new managers and the supervising managers will be engineers but the coaches may not necessarily be engineers.

3.2.1.2 Sample and sampling method

The purposive sample was chosen consistent to include engineers who had been promoted in the recent 18 to 30 months. Originally the plan was to select professional engineers but low numbers of professional engineers required the expansion of the sample to all Engineering professionals. The sample consisted of 16 participants. Only one of the participants was formally prepared for the role in a structured process.

Table 4: Profile of respondents in sample

	Engineers		**Technologists**		**Total**
Demographic	**Black Asian or Coloured**	**White**	**Black Asian or Coloured**	**White**	
Women	2	1	5		8
Men	2	3	3		8
Total	4	4	8		16

A number of managers were approached for a short discussion to determine what the criteria for selection were and how the process was perceived.

Table 5: Managers interviewed

	Engineers		**Technologists**	
	Black Asian or Coloured	**White**	**Black Asian or Coloured**	**White**
Managers	1	2	1	1

The other interviewees provided context to the business in the current economic environment. None of the participants were coached by external coaches or management coaches. No managers who were interviewed were trained as coaches.

3.3 THE RESEARCH INSTRUMENT

The interview questionnaire is included in the appendix. The intent of the questionnaire was to provide the opportunity to explore the experiences from the participants' point of view and also to allow the researcher to be receptive to new information and clarify her understanding. The researcher had some understanding of the context of the philosophy underpinning the study as well as some awareness of the assumptions in the study. These assumptions were clearly identified. The participants had the required experience in the situation under review. The result is that the researcher and the participants developed a shared understanding of the experience (Creswell, 2012; Elo & Kyngäs, 2008; Hsieh & Shannon, 2005).

3.4 PROCEDURE FOR DATA COLLECTION

Interviews with a number of participants were arranged formally with a letter of introduction. The letter introduced the researcher and a personal telephone call confirmed the letter and the request for participation. The confidentiality of the information was emphasised and the process of tape recording and transcription explained. Face to face interviews were conducted at their offices where possible. A follow up letter provided a broad outline of the questions in order to make the participant comfortable with the kind of questions that would be asked; it also provided time for reflection so that they were more prepared and at ease during the interview.

I recorded the interviews on a digital voice recorder and used compatible software to convert the audio file to a MP3 which was the medium of exchange with the transcriber. Each interviewee was assigned a code, for example such P# filename quote line. Soon after each interview I reviewed the recordings, made notes of words, expressions and terminology as well as emotion.

One issue during data collection included problems with the arrangement and execution of interviews (Creswell, 2012). These problems were contained by good

planning and by providing a greater amount of time for incidental events such as cancellations. A further point to note is that, in order to be an instrument of research, the researcher is expected to maintain awareness at all times that the participant carries the data (Creswell, 2012, p.83). As Moustakas (1994) explains, the transcendental phenomenology attempts to contain the researcher's own assumptions and experiences to concentrate on the experiences of the participants (Creswell et al., 2007, p19). This was applicable to me and this issue is discussed in the Ethics paragraph.

3.5 DATA ANALYSIS AND INTERPRETATION

Qualitative data analysis is specifically designed around the study and the process is non-linear and iterative (Creswell, 2012; Elo & Kyngäs, 2008). The process consists initially of procedures to manage the large amounts of information gathered during interviews, reading and capturing thick notes at relevant places in the transcripts and classifying or coding before data analysis. As discussed in Hsieh and Shannon (2005), the data was grouped into codes or categories. These codes may be created new or be part of existing theory. The inductive approach to content analysis is recommended when existing knowledge is limited (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). In this study there are some codes available from existing research, but since the link to coaching is unexplored, it is considered to be new territory and therefore new codes are required (Braun & Clarke, 2006; Quest & McLellan, 2003; Thomas & Harden, 2008). The diagram in Figure 11 process of data analysis

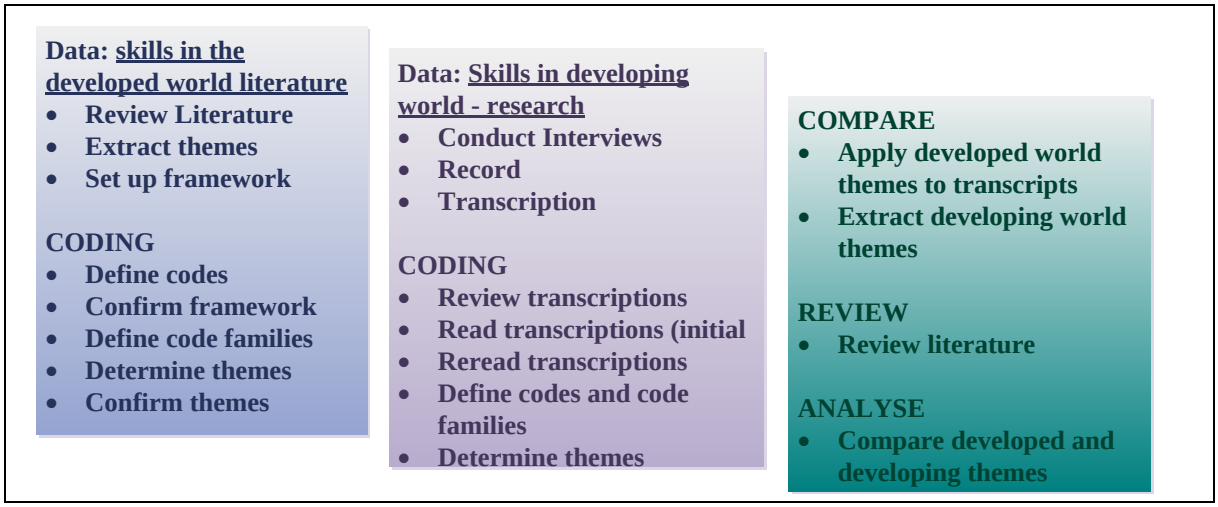


Figure 11: Process of data analysis

Source: Adapted from Hsieh and Shannon (2005)

This figure illustrates the two parts of the coding and the analysis and comparison between of the codes. The next phase was to develop themes and create a detailed description of the themes in terms of the researcher's own perspectives gained during the literature review (Creswell, 2012; Saldaña, 2009). The main principle was to condense the various themes to a usable number where each theme contained a number of sub-themes. (Creswell, 2012, p. 185). There were some codes available from literature by Howard, Younts, and others but since the link to coaching is unexplored, it was considered prudent to determine new codes and themes (Braun & Clarke, 2006; Quest & McLellan, 2003; Thomas & Harden, 2008).

The next step was to expand on the codes to create abstract meaning or principle. These principles were determined, with due regard for the data, the abstractions were based on an interpretation intuition or insight derived from the data (Creswell, 2012).

3.6 LIMITATIONS OF THE STUDY

The limitations of the study relate to the sample and the context. The participants did not necessarily know what they did not know. This means that they provided information that was top of mind for them which means that some information may be excluded by omission. There may also be issues that underlie the transition to management that did not surface in these interviews.

Qualitative research methodology is criticised for perceived inadequate generalisability. The research will not be generalisable over the whole population. As an explorative study, it may provide some insight for a larger sample study in future.

3.7 VALIDITY AND RELIABILITY

The three types of validity defined in quantitative research are content-validity, criterion-validity, and construct-validity (Giorgi, 2002; Zhang & Wildemuth, 2009). The issue of subjectivity cannot be excluded in phenomenological research but the challenge is to design the research to establish an objective method to view the

experiences which would be the object of the study. Going further and considering the viewpoints of coaches and managers will provide a three-dimensional view on the phenomenon.

3.7.1 External validity

External validity is also referred to as transferability. External validity strategies include a number of methods such as persistent observation, triangulation, peer review, negative case analysis and clarifying researcher bias (Creswell, 2012; Hsieh & Shannon, 2005). It was assumed that the interview questions would provide sufficient engagement to ensure that the researcher is able to build good rapport with the participants. The confirmation strategy involves interviewing a number of participants to confirm and corroborate the theme or code (Saldaña, 2009). Sometimes however, in the case of an alternative viewpoint, one comment may carry significant weight because it provides critical insight or meaning despite the fact that the opinion is not held by many participants (Creswell, 2012). Finally, the researcher commented on previous experiences, biases, and preconceptions that may have influenced the data analysis or interpretation. In view of these several strategies, the validity of the study is ensured.

3.7.2 Internal validity

Internal validity is also referred to as credibility, which entails checking the credibility of the categories, codes or themes (Giorgi, 2002; Hsieh & Shannon, 2005). Where relevant, these may include a) a check to determine whether the understanding ties in with the original participants; b) using additional qualitative analysts or a reviewer to verify the data by looking for discrepancies and errors; c) comparing other qualitative perspectives; or d) triangulation with external factors or available quantitative data.

In summary the research methodology was applied in the tradition of Qualitative Phenomenology using well documented methods and coding content analysis to assure credibility, confirmability and to provide rich descriptions so that the participants' experiences would be clear to another researcher through the well-chosen coding and analysis of data.

3.7.3 Reliability

Reliability is safe-guarded by ensuring quality procedures during all data capture and transcription phases (Creswell, 2012; Golafshani, 2003). The literal transcription was done by an independent company and all comments and pauses were included according to the requirements mentioned in the literature (Frankel & Devers, 2000).

The next part of the reliability analysis was to ensure that the coding structure was reviewed during creation. Any duplication or overlap was highlighted and resolved. This was done by the researcher confirming her understanding with the participants where necessary, peer debriefing during colloquia and the use of field notes (Hsieh & Shannon, 2005; Saldaña, 2009).

The processing was done under controlled conditions and the transcripts are kept in a locked room. The transcripts will be destroyed. Informal meetings were arranged with some senior managers in order to obtain feedback on their opinions of what would be required from new managers and what the experience has been up till now. The questionnaire is provided later in the report.

3.8 ETHICS

The issue of ethics in research is naturally a concern where people are involved. It was explained that their names would not be used as the data was the concept or the experience they described. As the information is not of a highly sensitive nature, none of the participants became uncomfortable or asked to stop the interview.

The participants granted informed consent for the interview and recording in writing. The interview was conducted in English and most of the participants were able to understand English due to the nature of the business which provided some measure of comfort that the participants did understand the purpose and intent of the questions.

The conversation appears staccato in places and I took care not to pre-empt the missing words. In some case this may be a result of language and vocabulary or a need to avoid an uncomfortable moment. Since I could not create a word without introducing noise into the conversation I allowed the interaction to find its own way. The questions were focussed on the participants' experience without any judgement.

In cases where participants identified successes and problems these were received with ease and no evidence of judgment. They were encouraged to ask questions at any stage.

The process followed was in alignment with the 6 step process in Zhang and Wildemuth (2009). The interviewer started by establishing rapport and expressing appreciation for the experience of the participant as well as the language and culture of the participant. The participant was the most important person in the room and the interview was centred on his/her experience. The interviewer was there to learn. Most meetings were held in the participants' offices and permission to record was obtained after explaining that it was important to provide a clear chain of evidence for any data. The fact is that the interviewer was also part of the process and as such it was not objective in every way.

I, as the researcher, was an engineer who had experienced a similar situation some years before and had to be aware of and avoid any leading questions during the interview. It may be that some engineers were concerned to present a 'successful' front and not to show any weakness while other participants were quite comfortable in expressing their opinions and challenges. It is possible that had I asked more leading questions that the participants would have responded differently but it was more important in this context not to interfere with their reality.

In the following chapters the findings are presented in two parts. The first part describes the findings that confirm the competencies in the literature on management transition based in the first world. The development of these competencies constitutes the first part of the challenge to the engineer during the transition to management. The second part highlights the research findings that lie outside the competencies in the first world literature on managerial transition. The development of these competencies constitutes the second part of the challenge to the engineer during the transition to management, specifically in the context of a developing country represented by South Africa.

4. FINDINGS CONFIRMING COMPETENCIES FOUND IN THE LITERATURE

The research findings are presented in two parts. The first part reviews the findings that confirm the transition challenges mentioned in the existing literature. In some interviews, the new managers indicated that there were specific challenges that were addressed by their receiving managers and some difficulties that they had to manage alone or with help from other colleagues. The second part reports on the findings that contain additional information on managerial transition challenges that will complement the existing management literature. Where a new manager develops competencies to deal with challenges, these competencies are collectively called a model.

4.1 INTERNATIONAL MANAGEMENT COMPETENCIES

The first part of the chapter discusses the findings derived by means of a deductive process. Literature on engineering managers' transitions, based in Europe and America, confirmed that engineers who want to become managers need to improve their ability to motivate subordinates and manage the administration (Biddle & Roberts, 1994; Bland, 1996; Dittmann, 2009; Goldberg, 2006; Hood, 1990; Howard, 2003; Johnson & Sargeant, 1998; Liu et al., 2012; Quey-Jen, 2008; Roberts, 1994; Seethamraju & Agrawal, 1999). This study showed that there are managerial competencies that are well reported in the engineering transition literature based in the developed world. The development of intrapersonal and interpersonal or social skills is considered a foundational part of managerial behaviour when engineers start managing people.

The developed world literature referred to management as a way to improve efficiency in operations, where efficiency was defined as improving productivity, reducing waste and cost, as well as ensuring procedural consistency and managerial control of execution (Aster, 2008; Cordero & Farris, 1992; Fowler, 2015; Hood, 1990; Lannes, 2001). The *international engineering management competencies* are contained within the well-established management theories (Boyatzis, 2008; Childs & Gibson, 2010; De Meuse et al., 2011; Wu et al., 2005). In Figure 12, the engineering managers' competencies required to manage junior engineers include

communication, planning and administration, teamwork, strategic action, global awareness, self-management and technical skills. The increased weighting on planning, administration and communication skills arise as a result of the operational efficiency required of the department which is the primary responsibility of the manager in this role.

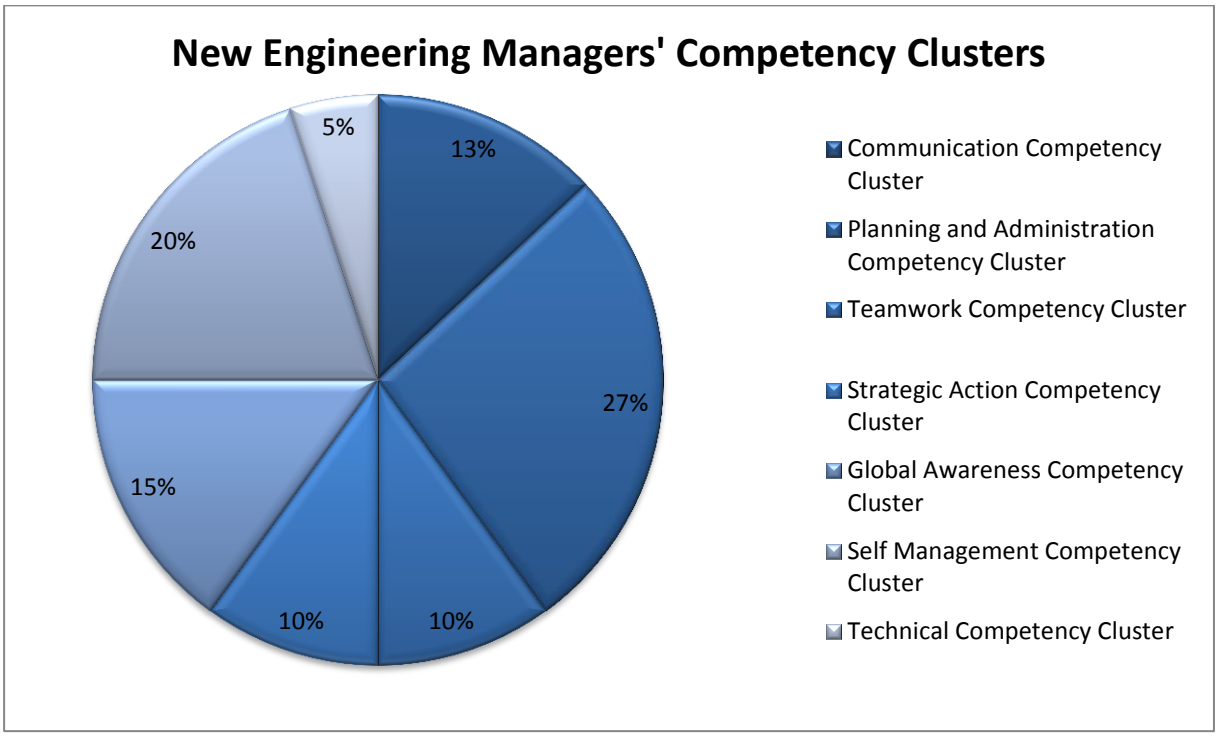


Figure 12: International managers' competency cluster model

Source: Adapted from Wu et al. (2005)

The diagram illustrates the relative importance of the various competencies as rated by the researcher based on the literature. It also shows that the importance of the technical competency cluster reduces over time. The concept of the international managers' competency model includes the general management competencies such as finance and human resources as it is taught at most business schools.

International managers' competencies are based in the Western management discourse where the common language is English and there is at least a tacit agreement on the basic rules of production, profit, and competition as represented by the Capitalist economy where Capitalism may be defined as a system of production, legitimised private ownership and control of the means of production and negotiated labour (Jessop, 2013) . In a developing country, most of these rules cannot be

assumed although the “Washington Consensus” previously attempted to convince developing country governments to open their markets (Birdsall & Fukuyama, 2011).

It became clear that there is no consensus on what a manager is supposed to do except be efficient at motivating people to deliver engineering work. The study revealed a set of challenging behaviours that a new engineering manager needs to manage in a culturally diverse and politically sensitive society. This set of competencies was not clearly covered in the transition literature. The engineers working in South Africa are diverse and so new managers in a developing country like South Africa have to be aware of diversity (Human, 1996).

The *transitionery managers' competencies* in Figure 13 illustrates the relationship between the international and transitionery managers' competencies and the neglected area of transition between engineering and management in the developing world as indicated by the right arrow.

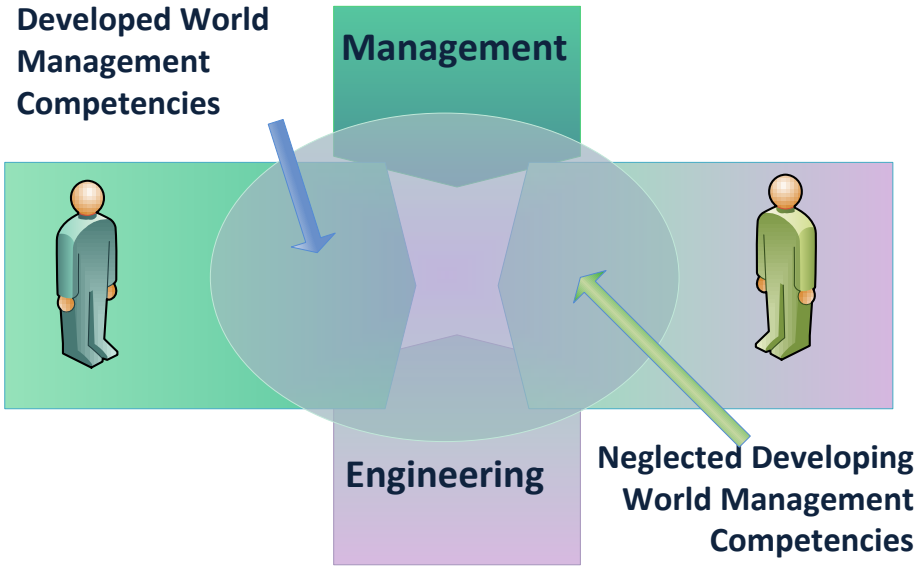


Figure 13: Illustration of international managers' competency model

This illustration shows the two groups of competencies and how they fit together to make up the engineers' skill set combining the international engineering managers' competency model and the transitionery managers' competency model.

In order to address the first part of the findings, the list in Table 6 provides a summary of the transition processes related to the international manager's competencies that appeared in the literature.

Table 6: International Managers' transition competency model

Found in the literature	Reference
Identifying and promoting the new manager	(Aucoin, 2002) (Aster, 2008; Couch, 1979; Dittmann, 2009; Dixon, 1993; Thamhain, 1986)
The role of the receiving manager during on-boarding	(Chao, O'Leary-Kelly, Wolf, Klein, & Gardner, 1994; Dai, De Meuse, & Gaeddert, 2011; Sweeney, 2009)
Learning to prioritise and manage conflict; Communication and transfer of policies and procedures	(Badawy, 1995; Biddle & Roberts, 1994; Bland, 1996; Chari, 2008; Cordero & Farris, 1992; Goldberg, 2006; Hood, 1990)
Strategy, vision and company values	(Casey, 2011; Dolan et al., 2000; MacTavish, 2007; Mayer & Louw, 2012)
New manager training and development	(Avolio & Gardner, 2005; Bigliardi et al., 2005; Boyatzis & Saatcioglu, 2008)
New manager assessment and performance management	(Badawy, 1995, 1998, 2009; Eisner, 2000; Howard, 2003; Sithole, 2012)

This table is used as a structure for the following paragraphs: identifying and promoting the new manager; the role of the receiving manager during on-boarding; learning to prioritise and manage conflict; strategy, vision, and company values; new manager training and development; and finally new manager assessment and performance management. The engineering path into management usually starts with the engineer being assigned to lead a small project team to produce a design and it is during this period that the potential manager is noticed. The findings from the interviews with participants are presented under the headings below.

4.2 IDENTIFYING AND PROMOTING THE NEW MANAGER

The receiving manager identifies a gap in the structure due to growth in a department, new engineering appointments, the span of control becoming difficult to

manage or a new function added to the mandate. The potential new managers are identified by the receiving manager through evidence of visible leadership behaviour as well as the ability and willingness to work with others. One new manager explained that:

> the whole reason I stepped into that was I was asked as such, and it was because of restructuring and people moving into different positions, acting in other levels and such, and our boss at that time was moving into an acting position of senior manager, so I moved into an acting position for the discipline manager

This participant was identified as a potential manager and although she did not yet see herself as a manager she explained how her manager told her that he thought that she would be a good manager

> And he said, because you would… I think you'd make a good manager. And then I said, oh, okay, I don't really want to be a manager, I want to be a specialist, I want to specialise in what I'm doing. Then I was, like, really in love with what I was doing

She was hesitant to move out of engineering at that stage as she enjoyed the technical part of her job and wanted to prove that she could do engineering design work. The reason was that the few women engineers stand out and often their male colleagues expect them to leave or fail. This new manager wanted to prove that she could stay the course and she said:

> I don't want to cop out as a lady engineer; I want to stick it out

Potential new managers are identified by their ability to marshal and motivate members of a small team to produce engineering work. One respondent thought that he was identified as a potential manager because he was inclined to take the lead. As he began to lead a small project team he realised that he enjoyed it more than he expected and accepted bigger projects with more people. He explained that:

> I started with small project, leading a small team of people, and as the team grew and grew, I felt that I actually enjoyed management a lot more than I enjoyed doing design

In contrast with this participant, another new manager revealed that she doubted if she was ready to be a manager because she still wanted to keep up to date with

technical work. When potential managers are promoted to line managers they are responsible to manage the people with the speciality skills in the department in addition to their previous technical deliverables. This female engineer was glad that the role included part of the technical side. She explained that her receiving manager had said that:

> [I would be] the leader of the department and all of that. So I felt that there were elements of me that needed growth and so this decision doesn't feel as bad.

This sentiment was contrasted when another newly appointed manager remarked that a manager could not combine both areas when she explained:

> The one problem we normally have, people when they are in a technical environment, when you start being a manager, you start losing touch of being so technical, so other people have that problem of wanting to be technical when they are managers, so they are becoming bad in both, at the end of the day

Sometimes an engineer is unwilling to take the lead or unable to delegate and prefers to do everything himself. Then the senior manager will recognise that this engineer would not be a suitable candidate for the new manager role. The senior manager explained how he noticed when an engineer would prefer to stay in the technical field:

> The guys that sit in their desk and do their own thing, yes, we must train them to be [a] specialist; they sit there and do their own thing.

For the receiving or senior manager the process of identifying the engineer with managerial potential is based on perceived leadership and willingness to interact with people. After potential managers are identified, interviewed and after the recruitment processes the successful candidate is promoted to the role. This confirms the findings described by Aucoin (2002) and others (Aster, 2008; Couch, 1979; Dittmann, 2009; Dixon, 1993; Thamhain, 1991). After appointment the new manager will learn the additional skills that are expected of a formally appointed manager

4.3 THE ROLE OF THE RECEIVING MANAGER DURING ONBOARDING

In the literature on-boarding or socialisation is mentioned in the context where new employees are appointed from external companies. The term is applied here because the new manager is appointed to a new role and although the new manager is still in the same organisation he has crossed a threshold into management. A subset of the on-boarding process can be recognised in the literature. (Dai et al., 2011; De Meuse et al., 2011; Deshopande & Golhar, 1994; Deshpande, 2013; Golhar & Deshpande, 1997). Snell (2006) and Dworkin et al. (2006) have augmented the understanding of socialisation as a contributor to the successful transition of new managers.

The management style of the receiving manager is a factor in the recognition and selection of an engineer as a potential manager. Typically an increase in workload combined with a need to split a department to reduce the span of control will trigger the process. If the receiving manager was not on-boarded and had to survive a 'sink-or-swim' experience, he would expect the incoming manager to do the same. The new manager would have to find his own way without much involvement from the receiving manager. One participant said that:

> I think my boss just had his own confidence over me, because he just throw me there, and then he never really helped me in the day in terms of how to deal with those things, I ended up not even taking my issues to him, because it was like, no you will grow up, just see how you get out of the situation.

This new manager established his own support system. Another newly appointed woman engineer related her experience this way:

> I would have really liked for the first few months to be seeing my boss and not formally at a management meeting but informally, just talking about things, the direction he wants to take, what he expects and all of that. So I would initiate that to say, You know what, let's go hang out somewhere and just chat, Where do you come from, get to know them a bit. And for me that's only happening, like, now ….. When he did come back he had quite a bit of stuff to handle because he was still trying to catch up with what has happened.

This new manager needed to feel a sense of belonging and is voicing a need for guidance and reassurance. This need for guidance was also noted in the South

African literature on personality in the literature review (Meiring et al., 2005; Valchev et al., 2011). There is a personal and cultural requirement for relationship building during the time of adjustment in the new role.

In contrast to the need for guidance, some engineers want challenging work and as such they prefer to be dropped into the deep end. Some of these engineers think that the 'sink-or swim' method of management is an appropriate way to separate the men from the boys in engineering. The unwritten law of engineering says that one should tough it out and one new manager explained he thought that is a good way for engineers to learn fast:

> The new-build engineers get a lot more experience, a lot faster; I think because it has fast deadlines and it's a high pressure project people are forced to meet deadlines. So what I find is that if we start moving people towards the new build projects and we start developing the experience there you can actually bridge the gap very quickly. (P 1: 811_0031 Id.docx - 1:18) (43:44)

This new manager thinks like the group of receiving managers who assume that the newly promoted managers will find out what they need to do on their own in the same way they did when they were new engineers. This may have been the culture in the past decades when the receiving managers were new engineers in the late 1980s. Some new managers may find their own way while some other managers will not. The new managers who lose their way and still blunder on without help are only discovered when the junior engineers who report to them resign, leave, or ask for a transfer.

In a case like this, the receiving manager had not made the new manager aware that he may be dealing with a wide variety of cultures. As such he will be expected to provide more information and guidance to those of his junior reports who need more information and guidance from their manager. It should be made clear that this is part of his responsibility. One competent newly appointed manager was surprised to notice his junior engineers also exhibited similar behaviour.

> One of biggest problems I found was people don't know what they need to do, and if they don't know what they need to do they sit and do nothing (P 1: 811_0031 Id.docx - 1:52) (167:167)

This finding points to a generational or cultural difference where new managers would rather not ask a question if they thought they would be ridiculed or made to feel inadequate in some way. Most engineering management problems do not arrive in neat well phrased packages; more often they are wrapped in anxiety, chaos, and confusion. So a new manager would expect his junior engineers to engage each problem courageously. Instead receiving managers should make new managers aware that their reports may need more attention and guidance on how to resolve problems. So if a junior engineer sits quietly too long he may expect the new manager to notice that he needs help and offer assistance. One participant linked the need for guidance to the generation gap between the Baby Boomers and generation Y. The new manager's unspoken wish that the receiving manager provide an answer or guidance may also be an expression of a personality trait. The differences in the way the various generations approach problems has been noted in the literature (Callanan & Greenhaus, 2008; Conger & Benjamin, 1999; Eckleberry-Hunt & Tucciarone, 2011).

Some respondents were lucky to have someone to talk to while others were more proactive and made it a priority to contact a senior person inside the company. One participant asked her manager directly about what to do when she said:

> I'm moving into this role, what must I be aware of? And then informally he gave me some tips. And then otherwise I read. I literally just figured, you know what, let me read something and then let me put it on paper and I just followed that. And I read "The First Hundred Days", what to do in the first hundred days.

A new manager with a supportive receiving manager was able to cope with his role in this way:

> I had a senior manager who was with me, and I'll be able to contact him at any time, so he was available. And some of the colleagues were there for a long time – they will guide me, how… they were accessible, because some of them, I worked with them under… I worked for them in their projects before, yes, so it will be… it was easy to talk to them, yes.

If new manager asks for guidance from a receiving manager who was not exposed to assistance in the role, the receiving manager may not know how to assist the new manager. If however the manager received guidance earlier in his career, then he

would know how to assist a new manager. These findings confirm those findings noted in the literature (Bigliardi et al., 2005; Chao et al., 1994; Cooper-Thomas, Anderson, & Cash, 2011; Dworkin et al., 2006; Field & Coetzer, 2011; Haueter, Macan, & Winter, 2003; O'Brien & Drost, 2011; Riordan, Weatherly, Vandenberg, & Self, 2001; Saks, Uggerslev, & Fassina, 2007; Van Maanen & Schein, 1979)

Socialisation is part of a much larger engagement with the new management cohort who are expected to maintain control and enforce operational rules. The next step is to ensure that the new manager is informed and made aware of the applicable policies and procedures that are considered essential to the good order in a department and are also required to ensure fairness and transparency as required by the Labour Law as amended (Republic of South Africa, 1998).

Engineers are asked to lead larger project teams or the person is placed in an acting position to see how they perform. During this time, in addition to the technical deliverables, the new manager is required to manage the team and approve their timesheets, ensure the accuracy of financial reports. The manager soon learns the importance of human resources policies, procedures, and skills reporting. The manager is also a manager of a budget and is required to manage expenditure, commercial, and procurement approvals.

4.4 LEARNING TO PRIORITISE AND MANAGE CONFLICT

New engineering managers have to learn to prioritise their work, to manage conflict, and structure the work of their subordinates. In a matrix organisation it is much more pressured and complicated. In the beginning by managing small teams the potential manager engages with people and the receiving manager has an opportunity to see how the new manager prioritises work and deals with conflict, communicates about a problem and whether he is willing to delegate. The ability to prioritise conflicting demands and plan accordingly are skills that will enable the new manager to negotiate his way around an avalanche of demands as mentioned in the literature (Bland, 1996; Chari, 2008; Hall, Munson, & Posner, 1992; Hood, 1990; Seethamraju & Agrawal, 1999; Wilde, 2009).

The more introverted and autonomous engineers may initially want to solve all the problems themselves first. The need for planning and prioritising is then learned the

hard way and can be stressful if the new manager has not been alerted to the demands of the new management position as this newly appointed manager explained:

> My relationship to the work – it must move; like you say, it must move, meaning I must see progress that I'm… I am… I'm educating things, I'm leaving behind… some of the things that I've done I'm leaving behind, I move forward. In that case, if I look at the way I was operating at first is like… because I wanted to do everything at once, and by myself I'll find that I don't get anything done, because I jump from this task, one [job], and realise, oh, I haven't finished the other one; I leave this and go to that. So this planning part was a challenge, yes. (P11: 811_0024 EdM.docx - 11:18 (151:151)

Learning on the job may be the usual way of initiating new managers but it does not always have to be that way. One respondent was formally prepared and her experience is described in paragraph 5.3.

The manager who is appointed from team leader to manager finds overnight that the technical workload includes taking care of the administration for, financial control of and the management of a number of people. His financial knowledge is tested quickly when his subordinates do not fill in time sheets accurately and timeously,

> [Obviously] it's a little bit difficult, just to grasp everything, financial aspects, which I was never involved with before the budgeting, the cost centre, that type of thing.

The budgetary demands are not complicated per se but there is little time to acquire the expertise before the reports are due and one manager expressed as "being split" when she explained:

> [Because] I was still the owner or accountable and responsible for my technical responsibilities, no one took that owner [ship], so it was basically just me being split in two.

The technical work does not stop or become less challenging and the senior managers want to have the reports accurate and on time. The reports would be in order but that would depend on her reports completing them accurately and on time for the financial data to be captured on the system. The overload is also related to the absence of enough time, money, or resources to complete the work. She

explains the importance of balancing the technical work with the management responsibility:

> There are no margins. Nothing. If you just look at the scenarios mentioned, having the manager taking responsibility and accountability for 40 other people, but also still trying to do your technical job, that's just something that's a little bit thin, at a stage some balls get dropped
>
> (P 2: 811_0044 Myu.docx - 2:44 (93:93)

There is no margin for error and little opportunity for learning as a mistake could have reputational consequences. Certain financial mistakes do cost the manager his or her career. New managers are caught unprepared by the increased workload and how difficult it is to complete simple things like reports. One newly appointed manager expressed her dismay at finding out how little she knew even after attending the required training on the financial system. She said that:

> So the first step was just not nice, and eventually when I got that, I think the actual cost centre owner course doesn't tell you anything, based on what you are actually supposed to do
>
> (P 2: 811_0044 MqA.docx - 2:2 (43:43)

She noted how complicated the financial reporting turned out to be when at last she finally understood the process. Nobody explained what was involved and what was expected of her. The financial reporting issues were only clarified after an uncomfortable management meeting where the errors in the financial software reports were pointed out to her

In the role of manager, she is now responsible to insist that her subordinates fill in the timesheets correctly and she will be held accountable to the senior manager for their lack of compliance. The new manager explained how she realised that she was responsible:

> Then you have to go and stand on the red carpet for things because Fine, you didn't follow processes, but I think one of the aspects of us being given [a course], it's fine being trained as a cost centre owner from a tool perspective for SAP, no one's showed you anything about process and what and what, if you don't go out to the finance guys and try and figure out what this costings or GL accounts, or what does this GL accounts fall and whatever, to ensure that you place the stuff in the correct areas, etc. Then you will struggle from start to finish.
>
> (P 2: 811_0044 Md.docx - 2:4 (53:53)

She understood that she would have to resolve the financial reporting problem with the finance department to avoid another uncomfortable management meeting. Similarly there are serious consequences when errors do slip through. The new manager is reproached at the management meeting for lack of compliance or reporting errors. She sighed and said:

> To be accountable for something that you have no control over is a little bit tricky.
>
> (P 2: 811_0044 Mq.docx - 2:5 (59:59)

The theme of being responsible for something out of the manager's direct control is a constant reality running through projects in an engineering company using a matrix structure. In a project engineering environment there are two managers: one project manager and one engineering line manager. The project manager is responsible for the project deliverable and the line manager is responsible that the design conforms to the engineering standard. Most engineers work on a project, reporting to a project manager for project related tasks while having to adhere to the standards and processes determined by the engineering line manager. This can create conflict when the two managers have competing interests and the engineer has to balance his workload. The project manager may want the cheapest solution in the shortest time while the line manager has to ensure the design meets the standards and operates for the next 50 years. In many cases, the engineer is caught between two conflicting points of view. This structure is known as a matrix organisation and there are many forms of this kind of structure; however the reporting lines and role definitions have to be very clear for the system to work effectively in spite of the

conflict. One newly appointed manager referred to the lack of role clarity and vague reporting structures and explained how the conflict caused additional stress in the department:

> That aspect makes it extremely difficult, in our management structure, I don't know why or whatever, where now you've got individuals having multiple reporting structures, so we are the line management function, but from a project management function, which is the day to day aspect as a project engineer, they actually report daily to someone else
>
> (P 2: 811_0044 Mwe.docx - 2:6 (73:73)

The project and line priorities not only conflict but there are various initiatives from other parts of the corporate business that increase the workload on the new managers and their reporting engineers. A new manager referred to the overload in this comment:

> We are overloading people so much that one of two things happens. Either they make their own priorities, and in those they excel and the rest drops, or they just give up, and nothing really gets done, and most of the time it's the 'give up' aspect. They try and do what they can do, but there's no urgency, there's no pride, there's no… because they've tried so many times, and every time they try someone bites them about something else, so what's the point in trying anymore.
>
> (P 2: 811_0044 Mxa.docx - 2:19 (193:193)

During conditions of burnout and exhaustion, the people have to be able to prioritise according to the mandate and the criteria set by the management. In this case, the lack of priorities is complicated by the skills shortage and constraints on hiring. The competing priorities inherent in running projects in a matrix structure are found in most countries. The issues are managed by a combination of training, compliance and disciplined execution. New managers are not guided to deal with these problems and they are not generally exposed to the advanced techniques available to project managers. This item will be addressed in the chapter on recommendations. These findings confirm the findings in the literature (Cohen, Ornoy, & Keren, 2013; Edmondson & Nembhard, 2009; Ford & Randolph, 1992; Gray, 1979; Hall et al., 1992).

4.5 STATEGY, VISION AND COMPANY VALUES

In the literature, the new manager became part of the management team and that included being a conduit for company strategy, vision and values (Bland, 1996; Hood, 1990; Howard, 2003; Johnson & Sargeant, 1998; Mahlangu, 2014). Only two respondents mentioned the importance of values and strategic direction. They were somewhat older than the average new manager having spent some time in various other roles before accepting this management position

> As a manager you need to look at the business as a whole and give the business direction. And the part that I enjoy the most in management is actually providing strategic direction to the business and identifying gaps; because when you say identify that gap and you see where we're falling short it is almost like a light bulb clicks in your head, and it's a good feeling to identify this
>
> (P 1: 811_0031 Iqw.docx - 1:66 (22:22)

This participant had identified his strength and speaks to the international management competencies. The other new managers did not mention strategy or vision and focussed on the operational part of the business.

4.6 MANAGER TRAINING AND DEVELOPMENT

Training and development form part of employment equity in South Africa. In this study, only one participant was formally prepared and trained for the new manager role and the other new managers were occasionally and informally assisted. Generally, management development is part of an HR initiative in a SOC. Under the current financial constraints, these initiatives have either been scaled down or cancelled.

4.7 MANAGER ASSESSMENT AND PERFORMANCE MANAGEMENT

Assessment and performance management form part of the human resources management strategy, as such these policies affect not only the new manager, but the receiving manager and the junior engineers reporting to the new manager. The participants did not refer to any current HR initiatives that prepared or assisted the new managers during their transition to management. The literature refers to

manager assessments that are done to aid the selection of new managers as well as structured work assignments and assessments to develop new managers.

4.8 CONCLUSION

In most cases, managers will only be developed after they have shown that they are able to negotiate the choppy waters of the transition. Coaching is generally the prerogative of high flyers and top management. The cost of external coaches contributes to this situation. The transition to management resembles a trial by fire and those who are motivated enough to climb the management career ladder towards the promise of increased salary will pull through in order to gain the prize. The participants have shown that the issues highlighted in the international literature do apply to them. In this, they are not different from engineers all over the world going into management for the first time.

The next chapter presents the other set of competencies that enable a new engineering manager to negotiate the dynamics in a culturally diverse and politically sensitive society. It is based on new findings that were not clearly covered in the literature or found in sources indirectly related to transitions.

5. THE TRANSITIONERY COMPETENCY PROCESS

In addition to the managerial competencies identified in the international literature on engineering managerial transition, this study also revealed an additional set of competencies required in the South African environment. These transitionery management competencies enable a new engineering manager to manage a diverse cultural team in order to achieve healthy team dynamics and achieve technical productivity. These new findings were not clearly covered in the international literature based in more developed societies or first world countries.

In this research, I describe the transitionary managerial process to include the ability to manage diversity aspects that have the potential to create friction or misunderstanding in projects and managerial contexts. The skills to manage a heterogeneous workforce where the majority employees are diverse in most aspects are described in the literature by April and Shockley (2008); Human (1996); Kokt (2003) and Kapoor (2011). These competencies that managers need to develop are therefore part of the skillset required to manage engineers in a developing country and are known as the transitionary management competencies in this report.

5.1 THE TRANSITIONERY MANAGEMENT PROCESSES

The transitionary management processes were compiled from the interviews with the participants working on projects in the South African context. The themes that were identified in the research are summarised in Table 7. The themes that emerged during the interviews as part of the research process in this study and in the review of literature, describe how a management transition can be more effective in a South African context. Some of the themes were found in other disciplines such as project management, psychology, human resources, and diversity management. The themes in Table 7 did not receive much attention in engineering research per se as far as I could ascertain and the association of diversity with engineering management transitions provides a specific area for a meaningful intervention. This intervention may include mentoring, coaching, and training and other development work aimed at facilitating the new manager's transition. In Table 7 the identified themes are summarised and related to the participant's experiences.

Table 7: Competencies in this research

Competencies from the research	From the literature	Participants' Experience
Identifying and appointing the new manager	Rarely mentioned	The process is unstructured and intuitive. The criteria are not formalised. This process is mostly cursorily performed
Preparing the new manager	Occasionally mentioned	The manager may be appointed in an acting capacity to reduce risk. Only one respondent was formally prepared using a process.
Role of the receiving manager during on-boarding	Not seen	The receiving manager rarely knows how to coach new managers. Only one receiving manager prepared the new manager for the role.
Prioritisation and transfer of key policies	Mentioned in specific contexts	Managers had to find the policies through experience. The receiving managers assumed that the new managers knew what the values were. One manager was effectively on-boarded.
Structured work assignments during the first 3 months	The First 100 days is a book recently popularised in the business literature	One manager found the book by chance and found it useful

The competencies in Table 7 provide the structure for the discussion that follows.

5.2 IDENTIFYING AND APPOINTING THE NEW MANAGER

The new managers' parents play a marked role in their career choices and their values. One participant remarked that he had been working in the family business since a young age. He saw that as his preparation for management as he explained:

> I actually worked in our businesses, my family businesses
>
> (P 1: 811_0031 Ir.docx - 1:33 (103:103)

He was also taught the value of money and how to manage a business. He was brought up to make business decisions and he explained his view on money in this way:

> You must earn it, and I never got spending money, he said I must get a job ……..You need to work for what you want and you need to plan and you need to structure because that's how you get things in life, it wasn't just given to me
>
> (P 1: 811_0031 Id.docx - 1:35 (103:105)

The family's view of business can influence the young person's approach to work. In this participant's experience, it comes through in his approach to management. This individual learned the value of planning early in life. While his experience was not unusual, he was one of three respondents who mentioned how their parents determined their approach to work. Another participant recalled his home village but explained a different aspect. He emphasized the cohesion and family focus that determined how he conducted himself at the work place. He indicated that as part of his work team they could not "let the team down".

The findings in this section provide some insight to the variety of backgrounds a new manager will face after his appointment. The receiving managers should prepare new managers for diversity in the workplace so that they are not surprised when one employee understands a cash flow statement without explanation and another cannot complete a financial report while a third employee expects the manager to provide child care at the office.

5.3 PREPARING THE NEW MANAGER

The new managers are most often not prepared for their new position. They experience frustration with increased workload and in some cases they have no staff to do the work. One new manager said that when he was appointed he prepared a structure and identified the positions he required to manage specific areas. When he presented the plan to his manager the staff numbers were constrained and he was not allowed to appoint anyone. He explained this as follows:

> It was just frustrating, and in my case, particularly so, maybe just to give you a high level structure of how we work. We have got roles for managers, in other words the middle managers, but there's nobody there, literally nobody. That role is actually currently fulfilled by the technical specialist, so my technical specialists are sort of fulfilling that administrative part, then I expect them to actually do what they're supposed to do, as chief engineers, and obviously when I came in, they basically said, look, you are expecting us to do these dual roles, and we just don't have the time.
>
> (P 4: 811_0039 PT.docx - 4:13 (54:65)

He had to realise the structure was incomplete and he would not be able to deliver all the work assigned to his department. He felt responsible nonetheless and expressed his discomfort in this way:

> And, I was saying, I have already spoken with the GM, because that's actually what I expressed to him on day one, to say, there is this dysfunctional structure, and I really would like those manager roles to actually be filled, for me to actually function properly.
>
> (P 4: 811_0039 PT.docx - 4:13 (65:69)

The conclusion is that there is an optimal level of challenge where a new manager can cope and there can be a case where the stretch is too much. One manager said that he grew with increased project responsibility as mentioned in chapter 4. Only one respondent of the 16 participants was formally prepared and assisted during the transition process. She said this about her preparation for her new role:

> They put me for a programme, I think a six months programme, while I was acting, and then the appointment came in 2012, when they put the advert, and I applied and then I was appointed
>
> (P 7: 811_0041 Xol.docx - 7:2 (30:30)

Her training programme included much information on situations that can create difficulties for a new manager. The programme gave practical exercises on how to make presentations to senior management and how to deal with company politics. It also taught her how to write and present technical reports. The awareness she developed as part of this training was unique and valuable as she describes here:

> How do deal with your, I can say, your stressors, your past, as some other people will have baggage from their past, and if you are in a management position, you will take that baggage to other people, which they don't deserve, so you need to know who you are, so they took us to some workshops.
>
> (P 7: 811_0041 Xiw.docx - 7:2 (30:30)

One new manager was formally assigned to the new position with a public introduction. In a rather unusual event a new manager was elected to the position through voting. She explains how this happened:

> First of all, for me to act for the position, the engineering manager at that time was a little bit sceptical because of my age, and then he called me, and he said, are you really sure you want to take this? Is the team ready for you? …. I said, you can ask them. They can choose somebody else, if they want to choose somebody else, but you can call all of us, and then we agree who can act for the department. … And then, he actually called everybody. There was a voting system. .. … [And] they voted for me.
>
> (P 7: 811_0041 Xzl.docx - 7:8 (200:202)

The receiving manager prepared this new manager and he also prepared her team so that when the new manager was appointed she was appointed not just to fill a *gap* in the structure but she was ready to make the position her own and express her skills technically and managerially. Her experience was so unusual and her expression of confidence shone through the whole interview. She elaborated on her relationship with her team, her management style and how she insured her continued confidence in her new position.

> I must say, I was blessed with a strong team, and dealing with the...because the younger ones, they wanted to prove that they can work on their own, so you give a person some system to run with it, and don't try to micro manage …. Just tell them to give you the reports, and then because we had that engineering projects that we are working with, so our client was a project guy, so we would make sure that our deliverables from our side engineering to projects was done, so we will have weekly meetings to see the progress on our side.
>
> (P 7: 811_0041 Xzl.docx - 7:8 (200:202)

She also elaborated on the context of her new appointment and highlighted her own situation in that environment by saying:

> First of all, I believe we are in a project environment, and the problem with that environment is people who've got that age gap. Either the people are very old or very young, in the project, so most of the people in their senior management is all that mix, so I'm young, and I'm mixed with the very experienced people, and for me, that was a first challenge. I was a little bit scared, but I was acting, that this girl just came here two years as a [technologist], after that was appointed and now is acting in a management position. ….. But, they only thing that helped me is because I know I'm in this programme, so I need to prove myself now, what I'm learning there. So much so that I'm learning, because even the person that was organising the programme was having those monthly presentations, come and see in the office, how are you doing? How are you coping? How can
>
> (P 7: 811_0041 Zd.docx - 7:4 (72:78)

The importance of some management training for all engineers in this project environment cannot be denied, as most engineers are expected to work on projects and the ability to jump in and hit the floor running is a skill not everyone is born with. In comparison to the 15 new managers who were not prepared, this young manager was prepared for the project environment and was therefore able to be more productive as the evidence shows:

1- She had a strong team of young engineers who supported her enthusiastically,
2- She did not need to micro manage her team,
3- She just said what she needed and her team did the work,
4- She was used to working in projects
5- She knew how to manage the weekly deliverables.

The training preparation provided a common base for the new manager to engage confidently with her peers and subordinates and the project benefited from the ease of her transition. This shows that South African engineers experience similar situations to those identified by Hood (1990), Aucoin (2002) but that in most cases, the organisations do not provide the necessary preparation.

5.4 ROLE OF THE RECEIVING MANAGER DURING ON-BOARDING

The receiving manager seldom coaches their new managers, as in this study, only five new managers could rely on the receiving manager to provide guidance. Generally, they only provided help on an 'as needed' basis and new managers find it difficult to perform without support as they want to appear competent and do not want to ask for assistance:

> I think my boss just had his own confidence over me, because he just throw me there, and then he never really helped me in the day in terms of how to deal with those things, I ended up not even taking my issues to him, because it was like, no you will grow up, just see how you get out of the situation
>
> P14: 811_0030 AM.docx - 14:21(147:147)

Many engineers expect to have to discover their way on their own but their training provides the tools. When these engineers become new managers they have not been trained or prepared to work out what they have to do. One newly appointed manager explained this about his situation:

> Tools and equipment must be available but if you throw them into an environment where they need to swim and make up their own things I think that is the biggest challenge.
>
> (P15: 811_0029 AK.docx - 15:11 (76:76)

This may be the way to grow self-reliance and force them to ask for help. The assumption is that the new manager had been a part of the organisation for a while and knew people to help her out. This is exactly what works in the new manager's favour: regular contact and modelling of coaching behaviour. This respondent expressed the need to have a better understanding with her senior manager:

> Ultimately you should have some form of deeper relationship than being at a Management meeting every day looking at the numbers of employees who are absent, whatever the case might be. Then you can really see where her heart is and what she's driving towards and how best to support that vision and what she wants to achieve with the department. And also share things, because I find you get a lot of feedback from people that if you don't have a certain type of relationship with your boss it's very difficult to feed that through, which could be very good input to the direction of the department but if there's no relationship you're, like, I don't know
>
> (P 3: 811_0022 EdN.docx - 3:28 (347:347)

One receiving manager prepared her new managers by providing them with a pack of information to ease their transition into the role. It contained essential human resources policies and processes they would be expected to know. The new manager commented on the process when she said:

> I must say my manager, the manager I'm reporting to, helped quite a lot in terms of, you know, what to expect or... I remember, one of the first few meetings, she basically, sort of, gave us a starter pack, if you like, to say, if you've an HR issue, this is the person to contact, if you've got this issue, this is the person to contact. But in terms of processes, how to do... how to go about doing that, resolving issues, I... somehow I... we had to learn that on the go. And I think it also helped that it was a number of us, you know, young, or not so young, engineers who became managers at almost the same time, and we were sharing notes. We were saying: how are you doing this and what are you experiencing, and things like that.
>
> (P13: 811_0033 TR.docx - 13:8 (154:154)

In contrast one woman manager explained what on-boarding was for her and in reviewing her list of challenges she concluded she was not on-boarded. Although her receiving manager helped occasionally it was not on-boarding. She explained exactly what on-boarding would mean for her:

> Not really. I think on-boarded would have been something, like, Sandra you're now a manager; in terms of HR these are the policies you need to worry about, be concerned about this. In terms of Safety, these are the regulations we work with. In terms of this, this is this and this is how you would approve timesheets, whatever, and actually have a session.
>
> Please come to my desk and show me, this one is giving me trouble. And then eventually you're all sorted in terms of your IT stuff and everything and everything is linked to you and you start getting the feel of it. And then somebody then mentions it in passing, oh, when you approve travel please remember to check their home-work-home [distance] declaration and that information. And you're, like, oh, yes, yes, we used to do that. Okay, I'll do that.
>
> Please check that they're not booking time against your own cost centre because people make mistakes. And you're, like, which one is mine again? Okay. And you figure that out.
>
> (P 3: 811_0022 EeN.docx - 3:13 (93:93)

New managers can inherit challenges from another manager when a situation has been neglected. It is difficult for a new manager to know how to manage a long term problem when she is still learning the basic processes. In this case she explained how she had to step in and take control of a difficult human resources issue:

> So all that stuff I'm learning now because I have cases that actually have been badly managed [before], by myself in the few months I've been here and by everybody else before me and I need to sort that out. But I keep thinking a proper on-boarding would have been: you have people on your [staff] - because it wasn't a new thing, they had been there for a while, you have people on your structure [who] are not performing and please understand this procedure in order to address things properly.
>
> (P 3: 811_0022 E2N.docx - 3:15 (103:103)

There are many processes in the organisation and if the human resources practitioner and the industrial relations practitioner do not work together, it can result in them providing confusing advice to the new manager. There was a situation that was not managed correctly in the past and when she received all the information she still had no clear plan of action to solve the problem. She explained what happened to her and said:

> And the stuff wasn't done. But I don't think everybody else around me knew what to do anyway. So you, kind of, figure it out as you go along and you call HR and they're, like, oh, talk to IR, and then you talk to IR and they're, like, but there's a procedure for that, and you're, like, there is? Oh, okay, where is it? You read it and then you don't understand it and you call them back and you're, like, okay, wow. So now I've handled this was completely wrong. So for me that was a big learning. It would be nice to know exactly what is what when you come on board. Especially if there were things like that if you were [doing] technical [work] there would have been no time when you were dealing with that type of stuff.
>
> (P 3: 811_0022 EpN.docx - 3:16 (109:109)

It is evident that a formal on-boarding process with HR and Finance would provide an essential foundation for the new manager to manage her staff. Only one receiving manager required her newly promoted managers to develop a 100 day plan and she met with them regularly to assist in the development and execution of that plan. The new manager who developed her 100 day plan had this to say about the experience:

> In fact my biggest guide was that First Hundred Days thing…….A friend of mine who had just become an executive at another division forwarded it to me and she was, like, somebody else gave it to her. So I was, like, oh, okay. So it gives you what to do in the first month, what to do, like, over 90 days and so on. And then it says if you haven't done these things by the first 100 days you're probably going to have a very dysfunctional team or you're going to just be ineffective in your management or people would have lost hope or credibility, that type of thing.
>
> (P 3: 811_0022 Euty.docx - 3:19 (129:129)

Clear information contributes to the new manager's confidence to step forward and to take on the authority of the role and so become effective. Most of the technical work is done in small teams yet small team dynamics are not part of the new manager's development. These small teams are generally multi-disciplinary and often multi-cultural and there is a need to add an understanding of small group dynamics to the development of new managers.

In South Africa, the receiving manager plays an important part in the development of new managers which is similar to the experiences in developed countries (Dai et al., 2011; Pomeroy, 2006; Snell, 2006; Sweeney, 2009). Even though on-boarding is

usually discussed in the context of external hires, this research indicates that unless the human resources practitioners and the receiving managers integrate the talent and skills development with a well design on-boarding process, it will not benefit the new manager. The organisation cannot rely on the receiving manager to integrate the new managers by default and without suitable development. Training the manager as coach is part of the skills retention strategy.

5.5 LEARNING TO PRIORITISE AND MANAGE CONFLICT

New managers are surprised by the increased workload, the unstated expectations, as well as the extent to which they are unprepared for the role. The overload issue is complicated by the lack of resources or depending on what the policy is: to do more with less or to improve productivity

> Because we don't have enough people; I don't see a way around that, except for getting additional people in at required times, but then that is also very difficult now, in our environment, to get people in for a certain period of time and then they go away again, because of that knowledge that you build up during that time.
>
> (P 2: 811_0044 Mqw.docx - 2:24 (263:263)

The resourcing at the sites may be worse because of turnover and the fact that most young people prefer to stay close to the city. Then project managers may hang on to resources unreasonably even to the point of refusing them to attend management meetings at head office. They probably want to ensure that they stay at site.

> They were not allowed to come up for any meetings; they were not allowed to come up for any training.
>
> (P 2: 811_0044 Mdw.docx - 2:42 (79:79)

If the reporting conflict cannot be resolved by the senior managers, the engineer has to pick the crisis of the day and fight fires. The new manager should be prepared to manage conflict from the first day. Aucoin (2002) stated that managers should just get comfortable with conflict as it could not be avoided.

Some managers referred to the importance of listening. Some were introverted by nature or that they "liked talking"

> I've got that thing with people, that, you know when I talk... and they seem to listen, because I also listen, anyway, so... I listen, I'll let you talk, and I'll sit there and... and, you know, the funny thing with that, you know, other people, they think that I'm not actually listening, because they're used to someone talking and then they talk back. But I don't do that; I say, talk, I'll listen
>
> (P18: 811_0018 Za.docx - 18:19 (389:389)

The manager should communicate his or her expectations to the new manager and consider providing coaching in order to provide essential information to ease the transition.

> Now as we are talking I now realise, it's not something I ever thought really, it can be such a big role, maybe it's because at the moment, I don't have anyone reporting to me as such, but the coaching, it's extremely important, especially we need to look out for people who are turning to a totally new area, like with no background of the new job, definitely how will you expect the person to carry out their very first activity, if he doesn't even have a clue what's supposed to be done? Just a quick course on things that he needs to know, by when, at least to give you an idea of what you will be doing.
>
> (P14: 811_0030 AM.docx - 14:25 (189:189)

One respondent compared management to being a parent and explained why he thought so by saying:

> I think being a boss is like being a parent, you need to explain things, because don't think people just, the assumption is not the same, so fair and honest, and you need to explain things properly, and you need to get back to people when you say you are going to get back to them, don't tell the person you're going to get back to them and you never get back to them, as if they ask something about a process or a procedure, whatever question they have
>
> (P 2: 811_0044 MA.docx - 2:30 (342:342)

The manager creates trust by being trustworthy and reliable. The manager also models the correct leadership behaviour in this way. It was mentioned that the new manager had to be more visible and to be an example. She could not as an example arrive late and leave early for lunch; she explained what being a manager meant to her and said:

> I thought I must always show commitment in everything that I do. And then like I'm not saying I was doing it before, but like taking lunch, you find that a person goes maybe for two hours, maybe sometime during the day just disappears, you know, those things. I just told myself, those are the things I was not doing before but, maybe, you know, it's a little bit awkward, maybe just move out of my desk for some few minutes. Whenever I go anywhere someone has to know where I am, yes. And then, also, the other thing is to learn more things, must be willing to learn.
>
> (P9: 811_0045 Mq.docx - 9:20 (68:70)

This participant was aware that her actions would be scrutinised and she was ready to deal with it. The issue of conflict attracted more interest. One new manager mentioned that he was conflict averse and had to learn to deal with conflict better. As he became aware of it he realised that as a manager he was expected to deal with conflict and said that:

> I'm not assertive by nature. I'm very friendly and I try and avoid conflict, and that's not very good as a manager.
>
> (P13: 811_0033 TRw.docx - 13:9 (182:182)

He decided to manage his conflict handling skills as part of his personal development as a manager. While it was not easy, he persevered and said that:

> So for me that has been the most difficult, to try and deal with conflicts, and we get a lot of them in our environment, be it among our guys or be it between management and our guys, be it between our department and another department, so that has been, you know, the biggest challenge for me.
>
> (P13: 811_0033 TqR.docx - 13:10 (182:182)

In another case a new manager had the opportunity to test his conflict management skills and he did that by addressing the conflict directly with the two people. He explained how he defused the situation and said:

> I asked both of them to sit down and I explained to the girl that he is very important to the company, we cannot do without him as an experienced guy, but it would be best for him to share the knowledge with the young ones, so that he doesn't have to do something that he has been doing for the past twenty years, he can just coach people and see that they are growing, and at the end of the day, they will be learning and they will be excited to commission the plant and doing other jobs that he still has to do like paperwork, so in that way he understood what I was saying, and then the conflict really stopped in terms of them.
>
> (P14: 811_0030 ApM.docx - 14:18 (133:133)

This process was successful and the new manager handled it elegantly. Some engineers would have sent an email and achieved more conflict. One manager decided to step out of the manager role and resume the technical position she had before. The main consideration was that she was extremely tired by the continuous interrupts and the difficulty in getting people to work.

> [Because] I am an introvert, and I know that about myself, after a day of handling people, I was very very tired, because this one's arms sore and this one's toe's sore and this one has a headache, that freaked me out completely, that I couldn't handle very well and very diplomatic, .. So I think the management made me very very tired, okay number one from all the barriers that we have, and all the, you run into walls everywhere you go, from an HR, financial, whatever perspective, of the things that you try and do, but the people aspect, I think well personally to myself, as an introvert was very very tiring
>
> (P 2: 811_0044 MwA.docx - 2:13 (139:149)

The importance of personal energy is central to success as a manager. If the manager does not thrive in the environment, it will be difficult to sustain the enthusiasm and drive to manage the bureaucracy and to continue to find ways to get things done, in spite of the system without breaking the rules (Conversation with Senior Manager).

A significant part of a new manager's time is spent communicating with subordinates. Two new managers indicated that it was difficult to distance themselves from their subordinates who used to be their friends. They could not sit with their old friends at

lunch and they had to make new friends at a different level. One participant explained the unexpected shift in the friendship dynamic and how she realised it:

> I think one turning point for me is moving from the people that you used to work with as colleagues and then you become their manager, and then, for some reason, their attitude changes also. That was like a blow for me; I'm like: what? I thought we were cool! But now it seems like we're not cool. It was a major, major, major change for me. You know, it was like fully 360 degree change. And, of course, you know, you get those individuals that you can communicate with well and, you know, they engage, they... and then I think, for me, also, if you're honest with me, that's good. But don't come in and say something else, but then go out and say something different
>
> (P18: 811_0018 Zrm.docx - 18:5 (125:125)

The new manager realised that she had to clarify her position and manage expectations in order to avoid boundary issues in the future. In the literature, the change in relationships is mentioned (Aucoin, 2002; Biddle & Roberts, 1994; Goldberg, 2006; Hall et al., 1992; Howard, 2003). The difference in South Africa is that the diversity of cultures and the political history adds another dimension to the change in allegiance when the new manager has to enforce discipline on a subordinate who used to be a friend. There may be situations where it may be inadvisable to appoint a new manager from their peer group.

5.6 STRATEGY

A new manager appreciated it when the senior manager determines direction and sets a goal with reasonable explanations and interpretations of values. A participant said that for him it was important that the senior manager provided guidance:

> And direction, setting direction is important, which fortunately for me my boss did do. Before she left she did leave me some guidelines of more or less what she expects from me and within which time frames. And I really appreciated that because even when she wasn't there I knew exactly what I was working towards and what more or less she wanted out of it.
>
> .. (P 3: 811_0022 EsqN.docx - 3:27 (337:337)

In the interviews it became clear that the receiving managers assumed that the new managers knew what management was. Management consisted of doing more administration, enforcing discipline, and motivating people to work. What then became evident is that the new managers needed to understand how to work at different levels with human resources and finance. They had to take responsibility for other people who were not as conscientious as they are and may resent their progress. One participant remarked:

> People do not have a clear idea of what a manager is
>
> (P 1: 811_0031 Igt.docx - 1:12 (26:26)

This echoes the importance of preparing the new manager on what management is and how HR and Finance processes contribute to the business. As operational managers the general approach is to follow procedures and ensure delivery but is it possible that there are no strategic consequences at this level of management? The role of strategy is smaller at this level but it is not absent, new managers are part of the decision making structure in an organisation (Erosa & Arroyo, 2009). It is said that one careless servant can cause more damage than a determined enemy. Waste is created at the level of operations and new managers have to be conscious of their role as custodian of assets.

5.7 SUMMARY OF CHALLENGES DURING TRANSITION

The challenges during transition are related to the new manager's skill in managing the diversity in the engineering environment. The new managers are identified and appointed based on the senior manager's evaluation and the criteria are not clearly communicated. There are minimum criteria with respect to years' experience and qualifications but it seems that the most important skill of working with and through people is evaluated without assessment. The preparation of the new manager is mostly neglected as the evidence showed only one new manager was formally prepared. The results showed that the effort was well rewarded with the new manager's response, confidence, and resulting productivity. The transfer of key policies and procedures is mostly done without due consideration for the damage

that can result when the new manager acts incorrectly. The formal transfer of policies and procedures can be included in the preparation of the new manager where possible.

There is no evidence of structured work assignments except where the senior manager required the new manager to provide a 100 day plan. This initiative was well received and alerted the new manager to ask the right questions during the transition.

In the following chapter, the findings are discussed and some recommendations are suggested.

6. DISCUSSION OF FINDINGS

Major infrastructure projects require civil, electrical, and mechanical engineering expertise, amongst others. These major infrastructure projects are central to the economic development of the country. For the last five years as the energy utility State Owned Company, Eskom, constructed the two largest coal fired power stations in Africa, the impact of the delays and construction issues on the economy were recorded in the news daily. Specific skills are required in certain industries and skilled engineers are in demand because they have the skills to design and construct the infrastructure that the country needs.

Factors that influence an engineer's career are training, experience, and progression. In the state owned enterprises progressions have been put on hold for financial reasons. Some engineers will look at the private sector and migrate to the better rewarded positions. The independent power producers are looking for engineering skills to develop the next growing market sector. Developing a person as a leader as an individual is one process but in the multi-cultural environment; it should include leadership as a social construct which include diversity awareness.

South African society historically has a strong sexist, racist, and authoritarian culture. The current culture still has some vestiges of the chauvinism and authoritarianism left. This is not strange as anyone who has travelled in the Arabic Middle East, Turkey or Europe would prepare by studying the local customs. The new engineering managers bring technical skills and they need managerial skills to ensure that the next group of young engineers build on the foundations that exist today. In South Africa, the first world economy is side by side with the third world economy and for the engineer of tomorrow that presents a challenge of opposites: how to develop technology that all the citizens can afford and how to make the technological comforts available to everyone from the urban jungle to the rural villages.

The real world issues are complicated and the many stakeholders make solutions unrealistic; the best we can hope for is to manage them. This is where the development of a competent engineering manager becomes part of the creative approach to complex problems, but it will not help if the engineering manager is not well prepared for the diversity of issues that will be part of every decision he has to take.

The projects he leads, the customers that use the product and the technicians who maintain the products are all part of the value chain. The more the engineering manager can come to terms with the business of engineering, the better the result and the happier the stakeholder will be.

The South African challenges relating to historical racial discrimination, the role of 11 official languages, logistical problems in education and urbanisation is just part of the context for which the new engineering manager has to be prepared. It will not serve anyone to work on old stereotypes any longer. The difficulty is to become efficient at managing diversity in all its shapes.

The research highlights the need for senior engineering managers to become coaching managers to new engineering managers. The five values of building trust, collaborating, learning, helping, and empathy ease the way for difficult conversations. The skills competencies such as effective questioning, active listening, problem solving, giving feedback, motivating, and reflecting provide critical awareness to deal with conflict and stress in the workplace. This study highlighted the challenges and the few instances where the organisation has initiatives to address the new management challenges. It is clear that there are two essential parts to the solution: firstly, the receiving manager must be developed as a coaching manager and secondly, the new manager must be prepared appropriately. The preparations may include training, mentoring and coaching or any number of variations. The preparation should include standardised basic policies and knowledge as well as a highly tailored coaching intervention suited to the person and their future career.

The preparation and development of an engineer prior to the transition will be instrumental in the successful completion of the process. Organisations can train their new managers to practise leadership behaviours that model the values of the organisation. They learn how to inspire and motivate employees to deliver better performance and higher levels of commitment by watching their senior managers model these skills (Detert & Treviño, 2010).

Training and development remain key practices for enhancing affective and normative commitment and, by implication, for retaining valuable staff. Formal and informal training and development opportunities should equip employees with the skills and knowledge they need for future career advancement. Although managers

should be held accountable for the development of their employees, employees should be encouraged and empowered to take control of their own growth and development within the organisation by means of regular performance and development discussions (Dockel, Basson, & Coetzee, 2006)

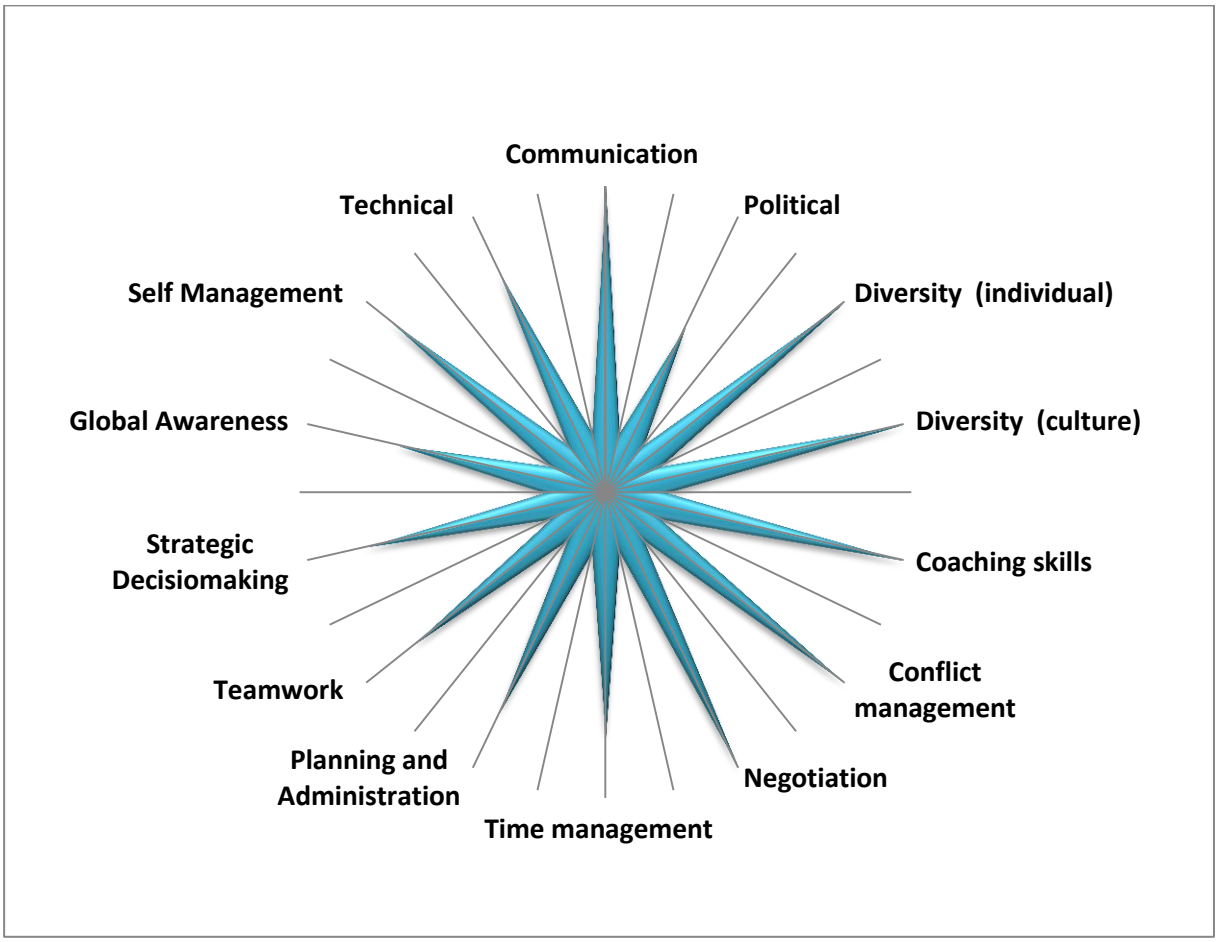


Figure 14: Transitionery Management Competencies

The Figure 14 the transitionery management competencies include the developed communication skills cluster that includes diversity for groups and individuals, negotiation, conflict management and political awareness. The coaching skills competency is essential to develop these skills in subordinates not only through mentoring but also through example. This is one of the ways the business can improve the emotional maturity and intelligence in the people to improve strategic decision making (Wallace & Rijamampianina, 2005)

People in the developing world expect engineers to be part of a social structure and not ivory tower academics. HR strategy is therefore an essential aspect of the development of organisational culture and the retention of professionally qualified employees, such as engineers (Aggarwal & D'Souza, 2012; Chang, Wang & Huang, 2013; Deloitte & Touche, 2009). The May 2014 draft of the South African National Scarce Skills List indicated engineering skills as one of the top five scarce critical skills for economic growth. To deal with these challenges, organisations strive to improve their culture and implement HR practices that will enable them to attract and retain talented employees, remain competitive, sustain their business functions and grow in a turbulent business environment (Arachchige & Robertson, 2011; Coetzee & Bergh, 2009). The hiring behaviour of employers has also changed to keep pace with the demand for profit and productivity. So with a cap on head count, good engineering managers are required to do technical work and manage new engineers. It is these new engineering managers who will enable the future generation of engineers. We should not let their energy be wasted on the wrong things. As identified in this study, the development of new engineers requires well prepared receiving managers and ongoing training, mentoring and coaching for the new managers.

7. CONCLUSION AND RECOMMENDATIONS

The art of management is not one person's problem; it is a social phenomenon. The technique of management is not simply doing things better and faster; computers can do that. If management is to be part of the social fabric in society it should act as caretaker for the skills, talents, and contribution of its constituency. There may have been a time when workers came to work and left their personalities at home but no longer and managers have to adapt to survive the talent war. In engineering management these arguments are intensified because the foundation of modern society rests on efficient and effective infrastructure. Failures in energy generation and water supply can be avoided with good planning and sound judgement. It is not technology that fails. Technology fails as a result of a failure of management. If we do not attend to the skills that make these construction projects timeous and effective we will argue about who is to blame – in the dark.

Before a promotion, the new manager should be prepared. The research showed that the current identification and preparation process stops at the appointment and this is not functional. Rather prepare the new manager in advance with basic training and tailored coaching. In the process of on-boarding the new manager will be acquainted with essential knowledge and understanding. The research showed that here is little on-boarding and with no formal process, it is ad hoc and unstructured. The new manager would benefit from formal and structured on-boarding of all new managers. The added benefit would be that they learn as a group which reinforces the cohesion and enables the group to work together. Simultaneously the receiving manager should be trained to coach new managers and to understand the importance of mentoring a new manager. If one falls, both fail.

The communication of policies and procedures during the transition is a challenge and the larger the company the more policies there are to master. The new manager should be able to have dedicated time to master the formalities of the role as the role demands that she be able to communicate effectively and promote and motivate the company policies to new employees. The transition is marked by a significant increase in administrative tasks. Policies and procedures are loaded on the intranet portal and managers are expected to study them. The new manager has very little

time and energy to study so formalised transfer of policies and procedures with clear expectations and guidance can assist. The guidance can be automated but a knowledgeable receiving manager can make a difference.

The new manager becomes the trustee of company skills and the conduit for company values and if these new managers do not manage the junior engineers correctly they cannot develop the next generation of engineers. Therefore the company values should be communicated through more than a general email. Rather communicate company values through active learning and as an example before and after the final appointment. The authentic transmission of values should attract engineers and provide a suitable foundation for engineering as part of the country's future.

Manager development initiatives are not connected to the transition period and seem to be dependent on corporate financial planning. The manager development should be linked to the individual development plan and the receiving manager's training pipeline.

The continued development of managers with refreshers and on-going small group dynamics will become a foundation for the management of employees so that some standardisation can exist between managers and departments.

The assessment of managerial potential and personality traits should happen at this level before the purely operational person is expected to become a strategic executive. It is potentially damaging to the long term company strategy if the potential strategic managers are derailed because they are not good operational managers.

There is no defined role or action list that describes to the new manager what he has to do. Many versions of the management role exist then it will be increasingly difficult to obtain agreement on how the department should be run. There may be some motivation to introduce some of the project management techniques into engineering at an earlier stage so that they can cope with the project environment with greater ease before the general management issues arrive.

The first recommendation is that the receiving manager should be prepared and coached on the style of coaching required by managers. By preparing the receiving

manager, the expectations will be explicit and clarified in a face to face meeting where all required policies and procedures will be highlighted for future explanation:

Secondly: prepare the new manager in advance and ensure she has the basic knowledge to do the work. Alert all employees to culture sensitivities and investigate diversity awareness training to enable the conversation about differences to be natural.

Thirdly: Follow up new manager training with regular check-ins with mentoring and tailored coaching. Not all managers will need to be mentored and coached on the same aspects.

Fourthly: ensure all managers have basic knowledge of coaching behaviours and are aware that they are expected to coach their employees on specific skills. Also that receiving managers are the coaching managers for new managers.

Fifthly: ensure that the new managers know exactly what is expected of them in terms of basic requirements through training, information and mentoring. Part of this process should be a formal appointment announced at a formal meeting.

Managers as coaches should be made aware of the diversity models such as the Spiral dynamics model as an example and complexity theories such as those discussed by Elliott Jaques (1986; 1994). The benefit will be that operational managers are used in their strength and strategic thinkers will be nurtured for appropriate roles.

It can be concluded that the role of coaching is to facilitate the transition of engineer to manager by providing the skills and the insight to transcend differences and gather our abilities and enable creative solutions not only to the way we collaborate but also to how we provide the infrastructure for our people.

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APPENDIX A

Questionnaire

Topic	Questions for semi structured interview 30-45 minutes
General	Gender
	Age
Establish rapport	Are you registered with ECSA
	In what field of engineering did you qualify
	How many years' experience did you have when you were promoted to the current position
	What is your current position
Topic 1	Did you always want to be a manager
	How did you become a manager
Topic 2	What experiences prepared you for management
	What training did you receive that contributed to your decision to enter management
	What other factors influenced you decision to go into management
Topic 3	What was it like for you when you became a manager
	What was difficult for you during those first few months
	What helped you in that time
	Were you promoted in your group or from outside
	How did that go? How did the subordinates respond to you
	Did you experience support from your new supervisor

Topic 4	Looking back what did you wish you knew then
	Looking back what would you do differently
	Looking back what would you do again
Topic 5	How would you advise a new manager to act in future
	How would you advise a new manager to prepare in future
Topic 6	How would you mentor a new manager in future
Topic 7	Anything else you would like to add?
	What aspect of management should be trained
	Which competencies should be coached

APPENDIX B

Proposed letter of introduction

Dear Sir / Madam

My name is Esther Wallace. Currently I am studying a Masters of Management in Business and Executive Coaching at the University of the Witwatersrand. I am contacting you with the request to assist in completing my research report on the experiences of engineers moving into management and how coaching may facilitate that transition.

As part of my research I need to interview South African engineers who have moved into management within the last 30 months.

Would you be prepared to be interviewed for approximately 30 to 45 minutes on your experiences during the transition phase to management? The interview will be tape recorded for the purposes of data collection efficiency and accuracy. The information will be treated with the utmost confidentiality and your name will not be linked to any information in the report.

Your time is precious and I would appreciate it if you would be available to be interviewed. Your convenience is of primary concern and I would gladly meet you at a venue of your choice.

May I assure you that your contribution is important and your anonymity and information confidentiality will be safeguarded at all times?

Thank you in advance for your participation in this study and contribution to the understanding in this important area of career development.

Yours sincerely

Esther Wallace (wallace@eskom.co.za)

APPENDIX C

Clearance letter