

**BOTTLENECKS AND CONSTRAINTS WITHIN THE LOCAL  
LABOUR MARKET FOR ENGINEERS IN THE  
PETROCHEMICAL INDUSTRY SECTOR:  
A CASE STUDY OF ENGEN REFINERY - WENTWORTH**

Awarded by the Faculty of Humanities, Development and Social Sciences

University of KwaZulu-Natal (South Africa)

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December 2009

Master's Thesis submitted in partial fulfillment of the requirements for the degree of  
**Master of Social Sciences (MSocSc)**  
**Industrial, Organisational and Labour Studies (IOLS)**  
**University of KwaZulu-Natal, Howard College**

## ***DECLARATION***

Submitted in partial fulfilment of the requirements for the degree of Masters of Social Science (MSocSc), in the Graduate Programme in Industrial, Organisational and Labour Studies (IOLS), University of KwaZulu-Natal, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. I confirm that an external editor was used and that my Supervisor was informed of the identity and details of my editor. It is being submitted for the degree of Masters of Social Science in the Faculty of Humanities, Development and Social Science, University of KwaZulu-Natal, South Africa. None of the present work has been submitted previously for any degree or examination in any other University.

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## ***ABSTRACT***

This research investigates the specific labour market dynamics that underline the shortage of engineers in the Petrochemical Industry in South Africa. The central argument of this dissertation is that an understanding of a skills shortage requires a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced. This dissertation develops a critique of the neo-classical perspective which dominates current analysis of skill shortages. While it is important to understand the external labour market, it is equally important to consider the internal labour market to better identify and understand the specific dynamics that underline a skills shortage in an organisation and industry.

Using Engen Refinery as a case study, this dissertation focuses on an in depth examination of the experiences of engineers working at the Refinery. The findings reveal that the dynamics that underline the skill shortage of engineers in the Petrochemical Industry in the South African context are manifold. Skill shortages are a consequence of dynamics in both the external and internal labour market; these I argue are interrelated.

## ***ACKNOWLEDGEMENTS***

Writing this dissertation has been another life lesson for me. I have met and worked with some brilliant minds along the way. It is a pleasure to acknowledge and thank some of them. Very importantly, I would like to express my deepest gratitude to my supervisor, Dr. Debby Bonnin, who has supported me and been so patient every step of the way. Debby has given so generously of her time. Her guidance and belief in me throughout the time it took to complete my research and write this dissertation is invaluable. I would also like to acknowledge and thank Engen Refinery for allowing me the access to the engineers for participation in this dissertation. In addition, I would like to thank all other respondents that contributed to this study. A special thanks to Deanne Collins for taking the time to edit my work. I would like to extend my appreciation and gratitude to the staff of the Department of Industrial, Organisational and Labour Studies (IOLS), particularly Professor Ari Sitas and Amanda Kinnors for their assistance and support in the initial stages of my research. To A-Cubed, my employer as an intern, who deserve special thanks for supporting me and understanding my commitments to completing this dissertation.

To my family and my special friends, you have all shown so much love and moral support, despite my invisible presence during the composition of these pages. You all mean so much to me and will always be in heart. And finally, I would like to dedicate this to my mom, who has sacrificed so much for me.

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## *Acronyms*

<b>BSC</b>	Bachelor of Science
<b>BEng</b>	Bachelor of Engineering
<b>BSc Eng</b>	Bachelor of Science Engineering
<b>BEE</b>	Black Economic Empowerment
<b>DRC</b>	Democratic Republic of the Congo
<b>EBRD</b>	European Bank for Reconstruction and Development
<b>ECSA</b>	Engineering Council of South Africa
<b>EE</b>	Employment Equity
<b>ESKOM</b>	Electricity Supply Commission
<b>FIFA</b>	International Federation of Association Football
<b>FOREX</b>	Foreign Exchange
<b>GM</b>	General Manager
<b>HR</b>	Human Resources
<b>IBR</b>	International Business Report
<b>IEA</b>	International Energy Agency
<b>IOLS</b>	Industrial, Organisational and Labour Studies
<b>JIPSA</b>	Joint Initiative Priority Skills Acquisition
<b>MSc</b>	Masters of Science
<b>NACI</b>	National Advisory Council on Innovation
<b>SA</b>	South Africa
<b>SAIRR</b>	South African Institute of Race Relations
<b>SADC</b>	Southern Africa Development Community
<b>SAMP</b>	South African Migration Project
<b>SEB</b>	Sanlam Employee Benefits
<b>SET</b>	Science, Engineering and Technology
<b>UK</b>	United Kingdom
<b>UKZN</b>	University of KwaZulu-Natal
<b>US</b>	United States
<b>UTP</b>	Universiti Teknologi PETRONAS

# CHAPTER ONE

## Introduction

### 1.1 Introduction

The global concern regarding skills shortages has 'become more acute...in the new millennium' (Cohen & Zaidi, 2002: 1). South Africa shares in these concerns. In their research titled '*Global Skill Shortages*', Cohen & Zaidi (2002:1) argue that the world is heading into 'new periods of skill shortages in the 21<sup>st</sup> century'. Bac (2008), cited by Motsoeneng (2008), draws attention to the fact that, *'Globally, 37% of privately held businesses in 34 countries rank a shortage of skills as their greatest constraint to business growth...this is the first time in the history of the IBR survey that workforce issues top the chart as a global concern for growth.'*

The 2000 *European Bank for Reconstruction and Development (EBRD) Annual Transition Report* (Anon, *Fin24.com* 14 November 2000) highlighted that rapid economic growth in transition economies<sup>1</sup> has been a feature of the 21<sup>st</sup> century especially with integration into the increasingly more global economy. It is in the context of this growth that labour markets throughout the world are criticised for failing industry due to the lack of readily available skills and 'restrictive employment laws' (Anon, *Fin24.com* 14 November 2000). The lack of skills in particular is viewed as one of 'the most critical barriers' to future and current economic development worldwide (Anon, *Fin24.com* 18 October 2007). Bac (2008), cited by Motsoeneng (2008), argues that 'although the skills shortage is a global concern, South African businesses are the hardest hit'.

South African newspaper reports echo concerns about current skills shortages, and speculate on the negative impact this might have on local economic expansion. A number of South African companies been experiencing a significant shortage of skilled and competent personnel, which has 'drastically increased since 1994' (Leuvenink, *Fin 24.com* 8 November 2001). This is in direct contrast with the

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<sup>1</sup> Such as Eastern Europe, the Baltics and the Commonwealth of Independent States.

recent economic expansion in South Africa<sup>2</sup>. Companies are concerned that this will place South African firms at a disadvantage when faced with competition from international businesses (Mlambo-Ngucuka, 2007; Naidoo, 2007).

South African press reports in recent years have pointed the ‘shocking skill figures’ (Anon, *Fin24.com* 5 July 2007) and the ongoing shortage of skilled professionals, echoing concerns expressed at the various levels of the supply and demand chain in the country (Carrels, 2005; Govender, 2006; Quintal, 2006; Mlambo-Ngucuka, 2007; Naidoo, 2007; Ridout, 2007; Wray, 2007; Creamer, 2008; Momberg, 2008). Public debate over the nature of the skill shortage in South Africa is central to questions of the sustainability of current and future economic expansion.

According to Barker (2006), *‘the shortage of skilled professionals in the country has given rise to various debates and speculations over the causal factors [vis-à-vis the brain-drain debate, issues of supply, increases in demand, and socio-economic-political factors], and the resulting consequences that this trend will have on the future survival of South African industry’*. In the intense, often hotly debated exchange over skill shortages it has been suggested that this is responsible for placing businesses in a desperate situation. Skills shortages are considered to be one of the most costly and troublesome issues affecting the management of South African businesses (Anon, *Fin24.com* 20 June 2007; Creamer, 2008).

Organisations in South Africa operate in a highly competitive local and/or global economic environment. Their competitiveness is compromised by the shortage of skilled professionals in the local labour market. The skills shortage in South Africa is resulting in serious cost implications for organisations, causing major delays and cost overruns. An examination of the relationship between local and global skill shortages to that of supply and demand provides an opportunity to

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<sup>2</sup> It is important to note that the fieldwork for this study took place during 2007 – a period in which economic expansion was taking place in South Africa, in direct contrast to the current (2009) world-wide economic recession.

identify the specific problem(s) and ultimately find the solution to this complex issue.

According to Callaghan (1997: 89) *'there is a lack of consensus over what constitutes a skill shortage... the specific understanding of skills shortages in labour markets is both complex and contentious.'* Within South Africa, Barker (2006) argues that this situation becomes more problematic as there is 'relatively little empirical research' to explain the current skill shortage situation. In addition, much speculation and heated supply-side vs. demand-side debate over the actual causes of the current (perilous) skills shortage prevails (See Yessel, 1999; Findlay, 2000; Borat, Lundall, Rospabe, 2001; Fedderke, Henderson, Mariotti, Vaze, 2001; Borat, Meyer, Mletsheni, 2002; Moleke, 2004, 2005, 2006; Carrels, 2005; Lawless, 2005; Govender, 2006; Jenkins, 2006; Quintal, 2006; Mlambo-Ngucuka, 2007; Naidoo, 2007; Wray, 2007 for South African debates). I have identified four major themes in this debate.

The first of many problems identified is emigration – the so-called 'brain-drain' (Leuvennink, *Fin 24.com* 8 November 2001). Participating companies in a 2001 survey conducted by the *South African Migration Project* (SAMP) considered emigration the primary factor for the skills shortage in South Africa (Leuvennink, *Fin 24.com* 8 November 2001). Yet, as former Labour Minister Membathisi Mdladlana (2001) argued (as cited by Leuvennink, *Fin 24.com* 8 November 2001), the skills shortages being experienced by South African companies are not only attributable to the emigration of professionals and skilled people.

The above-mentioned argument gives rise to a second area of the skills shortage debate. It is argued that the skills shortage is a result of the socio-political climate. Specific contributions include:

- *'the decline in the quality of the country's electricity supply;*
- *a deterioration in its health and education;*
- *rapidly increasing levels of violent crime;*
- *the worrying situation of macro-economic stability;*

- *low levels of training in the industrial sector; and*
- *a decline in socio-economic conditions'* (Leuvenink, *Fin 24.com* 8 November 2001; Creamer, 2008: 22).

A third issue is the strong need for improved supply-side factors (Lawless, 2005). This is seen as critical to finding a long-term solution to the current skills shortage situation. These debates, however, have given rise to the strong criticism that has been levelled directly at the quality, capacity and output levels of secondary and tertiary educational institutions within South Africa; more specifically SET (Science, Engineering and Technology) disciplines. Having conducted an intensive study of the Civil Engineering sector in South Africa, Lawless (2005) concludes that an inadequate number of engineers are currently entering into engineering fields of study at tertiary level. However, educational institutions (such as Universities or Universities of Technology) are only part of the 'training' solution. Organisations and industry, too, are key role players in terms of further developing and training their employees.

The supply debate extends itself towards organisations and industry, which introduces the fourth issue: an 'inadequately educated workforce' (Creamer, 2008: 22). As highlighted by Joel Netshitenzhe (2005), a former government spokesperson, this situation places emphasis on the contributing role of the organisation itself towards the skill shortages. For example, the focus of in-house training is increasingly considered as crucial in improving the skill shortage situation in South Africa. This, it is suggested, can be achieved by focusing '*on local training to rectify the low output numbers from supply so that South Africans can acquire the skills necessary to participate in the economy*' (Netshitenzhe, 2005).

However, another perspective suggests that the country needs to encourage and recruit skilled expatriates to return to the country to 'join us in this endeavour to

grow the economy<sup>3</sup>.’ (Anon, *Fin24.com* 8 December 2005). Recruitment and the drive to encourage expatriates back to the country are, however, only part of the solution. ‘To complement these measures, the country would have to consider the recruitment of other nationals to address the skills deficit.’ (Anon, *Fin24.com* 8 December 2005). This perspective is further complicated by ‘anti-immigrationists’ who argue that governments are supposed to protect citizens from ‘outsiders’; not let them in to compete with locals for jobs and resources (Anon, *Fin24.com* 8 December 2005).

According to Momberg (2008: 12), South Africa needs about a million people to fill the vacancies listed in the *2007 National Scarce-Skills List*. This has impacted significantly on certain sectors such as the ‘computer and high-technology sectors, the industrial sector<sup>4</sup>, the banking and financial sectors, education and the health sector’ (Leuvenink, *Fin 24.com* 8 November 2001).

#### *The skills shortage in the Engineering Profession*

One of the most affected high-skilled professions has been that of engineering. (Anon, *Fin24.com* January 2008). Statistics taken from the *2007 National Scarce Skills Report* (Momberg, 2008: 12); indicate that the engineering fields in South Africa are:

*‘In short supply of more than 13 470 construction, distribution, and production and operations managers; more than 10 600 engineering professionals such as chemical and materials engineers, civil engineers, electrical, industrial, mechanical and mining engineers; 10 755 building and engineering technicians; 7 620 mechanical engineering trades workers, such as aircraft technicians and toolmakers; 15 835 fabrication engineering-trades workers, such as welders and sheet-metal workers; and more than 12 800 other technicians and trades workers, including chemical, gas, petroleum and power generation plant operators.’*

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<sup>3</sup> The Homecoming Revolution; The Come Home Campaign; and Brand South Africa are some examples of such campaigns.

<sup>4</sup> Such as the mining, petrochemical, civil, water and geotechnical engineering industry fields.

These figures underline the impact skills shortages in the engineering sector have had on the South African industrial sector, which is essentially one of the major contributing sectors of the South African economy. The Petrochemical Industry, in particular, makes an interesting case for the study of the current engineering skills shortage. Companies, contractors and other enterprises in the oil and gas industry have raised serious concerns over the difficulties of maintaining and expanding current output levels<sup>5</sup>, within ever-increasing global competitive-market pressures. This is exacerbated by the shortage of highly specialised Petrochemical engineering professionals (Anon, *Fin24.com* 30 June 2006). Furthermore, the shortage of engineers within the local labour market of the Petrochemical Industry is embedded within the local and global ‘war for oil talent’ (Anon, *Fin24.com* 30 June 2006). This refers to an intensifying situation perpetuated by the rapidly expanding oil and gas industry worldwide. It is within this context that my dissertation raises the major question of: ‘What are the specific labour market dynamics that underline the shortage of *engineers* in the *Petrochemical Industry* in the *South African* context?’

In order to investigate the overarching question of, ‘What are the specific labour market dynamics that underline the shortage of *engineers* in the *Petrochemical Industry* in the *South African* context?’ I have identified three sub-questions for investigation:

- 1.) What supply-side factors contribute towards the skill shortage of engineers in this labour market?
- 2.) How has the increased shortage of engineers impacted on those engineers currently working in the local Petrochemical industry?
- 3.) What are the consequences for the labour market?

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<sup>5</sup> Wakeford (2007) explains that ‘South Africa has relied on its indigenous coal reserves for nearly three quarters of its total energy requirements, and only 14 percent of its energy needs are met by oil (IEA, 2007). Imported oil makes up about 65 percent of South Africa’s annual petroleum consumption. The remainder comes from domestic production of oil (meeting about 5 percent of domestic needs) and the well-developed synthetic fuels industry (supplying approximately 30 percent of domestic consumption). South Africa processes imported crude oil into liquid petroleum fuels (petrochemical feedstock for production of plastics and other synthetic materials is derived from coal).

These questions will be answered through an in depth study of the internal and external experiences of engineers working at Engen oil refinery. I argue that industry-specific factors need to be identified and examined to fully understand the nature of the labour market skill shortage.

Engen refinery is an ideal location for such a study as: (1) It is situated in the hub of Durban's south-industrial basin, operating within the local and global markets for refining oil; and (b) during 2003/2004, the Refinery experienced a net loss of 45 experienced engineers, which is on average nearly two engineers per month over a two year period. The Engen refinery and the Petrochemical sector overall has attracted much attention and research focused mainly on environmental and socio-economic impacts of the Refinery (Parker, 2000; Wiley, Root & Peek, 2002; IBR, 2003; Gule, 2004).

## **1.2 Argument of Dissertation**

Although the engineering skills shortage is a global and local phenomenon (illustrated clearly in chapter two), I argue that the context for a skills shortage in each labour market needs to be examined differently. This is due to the distinct internal and external nature of a labour market to an organisation: *'...labour markets...incorporate extensive segmentation – barriers to mobility from one kind of job to another; selective recruitment to jobs and firms as a function of race, ethnicity, gender, citizenship, schooling, and friendship; and large variations in prerequisite working conditions, and forms of compensation among firms, industries, and categories of work.'* (Tilly & Tilly, 1998: 258).

Much of the literature to explain the skills shortage in South Africa, as I argue in chapter two, tends to be over-reliant on the external factors to explain and understand the skills shortage. These arguments and debates reflect a wide range of issues across all sectors and regions throughout South Africa:

- a. Emigration, the so called 'Brain-drain'; or
- b. Socio-economic-political factors such as:
  - a decline in socio-economic conditions;

- rapidly increasing levels of violent crime;
  - the decline in the quality of the country's electricity supply;
  - a deterioration in its health and education;
  - the worrying situation of macro-economic stability; and
  - low levels of training in the industrial sector; or
- c. The lack of supply; or
  - d. An inadequately educated workforce.

Over-reliance on such information can be contradictory and in some instances misleading (Barker, 2006; Daniels, 2007; Ridout, 2007). I suggest that while it is important to understand the context of the broader skills shortage debate, if we understand how and why a skills shortage in a particular industry and organisation is occurring, and how it differs specifically from other organisations and industries, then it is possible to determine and adequately address the issues contributing to the skills shortage in the organisation. In reality, as I argue in chapter four, the external and internal factors are interrelated which makes it difficult to disentangle one from the other. I suggest that a micro-level understanding can contribute significantly towards identifying and understanding specific factors related directly to a particular industry and occupation within that industry.

The following section provides brief summaries of the arguments within the following chapters of this dissertation. In addition it provides the structure that the dissertation follows in making these arguments.

### **1.3 Overall structure of the study**

The introduction (Chapter 1) presents a broad overview of the dissertation. More specifically, the following areas are outlined: introduction of the problem, background of the problem, motivation for the study and the argument of the dissertation. The content of the rest of the study will have the following structure:

### **1.3.1 Chapter Two: Literature Review**

The central argument of this chapter is that an understanding of a skills shortage requires a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced. In order to investigate skill shortages in labour markets one firstly needs to consider the theory developed to explain labour markets. For that reason, in the first section of this chapter, I outline the three predominant theoretical paradigms developed to explain labour markets *vis-à-vis* Neo-Classical, Marxist and Institutionalist paradigms. In the second section, I turn to the concepts of skill and skill shortages. In this section, I highlight the literature that attempts to define and identify causes of skill shortages in labour markets. In the third section, I argue against the commonly adopted neo-classical account for explaining the causes of skill shortages in labour markets. In the main, I demonstrate the shortfall of this perspective for understanding skill shortages in labour markets. In the last section of this chapter I provide an account for the engineering skill shortage debate in South Africa. In this section, I argue that much of the literature to explain the skills shortage in South Africa tends to be over-reliant on external factors to explain and understand the skills shortage. As a result, I argue that although engineering skill shortages are global and local phenomena, the context for the skill shortage in each labour market needs to be examined differently.

### **1.3.2 Chapter Three: Research Methodology**

Chapter three motivates the use of the qualitative research approach for this study. The research strategy utilised is that of a case study. A brief discussion of the use of the case study, the most appropriate for the context of this research as a research strategy is discussed. The qualitative data collection and methods of analysis are clearly discussed.

### **1.3.3 Chapter Four: Analysis and Discussion**

This chapter identifies and examines the specific key internal and external factors that underline the shortage of engineers at Engen Refinery. In reality, the external and internal factors are interrelated which makes it difficult to disentangle one

from the other. Therefore in order to better understand this situation, this chapter is divided into two main sections: (a) External factors; and (b) Internal factors to the Refinery.

#### **1.3.4 Chapter Five: Conclusion**

A summary of the research will be provided, which will include a summary and conclusion of the main findings of this study.

# CHAPTER TWO

## Literature Review

### 2.1 Introduction

This dissertation is interested in what a micro-level examination of one plant will tell us about the operation of the labour market. However, it is important to locate my study in the broader literature on the labour market. What follows consists of four parts. First, I consider the theory developed to explain labour markets. In this section, I outline the three predominant theoretical paradigms developed to explain labour markets, *vis-à-vis* Neo-Classical, Marxist and Institutionalist paradigms. By outlining these paradigms, I am able to illustrate how these underlying assumptions both assist and fail to explain certain phenomena in labour markets, in particular, skill shortages.

I then turn to the concepts of skill and skills shortages. I highlight that the differing paradigms to explain labour market phenomena (outlined in section one), such as skills and skills shortages, have shifted over time. In addition, I illustrate how this has resulted in a lack of consensus over the conceptual understanding of skills and skill shortages within labour markets. This, I argue, makes it problematic to define a skill shortage and therefore difficult to respond effectively to dealing with the skill shortage being experienced.

Third, I argue against the commonly adopted neo-classical account for explaining the causes of skill shortages. In the main I demonstrate the failure of this perspective fully to understand and explain skill shortages in labour markets. In the fourth section, I highlight the debates around the problems in identifying and measuring skill shortages in labour markets.

Finally, the last section provides an account of the engineering skill shortage debate in South Africa. In this section, I explore the extensive literature to explain the skills shortage of engineers in the South African context. In this section, I illustrate that the explanation for the shortage of engineers in South Africa is

dominated by the brain-drain, and supply and demand debates which are very much external labour market factors. I then suggest that this is a typical neoclassical account of the problem, and therefore argue that to understand the skills shortage of engineers, a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced must be obtained.

The central argument of this chapter is that an understanding of a skills shortage requires a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced. This proposition holds that the analysis of a skills shortage, equally at the global, local and organisational level, needs to shift from the dominant neoclassical perspective that sees labour as an abstract commodity of the capitalist economy. Conceptually, this chapter is influenced by the view that a realistic analysis of a skills shortage must recognise the intertwining of economic and non-economic motives (Granovetter, 1988: 187); and that the social context within which work transactions are embedded gives rise to a possible range of outcomes (Tilly & Tilly, 1998).

According to Barker (2006), *'the shortage of skilled professionals in the country has given rise to various debates and speculations over the causal factors [vis-à-vis the brain-drain debate, issues of supply, increases in demand, and even socio-economic-political factors], and the resulting consequences that this trend will have on the future survival of South African industry'*. What this literature fails to explain, as I demonstrate in chapter 4, is that the internal labour market needs to be interrogated just as equally as the external market to determine the specific dynamics that underline the shortage of engineers in an industry and organisation.

## 2.2 Understanding Labour Markets

*'The labour market is an imaginary marketplace where labour is bought and sold ...' (Barker, 2003: 2)... 'Like any other market, the labour market is a link between potential sellers (suppliers) and potential purchasers (demanders). Individuals...supply their labour services to firms...who hire these services at a price' (Mohr, 2004: 314)*

.....

This neo-classical economic account of labour and labour markets as an 'imaginary marketplace' has not gone unchallenged as these three citations demonstrate: (1) *'Among economists, it is not obvious at all that labour as a commodity is sufficiently different from artichokes and rental apartments to require a different mode of analysis'* (Ackerman, 1998: 15). (2) *'Labour markets are not natural, universal phenomenon'* (Tilly & Tilly (1998: 4). Labour markets in fact, (3) *'are different'* (Ackerman, 1998: 15; Jones, 1996: 109), and have changed over time<sup>6</sup>. Drawing from these views I argue that labour markets are spatially differentiated and not homogenous. Therefore each labour market needs to be examined specifically and differently.

The theoretical landscape and framework for understanding labour markets has been dominated by three paradigms *vis-à-vis* Neo-classical, Marxist, and the Institutional. Below, I will outline each paradigm to illustrate that understanding labour markets and the dynamics of labour markets is not a simple task.

### a. Neo-Classical Paradigm

The field of labour economics, predominantly mainstream economics, has been dominated by the neo-classical market paradigm. This paradigm assumes that labour is an abstract commodity of the capitalist economy. It is no different from any other commodity that may be bought or sold in the market, and whose price is set by supply and demand (Marshall, 1980; McConnel & Blue, 1989). Its account

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<sup>6</sup> See Thompson (1967), Kaufman (1994); Kerr & Staudohar (1994); Hildebrand, Barbash & Kerr (1994), and Ackerman, et al., (1998) for accounts of the history of labour market studies. The work of Gordon, Edwards & Reich (1998) titled *Segmented Work, Divided Workers: The Historical Transformation of Labour in the United States*, is useful as it provides a framework for understanding the history of work since the early days of the Industrial Revolution – by identifying three chronological overlapping stages: Proletarianisation, Homogenisation, and Segmentation.

of the nature of work has been placed within the abstract conceptualisation of the market economy.

In short, the neo-classical perspective reduces work processes to a matter of individual maximising behaviour over a narrow set of quantifiable choices. The basic premise of the neo-classical account, is *'each person gets paid the value of the marginal product of the input (labour, capital, land) they provide'* (Tilly & Tilly, 1998: 8). The wage differentials, to measure and determine one's monetary worth (compensation) are explained and motivated by the Human Capital Theory (Becker, 1964; Willis, 1986) and the theory of Compensating Differentials (Rosen, 1986). These theories *'extend the basic model'*, further suggesting

*'in equilibrium workers must be rewarded for costly investments in their own productivity (through means such as education, training, and health care) and must be compensated for hardships and threats on the job (such as dirt, noise, or danger)'* (Tilly & Tilly, 1998: 8).

The problem however is that the assumption of the dominant neoclassical paradigm that labour is an abstract commodity of the capitalist economy (Marshall, 1980; McConnel & Blue, 1989) has failed. It has failed to consider the intertwining of economic and non-economic motives to explain certain labour market phenomena (Granovetter, 1988: 187), such as a skills shortage.

The use of conventional neoclassical theory is constraining in the study of labour markets, as it can threaten to stifle or obscure the understanding of what shapes and influences the notion of work (Ackerman, 1998: 1). The principal determinant in labour supply decisions (from the neo-classical perspective) is seen to be the wage, with workers moving in response to increased demand which is articulated through higher wages. Accordingly *'it is the articulation of the power between supply and demand that will bring the labour market into equilibrium'* (Callaghan, 1997: 9). This I argue does not explain the continued skills shortage situation of engineers to the petrochemical industry. If Engen Refinery (like many other organisations), has responded to increased demands for experienced

engineers by offering significantly higher salary packages<sup>7</sup>, why then does a skills shortage continue?

The neo-classical perspective fails to assist an understanding of a skills shortage in labour markets. The neo-classical view that ‘supply would increase [through higher wages], bringing supply and demand into balance’ (Callaghan, 1997: 9) fails to explain why engineers leave the Refinery despite increased salary packages being offered. My findings suggest that higher salary packages offered in response to the loss of key engineers only leveraged the problem temporarily. Therefore, in this dissertation, I argue that wages are not the primary determinant in the retention/recruitment of experienced engineers at the Refinery. An alternative framework from the neoclassical account of labour market phenomenon needs to be explored to understand skill shortages in the labour market.

Other paradigms have been developed in an attempt to explain these differences (between the economic and non-economic motives that can explain certain labour market phenomena). This has given rise to the argument that labour markets have become segmented, differentiated and increasingly unequal in outcome. In Section 2.4.2, below, I demonstrate the shortfall of the neo-classical paradigm, where I illustrate that ‘Neoclassical theories do not provide a believable analysis of work’ (Tilly & Tilly, 1998: 17). I argue that the lack of incorporation of the institutional, technological and political impacts on work and labour markets, as examples, result in an incorrect understanding of problematic situations, such as the skill shortage situation in labour markets.

## **b. Marxist**

*Marxism* on the other hand, increasingly influential from the 1970s, introduced a social perspective, which is distinct from the neoclassical account of labour markets. In contrast with the neoclassical notion of individual preferences, Marxists looks at the perspective of society as a whole, but in the form of the class

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<sup>7</sup> As a retention and recruitment strategy of engineers.

conscious collective (Tilly & Tilly, 1998: 10). This perspective maintains that social production involves a complicated and interconnected division of labour among a wide variety of people who depend on one another for their survival and prosperity. In other words, the forces of production<sup>8</sup> and the social relationships of production from the economic basis are largely shaped by the infrastructure. In addition, from this perspective, other aspects of society are largely shaped by the infrastructure – political, legal and educational institutions and the belief and values systems are considered to be primarily determined by economic factors (Legassick, 2007: 46). However, as explained by Tilly & Tilly (1998: 9), Marxists views diverge into the teleological and contingent perspectives. Furthermore, Tilly & Tilly (1998: 10) mention that ‘although most present-day scholars of Marxist and associated structuralist schools distance themselves from the mechanical formulation that the economic base dictates the world of ideas, they still generally hold that peoples perceived interests are greatly molded by their structural economic contexts’.

Within this school of thought, Marx and Engels (1958) argued that the history of existing society is the history of class struggle. Marxists emphasise that labour markets are a recent historical phenomenon, displacing work organised on the basis of feudal ties, slavery, and other bonds of obligation or direct coercion. The creation of labour markets depended not only on achieving a particular level of technological development, but also on the initial accumulation of wealth and productive resources by capitalists, as well as the proletarianisation of large groups of people (Tilly & Tilly, 1998: 9).

What is helpful from this perspective is the focus on the social relations with the firm, which shows that labour markets are not reducible to technological or market relationships; ‘...*the work process shapes the attitudes, skills, and preferences of workers, as well as being shaped by them*’ (Bowles, 1998: 29). Furthermore, what is helpful in the Marxist school of thought is the sense that the past is represented in the present. Therefore ‘skill’ and ‘skill shortage’ are

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<sup>8</sup> Forces of production includes technology, raw materials and scientific knowledge, employed in the process of production. (Legassick, 2007: 46)

contextually defined and one needs a historical perspective to fully understand the current problematics.

From this perspective, part of the framework for this study broadened from the focus on the individual (engineers employed at the Refinery), to include an analysis of the perspective(s) of engineers that previously worked at the Refinery. This perspective was useful in that it suggested the need to gain insight into the 'history' of the problem within the Refinery (the firm) to better understand and explain the current engineering skill shortage. A Marxist framework of analysis encourages one to consider the historical elements that can provide an explanation for the current organisation of labour; however, like the neo-classical approach, it fails to help explain the significance of the changes occurring within labour markets at present. As Tilly & Tilly (1998: 17) succinctly argue, *'Marxists have fashioned more fruitful models of conflict, coercion, and deceit than neoclassicists...but they have not produced an adequate theory when it comes to such matters as job finding, careers, and inequality by gender, race, or ethnicity.'*

Marxists reject the technological determinism<sup>9</sup> implicit in the neoclassical model to explain wage setting. Instead, they argue that it is a combination of class struggle and custom that set the overall wage level. But I suggest that the most recent phase of engineering skill shortages in a labour market cannot be explained completely from the Marxist perspective. Wage differences amongst engineers in the same labour market, as an example, cannot be explained in terms of the class perspective, although Neo-Marxists tend to view wage differences in terms of privilege and power (Tilly & Tilly, 1998: 10).

This paradigm, I argue, fails to explain the skills shortage of engineers in the labour market, as it is particularly associated with collective class action to explain labour market phenomena. From this perspective, this paradigm does not contribute significantly towards developing an understanding and explanation for the current engineering skills shortage in the labour market. Despite this, the

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<sup>9</sup> Technological determinism is a reductionist theory that presumes that a society's technology drives the development of its social structure and cultural values (Tilly & Tilly, 1997: 138)

Marxist paradigm, as noted, is useful in that it emphasises social relations in the labour market and focuses on the historical analysis of the organisation of labour. From this perspective, part of the framework for this study broadened from the focus on the engineers currently employed at Engen to include the views of engineers that previously worked at the Refinery.

### **c. Institutional**

The Institutionalists' focus on *group norms*. The analysis of labour markets and employment systems relies on the existence of stable, slow-changing and fairly transparent institutions to provide the foundations for their analysis. The work of social norms has been the foundation upon which Institutional theorists try to explain how and why labour market structures are resistant to change (Wootton, 1955).

Institutional analysis dissolves the division between capitalist and working classes into a set of smaller relationships shaped by product demand conditions, technology, custom, and a variety of institutions. Institutionalists observed that wage-setting criteria include comparisons with other firms, internal equity and custom, seniority, productivity, and firm performance – but the particular combination and weights of these criteria vary greatly across industries, nations, and time periods.

Institutionalists direct their attention towards the actual practises of wage-setting within firms. They argue that workers in long-term jobs possess job-specific knowledge that is of great value to their current employer and of little or no value to other employers. Further, they argue that the employee has little influence in the bargaining process over wages and other terms of employment with other employers. I argue that the opposite is true for skilled professionals. In the current situation professionals such as engineers, who are in high demand, are able to negotiate significantly higher incentive package offers to lure them from one employer to another. This however is not the same across each labour market. The findings of my study suggest that incentive packages and the bargaining

advantage are determined by certain labour market prerequisites. For example, in South Africa not only is there a high demand for engineers, there is a high demand for black engineers. This, as I explain in chapter 4, has created a situation where black engineers are more likely to move from employer to employer within the local labour market, whilst white engineers (and in some instances Indian and coloured engineers) are more likely to negotiate higher incentive salary packages with employers in overseas markets.

In summary, in this section, I outlined the three predominant labour market paradigms that explain labour markets *vis-à-vis* Neo-Classical, Marxist and Institutionalist. I argued that none of the theories in isolation were adequate to explain the skills shortage of engineers in the labour market. The neoclassical paradigm has failed. It does not consider the intertwining of the economic and non-economic motives to explain certain labour market phenomena, such as a skills shortage. The Marxist paradigm on the other hand is useful in that it emphasises social relations in the labour market and focuses on the historical analysis of the organisation of labour. From this perspective, I explained that part of the framework for the investigation in this study broadened from the focus of the individual engineer employed at the Refinery to include the views of engineers that previously worked at the Refinery. I argued that this paradigm failed to explain the skills shortage of engineers in the labour market, as it is particularly associated with collective class action to explain labour market phenomena. The Institutionalist paradigm also focuses on social norms, but goes further to consider the organisation (institution) in the framework of analysis.

In the section below, I turn to the concepts of skill and skills shortages. I highlight that the differing paradigms explaining labour market phenomena (as outlined in this section), such as skills and skills shortages, have shifted over time. In addition, I illustrate how the differing perceptions within labour markets impact negatively on the interpretation and explanation of the current skill shortage situation. The lack of consensus, I argue, makes it problematic to define a skill

shortage and therefore difficult to respond effectively in dealing with the skill shortage being experienced.

### **2.3 Understanding of skill and skill shortages**

While *neoclassical* theorists speak of individual preferences, *Marxists* of class-consciousness, and *institutionalists* of group norms, it is argued that none of these theories have been able to account for the post-fordist<sup>10</sup> labour market of the latter half of the twentieth century (Crompton, Gallie & Purcell, 1996). In an attempt to account for the changes in the organisation of work, the labour market, their explanations for skill shortages have shifted over time. Despite these attempts, their explanations have not gone unchallenged. The conceptualisations, theories and arguments of industrial labour within these above-mentioned paradigms have been significantly interrogated by researchers over the decades (to name a few – Taylor, 1947; Bendix, 1952; Becker, 1964; Guchs, 1968; Thompson, 1968; Bell, 1974; Braverman, 1974; Smith, 1976; Kumar, 1978; Sabel, 1982; Crompton and Jones, 1984; Drucker, 1993; Esping-Anderson, 1993; Crompton, Gallie & Purcell, 1996).

Often this has resulted in contentious, problematic situations, where a lack of consensus can and does exist, *vis-à-vis* the conceptualisation of skills and skill shortages within labour markets. I argue that the lack of a common understanding can make it problematic to define a skill shortage and therefore difficult to actually deal with the skill shortage situation being experienced. It obscures the identification of the real problems that exist in relation to the specific reasons for the shortage. If the foundation upon which you determine your level of understanding and consensus of what constitutes ‘skill’ and a ‘skill shortage’ lacks a coherent and informed understanding, the research and findings of one’s

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<sup>10</sup> Post-fordism refers to a shift from the predominance of economies driven by manufacturing industries characterised by a mass, relatively homogenous, semi-skilled workforce (Fordism), towards economies dominated by employment in services, associated with a more homogenous, fragmented workforce *vis-a-vis* Post-fordist. It is important to note that although post-fordism, is associated with explanations of the socio-economic phenomena in society, mostly in industrialised countries since the late 20<sup>th</sup> Century, it is contrasted to that of Fordism. Definitions of the nature and scope of post-fordism vary considerably and are a matter of debate among scholars. Various thinkers have different views of its forms and implications (Jessop, 1995).

investigation and inquiry into the skills shortage situation, as I argue, will be flawed. Below I illustrate clearly how the conceptualisation of skill and skill shortages (see section 2.3.1) can impact significantly on the understanding of the skill shortage situation currently being experienced.

The concept of skill has played a pivotal role in research on work and the labour process over the decades; however the notion of work and more specifically that of skill have also been greatly contested (see Thompson, 1988). Skill has not been an easy term to define or measure (Brown, Green & Lauder, 2001: 23). The debate over the nature of the skill shortage situation in labour markets bears witness (Crompton, Gallie & Purcell, 1996; Callaghan, 1997; Ackerman, Goodwin, Dougherty & Gallagher, 1998; Brown, Green & Lauder, 2001) to this.

According to Callaghan (1997: 89) in Chapter 5 titled 'Labour and Skill' of his book *Flexibility, Mobility and the Labour Market*, much of the often competing existing literature surrounding the notion of skills and skill shortages remains 'both complex and contentious'. The complexity of the debate and the absence of a common understanding of the notion of skill are evident in the literature (Brown *et al*, 2001; Frogner, 2002; and Richardson, 2007).

A section of the literature attempts to understand the notion of skill dealing with skill construction, skill perception, and skill acquisition. One approach recognises the power of both organised capital and organised labour to influence the conceptualisation of skill (Mackenzie, 1977; Coombs, 1978; Rubery, 1978; Lazonick, 1979; More, 1980, 1982; Stark, 1980; Littler, 1982; Penn, 1983, 1985; Penn & Scattergood, 1985; Thompson, 1988; Steiger, 1993; & Jones, 1996). The analysis of skill is split into three conceptual categories, relating it to the capability of the worker; the complexities of the tasks completed; and the ways in which skill is being socially created (Cockburn, 1983; Martin, 1988; and Penn & Francis, 1994).

Another section of the literature highlights the complexity of the skills shortage debate and the absence of consensus regarding what constitutes a skills shortage, how it is determined and measured, and how it arises in the internal and external labour markets (see Brown, Green & Lauder, 2001; Frogner, 2002; Barker, 2007; Daniels, 2007, for such debates).

### **2.3.1 Defining a skill shortage**

Within the broader framework of the skill shortage debate a number of studies provide a theoretical framework explaining the concept of skills imbalances, their measurement and the associated practical problems. These studies have enabled a better understanding of what skill shortages mean, and the nature of skill shortages in labour markets around the world. Some recent studies include Bosworth, Dutton & Lewis (1992), Roy, Henson & Lavoie (1996), Callaghan (1997), Borghans, de Grip & Van Smoorenburg (1998), Veneri (1999), Brown *et al* (2001), Frogner (2002), Cohen & Zaidi (2002), Richardson (2007), who argue that it is important to be clear about the various usages of the concept and isolate the circumstances in which shortages are experienced.

In practise, the term 'skill shortage' describes a variety of situations, some of which would not be considered an actual labour market shortage (Daniels, 2007). As Haskel and Martin (2001) note, the interpretation of skill shortages is a controversial topic. Haskel and Martin (2001) argue that the term may not be used consistently and the information tends to be collected from employers. Green and Ashton (1992) caution against an uncritical reliance on views from only one of the parties - the employer - and their representatives involved in the economic process. Yet the evidence shows that this continues to be the case. In addition, Arrow & Capron (1959) argue that some proposals for solving shortage problems stem from a misunderstanding of the causes of shortages as well as from an exaggeration of the evidence. For example, some of the definitions of skill shortages are to do with the absence of particular skills among current employees in a firm (internal labour market) rather than a shortage of the number of people available for work (from the external labour market) (Richardson, 2007). In

addition, much of the discussion, focused on the macro-labour market factors, is centered on *recruitment difficulties*, which are related to the shortage of individuals with the required skills in the accessible labour market (Richardson, 2007), and *skill gaps* which are linked directly to the deficiency in the skills of the employer's workforce (Roy, Henson & Lavoie, 1996).

The difficulties of such situations are further evident in the argument presented by Daniels' (2007) *Literature Review of Skill Shortages in South Africa* which argues that the lack of consensus about the definition of a skill shortage has grave implications for the approach developed to 'dealing' with the skill shortage situation. In one such instance, a portion of the literature extends its debate about the precise definition of skill shortages by focusing on occupation; further arguing that the term 'shortage' is imprecise (Bosworth, Dutton & Lewis, 1992; Bosworth & Warren, 1992; and Muysken, 1994).

A lack of consensus, Daniels (2007) argues, on what constitutes a skill shortage at the nation-state level can have serious implications for the way institutions deal with experienced skill shortages in labour markets. The lack of consensus can occur between influential decision-making bodies, which ultimately impacts on any related policy developments.

For example, there is a school of thought that Wade & Veneroso (1998) and Johnson (1998), link firmly to the neo-classical perspective that adopts the neo-liberal approach, and views the nation-state as virtually powerless. Thus the state should not attempt to intervene in economic matters that are related to skill formation policies (cited in Brown, Green & Lauder, 2001: 12). This, it is argued, suggests that a move towards a global convergence in policy is inevitable. Within this strand of the literature, the 'logic of globalisation', as argued by neo-liberals, suggests that governments should adopt neo-liberal market policies (Wade, 1990).

The lack of consensus as to what constitutes a skill shortage impacts on the identification and 'causes' of skill shortages in labour markets.

## **2.4 Causes of Skill Shortages**

A rich source of literature on the actual causes of skill shortages exists (Blanchard & Diamond, 1989; Burgess, 1992; Bosworth, Dutton, Lewis, 1992; Booth and Snower, 1996; Haskel & Martin, 1993, 1997; Brown, Green and Lauder, 2001; Cohen & Zaidi, 2000, 2002; Handel, 2000; Frogner, 2002; Richardson, 2007). More specifically, this literature illustrates how changes in supply are affected by factors such as:

- changes in education and training provisions;
- changes in preferences for various forms of work;
- demographic changes resulting from various factors such as an ageing workforce; and
- emigration and immigration factors.

Alternatively, demand changes are considered to be a result of changes in technology, work organisation, shifts in consumer tastes, commodity price changes, as well as demographic shifts (Green and Lauder, 2001; Cohen & Zaidi, 2000, 2002).

### **2.4.1 A neo-classical perspective**

From the neo-classical perspective, much of the theory about defining and identifying occupational shortages developed from research that focused on wage movements (Black & Stigler, 1957; Arrow & Caprson, 1959). Booth and Snower (1996) argue that skill shortages are a result of insufficient incentives for people to acquire skills. Further variables identified are tax rates, macro variables, market opportunities and availability of skilled labour (Cohen & Zaidi, 2002). Veneri (1999) provides a good but short review of the literature regarding these debates.

In the following sub-sections, I outline the dominant models developed within the neoclassical approach. These models illustrate, from the neoclassical perspective, how in a competitive economy, price and wage flexibility is considered particularly important in determining both the supply and demand of labour (Marshall, *et al.* 1980; Mc Connell, *et al.* 2006). Rubery (1996) however, argues

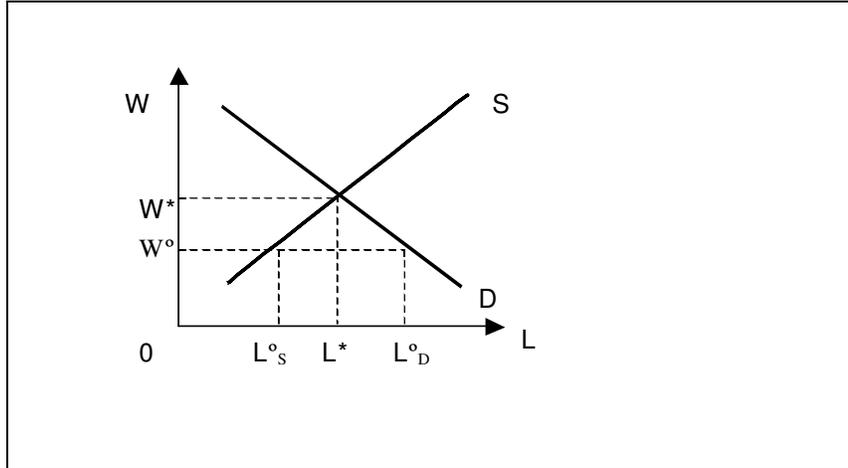
that 'labour markets cannot be reduced to crude notions of supply and demand.' I have included these models.

As explained above; the neoclassical approach has been the most commonly used to explain and understand various phenomena within labour markets. I illustrate that this paradigm and associated models fail to explain and rarely attempt to show how cultural and social, including political phenomena, originate and further impact on labour markets.

### **a. Static Model**

The *static model* was developed to explain the existence of skill shortages (Cohen & Zaidi, 2002). This framework suggests that if the demand for labour in an occupation exceeds supply then a shortage exists. According to the *static model* of the labour market, competitive labour forces will drive up the wage rate, eliminating the shortage. In other words, in a perfectly competitive labour market, there would be equilibrium where the supply of labour is equal to the demand for labour. This model is illustrated in figure 1 below, showing the supply and demand curves for labour services for a given occupation in a particular labour market. According to Cohen & Zaidi (2002: 4),  $W^o$  is the wage level for a certain occupation associated with the amount of labour demand  $L^o_D$  and the amount of labour supply  $L^o_S$ . The excess labour demand,  $L^o_D - L^o_S$  is a measure of skill shortage. It is from this perspective that the excess in demand for labour will drive the wage rate up to  $W^*$ , the market clearing wage at which employer and employee will exchange labour services. This model suggests that wage, labour supply and labour demand will equal  $L^*$ . While serving the necessary function of providing a simple analysis of the relationship of wages to that of supply and demand, the static view of labour markets is too simplistic and does not take adequate account of the dynamics involved in labour market adjustment (Cohen & Zaidi, 2002: 5).

**FIGURE 1: STATIC VIEW OF SHORTAGES**



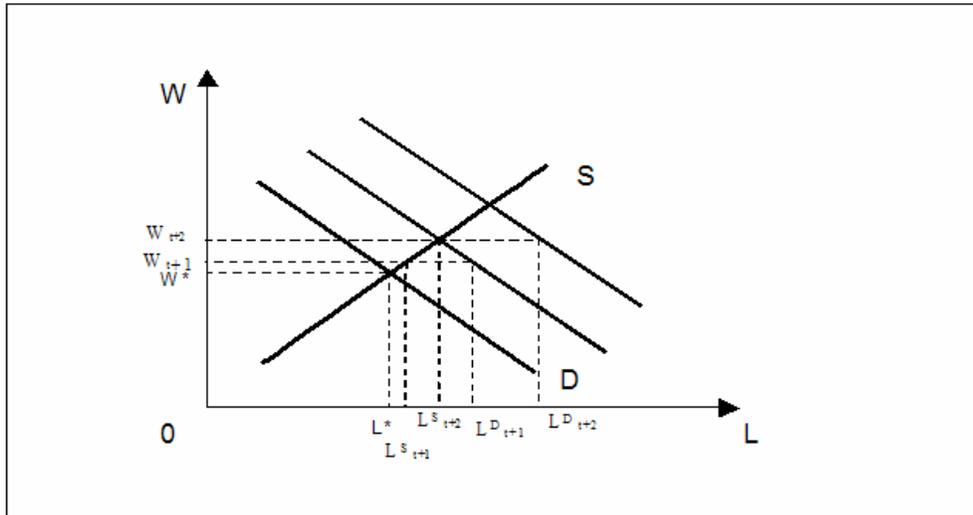
Source: Cohen & Zaidi (2002)

The static model is unable to explain the continued imbalances occurring within labour markets between supply and demand. As a result, Arrow and Capron (1959) developed a *dynamic view* of labour market adjustment in which demand for a skill grows faster than that of supply.

### **b. Dynamic Model**

Arrow & Capron (1959) argued that the cause of *dynamic shortage* is a rapid and persistent rise in demand, low elasticity of supply and a slow market reaction speed. They define the reaction speed as the ratio of the rate of wage rise to the excess of demand over supply. From this perspective, a shortage can therefore exist if these reaction speeds are slow to adjust, further imposing barriers to adjustments (Trutko *et al.*, 1991). The reaction speed is affected by the time it takes firms to recognise a shortage at the current wage rate; by the time it takes the firm to decide on the level for a new wage rate and the number of employees to hire at the new rate; and by the time it takes for information to flow to workers regarding new opportunities and the time taken to react to these opportunities. In other words, this shortage occurs in a situation when there are unfilled vacancies in positions where salaries are the same as those currently being paid to others of the same type and quality (Cohen & Zaidi, 2002: 6).

**FIGURE 2: DYNAMIC VIEW OF SHORTAGES**



Source: Cohen & Zaidi (2002)

The dynamic view, as explained by Cohen & Zaidi (2002: 6) suggests that the labour market mechanism could explain labour shortages if and only if the significant role of restrictions, the interaction of other relevant facts and the idiosyncrasies of the labour market are recognised and considered. This model suggests that instead of the wage adjusting toward a long-run equilibrium (as in the static model), the equilibrium itself will move because of the continuous shifts of the labour demand curve, when the concept of time period ( $t$ ) is added into the labour market framework. An example taken from Cohen & Zaidi (2002): Starting from market clearing status  $W^*$  and  $L^*$ , with the steady increase of labour demand the demand curve shifts outward,  $L^* \rightarrow L^D_{t+1} \rightarrow L^D_{t+2}$ . Although the wage makes corresponding upward adjustments to meet the extra need of labour demand the rate change is slower than the changing market ( $W^* \rightarrow W_{t+1} \rightarrow W_{t+2}$ ), therefore the labour shortage exists and increases over time.

### **c. Efficiency wage theory**

A third model, identified as the *efficiency wage theory*, suggests that the output levels of employees are not only determined by the labour input levels, but are also dependent on the variance of wages paid within the firm (Solow, 1979; and

Akerlof & Yellen, 1986). According to this model, higher wage rates can conceivably lead to higher productivity (Ehrenberg & Smith, 1985; McConnell *et al.* 2006). This theory is based on the premise that higher wages can, under certain circumstances, result in at least an equivalent increase in productivity in the firm. From the onset this model is specifically concerned with the incentive problem experienced within firms, reinforcing for employers that ‘compensation serves two main functions: attracting workers, and getting workers to exert effort and stay at the job’ (Tilly & Tilly, 1998: 84). This approach fails to explain the existence of skill shortages beyond the explanation of wage incentive problems.

#### **d. Insider-outsider theory**

However, the increased wage variable is not always the solution that firms want to adopt. According to the *insider-outsider theory* (Lindbeck & Snower, 1988, 2001; and Solow, 1990) firms may not want to pay outsiders more than they pay insiders in order to attract workers in short supply. In other words, in a tight labour market situation a firm may conclude that it has a skill shortage if the costs of making an appointment within a certain timeframe are too excessive. This approach is very specific to explaining shortages for the internal labour market (to the firm), where a firm is not willing to increase wage to attract the necessary skill required.

#### **2.4.2 The shortfall of the Neo-Classical perspective**

However, I take issue with the above-mentioned models and accounts of skill shortages within labour markets. Within the neo-classical approach, the role of wages is regarded as essential in influencing the actions of economic agents, by bringing supply and demand into balance (MacDonald, 1988; Erikson, 1991; and Ward, 1992). However, as mentioned above, the findings of my study suggest that wages are not the principal determinant in labour supply decisions. Employees, I argue, are influenced by wages but do not only respond to increased demand articulated through higher wages. In this study, as my findings suggest, factors such as career development, job security, job satisfaction and the work environment also significantly influence employees’ decisions.

I argue that there are other differences including: the amount of training or skills development an employer provides; and the non-financial attractions of the job, that is, elements impacting on the quality of working life. For example, the physical conditions of the workplace; the degree of flexibility of employee work hours; the intrinsic interest of the work; the intensity of work; support for childcare; job security; freedom from harassment and discrimination; opportunities for overtime work at the choice of the employee; whether there is a culture of long hours of work; whether work is expected in unsociable hours; the prospects of advancement on the job or for using the current job as a springboard to a better job elsewhere; the costs to the employer of fitting the new worker into the current work team – including developing their technical and interpersonal skills to the required level; and learning local aspects of the job (Richardson, 2007).

Considering the work by authors such as Thornley (1996) and Tilly & Tilly (1998), I strongly suggest that the debate within skill shortages literature needs to consider the social construction of the problem being experienced *vis-à-vis* skill shortages. I suggest a move away from the typical neo-classical economic perspective that dominates the literature. The analysis of a skills shortage, I suggest, whether at the global, local or organisational level, needs to shift from the dominant neoclassical perspective that sees labour as an abstract commodity of the capitalist economy. A realistic analysis of a skills shortage must recognise the intertwining of economic and non-economic motives (Granovetter, 1988: 187); and that the social context within which work transactions are embedded give rise to a possible range of outcomes (Tilly & Tilly, 1998).

## **2.5 Problems identifying and measuring skill shortages**

There are a number of different methods employed to measure skill shortages. A frequently-utilised approach to determine a skill shortage, is the (1) ‘vacancy duration approach’ (Haskel & Martin, 1997). The vacancy duration approach is used to assess the tightness in the labour market. Vacancy statistics however tend

to overestimate market needs because of job-to-job turnover of workers within and across occupations (Green, Machin & Wilkinson, 1998).

(2) Changes in relative wages can be used to study occupational labour market imbalances (Roy, Henson & Lavoie, 1996). According to Borghans, de Grip & Van Smoorenburg (1998), Frogner (2002); and Richardson (2007), other measures that give additional information on the tightening of a labour market and actual or potential imbalances include:

- 'hours and intensity of work (i.e. overtime, short-time);
- production levels and employment levels;
- flows of new entrants and leavers;
- training expenditure by firms;
- levels of subcontracting;
- hiring standards; and
- levels of immigration by skill group.'

(3) Employer-Based Surveys are commonly used to assess skill shortages (Laslett, 1992; Roy, Henson & Lavoie, 1996; and Green, Machin & Wilkinson, 1998). This can be problematic, as these Surveys rely strongly on the employers' perceptions of the causes of skills shortages. One of the difficulties is determining if an occupation is considered as a 'skill shortage':

*'A related problem of measurement is the assumption that wages reflect the productivity of labour: some people are paid more because their human capital is more valuable'* (Brown, et al 2001: 25).

These surveys, it is suggested, need to be used in conjunction with a suite of other indicators, including qualitative data and in-depth studies covering a group of interrelated occupations (Roy, Henson & Lavoie, 1996).

Despite these different 'methods' outlined above, there is generally no agreed-upon method for measuring skill shortages (Gingras & Roy, 2000; Brown, Green & Lauder, 2001; Cohen & Zaidi, 2002). Some authors argue that the evidence of skill shortages is notoriously tricky to interpret: firstly, because results are very sensitive to the economic cycle; secondly, because they rely on employers'

perceptions (Green, Machin & Wilson, 1998; Brown, Green & Lauder, 2001); and thirdly, because there are various restrictions that are always imposed by labour market conditions, the idiosyncrasies of specific occupations and the availability and reliability of the data (Cohen & Zaidi, 2002). In addition, Gingras & Roy (2000), in their article titled *Is there a skill gap in Canada?* conclude that while there may be a growing labour shortage (skilled and low skilled), there is no *aggregate* shortage of skilled labour.

Generally, these methods are normally adopted in isolation from one another. The findings of the chosen method would then be used to determine and assess skill shortages in the labour market. As I have suggested above, these approaches quantify the skill shortage situation in labour markets. They do not provide a means of measurement incorporating the social, cultural or even historical elements (Tilly & Tilly, 1998).

Concerns have been raised in the literature regarding the problem of identifying and measuring skill shortages. One study that deserves special mention is by Cohen & Zaidi (2002), who in *Global Skill Shortages* provide a detailed theoretical analysis of the existing literature related to the discussion of skill shortages. By focusing on the issue of global skill shortages, this study adds to that literature by exploring the various aspects of skilled labour shortages. Cohen & Zaidi (2002) developed a methodology to measure skill shortages by occupation, and predicted the likelihood of the occurrence of such shortages. They developed indicators which measure the degree of a shortage or surplus in different occupations. The difficulty in Cohen & Zaidi's (2002) work is that it discusses the causes and impact of global skill shortages, but does not provide an analysis for the local or internal labour market. Furthermore, their work focuses on data from skill shortages measured between 1995 and 1998, in 19 developed and emerging economies. However, these measurements are not without contestation.

In this study, I argue that it is not that such measurements do not explain a ‘skill shortage’; it’s that they focus on the ‘external’ economic problems contributing to the skill shortage. As I have already suggested above, an empirically grounded understanding of skill shortages in labour markets is needed to better identify, understand and explain the specific labour market dynamics that contribute to a skill shortage. This should involve examining the internal and external nature of each labour market in which the shortage is being experienced.

In order to demonstrate the difficulties with the dominant ‘economic’ explanation of a skills shortage, in the following section, I outline the substantial literature explaining the skills shortage of engineers in the South African context. In this section, I illustrate that the explanation for the shortage of engineers in South Africa is dominated by the brain-drain, and supply and demand debates. These are very much external labour market factors: factors, which I suggest are typical neoclassical attempts to explain the problem.

## **2.6 The engineering skills shortage debate in South Africa**

Studies within the engineering sector (such as Carrels: 2005; Govender: 2006; Hamlyn: 2007; Steyn & Daniels, 2003; Wray: 2007) report that in South Africa there is a significant difference between the current skills of the regional workforce and the skills required to meet business objectives. Engineering employment in particular has ‘increased in the manufacturing and finance sectors, but overall is following a moderately declining trend’ (*Independent Online*: 2006). The current shortage of skilled engineering professionals in the South African labour market was contradicted by the expansion of the South African economy and the skills-bias of employment trends. The skill shortage situation, as identified in Chapter 1, is placing businesses in a desperate situation, and is considered to be one of the most costly and troublesome issues affecting the management of South African businesses (Anon, *Fin24.com*, 20 June 2007; Creamer, 2008).

Since 2004, according to Pienaar<sup>11</sup>, Registration Manager at the Engineering Council of South Africa (ECSA), government and industry have increased their spending on massive development projects such as the Gautrain, Moatize Coal Mine in Mozambique, the Pebble Bed Nuclear Reactor, Transnet Infrastructure Projects, 2010 FIFA World Cup Soccer Stadiums, airports upgrading, ESKOM expansion, Coega plant development, new multi-product pipeline developments, and the Clean Fuels Programme II in the South African Petrochemical Industry. One major problem identified for industry is that projects cannot be built if exact product and job specification roadmaps are not confirmed. Part of these specifications is the qualified and experienced manpower requirements, i.e. skilled engineers. For industries across the country (both in the private and public sectors) the acute shortage of engineers has become significantly pronounced (Steyn and Daniels, 2003).

Steyn & Daniels (2003), Hamlyn (2007), and Naidoo (2007) argue that from the mid-1990s engineering employment should have increased in the prevailing expanding economic and seemingly stable political environment in South Africa. However, as I highlighted in Chapter 1, statistics taken from the 2007 *National Scarce Skills Report*, according to Momberg (2008: 12), indicated that the engineering fields in South Africa are currently in short supply.

The increasing mismatch between supply and demand is of concern to South African industry. In particular, Steyn & Daniels (2003), Lawless (2006) and Daniels (2007) argue that the educational institutions' low output of engineering graduates (over the years), into the local labour market has contributed significantly to the current shortage of skilled professionals. This raises the question: Does the problem lie in attracting and/or retaining engineers? Or is the problem one of supply to the South African labour market? As mentioned in Chapter 1, there is much speculation and heated supply and demand side debate over the actual causes of the current, perilous skill shortage situation. Contributions towards these debates have been mediated and published in the

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<sup>11</sup> Manager: Registration of the Engineering Council of South Africa (ECSA). See Chapter 3 for interview details.

South African press and in academia over the past few years. In the sections below, I will outline these debates:

- The Brain-Drain;
- The supply of engineering graduates; and
- The increased demand for engineering professionals in the South African labour market.

### **2.6.1 Brain-Drain?**

Much attention has been given to (real or potential) emigration since and even prior to the beginning of the political change of the mid-1990s (Crush *et al.*, 2000; Mattes & Richmond, 2000; Borhat, Meyer & Mlatsheni, 2002; Crouch, 2005). The brain-drain debate, a very popular debate in both academic and media circles, seems to be concerned with the loss of experienced skilled professionals from the local labour market. Crush *et al.* (2000), Mattes & Richmond (2000), Borhat, Meyer & Mlatsheni (2002), and Crouch (2005) argue that emigration is a recurrent theme in the media and is increasingly cited as the cause of a growing skills crisis in South Africa. The problem, however, is that this perspective is limiting.

In the main Crush *et al.* (2000), Mattes & Richmond (2000), Borhat, Meyer & Mlatsheni (2002), and Crouch (2005) demonstrate that there is a significant trend of skilled professionals emigrating from the country. However, they state further that it is extremely difficult to rely on immigration and emigration figures with regard to skill shortages. The reasons are manifold: emigration figures are being undercounted; the emigration data captured is of poor quality; and there is often a heavy reliance on data provided by one set of stakeholders whose assessment, understanding and reporting of the statistics is subject to a variety of influences, and is therefore regarded as unreliable (Mattes & Richmond, 2000; Borhat, Lundall, Rospabe, 2001; Borhat, Meyer, Mletsheni, 2002; Steyn & Daniels, 2003).

In addition, it is argued that the poor quality of the statistics has had a negative impact on the feasibility of studies that rely heavily on these quantitative sources of information to further understand the degree that emigration, alone, is contributing to the current skill shortage situation. Nevertheless, in the bulk of this literature, there is a general consensus that emigration figures are being undercounted. It is suggested that South Africa is actually losing a far greater number of engineers than what the official figures portrays (Crush *et al.*, 2000; Mattes & Richmond, 2000; Steyn & Daniels, 2003).

According to Pienaar (2008)<sup>12</sup>, between 1994 and 2004 there has been a significant outflow of qualified, engineering professionals from South Africa to places like China, Australia, and African countries such as Angola and the Democratic Republic of the Congo (DRC). Supporting evidence from Steyn & Daniels (2003) indicates that between 1994 and 2004 there was a decrease in the percentage of engineering professionals in the total labour force. This, as mentioned in Chapter 1 and earlier in this chapter, despite the newly-established democratic political environment (since 1994) and the expansion of the South African economy from the mid-1990s. This expansion should have resulted in an increase in engineering employment, not a decrease. The bigger question is: Why was there a significant decline of engineers in the South African labour market from the mid-1990s to 2004? How significant is emigration to the current skill shortage?

Within the brain-drain debate two main issues have come to the fore. The first issue highlighting the high number of skilled professionals emigrating from the country is not being balanced by the net immigration of foreign skilled-professionals into the country. This inequality it is suggested is resulting in the persistent skill shortage situation (Mattes, Crush & Richmond, 2000; Crush, *et al.*, 2000; Mattes & Richmond, 2000; Bhorat, *et al.*, 2002; Bailey, 2003; Crouch, 2005; Crush, Pendleton & Tevera, 2005; and Mattes & Mniki, 2005).

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<sup>12</sup> See Chapter 3 for interview details. Manager: Registration of the Engineering Council of South Africa (ECSA).

The difficulty with this perspective however is twofold. Firstly, in an attempt to balance out the skills deficit situation, it is argued that South Africa needs to become more active in encouraging and recruiting skilled South African expatriates to return<sup>13</sup>, (Mattes & Richmond, 2000; Bhorat, *et al.*, 2002; Anon, *Fin24.com* 8 December 2005).

In addition to encouraging the return of skilled expatriates, it is stated that there also needs to be active recruitment of other foreign nationals to address the skills deficit (Bhorat, *et al.*, 2002; Bailey, 2003; Anon, *Fin24.com* 8 December 2005). Immigration legislation would need to be changed to facilitate the recruitment of foreign labour (Crush *et al.*, 2000; Bailey, 2003; Daniels, 2007). Daniels (2007) in particular poses a variety of policy recommendations with respect to both closed- and open-economy solutions to skill shortages in relation to the emigration/immigration debate.

However this view is seen as problematic by some Anti-immigrationists within South Africa (Bailey, 2003) who argue that the 'government is supposed to protect citizens from outsiders and not to permit foreigners to compete with locals for jobs and resources' (Bailey, 2003; Anon, *Fin24.com* 8 December 2005).

In the second issue, a rich source of literature outlines the various driving (push) factors resulting in skilled professionals emigrating (Crush, *et al.*, 2000; Mattes & Richmond, 2000; Bhorat *et al.*, 2002; Bailey, 2003; HSRC Media Report, 2004; Myburgh, 2004, Barker, 2007). In summary, globalisation of the labour market for highly skilled workers and socio-economic and political factors has been identified as push factors within the South African context. I will discuss these factors below.

#### *Globalisation of the labour market*

Within the global context, a significant portion of literature suggests that people, capital, networks, systems and flows, and time and space boundaries have shifted

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<sup>13</sup> There are however such initiatives: The Homecoming Revolution; The Come Home Campaign; and Brand South Africa are some examples of such campaigns.

away from the well-known patterns of industrial organisation, onto a global scale, operating beyond the boundaries experienced at the local level (Castells, 1999; Thomas, 1999). According to Standing (1999: 52), in terms of labour, flexibilisation is a key requirement in 21<sup>st</sup> century development. This it is suggested is impacting on the seven forms of ‘securities’ of the era of statutory regulation. And it is resulting in an increase in the level of insecurities amongst workers *vis-à-vis* labour market (job opportunities); employment (protection against dismissal); job; work (in the sense of profession, career, qualification); skill reproduction; income (income protection); and representation security (collective bargaining)’ (Standing, 1999: 52). In addition, Dickens’ (2003:1) central argument within the context of globalisation suggests that ‘globalisation is not some inevitable kind of end-state’. Rather it is a ‘complex interdetermined set of processes operating very unevenly in both time and space.’

From this perspective, according to Bailey (2003) and Barker (2007), the market for highly skilled workers will become more globally integrated, and labour migration is expected to feature more prominently in the future. In regions such as the Middle East, rapid expansion is taking place. For example, between 2005 – 2007, the petrochemical industry was expanding significantly. A serious concerns, is whether such facilities will be able to secure the necessary skilled employees and experienced engineers required for these expansions, domestically. In addition, like other industries around the world, would they be able to recruit the number of newly qualified graduates from the local higher education institutions? In other words, will the demand for engineers for the current and future expansion(s) in the Middle East Petrochemical industry be satisfied? However, this is not unique to the Middle East alone.

The demand for engineers is high, particularly in countries such as the UK, Canada, Australia, Saudi Arabia, China, Malaysia, Kuwait, and in Africa, predominantly the Democratic Republic of the Congo and Angola. The problem however, taken from interviews conducted in this study, the demand for engineers

outstrips the supply. This it is suggested, Cronje (2006) is a significant factor impacting on skill migration trends from South Africa.

Despite the increased demand of engineers drawing on a limited supply (worldwide), there are a significant number of Petroleum engineering and technology schools. The table below lists examples of tertiary institutions highlighting the countries to which they exist.

**Table 1: List of Petroleum Engineering and Technology Schools, worldwide**

<b>Tertiary Institute</b>	<b>Country</b>
Instituto Tecnologico De Buenos Aires	Argentina
University of Buenos Aires	Argentina
University of Western Australia	Australia
Curtin University of Technology	Australia
University of Adelaide	Australia
University of Leoben	Austria
Khazar University	Azerbaijan
Bangladesh University of Engineering & Technology	Bangladesh
Universidad Mayor de San Andres	Bolivia
Universidade Estadual De Campinas	Brazil
Universidade Federal De Itajuba	Brazil
Dalhousie University	Canada
Northern Alberta Institute of Technology	Canada
University of Regina	Canada
University of Alberta	Canada
Cairo University	Egypt
Ecole Nationale Superieure du Petrole et des Moteur	France
Institut Polytechnique LaSalle-Beauvais	France
Freiberg University of Mining and Technology	Germany
University of Miskolc	Hungary
Indian School of Mines University	India
Rajiv Gandhi College of Engineering	India
Maharashtra Institute of Technology	India
Institute Teknologi Bandung	Indonesia
Universitas Indonesia	Indonesia
Universita Di Bologna	Italy

Kazakh National Technology University	Kazakhstan
Kuwait University	Kuwait
Universiti Teknologi Malaysia	Malaysia
Universidad Nacional de Mexico	Mexico
University of Benin	Nigeria
Norwegian University of Science & Technology	Norway
Stavanger College	Norway
University of Karachi	Pakistan
AGH University of Science and Technology	Poland
Texas A & M University at Qatar	Qatar
Universitatea Petrol-Gaze	Romania
Tomsk Polytechnic University	Russia
King Fahd University of Petroleum & Minerals	Saudi Arabia
King Saud University	Saudi Arabia
Delft University of Technology	The Netherlands
Istanbul Technical University	Turkey
Middle East Technical University	Turkey
California Polytechnic State University - San Luis	USA
West Virginia University	USA
University of Tulsa	USA
University of Texas at Austin	USA
University of Southern California	USA
University of Pittsburgh	USA
University of Oklahoma	USA
Missouri University of Science and Technology	USA
University of Louisiana at Lafayette	USA
University of Kansas	USA
University of Houston	USA
University of Alaska Fairbanks	USA
Texas Tech University	USA
Texas A & M University - Kingsville	USA
Texas A & M University	USA
Stanford University	USA
Pennsylvania State University	USA
Colorado School of Mines	USA
Louisiana State University	USA
Marietta College	USA
New Mexico Tech	USA

Montana Tech of the University of Montana	USA
Petroleum Institute	United Arab Emirates
Heriot-Watt University	United Kingdom
University of Aberdeen	United Kingdom
The Robert Gordon University	United Kingdom
University of Manchester	United Kingdom
Imperial College of Science & Technology, Royal Sc	United Kingdom

Source: Society for Petroleum Engineers

*Socio-economic and political factors*

Furthermore, it is argued that the skills shortage is a result of the socio-economic and political climate. It is suggested that part of the problem is the increased levels of crime and violence in the country (Crush *et al.*, 2000; Bailey, 2003; HSRC Media Report, 2004; Barker, 2007). In addition, Crush *et al.* (2000), Bhorat *et al.* (2002), and Bailey (2003) highlight that perceptions of a decline in public services, notably health and education, and a high cost of living in the country are cited as driving factors for skilled professionals.

In addition, political uncertainty (Crush *et al.*, 2000; Bhorat *et al.*, 2002; Myburgh, 2004) and concerns of the decreasing value of the national currency (Bhorat *et al.*, 2002; Bailey, 2003) and high levels of taxation (*HSRC Media Report*, 2004) form part of the push factor debate. Myburgh (2004) strongly argues that one of the most important push factors in South Africa is the real wage differentials between South Africa and the destination country, encouraging skilled engineers to leave the country. They would earn a higher salary, paid in a foreign currency if employed in a foreign labour market. Crush *et al.* (2000) and Bailey (2003) argue that there are more lucrative job opportunities overseas.

I argue that the driving factors explained within this context are contradictory. For example, Crush *et al.* (2000), Bhorat *et al.* (2002) and Barker, 2007 argue that racism and affirmative action, giving unfair comparative advantages to black job seekers, are considered a major driving factor of skilled professionals from the country. Myburgh (2004), on the other hand, using survey data, does not support

the hypothesis. This is in direct contrast to the ‘political issue’ of affirmative action which is widely cited in the public debate as one of the significant push factors for skilled whites out of the country (Mattes & Richmond, 2000; Crush *et al.*, 2000). In particular, Crush *et al.* (2000) argue that skilled whites are widely opposed to affirmative action policy (83%) while only 20 % of skilled blacks express similar views (See Table 2 below).

**TABLE 2: ATTITUDES OF SKILLED SOUTH AFRICANS TO AFFIRMATIVE ACTION**

<b>Attitudes of Skilled South Africans to Affirmative Action</b>		
	<b>% Whites</b>	<b>% Blacks</b>
<b>Strongly oppose</b>	42	6
<b>Oppose</b>	41	14
<b>Total</b>	83	20

Source: Crush et al (2000: 52)

Crush *et al.* (2000) argue that research findings suggest that as blacks are primary beneficiaries of the policy, the high level of support amongst blacks is unsurprising. What is striking though is the pervasiveness and strength of white opposition to affirmative action. The general arguments for affirmative action (righting of past wrongs) clearly have little resonance for whites.

Frans Cronje (2006), from the South African Institute of Race Relations (SAIRR), analysed the Statistics of South Africa’s Household Surveys between 1995 and 2005 and emigration figures. Cronje (2006) argued that crime and Affirmative Action have driven a fifth of South Africans white population out of the country. According to Cronje, a total of 841 000 white South Africans have left South African between 1995 and 2005. Furthermore, Cronje argues that a whole generation of white South Africans have left South Africa – argued as a result of crime and Affirmative Action. Cronje, predicts that the white population would continue to shrink, having far reaching impacts on the economy. One therefore could argue that the skills shortage of engineers is fuelled by the unintended

consequences of transformation policies. Respondents in this study, as I outline in Chapter four, argue that regardless of their race or gender, engineers in South Africa feel that unequal employment equity practices limits their career development (See chapter four for further discussions).

Despite this, the engineering skill shortage is not attributable to the emigration of professionals and skilled people alone (as cited by Leuvenink, *Fin24.com* 8 November 2001). Much of the existing literature and explanations for the ‘driving’ factors, I argue, focus on the external labour market for analysis, explanation and understanding of skill shortages. The brain-drain debate does not explain why skilled employees, such as engineers, leave an organisation but do not leave the local labour market (South Africa). The problem I suggest with this perspective is that it tends to ignore the dynamics of the internal labour market within this debate (See Chapter 4 for further discussion). Findings in this study suggest that not all engineers go overseas. In the sub-section below, I will outline the supply debate which also attempts to explain the skill shortage of engineers in the local labour market.

### **2.6.2 The lack of supply?**

*“The situation is really very simple: if education is inadequate, there will be insufficient skills. Without enough skills, the economy will not grow. If that happens, it’ll be increasingly difficult to provide the basic necessities of life for more and more people.” (van Zijl, 1991: 93)*

The brain-drain debate attempts to explain the current skill shortage of experienced engineers in the local labour market. However, there is a portion of literature that suggests that this perspective is problematic as the shortage of skilled professionals at the graduate level (i.e. newly qualified graduates) could in fact be masked by the focus on the emigration debate (Steyn & Daniels, 2003). In contrast to the above-mentioned ‘brain-drain’ debate, an alternative source of literature and debate levels its critique directly at the South African educational system, more specifically at the science, engineering and technology (SET) disciplines for the current skill shortage situation.

A significant portion of the literature argues that the low output levels of educational institutions over the years have strongly contributed to the current shortage of skilled professionals in the country (Steyn & Daniels, 2003; Lawless, 2006; Daniels, 2007). These studies further argue that one of the major reasons for the current skill shortage situation is that there has been a substantially declining output level of engineering graduates at technikons (now universities of technology) and universities, especially since the mid-1990s (Steyn & Daniels, 2003; Lawless, 2006; Daniels, 2007). Low output levels are not a new situation. Garrett (1991), Viljoen (1991) and van Zijl (1991), during the early 1990s, had already commented on the poor output levels of engineering graduates since the 1970s and 1980s, concluding that enrolment levels were relatively low during this period; a situation no different at present. More recently, in a report released by the National Advisory Council on Innovation (NACI) South Africa (2001) *'Human Capital and the South African Knowledge Base'*, it is shown that enrolments at higher education institutions between 1993 and 1999 were relatively static in an already weak academic system.

The literature which argues that the skill shortage is a result of the low output levels of engineering graduates is problematic on two accounts. Firstly a section of this literature argues that the low output level is worsened by the poor quality of graduates entering the labour market (d'Almaine, Manhire & Atteh, 1997; Steyn & Daniels, 2003; Lawless, 2006; NACI, 2007). This however is refuted by Crush *et al.* (2000) who suggested that industry is satisfied with the new local graduate recruits. The problem, they suggest, is that the current engineering training system is not producing adequate numbers of well-trained engineers of an appropriate demographic profile. For them, this is an indication that most training and educational institutions in South Africa are continuing to produce the quality of skills that are required for the economy to be globally competitive.

Alternatively, with regard to the poor-quality low-output debate, the NACI (2007) Report argues that the empirical situation of the poor quality and low output levels

of engineering graduates entering the labour market shows that South Africa has a relatively small number of strong centres and departments in the SET disciplines and fields of study. The problem, as Crush *et al.* (2000), suggest is that whilst the quality of university graduates remains high, educational and training standards have fallen at technikons. D'Almaine, Manhire & Atteh (1997) argue that the problem at technikons is a result of the serious shortage of highly skilled educators needed to teach engineering courses as well as the attendant courses in science, mathematics and computer technology.

Further to this, it is argued that recent history has also shown that the declining quality of major institutions can impact very negatively on the SET disciplines (d'Almaine, Manhire & Atteh, 1997; Lawless, 2006; NACI, 2007). These studies suggest that there is a need to recognise that the South African SET system is 'fragile in many areas where scientific production is currently maintained by a small number of institutions'. *'Unless these existing pockets of strength and excellence are protected, we could witness further erosion of our national knowledge base'* (NACI, 2007).

Steyn & Daniels (2003) argue that the shortage of supply could not be avoided as a larger output was not planned for in these earlier periods. The problem is exacerbated as training takes many years to complete. The current situation requires responses that will result in immediate solutions, but rectifying labour market supply is a long-term situation (Steyn & Daniels, 2003; Lawless, 2006; NACI, 2007). In addition, it is argued that the current low levels are a result of the poor capacity of the present educational institutions to deliver appropriately skilled people to the engineering industry. The incapacity of educational institutions presents a long-term problem to the engineering sector as a whole (Steyn & Daniels, 2003; Lawless, 2006). In addition, the training of individuals to meet current supply/demands needs will take too long to have a meaningful impact on current requirements. The urgency of future needs can be more easily addressed, as engineering graduates require four to six years of training (BSc to MSc). The future focus needs to extend at least that far ahead in order to ensure

that graduates with the requisite skills are supplied to the South African labour market (NACI, 2007).

According to a research report conducted by JIPSA, '*each year South Africa produced 1 400 engineers with BEng and BSc Eng degrees. Only about half of these graduates went on to register with the Engineering Council of SA as practising professional.*' (Jacks: 2007). This is likely to become more problematic as migration and retirement further reduce the highly-qualified pool (NACI, 2007). In addition, some literature argues that a significant number of graduates are moving abroad (Crush, Pendleton & Tevera, 2005; Mattes & Mniki, 2005). The identified contributing factors are that students want significant job creation, economic development, opportunities for professional advancement and improvements in their quality of life. Without these, graduates will continue to look for opportunities to ply their trade in other countries (Crush, Pendleton & Tevera, 2005; Mattes & Mniki, 2005).

Increasingly, some of the literature suggests that the skills crisis stems from both the national education institutions and the private sector. Such studies suggest that a correlation between education and the profession exists due to the 'overwhelming evidence that the education and engineering training system in South Africa is experiencing serious problems in producing adequate numbers of well-trained engineers of an appropriate demographic profile' (Steyn & Daniels, 2003; Lawless, 2006; NACI, 2007). It is argued that there is a strong need to strengthen the linkages between the existing university-based centres of excellence and other SET institutions (NACI, 2007).

Enterprise training is often seen as one of the more immediate responses (short-term) by industry to the current skill shortage situation, a situation where organisations are more often than not 'dealing with an inadequately trained workforce' (Creamer, 2008). One factor that underpins some of the emerging shortages is the rundown or lack of take-up of certain apprenticeship programmes

(SM & L Rogerson, 2000). This approach is considered as a major means for expanding an enterprises asset base of skilled personnel.

According to SM & J Rogerson (2000: 52),

*'the most common approach to skills training is through in-house or enterprise training programmes. A second, less common, approach is to bring in skilled personnel from overseas to operate training programmes. This training strategy is particularly prevalent amongst overseas-based multinational enterprises in South Africa. A third and more common training approach is to send South African personnel overseas for a period to upgrade their skills. Nearly 35% of sample enterprises applied this approach, including many multinationals that choose to send South African personnel to their parent plant or head offices on technology exchange programmes. Another aspect of overseas training is the sponsoring of South African personnel to attend international short courses or conferences. Finally, the outsourcing of training to other South African institutions is a strategy for one-third of enterprises. Among these specialist local training institutions are South African university business schools and local technikons.'*

Where enterprise training is provided, the risk for the organisation is high: *'the training of South African personnel is a double-edged sword for many enterprises'* (SM & L Rogerson, 2000). This literature argues that whilst training programmes improve the personnel skills and asset resources of enterprises, the heightened skills of employees opens the danger of corporate poaching, including from overseas enterprises (SM & L Rogerson, 2000; Crush *et al.*, 2000). Tilly & Tilly (1998) argue that organisations are faced with the increased pressures of competition (on all levels) together with the impacts of globalisation, and are therefore spending less time on training and instead are spending that money on recruiting individuals who are already trained and have experience: *'the talent skills, or productivity of the incumbent are decisive: established stars get paid more for acting in a movie than unknowns'* (Tilly & Tilly, 1998).

SM & L Rogerson (2000) argue that increased training increases the general awareness and marketability of South African skilled employees to alternative job

opportunities – the quality of South African IT personnel, health professionals and engineers is recognised by international overseas recruitment agencies.

### **2.6.3 The demand for engineering skills**

In the main, the demand for engineering skills, often referred to as the ‘war for talent’, within the local and global context, has risen exponentially. The major debate within the South African context argues that the predicament faced is that there is an increase in capital-expansion projects in South Africa, and a commitment increase in demand for experienced engineers. As introduced in Chapter 1, and further argued in chapter 2, the main problem is that there is a significant shortage of engineers available to complete the work.

Demand-side studies (see Holden, 1993; Bell, 1997; Fedderke & Vase, 2001; Marais, 2001; Steyn & Daniels, 2003; and Gelb, 2006) argue that the declining trend of the number of engineers available is ‘partly explained by the impact of large policy changes, resulting in a substantial decrease in the demand for white engineers’ (Steyn & Daniels, 2003). However, South African executives have identified the country’s inadequately educated workforce as being the single most problematic factor for doing business (Creamer, 2008: 84).

Another portion of the literature argues that there is little ‘concrete information’ that exists on the actual shortages experienced by different types of employers in the South African economy and how employers are addressing the question of the specific skills shortages’ (Crush *et al.*, 2000).

For example, between 1981 and 2005 Engen Refinery completed seven major upgrades which involved a substantial investment of about R3 000 million. This contributed to an accumulation of engineering knowledge and experience of those engineers involved at the Refinery. However, Thabani Zondi (Engen Refinery HR Manager) explained in the *Engen Refinery Skills Briefing* presentation to the Parliamentary Portfolio Committee (20 February 2007), that from 2003 – 2005, the problem of the skill shortage situation at Engen became clearly evident. This

period was characterised by an exodus of engineering professionals from the Refinery. The Refinery realised that both its engineering and construction resources (namely engineering skill shortages) were limited predominantly due to world economic growth factors resulting in an increase in emigration levels.

The future maintenance of the Refinery, and coping with additional demands on the country's already stretched construction and engineering skills resources during development phases are of serious concern for the Refinery in relation to the limited sources of skilled engineers available. These projects will be drawing on a limited pool of skills and construction/fabrication capacities. In such an intense industry<sup>14</sup> (petrochemical), the Refinery cannot compromise on its skills base. Skilled work implemented by semi-skilled individuals is not a feasible alternative – it would be too high risk to the plant. The problem is exacerbated further by the fact that *'engineering resources available are relatively inexperienced'* (Interview K, Sept/Oct 2007).

The Refinery would run the risk of increasing operation problems, failures, and inconsistencies and could face serious non-compliance penalties. Negligence at this level in terms of recruitment and appointment of low level skilled engineers is not possible. The poor execution of tasks will impact negatively on the Refinery and could impact directly on the surrounding environment and community at large.

As a result, according to Tilly & Tilly (1998), it is argued that organisations, faced by the increased pressures of competition (on all levels) together with the impacts of globalisation, are spending less time on training and instead are spending that money on recruiting individuals. These individuals are already trained and have enough experience. In addition, it is further argued that the cost to company for these 'skills shortage' is high. This is due to the job quality (for the individual they are poaching) and attractive incentive packages offered to these highly

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<sup>14</sup> The Petrochemical industry in relation to the HSEQ Legislation, standards and strict adherence compliance requirements; together with the nature of the Petrochemical industry itself qualifies it as an 'intense industry' in relation to other industries such as the services sector.

sought after skilled professionals (Crouch, 2005). This I argue is important, as *‘the heightened competition between industries, both on a local and global scale, is seemingly contradicted between the most cost-effective approach to production and the increased levels of ‘poaching’ by these organisations’* (Crouch, 2005).

In a situation of growing shortages for high skill labour, the costs attached to recruiting such labour have risen markedly (Crush *et al.*, 2000). The problem I argue is that this debate lacks the ability to criticise the inefficiencies of the direct ‘monetary’ response as a short-term solution to solving the current skill shortage situation. It is merely transferring the problem to the industry and organisation that loses the ‘poached’ individual, and is not actually treating the problematic situation.

## **2.7 Conclusion**

Understanding labour market phenomena, such as a skills shortage, is not a simple task. In this chapter, I outlined the three predominant theoretical paradigms to explain labour markets, *vis-à-vis* Neoclassical, Marxist and Institutional paradigms. Where neoclassical theorists spoke of individual preferences, Marxists of class-consciousness, and Institutionalists of group norms, I argued that these three theories have fared badly in the second half of the twentieth century. Overall, I argued that none of the theories in their entirety was adequate enough to explain the skills shortage of engineers in labour markets.

In particular, I argued that the neo-classical paradigm has failed to consider the intertwining of the economic and non-economic motives to explain certain labour market phenomena, such as a skills shortage.

The Marxist paradigm, I explained, was more beneficial than the neo-classical given its account of the social relations within labour markets, and its focus on the historical analysis of the organisation of labour. From this perspective, I explained that part of the framework for the investigation in this study broadened from the focus on the individual engineer employed at the Refinery, to include the views of

the engineers that previously worked at the Refinery. I argued that this paradigm failed to explain the skills shortage of engineers in the labour market, as it is particularly associated with collective class action to explain labour market phenomena.

By outlining these three-broad paradigms, I was able to construct the central argument for this chapter: that an understanding of skill shortage requires a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced. This proposition holds that the analysis of a skills shortage, equally at the global, local and organisational level, needs to shift from the dominant neoclassical perspective that sees labour as an abstract commodity of the capitalist economy.

By focusing specifically on the theoretical literature to explain skills shortages, I argued that these explanations continue to be dominated by the neoclassical account. By demonstrating the shortfall of the neoclassical perspective, I further explained how the 'flawed' conceptualisation and lack of consensus of a skills shortage is problematic. Turning to the brain-drain, demand and supply literature and debates that attempt to explain the engineering skills shortage in South Africa, again I argued that this is dominated by the economic account of the engineering skills shortage in South Africa. I argued that much of this literature tends to be over-reliant on 'external' factors to explain a skills shortage. While it is important to understand the context of the broader skills shortage debate, it is equally important to consider the 'internal' - what I referred to as 'micro-factors' - to better identify and understand the specific dynamics that underline a skills shortage.

In the following chapter I explain and motivate the qualitative approach and research methodology used for this study.

# CHAPTER THREE

## Research Methodology

### 3.1 Introduction

In this chapter I explain and discuss the qualitative paradigm employed in this study. In the first section, I outline and explain the rationale for the methodological approach and qualitative framework employed. I further explain how the use of the case study method proved to be the most appropriate research design for this type of study. The second section describes and examines the methods used for gathering and analysing the data. The third section of this chapter highlights the ethical considerations that needed to be taken into account. The last section provides an account of the constraints and problems encountered throughout this study.

### 3.2 Rationale for the Methodological and Qualitative Approach

#### *Methodological Approach*

This study falls within what is termed social constructionism. One of the principals of social constructions is that all knowledge is socially constructed (Hoffman, 1993). Within this methodological approach, it is assumed that people's representations of the world are always mediated. The framework within this approach requires an interpretative component in research (Banister, Burman, Parker, Taylor and Tindall, 1994). It is this interactive nature of an identified issue to be study that is widely noted as the defining feature of qualitative research methods (Banister et al., 1994; Babbie and Mouton, 1998). A major focus of social constructionism is to uncover the ways in which individuals and groups participate in the creation of perceived social reality. According to Berger and Luckmann (19970, they argue that it is within this perspective that all knowledge of everyday reality is derived from and maintained by social interactions. Given the theoretical framework and objectives of this study, there

is a clear argument for the use of qualitative research procedures (set out in the subsection below).

### Qualitative approach

Qualitative and quantitative research differs in many ways. The main difference between the two styles comes from the nature of the data. Quantitative researchers use a technocratic perspective, applying reconstructed logic and following a linear research path (Neuman, 2000: 122). They measure and understand their research findings by measuring certain variables and testing hypotheses (Neuman, 2000: 122). Qualitative research, on the other hand, helps to provide a deeper understanding of social phenomena being examined than would be obtained from purely quantitative data (Silverman, 2001: 32).

As discussed in chapter one, this dissertation attempts to investigate the main overarching question, ‘*What are the specific labour market dynamics that underline the shortage of engineers in the Petrochemical Industry in the South African context?*’ Subsequent to this, I further identified three sub-questions for investigation:

- 1.) What supply-side factors contribute towards the skill shortage of engineers in this labour market?
- 2.) How has the increased shortage of engineers impacted on those engineers currently working in the local Petrochemical industry?
- 3.) What are the consequences for the labour market?

In order to address the above-posed questions, I have chosen to adopt the qualitative research approach for this study. Firstly, while this study is situated within the broader skills shortage debate within the South African context, it is argued that very little research of a qualitative nature currently exists (Barker, 2007). Having identified this as a research gap, this study attempts to contribute towards the qualitative understanding of the engineering skills shortage situation specifically within the Petrochemical industry.

Secondly, the qualitative approach is adopted due to the fact that this approach is an ‘inquiry process of understanding a social or human problem, based on building a complex holistic picture, formed with words, reporting detailed views of informants, and is conducted in a natural setting’ (Leedy, 1997). The definition of the qualitative research method is understood to be a systematic empirical inquiry in which the researcher does not have direct control of independent variables, as their manifestations have already occurred, or because they are inherently not manipulable<sup>15</sup>.

Thirdly, the qualitative approach allows for adaptability (Lincoln & Guba, 1985). Adaptability in research of this nature is important, as it allows for a flexible research design, permitting the research to evolve as the process unfolds. The primary goal of qualitative research is ‘understanding’ and not generalising (Silverman, 2001: 32). This is a crucial component to sociological researchers, as it allows for the study to be conducted keeping the original research question in mind.

Fourthly, the qualitative micro-level approach was used to facilitate the examination and further understanding of the explanations for the multi-dimensional factors contributing towards the skill shortage situation of engineers within the local Petrochemical industry. The adoption of this approach is important for small-scale research studies as they attempt to more fully understand the nature and structure of larger orders. The micro-level approach is an approach to qualitative studies, described by Knorr-Certina (1981):

*“as ‘micro-social’... It is argued that such a micro-level approach, where the views and values of a small number of respondents are recorded and analysed, produces data which are both rich and reflexive, allowing the identification and investigation of the processes which shape such views and values and by so doing inform conceptualisations of the macro-order.”*  
(Callaghan, 1997: 27)

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<sup>15</sup> See Leedy (1997) for further discussion.

Turner (1988: 119) further comments:

*One of the major virtues of qualitative research is that it does not try to reduce the world to a few simple categories, but offers instead theoretical accounts which are multi-faceted. This quality makes it more likely that they will offer to the reader and the practitioner an adequately complex map of the portion of the social world which is under investigation.*

Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context is largely lost when textual data are quantified. In order to develop an in-depth understanding of the multifarious contributing factors towards the skill shortage situation of engineers in the Petrochemical industry, the qualitative approach is most appropriate for this study.

The qualitative methodologies employed were advantageous as the data is 'rich' in quality (Mitchell, 1983; Rose, 1991; Hesse-Biber & Leavy, 2006); the importance of human agency and of respondents to create their own frames of reference is recognised (Schutz, 1964; Bresnen, 1988; Crompton & Jones, 1988); there is 'flexibility' in this approach (Bryman, 1988; Allan, 1991); the analysis of processes is encouraged (Knorr-Certina, 1981; Allan, 1991) and the potential for interaction with respondents is possible (Knorr-Certina, 1981; Allan, 1991). The qualitative approach therefore has proven to be the most suitable method of investigation.

The most appropriate qualitative method used for this study was that of the case study method. The following sub-section outlines the theoretical implications of adopting the case study method.

### **3.2.1 Case Study**

In order to answer the above-mentioned questions of this dissertation, this study was directly concerned with the investigation of the declining trend of professional engineers since 1994 in the Petrochemical industry. Within the framework of the qualitative approach, guided by the scope of this dissertation, the case study method

was an important tool to gain the necessary information for this study *vis-à-vis* Engen Refinery, Wentworth, Durban.

The importance of this design strategy rests on the fact that the case study method is ‘an intensive investigation of a single unit’ (Runyan, 1982; Handel, 1991; Yin, 1994). Furthermore, it is suggested that the case study design is most appropriate when research is interested in a clearly delineated entity (Babbie & Mouton, 2005). This method is most appropriate ‘as it gives the researcher an opportunity for one aspect of a problem to be studied in some depth, especially within a limited time-scale’ (Bell, 1999). In addition, Bell (1999) highlights the fact that the case study approach allows for the researcher to concentrate on a specific instance or situation and to identify, or attempt to identify the various interactive processes at work. These processes may remain hidden in a large-scale survey but may be crucial to the success or failure of systems or organisations.

It is important to note that the aim of the case study is not to make valid statistical inferences but to use the analysis of micro data to investigate, inform, expand and explain general theories (Yin, 1984). It allows for the intensive examination of the interaction between multiple variables within the unit of study. This approach therefore allows for investigations to take place in the natural setting of the unit of investigation, further allowing for thick descriptions where multiple perspectives need to be taken into account. The case study method allows for the context and the needs of the case to determine the methods used. For this dissertation, the use of the case study method allowed for the unique experiences of the engineers (both internal and external factors to the Refinery and labour market) contributing to the engineering skill shortage situation to be identified and examined.

The following section will highlight and outline the main research methods employed in this case study.

## **3.3 Research Method**

### **3.3.1 Research Methods**

This study has three main components. The first was to develop a better understanding of the broader skills shortage situation in South Africa, and more importantly to develop a contextual understanding of how the skill shortage situation is impacting on the engineering labour market, specifically that of the Petrochemical industry. Various key informants were therefore identified for this initial stage of interviewing (see below). The second was the investigation of the ‘currently employed’ engineers at Engen Refinery. Lastly the perspectives of those engineers ‘previously employed’ at Engen Refinery (whom are either working locally or abroad) were sought. In addition to this, sources of secondary data (Exit Interviews) were made available for use in this study. The methodologies employed will be reviewed below according to each primary component group.

### **3.3.2 Access to Respondents and Engen**

A good working relationship between Engen Refinery and me had to be established before attempting to design and conduct interviews with engineers at the Refinery, as well as establishing contacts and networks with those engineers previously employed at the Refinery. This was considered a primary critical factor for the success and completion of this study. In addition, due to the highly competitive and intensive nature of this industry, a clear understanding of my boundaries and constraints had to be established with regards to ‘access’ into the Refinery and the types of interviews that I would be able to conduct with the desired respondents for my study.

Initially, I approached Mr Thabani Zondi, the Human Resources Director to negotiate the Refinery’s participation in this case study. After much negotiation, access to the identified engineering respondents at the Refinery was granted.

### **a. Key Informants**

During the early stages of this study, as I was investigating answers to specific questions related to the moderate decline of skilled professionals, more specifically engineers in South Africa, I identified a total of six key informants who were likely to share their knowledge and opinions about this topic. These informants were from both the supply (education and labour market) and demand side (those within or related to the Petrochemical industry and engineering labour market on a local and global scale). To give the interviews direction and purpose, prior to the interviews I forwarded information regarding my research topic to each respondent and further indicated the kind of information that I would want to discuss. This allowed for the informants to give my research topic some thought, relating it to their expert opinions and knowledge in their specific fields of work.

Each interview was aided by a rough interview schedule and was conducted face-to-face. The interviews varied between 1.5 to two hours in length. Hand-written notes were made throughout each interview. I did not make use of audio recordings, as I wanted to create a trustworthy and 'open' environment for information to be disclosed to me. Due to the sensitivity of some of the information shared with me, it is important to note that four informants wished to remain anonymous for confidentiality reasons (See *Table 3* below for list of key informants).

**Table 3: KEY INFORMANTS**

<b>Key Informants</b>					
	<b>Name</b>	<b>Organisation</b>	<b>Position</b>	<b>Place of Interview</b>	<b>Date</b>
1.	Mr Thabani Zondi	Engen Refinery, Wentworth	HR Director	Engen	November 2007
2.	Mr Johan Pienaar	ECSA	Manager: Registration	ECSA – Johannesburg	April 2008
3.	Colin Ngubane*	N/A. Experience is both local and global	Global oil and gas industry Expert	Durban	May 2008
4.	Des Governder*	N/A. Significant engineering experience in local petrochemical industry	Engineer	Durban	September 2007
5.	Sally Book*	Refinery in the Durban-South region	Education/training	Durban	September 2007
6.	Howard Smith*	Petrochemical Industry	Operations	Durban	October 2007

\*Names that have been changed for confidentially purposes.

### **b. Engineers currently employed at Engen Refinery**

The second step was to design an interview schedule with which to conduct semi-structured interviews with engineers currently employed at Engen Refinery. The semi-structured interviews were conducted using the face-to-face method aided by the use of an interview schedule. The face-to-face method was most beneficial as it allowed for me, the researcher and the respondents to interact and engage with the interview. This allowed for related information to come to the fore. Personal interviews provide the researcher with the opportunity 'to probe complex issues in a relaxed atmosphere, as well as to record additional pieces of information concerning the behaviour of the interviewee during the interview (Remenyi *et al.*, 1998: 157).

The interview schedule was composed of a list of open-ended questions, which allowed for the interviewees to engage with each interview more freely, and for the respondents to be probed further during each interview (See Appendix A for complete interview schedule). This was helpful as it allowed for flexibility during each interview in which more information from the respondents' answers could be obtained gaining more indepth responses without biasing later answers (Bailey, 1978; Robson, 1993; Denscombe, 1998; Babbie & Mouton, 2004).

The interview schedule focused predominantly on three main aspects: that of the individual in the Petrochemical industry labour market on a local and global level; the types of constraints experienced within the Petrochemical industry itself including those factors that are internal and external to the Refinery; and the nature of the engineering skill shortage issue experienced within the Refinery. The last section is concerned with the demographics of each respondent.

In order to gain an understanding of the various types of bottlenecks and constraints experienced by engineers, both internally and externally to the Refinery, semi-structured interviews were conducted using a purposive non-probability sample of 20 participants. Purposive non-probability sampling is where a list of the population is not known or easily available (Babbie & Mouton, 2005). The non-probability method of snowball sampling was adopted in this study due to the difficulty in obtaining the necessary population list. In drawing the sample, the following criteria were considered: race, gender, age and number of years experience in this field. The aim was to help prevent any bias towards a specific variable of analysis.

Each interview varied between 45 minutes to one hour. For each interview, with the permission of the interviewee, I made use of handwritten notes and audio recordings. After each stage of the data collection process, transcripts of the interviews were completed as soon as possible, so as to ensure accurate memory of the interviews. This process was brought to the attention of each participant before the start of each

interview. Each participant had the right to decline the use of these data gathering tools; three made specific requests that I make use of handwritten notes only.

Prior to the interview process, I forwarded information regarding my research topic to each respondent and further indicated the kind of information that I would want to discuss. This allowed for the respondents to give my research topic some thought, relating it to their expert opinions and knowledge in their specific fields of work. Furthermore, each participant was made aware of the fact that their participation in this study was voluntary, and they could withdraw from this research study at any stage. Due to the highly sensitive nature of this research topic, all interviewees wished to remain anonymous. Due to time and access constraints, and for the sake of convenience, interviews were conducted at the Refinery. (See *Table 4* overleaf for a list of engineers currently employed at Engen Refinery that participated in this study).

**Table 4: ENGINEERS CURRENTLY EMPLOYED AT ENGEN REFINERY**

<b>Engineers Currently Employed at Engen Refinery</b>						
	<b>Respondent</b>	<b>Gender</b>	<b>Race</b>	<b>Ladder</b>	<b>Place of Interview</b>	<b>Date of Interview</b>
1.	Respondent A	Female	Indian	Management	Engen Refinery	Sep/Oct 2007
2.	Respondent B	Male	Indian	Management	Engen Refinery	Sep/Oct 2007
3.	Respondent C	Male	Indian	Management	Engen Refinery	Sep/Oct 2007
4.	Respondent D	Male	Indian	Technical	Engen Refinery	Sep/Oct 2007
5.	Respondent E	Male	White	Technical	Engen Refinery	Sep/Oct 2007
6.	Respondent F	Male	Indian	Technical	Engen Refinery	Sep/Oct 2007
7.	Respondent G	Male	Black	Technical	Engen Refinery	Sep/Oct 2007
8.	Respondent H	Female	Indian	Management	Engen Refinery	Sep/Oct 2007
9.	Respondent I	Male	Black	Technical	Engen Refinery	Sep/Oct 2007
10.	Respondent J	Male	Black	Technical	Engen Refinery	Sep/Oct 2007
11.	Respondent K	Female	Indian	Management	Engen Refinery	Sep/Oct 2007
12.	Respondent L	Male	Coloured	Technical	Engen Refinery	Sep/Oct 2007
13.	Respondent M	Male	Indian	Technical	Engen Refinery	Sep/Oct 2007
14.	Respondent N	Female	Black	Technical	Engen Refinery	Sep/Oct 2007
15.	Respondent O	Male	Indian	Management	Engen Refinery	Sep/Oct 2007
16.	Respondent P	Female	Black	Management	Engen Refinery	Sep/Oct 2007
17.	Respondent Q	Male	White	Technical	Engen Refinery	Sep/Oct 2007
18.	Respondent R	Male	White	Technical	Engen Refinery	Sep/Oct 2007
19.	Respondent S	Female	Indian	Technical	Engen Refinery	Sep/Oct 2007
20.	Respondent T	Male	Coloured	Management	Engen Refinery	Sep/Oct 2007

### **c. Engineers previously employed at Engen Refinery**

During this stage of my research, I had established a few ‘links’ and contacts with engineers previously employed at Engen Refinery, many of whom were working abroad at the time. Face-to-face interviews were not possible due to financial and practical constraints, and it was not possible for me to interview the ‘exit engineers’ working outside of Durban and abroad. As a result, I designed an email self-completion questionnaire, which was sent to engineers that had previously worked at Engen Refinery (See Appendix B for complete email-questionnaire). The use of

email self-completed questionnaires is advantageous as it is a 'cost-effective way of collecting data' from respondents who are widely dispersed in location (Bridget & Lewin, 2005: 219).

This questionnaire contained five main sections. Section one dealt with demographical information on each respondent. Section two focused on employment history. Section three dealt with the factors contributing towards the engineer leaving Engen Refinery. Section four focused on the Petrochemical industry and the issue(s) of skills shortages. Lastly section five attempts to develop an understanding of the 'exit engineer's' global working experience.

Using the snowball sampling technique, a total of 18 potential exit engineers were identified. Snowball sampling is appropriate when the members of a special population are difficult to locate (Babbie & Mouton, 2005). In addition, this method of sampling allows for the researcher to identify subjects suitable for research, asking for referrals to other participants that may be of value to the study. Using the snowball technique for establishing contacts with previously-employed engineers of Engen Refinery, email questionnaires together with informed consent forms were sent out. The questionnaire was organised to facilitate the gathering of structured data from the respondents in a standardised format, through self-completion.

According to Bridget & Lewin (2005: 219) in order to maximise your respondents' response rates and to ensure that your research instrument is reliable and valid constant tabs need to be kept on all respondents. The use of 'follow-up mailings' helps to encourage the respondents to respond to the self-administered email questionnaire. This approach can consist of 'follow-up letters' and a copy of a 'new self-administered questionnaire'. This is considered an effective method for increasing return rates in mail questionnaires (Babbie & Mouton, 2005; Bridget & Lewin, 2005). Following these methods of increasing response rates of the email self-completion questionnaire, a total of 12 out of 18 responded and were willing to take

part in my research (See *Table 5* below). I was able to identify three engineers currently working abroad, and nine currently working in South Africa (some of whom had already worked abroad and returned to South Africa).

**Table 5: ENGINEERS PREVIOUSLY EMPLOYED AT ENGEN REFINERY**

<b>Engineers Previously Employed at Engen Refinery</b>					
	<b>Respondent</b>	<b>Gender</b>	<b>Race</b>	<b>Country currently living in (working)</b>	<b>Completed email-questionnaire received</b>
1.	Respondent AA	Female	Black	South Africa	29 May 2008
2.	Respondent BB	Female	Black	South Africa	29 May 2008
3.	Respondent CC	Male	Black	South Africa	10 April 2008
4.	Respondent DD	Male	Black	South Africa	20 February 2008
5.	Respondent EE	Male	Black	South Africa	6 March 2008
6.	Respondent FF	Male	Black	South Africa	10 April 2008
7.	Respondent GG	Male	Indian	South Africa	25 June 2008
8.	Respondent HH	Male	Indian	Australia	26 March 2008
9.	Respondent II	Male	Indian	South Africa	27 February 2008
10.	Respondent JJ	Male	White	Australia (working in Angola)	20 February 2008
11.	Respondent KK	Male	White	South Africa (working in Angola)	27 February 2008
12.	Respondent LL	Male	Coloured	South Africa	20 May 2008

### **3.3.3 Secondary Data**

#### **a. Exit interviews conducted by Engen**

I received 13 Exit Interview Questionnaires from the Human Resource Department of Engen Refinery. These exit interviews were conducted by the Refinery at the time of the resignation of these engineers. I was only able to locate two of the 13 exit respondents. I conducted a content analysis of the '*exit interviews*' (See *Table 6* below).

**Table 6: Exit Interviews conducted by Engen**

<b>Exit Interviews conducted by Engen</b>			
	<b>Employee</b>	<b>Gender</b>	<b>Date interview conducted</b>
1	Exit employee 1	F	27 June 2003
2	Exit employee 2	F	31 May 2006
3	Exit employee 3	M	31 February 1997
4	Exit employee 4	M	31 May 2000
5	Exit employee 5	M	17 November 2000
6	Exit employee 6	M	30 April 1998
7	Exit employee 7	M	02 February 1998
8	Exit employee 8	M	11 June 1999
9	Exit employee 9	M	31 May 1997
10	Exit employee 10	M	30 July 1999
11	Exit employee 11	M	30 April 1998
12	Exit employee 12	M	31 January 2006
13	Exit employee 13	M	31 December 2001

**b. Newspaper Articles**

From the onset, I consulted various local newspaper print and electronic sources. These articles were sourced from a wide range of national newspapers and included all the KwaZulu-Natal newspapers. The articles were related to the current skills shortages situation within the local and global labour markets, covering the period from January 2007 until the end of October 2008. I went through each business section of most newspapers available, so as to develop a broader understanding of the skill shortage situation in the South African context, and on a global scale. Of the newspaper articles that I was able to source, I tried to make copies of all articles relating to the engineering and Petrochemical industry more specifically. The material from the newspapers were not used as extensively as I had hoped, as the primary source of information for my research came directly from the respondents interviewed in this dissertation. The newspaper material enabled me to develop an understanding of the skills shortage situation in South Africa. For example, these

sources of information enabled me to consider how other developing regions in Africa are impacting on the skill shortage situation in South Africa.

### **c. Internet Searches**

The Internet is a very useful research tool. Information placed on the internet tends to be more up-to-date and in my case, allowed for me to source online journal articles and reports that were more in touch with my topic of investigation. In addition to the local newspaper print articles, I was able to view articles written in other parts of the country, Africa and the rest of the world. Such websites included *The Cape Argus*, *Fin24.com*, *Pretoria News*, *Business Report*, *Independent Online*, and the *Mail and Guardian*.

In addition to online news media sources, the internet allowed me to access information on websites such as The Homecoming Revolution, The Come Home Campaign, and Brand South Africa.

To ensure credibility of such internet sites accessed, I ensured that these were:

- Not personal websites
- That the user domain from which it came from was educational or peer reviewed based
- In some instances, internet sites such as The Homecoming Revolution, The Come Home Campaign, and Brand South Africa were accessed to contextualise some of the discussions engaged with respondents in the study.

### **d. Consultant reports**

Consultant reports also provided a very useful source of information. These reports were used for a number of reasons. Firstly, I was able to develop a contextual understanding of the skill shortage situation in the engineering labour market by reading the consultant reports published in various media sources, namely

*Engineering News, Mining Weekly, Government Digest, National Scarce Skills Reports, and Civil Engineering.*

### **3.4 Data Analysis**

Following the collection of data, both written and through the use of audio recordings, the next task was to transcribe and analyse the material. This proved to be an exhausting and time-consuming task. The objective was to systematically analyse each tape and extract all relevant data, followed by a thematic form of analysis. The information gathered from the transcripts of each interview was analysed and interpreted according to key themes and issues identified by the interviewees, more specifically within a framework using the modes of case-study analysis, *vis-à-vis* “*pattern-matching*” and “*explanation-building*” (Yin, 1994).

It is argued that case study research analysis is ‘rarely isolated from and unaffected by factors in the environment in which it is embedded.’ (Babbie & Mouton, 2005: 282) It is therefore suggested that this type of analysis requires the ‘breaking-up’ of data into manageable themes, patterns, trends and relationships. According to Meyer (1983) to understand and interpret case studies, the researcher needs to ‘describe the context in detail’. This approach helps the researcher to ‘conceptualise the contexts in which the unit of analysis is embedded.’ The aims of analysis in this context, as stated by Babbie & Mouton (2005), is to understand the ‘various constitutive elements of one’s data and to see whether there are any patterns or trends that can be identified or isolated to establish themes in the data’.

In order to analyse the primary sources of data gathered, according to key themes and issues identified by the interviewees, within the modes of case study analysis framework, the *coding system* was employed. This was completed manually in a qualitative manner. According to Miles & Huberman (1994: 9), the coding system is a process that makes ‘*large mass data manageable. Coding allows the researcher to quickly retrieve relevant parts of information required through this ‘mass’ of raw*

*data information.*' Although difficult, the coding system did allow for a thorough exploration of the various issues and debates to emerge from the different perspectives whilst presenting the inter-connectedness of the themes. This, however, is not a simple process (Plath, 1990; Miles & Huberman, 1994), especially for 'inexperienced researchers to understand and to master' (Strauss, 1987: 55).

The following section briefly outlines the main research problems and challenges encountered, further highlighting the ethical considerations that needed to be taken into account.

### **3.5 Ethical Considerations**

In order to ensure the anonymity of participants and the confidentiality of the information given to me, this study does not mention the names of interviewed participants or specific details about their positions/jobs through which they can be identified. To ensure the confidentiality and anonymity of all participants in this research, I requested all participants to sign an informed consent form. This form ensured that each respondent:

- was made aware of the nature and purpose of my research;
- were informed of my identity and institutional association as a researcher, as well as that of my supervisor, including both our contact details;
- were informed that participation was voluntary and that responses would be treated in a confidential manner;
- knew that anonymity would be ensured where appropriate, and/or if requested (e.g.: coded/disguised names of participants/respondents/institutions); and
- were free to withdraw from the research at any stage, without any negative or undesirable consequences to themselves.

This form acknowledged confidentiality/anonymity of all participants in this research. It also informed each respondent that any further presentation and publication of any

materials requiring further anonymity and confidentiality of each participant will be understood clearly at the start of each interview.

In addition, if any further concerns are to be raised by participants in this study, revisions will be completed to correct any mistaken identity within this research. Each respondent was informed that within this report (and any other materials developed related to this study), they would be acknowledged and represented as 'the respondent'. Respondents were assured that the information identifying them would not be taken into account during analysis. It was important to establish some form of trust between each participant and myself.

To ensure responses from 'exit' engineers I used a 'covering letter' in my initial contact via email. This allowed for me to introduce myself as the researcher, verify my affiliation to the University (through my University email account) in an attempt to improve the initial response rates of these engineers. The letter outlined the aims of the research, highlighting the importance of the individual's contribution to this study. Again, I assured respondents of confidentiality (using an informed consent form), which did encourage replies. Follow-up emails were administered to ensure that I got as many responses back from the respondents as possible.

The use of exit interviews from the Refinery was conditional on the agreement that I would not use any of the names of these 'exit engineers' within my report and any other form of documents/material developed from this study. I did however obtain permission to make attempts to contact these engineers and any other engineers that had left the Refinery. However as mentioned earlier, due to time and access constraints this was a difficult process. All raw data collected for the purposes of this research is stored in a secure place.

### 3.6 Research constraints and problems

As with any research, a number of research problems and challenges were encountered. For the purposes of this section, I have identified five main research problems that were encountered. These were the: size of the study; access to the research site and information; access to respondents; ‘positionality’ as a researcher; and the use of exit interviews conducted by Engen Refinery. Below are brief explanations of these problems and challenges.

Firstly, *access* into the Refinery proved difficult. Due to the highly intensive, competitive and rapidly changing nature of the Petrochemical industry, this process took many months to achieve. According to the Refinery, I was the fourth ‘outsider’ ever allowed into the Refinery to conduct interviews towards a research study (hence this process took much negotiating and convincing on my behalf). The fieldwork involved some difficulties. *Sensitivity* factored significantly in the data collection stage of my dissertation. The HR Department of the Refinery asked to review the interview schedule that I would be using, so as to ensure that my schedule was in line with my research topic. No comments or changes were actually made to the original set of interview schedules sent to the Refinery for review.

Secondly, *access to respondents* proved to be difficult due to a *series of events* that contributed to a further delay in my gaining access to the site. These were: the Petrochemical industry strikes, which peaked in the months of July and August 2007; a series of plant explosions dated 3<sup>rd</sup> July, 19<sup>th</sup> November, and 7<sup>th</sup> December 2007; and an internal audit that was conducted during the second half of 2007. For safety reasons, I was requested to not conduct any interviews on site during this period.

In addition to this, I relied on the HR department to make initial contact with the *engineers currently employed* at the Refinery – I was not allowed to have access to a comprehensive list of all those employed at the Refinery. This did limit the selection of respondents for my study. Overall I encountered several difficulties in securing

information (such as the demographics and actual number of engineers currently employed at the Refinery, and the number of engineers that have left the Refinery since 1994), locating suitable participants and accessing the Refinery itself. As a result, my case study was not of Engen Refinery itself, but rather the engineers employed at the Refinery.

Furthermore, locating and gaining access to those *engineers previously employed* at the Refinery was not an easy task. Financial and logistical constraints meant that I had to rely strongly on the snowball sampling technique to obtain contact details of those ‘exit’ engineers, mainly through those currently employed at the Refinery. This was most beneficial. There are many engineers from South Africa working abroad, but trying to find those that previously worked at Engen proved testing. Even although I had emailed these respondents self-completed questionnaires, I incorporated more open-ended questions into the questionnaire, which is more suited for the qualitative approach to my study, with the aim of encouraging the respondents to provide sensitive information and to respond freely in continuous text (Bridget & Lewin, 2005: 220).

In addition, a content analysis of the ‘*exit interviews*’ given to me was conducted. As mentioned earlier, these copies were obtained from the Human Resource Department of the Refinery. Generally, very limited data is captured when an employee leaves the company.

### **3.7 Conclusion**

This chapter outlined the research strategy and processes followed in this study. By drawing attention to the problematic nature of quantitative methodologies employed in the study of skill shortages, and considering the small-scale size of my research and the complexity of the topic at hand, to go beyond the realm of the skill shortage debate as presented by statistics, and the overall aim of my dissertation which was to identify and examine the multi-dimensional labour market constraints for engineers

within the Petrochemical industry, further identifying the causal factors contributing to engineers' increased mobility, it was necessary to use a qualitative methodology. Following an examination of the theoretical rationale for using such a methodology, the results of this study will be discussed in the following chapters.

# CHAPTER FOUR

## The Case Study

*'...refining...is presently experiencing their best margin [2007] improvements that they have seen in the last 10 years given the high oil price and refining capacity shortage. I am surprised if a refinery [referring to Engen Refinery] is not able to retain and attract engineering talent with this kind of profit windfall.'* (Respondent HH, Interview 8, March 2007)<sup>16</sup>

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### 4.1 Introduction

During 2003/2004 Engen Refinery experienced a net loss of experienced skilled engineers. According to key informants (Smith, Interview 6, October 2007; Zondi, Interview 1, November 2007; Ngubane, Interview 3, May 2008) this resulted in a skill shortage of engineers at the Refinery. Technical experts from Engen informed the Parliamentary Science and Technology Portfolio Committee that a total of 45 experienced engineers (across the Chemical, Mechanical, Electrical and Control engineering disciplines) left the Refinery during this period<sup>17</sup>; which is on average nearly two engineers per month over a two year period. The net loss of highly-experienced, qualified engineers to the Refinery particularly during 2003/2004 raised serious concerns as to why this situation developed.

Much of the existing literature and explanations, as I argued in chapter 2, tends to be focused and over-reliant on external labour market factors for analysis, explanation and understanding of skill shortages *vis-à-vis* the brain-drain debate, issues of supply, increases in demand, and the socio-economic-political factors. Although the engineering skills shortage is a global and local phenomenon, I have argued that these external factors do not sufficiently explain the current shortage of engineers at Engen.

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<sup>16</sup> Respondent HH used to work at Engen is currently living in Australia and working in Angola.

<sup>17</sup> In addition to this, Thabang Tawarima, Deputy Managing Director of FluorSA, during the presentation to the Parliamentary Science and Technology Portfolio Committee, stated that skilled persons within the petrochemical industry were found to be emigrating at a steady pace.

The central argument of this study, as explained in chapter 2, is that an understanding of a skills shortage requires a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced. Therefore, I suggested that while it is important to understand the context of the broader skills shortage debate, it is equally important to consider the ‘internal’ - what I referred to as micro-factors - to better identify and understand the specific dynamics that underline a skills shortage.

Accordingly, this chapter aims to understand the shortage of engineers by focusing on the internal and external experiences of engineers working at Engen Oil Refinery. In reality, the external and internal factors are interrelated which makes it difficult to disentangle one from the other. However, in order to better understand this situation, referring to figure 3, the findings, analysis and discussion will be presented in two main sections, the (1) External and (2) Internal factors to Engen Refinery.

The first section consists of four sub-sections. The first two sections start by examining the engineering skill shortage in relation to the increased demand for engineers in the (a) global and (b) local labour market. The main findings in this section indicate that the global and local demand for engineers has increased significantly as a result of the increase in economic capital expansion<sup>18</sup> and development projects worldwide. The shortage of skilled, experienced engineers has resulted in favourable incentive packages offered by both local and global organisations to these engineers. The findings, however, suggest that white, Indian and coloured engineers are more likely to work abroad. Black engineers, on the other hand, are less likely to move abroad to work and are more likely to stay within the South African labour market. This is a result of the increased demand for black engineers in the local labour market. The findings further suggest that the increased

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<sup>18</sup> Capital expansion projects and development in this context refers to projects that expand infrastructure and involve logistics, team mobilisation and major procurement. Refer to sections 4.2.1 and 4.2.2 for global and local capital expansion and development project examples used in this chapter.

demand for black engineers locally is driven by transformation efforts in the South African Petrochemical Industry (the issue of employment equity will be dealt with in detail in section 2). The findings indicate that black engineers are more likely to move from company to company, locally, than their white, Indian and coloured colleagues who are more likely to move from company to company globally.

The central argument of this dissertation is that to understand the skill shortage of engineers, a detailed examination of the internal and external labour market in which shortages are being experienced is required.

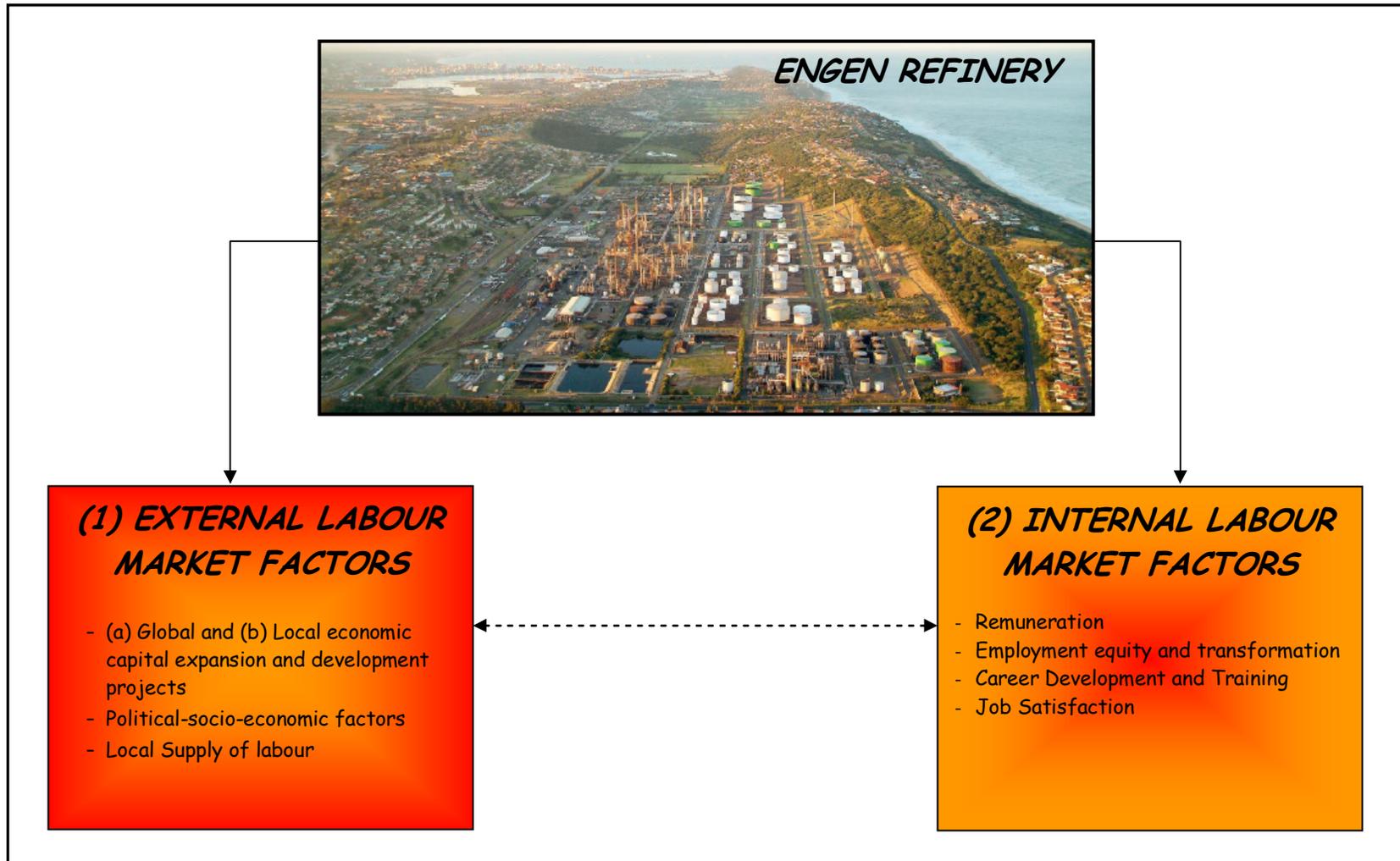
In the section below, I outline the key issues identified. In the first section I explore the dynamics of remuneration and the role it plays in the context of skill shortage. In this section, I show that my findings suggest that remuneration, although important, is not the only factor engineers are concerned with. In the second section, I focus specifically on the perceptions and experiences of affirmative action at the Refinery. A key finding suggests that affirmative action is strongly supported by the Refinery and the engineers. However the implementation of affirmative action at the Refinery has been problematic. I suggest that this has resulted in a loss of engineers from the Refinery, across all race groups.

The third section deals with career development. My findings suggest that career development is just as important as remuneration. This, however, requires succession planning, which does not exist at the Refinery. In addition, the lack of a structured training programme for new graduates entering the Refinery has contributed to the problematic context of skill shortage at the Refinery. In the last section, drawing on these frustrations, I explain that increased levels of job ‘dissatisfaction’ are resulting in the loss of engineers from the Refinery. The levels of dissatisfaction, I explain, are related to:

- (a) the increased intake of newly qualified ‘poor quality’ engineering graduates;

- (b) the inconsistent implementation of affirmation action plans and retention strategies; and
- (c) inconsistent levels of communication at the Refinery.

**FIGURE 3: EXTERNAL AND INTERNAL LABOUR MARKET FACTORS TO ENGEN REFINERY**



## 4.2 External labour market factors

According to Barker (2006), *'the shortage of skilled professionals in the country has given rise to various debates and speculations over the causal factors [vis-à-vis the brain-drain debate, issues of supply, increases in demand, and even socio-economic-political factors], and the resulting consequences that this trend will have on the future survival of South African industry'*. I have argued in previous chapters that the external labour market perspective, alone, fails to explain the labour market dynamics of skill shortages. However, I have argued that the external factors need to be interrogated just as equally as the internal. The section below is divided into four sub-sections:

- Global economic capital expansion and development projects;
- Local economic capital expansion and development projects;
- Political-socio-economic factors;
- Supply.

### 4.2.1 Global Economic Capital Expansion and Development Projects

*'...the loss of engineers...was experienced across the whole petrochemical industry in South Africa [and not only at the Refinery] (Zondi, Interview 1, November 2007)<sup>15</sup>.*

Much attention has been given to (real or potential) emigration<sup>16</sup>. The brain-drain debate, a very popular debate, is concerned with the loss of experienced skilled professionals from the local labour market. In chapter 2, I noted that Crush *et al.* (2000), Mattes & Richmond (2000), Bhorat, Meyer & Mlatsheni (2002), and Crouch (2005) argue that emigration is a recurrent theme in the media and is increasingly cited as the cause of a growing skills crisis South Africa.

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<sup>15</sup> Zondi is the Human Resource Manager at the Refinery.

<sup>16</sup> In Chapter 2, I provided a detailed discussion on the literature and debates surrounding the brain-drain debate.

At Engen, during 2003/2004, a net loss of 45 experienced engineers occurred. From the Engen perspective, serious concerns were raised as to why this situation had developed. It was argued that this was not unique to Engen, but was experienced across the whole Petrochemical industry. Supporting evidence, outlined in chapter 2, from Steyn & Daniels (2003) and Pienaar (2008)<sup>17</sup> indicates that from 1994-2004 there was a significant outflow of qualified, engineering professionals from South Africa. Ngubane<sup>18</sup> (Interview 3, May 2008) argued that the shortage of engineers at Engen was a direct result of the *'unpredicted increase in the global demand for engineers..., [resulting in] a worldwide shortage of engineers across all disciplines'*. The increased demand for engineers, it was explained, *'occurred mainly in emerging markets of China, India, Central Asia, the Middle East (such as Kuwait and Saudi Arabia)'*, and in regions such as *Angola, the DRC, Canada and Australia*<sup>19</sup> (Zondi, Interview 1, November 2007; Ngubane, Interview 3, May 2008).

One of the main reasons identified by some respondents for the increase in demand for engineers is the unexpected<sup>20</sup> increase in global capital expansion and development projects within the Petroleum industry around the world. The unexpected increased demand was problematic for organisations worldwide, as (a) they are drawing on a limited supply of engineers throughout the global labour market, and (b) the cost to company for the 'skills shortage' of engineers is high as these organisations are seeking individuals who are highly trained with at least 10-15 years of work experience in the Petrochemical industry.

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<sup>17</sup> See Chapter 3 for interview details. Manager: Registration of the Engineering Council of South Africa (ECSA).

<sup>18</sup> Ngubane is a key informant for this study. Ngubane has extensive working experience in the local and global petrochemical industry. Ngubane currently resides in Durban but works for a consulting company in the Petrochemical Industry based in the UK.

<sup>19</sup> Most engineers in this study mentioned that those engineers that went abroad went to work in places such as Angola, Australia, Canada, DRC, off-shore oil rigs, and the Middle East.

<sup>20</sup> Some respondents referred to the increase in demand for engineers as 'unexpected' as no planning or communication between industries around the world had taken place. Investors were investing in capital development and expansion projects around the world.

In this dissertation I have argued that the ‘brain-drain’ (an external factor to the Refinery) alone, as an explanation of the skills shortage at the Refinery is limiting. According to the neo-classical perspective, shortages will cause wages to rise which will cause an increase in supply. Theoretically, this would then bring supply and demand into balance (Callaghan, 1997: 9). However, the increased demand and limited supply of engineers has resulted in a global (and local) ‘*talent war*’<sup>21</sup> between global and local organisations (Zondi, Interview 1, November 2007). The shortage of engineers prevails.

Furthermore, it becomes vividly clear that the high level of competition for experienced engineers in the global labour market has compounded shortages within the local labour market. According to Ngubane (Interview 3, May 2008), global players in the Petroleum industry actively target (poach) experienced engineers from the South African Petrochemical industry. South African engineers are highly regarded around the world due to their high levels of refining experience, competency and their reputation for being hard-working. Respondents in this study stated that experienced South African engineers are highly sought after worldwide. Interestingly, of the 20 engineers I interviewed, 18 had been approached by other companies, 12 of which were from the global labour market.

The majority of these engineers indicated that they had been offered significantly higher incentivised salary packages in the hope of them being persuaded to move abroad. There were mixed responses to these salary package offers. I will discuss the responses below.

The respondents generally argued that ‘*the financial incentives offered for working overseas are more lucrative and are very attractive [in comparison to the local context]*’ (Respondent R, Interview 18, Sept/Oct 2007; Zondi, Interview 1, November

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<sup>21</sup> Commonly referred to as the ‘war-for-oil talent’ by respondents in the Petrochemical industry.

2007). Notably, engineers' perceptions<sup>22</sup> of those who had left the Refinery were that they were 'lured' by the significantly higher salary package offers by overseas firms. They believed that those who had left were motivated to work abroad based on extrinsic factors. In other words, the drive to work is based on the economic motives of the individual.

From the outset, it appeared to be evident that the lucrative salary package offers by overseas firms played a significant contributing factor in engineers working abroad. Interestingly, my findings revealed that within a skill shortage context, engineers (in high demand), and are able to negotiate with potential employers for significantly higher incentive package offers. In addition, the lucrative salary packages offered are more often than not paid in US Dollars and are in most cases tax free.

Working overseas has additional incentives. (a) According to Respondent K (Interview 11, Sept/Oct 2007), labour markets abroad tend to be more flexible and less rigid (in comparison to the local South African labour market), *'as an engineer, I am seeking to work in a more flexible work environment'*. (b) In addition to the lucrative salary packages, engineers are attracted overseas by the short-term contracts (2-4 years) offered. Respondent Q (Interview 17, Sept/Oct 2007) argued, *'you can do that [work overseas on short-term contract] for three or four years [contract working abroad] and would be able to retire nicely and then have the option of coming back home [South Africa]...you then don't need to work for a corporate where all the money is.'* And, (C) was of the view that *'earning a much higher salary over a shorter period of time allows you to become more financially independent.'* (Respondent O, Interview 15, Sept/Oct 2007).

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<sup>22</sup> What I observed was that the engineers at the Refinery felt that those who had left for reasons predominantly related to economic motives. As the neo-classical theory suggests, individuals respond to higher salaries. However, in terms of an employer, these engineers argued that there are other factors that they favoured. I will discuss these later in the chapter.

These factors it is argued have resulted in engineers increasingly ‘*job-hopping... [namely] overseas*<sup>23</sup>. The shortage of engineers has allowed for them, such as Respondent JJ (Interview 10, February 2007), to work in one country and live in another: ‘*I stayed in South Africa [initially] and worked in Angola, and then moved to Australia and worked in Perth for four months...[and am currently] back in Angola working for Chevron. I work 28 days on and 28 days off. I [including his wife and children] still live in Perth.*’

*Constraints to the firm in the local labour market:*

Engen’s difficulty, as Zondi (Interview 1, November 2007) argued, is that it has to compete with the global players in the ‘talent war’. In the face of higher paying jobs (primarily paid in US Dollars) in places like the Middle East and Australia, it is proving extremely difficult to retain their current core of engineers. Zondi (Interview 1, November 2007) explained that the salary packages offered within the local context are uncompetitive at the global level. The differential gap between the global and local level is significantly influenced by FOREX exposures. The inability to match some of these packages has resulted in the loss of engineers from the Refinery.

I suggest that that this allows for (a) wages to be influenced (greatly) between the employee and employer; however, (b) the geographical location in which the employer and the contract of employment reside also determine the levels at which salaries can be benchmarked. Salaries, as I argue, cannot be benchmarked (or determined) beyond the local labour market parameters.

Even though the salary packages that are offered locally have increased significantly in response to the increased demand, salaries can only be increased to a certain point. If local salary packages are benchmarked equally against global standards, organisations such as the Refinery would have to (a) downsize dramatically in order

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<sup>23</sup> *Engen Refinery Skills Briefing Presentation* Presented to the Parliamentary Portfolio Committee – 20 February 2007.

to sustain the salaries that have to be paid; or (b) have to close down due to financial constraints, or possibly merge with another similar entity to ensure they have the ability to operate with enough finances. The Refinery still needs to remain competitive within the local and global markets in order to remain sustainable (Respondent Q, Interview 17, Sept/Oct 2007). It is of vital importance that the Refinery continues to benchmark salary packages and salary structures to the local context, so as to ensure they continue to remain competitive and economically sustainable; enabling the Refinery to retain the core of their key engineers as well as support staff necessary to function efficiently and optimally. The Refinery however cannot ensure all this if they were to match all salary packages offered in the global labour market (more often paid in US Dollars).

#### Consequences for the refinery

*'Retention are big issues at the moment [within the Refinery]...there is a lot of drive to try 'cure' these issues [resignation of engineers from the Refinery]...there is a lot of salary structure changes...which is being revised at all levels... market related within South Africa...as its such a competitive market...we can't compete with international markets...for example, tax free packages.'* (Respondent D, Interview 4, Sept/Oct 2007). The constraint with uncompetitive salary packages within the global context, Zondi (Interview 1, November 2007) argued is one of the main reasons contributing towards the net loss of skills from the Refinery to the global labour market.

#### Are all engineers that leave the refinery going overseas?

The findings within this context are two-fold. (1) Although the emigration/'brain-drain' argument does provide some explanation for the shortage in the local labour market, this perspective tends to ignore the dynamics of the internal labour market. Not all engineers 'job-hop' overseas for higher salaries. A significant number are moving between companies in South Africa. Therefore, I argue that the 'brain-drain'

debate does not sufficiently explain why skilled employees, such as engineers, leave an organisation but do not leave the local labour market (South Africa).

The findings indicated that engineers leaving for abroad were primarily white engineers who were 40 years or older. One of the main reasons for this is that there is an aging workforce. In discussion with respondents, it was evident that these 'aging' engineers are not willing to retire due to an insecure financial future. As a result, a number of key engineers with more than 15-20 years Petrochemical experience and those reaching the age of retirement have capitalised on the global shortage situation. The increased demand has resulted in favourable salary package offers for experienced engineers. The opportunity to move abroad has the potential to significantly improve their retirement funds and savings. I will examine remuneration as a theme in greater detail in the second main section of this chapter.

Despite this, responses also revealed that remuneration was not the primary factor that contributed towards the 'pull' of engineers, aged between 35-38 years (predominantly white, but also Indian and coloured) overseas. The findings indicate that these engineers are influenced to enter the global labour market by factors other than remuneration. Of serious concern are elements of job opportunities related to career development and the nature of the work environment. For Respondent O (Interview 15, Sept/Oct 2007), *'it [would] depend on the opportunities for me...for me I would be more interested in particular projects that are taking place overseas...projects that they [Engen Refinery as well as the South African Petrochemical Industry as a whole] will unlikely to be doing over here [South Africa].* In addition, those that were married with children stated the move would need to be in the best interests of the whole family.

The nature of the work is taken seriously in their considerations to move abroad. Respondent B (Interview 2, Sept/Oct 2007) argued that he is *'bored of the challenges here – I want to look for challenges abroad'*. According to Respondent S (Interview

19, Sept/Oct 2007) *'Once you have achieved [within the Refinery], there is only so much you can do in one place, and I don't really want to work anywhere else in South Africa. Once I have reached my potential here...I might consider going overseas just to get a different experience.'*

In particular, my findings suggest that the younger engineers (aged between 25-28 years) would leave the Refinery in pursuit of engineering work that is more challenging, presenting an opportunity to broaden and diversify their engineering work experience vs. remuneration. This is important in terms of career development for the respondents. As explained by Respondent R (Interview 18, Sept/Oct 2007) some engineers want to work abroad on projects that would not necessarily take place at the Refinery or within South Africa. The problem at the Refinery however is that it is a *'maintenance refinery...so your experience is limited in that sense'*<sup>24</sup> (Respondent O, Interview 15, Sept/Oct 2007). Respondent R (Interview 18, Sept/Oct 2007) explained that a competent female engineer [at Engen] left the Refinery to work for an engineering company abroad: *'it was a chance for her to get into Design and Engen couldn't really counter the offer [not only from a salary package perspective but from the work opportunity].'* I will fully examine the factors of career development, job satisfaction and training in greater detail in the second section of this chapter.

### Culture barriers

*'In some places it's actually not that great to be working in'* (Respondent O, Interview 15, Sept/Oct 2007). This posed a problem for the majority of those interviewed. Being offered a lucrative salary package to work abroad was not enough. The engineers also need to take into account the location of the work to be done abroad. Female engineers interviewed, in particular argued that location is a huge factor in their decision to move overseas. According to Respondent P (Interview 16,

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<sup>24</sup> The Refinery is considered a maintenance refinery as it has already been built – in other words the infrastructure at the Refinery needs to be maintained so that it can operate effectively.

Sept/Oct 2007) *'it depends where...It needs to be open-minded wherever I go to work. I was offered to go to Malaysia but then I would find it too conservative. The culture is too Muslim, too confined, gender-specific roles. So I thought why would I want to go there? But if they [Engen Refinery] offered me [by means of cross-postings] to go somewhere else I probably would have taken it.'*<sup>25</sup> Ultimately, location, cultural differences and in some instances religion are serious concerns for engineers when considering moving abroad.

#### *Not all engineers go abroad*

The brain-drain debate I argue is limiting. As findings strongly indicate, not all engineers leave Engen to go overseas, *'...if most have left [Engen] they stay in South Africa anyway.'* (Respondent D, Interview 4, Sept/Oct 2007). Therefore one can argue that they are increasingly *'job-hopping'* [employer-to-employer] within the local context, and not only overseas. It cannot be concluded that the reasons for the skill shortage situation are due primarily to the brain-drain (an external factor), which is perceived as the primary causal factor for the shortage of engineers in the local labour market. The focus on the pull factors on engineers from abroad provides some clarity but does not explain why the engineers leave the Refinery and stay in the local labour market.

In the sub-section below, my findings provide evidence that the skill shortage is compounded not only by the global demand (pull) for engineers, but also by the *'talent war'* amongst organisations within the local labour market. Not only is the shortage of engineers proving difficult for local employers, but so is the convergence of increased local economic development and expansion projects. It is this point that forms the focus of the next sub-section in this chapter.

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<sup>25</sup> I learned about one year later that this engineer had left Engen, but did not go abroad to work. She had been employed at another refinery in South Africa.

## **4.2.2 Local Economic Capital Expansion and Development Projects**

Engen's presentation to the Parliamentary Portfolio Committee on Science and Technology indicated that the retention of existing engineering skills at the Refinery proved to be one of their most significant challenges<sup>26</sup>. At the heart of the problem, they said, was increased national and international investment, driven by sustained high oil prices and at a local level by South Africa's investment in infrastructure and 2010 FIFA World Cup Stadium development projects<sup>27</sup>.

More specifically, Engen and FluorSA technical experts<sup>28</sup> argued that in South Africa the 'retention challenge' is worsened by the convergence of engineering projects. These are escalating the demand for engineers at the local level. A few examples of current projects are:

- The 2010 FIFA World Cup deadlines (which include, but are not limited to, the Gautrain, soccer stadia and airports upgrading);
- ESKOM's scaled-up investment programme of more than R97 Billion;
- The strong global demand for Southern African minerals: Botswana, DRC, Zambia, Madagascar, and Mozambique (to name a few); and
- The Clean Fuels Programme Phase II in the South African Petrochemical Industry.

In addition, FluorSA experts raised concerns that projects related to:

- Infrastructure development;
- Mining (namely the developments of Mineral Processing Plants);
- The developments of Power Stations and Transmission Lines; and

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<sup>26</sup> In the presentation to the Parliamentary Science and Technology Portfolio Committee, 20 February 2007.

<sup>27</sup> Other mega development projects within South Africa include: Gautrain; Coega Plant; New Multi-Product pipeline; the Pebble Bed Nuclear Reactor; Project Mafutha; and Transnet Infrastructure Projects, to name a few. Mega projects within the SADC region include: the Bluewater Project; the Moatize Coal Mine in Mozambique; Mmamabula (Botswana) and Matimba II Power Stations.

<sup>28</sup> *Engen Refinery Skills Briefing*, 20 February 2007.

- The development of Petrochemical, Chemical, Paper, Sugar, Pipelines, and Refineries planned for 2006-2012. This would have additional consequences for labour market shortages.

Engen Refinery raised grave concerns regarding the increasing convergence of such projects which will draw on the limited pool of skilled engineering professionals especially from the local labour market. These issues, namely:

- The retention of existing skills at the Refinery (within the context of the above-mentioned current and future potential projects at the local and global scale); and
- The limited ability to draw on a very inadequate pool of engineering experts from the local South African labour market.

The limited ability to draw on the local labour market as argued by Peter Watts<sup>29</sup>, the Managing Director of Fluor, is further impacting on the deadlines that need to be met for the completion of the scope of work required for these projects. Of concern is that the pressure to meet project completion deadlines will result in the recruitment of foreign and expatriate engineers. This would allow projects to be completed timeously, however at a cost. Firstly at a capital-drain cost to industry and the companies meeting the financial demands of these recruited candidates. Secondly, there will be lost employment opportunities for South Africans.

Interestingly transformation efforts within the local Petrochemical industry have contributed significantly to the engineering skill shortage situation in the local labour market. Many felt that the skills shortage situation is fuelled by the unintended consequences of transformation policies. Transformation efforts, particularly if not managed properly result in the loss of engineers of all racial categories as a

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<sup>29</sup> During the presentation to the Parliamentary Science and Technology Portfolio Committee, 20 February 2007.

consequence. The impacts of transformation efforts at the Refinery will be discussed in the second section of this chapter.

### 4.2.3 Socio-economic-political factors

*'I left the refinery purely because the safety and security in the country had deteriorated to an extent that I could not live with anymore...My decision to leave the country had nothing to do with Engen...therefore unless Engen could guarantee the safety and security of my family I could not stay [In South Africa and therefore the refinery].'* (Respondent HH (Interview 8, March 2007)<sup>30</sup>

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Along with the increased global demand for engineers and the resulting 'brain-drain', the socio-economic situation in South Africa is often cited as one of the main reasons why skilled professionals leave the country. Crime is often singled out as the major reason for people leaving. Can crime sufficiently explain and justify the reasons for the skill shortage situation at Engen and the local Petrochemical industry? According to Respondent GG (Interview 7, June 2007) *'I believe it is a factor, but not the major driver...put it another way, if crime disappears tomorrow, there will not be a rush of engineers back to South Africa because there are other factors playing a bigger role.'*

The common perception is that the increasing incidences of violent crime reported in the country contribute significantly towards the decision to leave South Africa. My findings suggested that respondents with families (particularly ones with young children) are more inclined to leave the country *'if the crime situation continued to worsen'*. This was not always the case.

In discussions with the respondents, what became evident is that those who became victims of crime, particularly violent crime (or had family and/or close friends who became victims) tended to immigrate overseas. To illustrate this point, Respondent Q

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<sup>30</sup> Respondent HH is currently working and living in Australia.

(Interview 17, Sept/Oct 2007) stated that *“my wife was hijacked last week, I have had enough, I can’t live like this. We live in fear for our lives. I have had enough. I love this country, it is my home, but I need to leave, I need to feel safe where I live. I know that my years of experience and my knowledge will get me a high paying engineering job anywhere I go in the world. I just have to choose where I want to go.”* Respondent Q (Interview 17, Sept/Oct 2007) further argued that *‘safety and crime are reasons why I am leaving [South Africa]...there is no way that the lengths of Engen can solve this.’* This is not something that Engen can control. The safety and well-being of their staff is taken seriously. However outside of the Refinery it is beyond their control.

Many respondents felt that crime alone could push them from South Africa (and as a result the Refinery). These engineers indicated that that they would be more inclined to move to places such as Australia to live. As Respondent JJ (Interview 10, February 2007) explained, *‘I can walk around freely any time of the day without worrying about being mugged. I can leave my house without knowing that there are many eyes watching me come and go. And I do not need electric fences and burglar bars to stop people breaking into my home. I am secure and know that I will be safe in retirement. I can also see the Tax Dollars being spent on things that will benefit me.’*

Australia has a significant and active recruitment drive at the National Strategic level to encourage skilled professionals to emigrate<sup>31</sup>. They are facing a serious skill shortage situation, related directly to an aging workforce (soon to be retiring). As a result, the lack of supply within the context of increased demand (at a local and global level) has resulted in the Australian government actively targeting and encouraging skilled professionals to move to that country. A number of respondents within this study indicated that Australia would be a great country to relocate to.

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<sup>31</sup> This is clearly evident. Every week in the local newspapers there are ‘Immigration Adverts’ encouraging skilled professionals, particular engineers, to apply to work and live in Australia. The Internet too, using a typical search engine such as Google ([www.google.co.za](http://www.google.co.za)) can allow one too see the volume and ‘effort’ to actively encourage South Africans to work and live there.

The political environment within the African context, particularly within the SADC region (Southern African Development Community) has raised some serious concerns. Respondent JJ (Interview 10, February 2007) argued that, *'The Zimbabwe situation and the fact that Mbeki was helping Mugabe. I also saw the writing on the wall when the same problems Zimbabwe had become obvious....Retiring in a country that had no security (socially and from a crime point of view) were also factors. Being a Pensioner in Zimbabwe now must be awful. US\$ 1 – Zim S1 in 1980 vs. US\$1 = Zim \$ 5 million now (after three zeros have been knocked off) so really US\$1 = Zim \$5 billion now. I did not want to become a financial prisoner as the Rand becomes weaker – as I am sure it will. [As a result] I decided to move to Australia.'*

Respondent L (Interview 12, Sept/Oct 2007) argues that *'political uncertainty [causes] white skilled labour to often feel threatened [living and working in South Africa] and therefore leave South Africa as a result.'* Respondent C (Interview 3, Sept/Oct 2007) and Respondent S (Interview 19, Sept/Oct 2007) argued that they would consider moving overseas if they felt that *'there was no future in South Africa'* for their families.

Findings further suggested that the Zimbabwe situation has made white-middle-aged engineers feel insecure about retiring in South Africa for fear of the socio-political-economic situation taking place within South Africa in the near future. Respondent JJ (Interview 10, February 2007) is of the view, that *'... [he does] not believe I can retire securely in Africa. We are not wanted here. Not even as a worker in Angola. We are despised even though we have skills and ability they need to make things happen and work. And to help them develop themselves.' ... I would have probably stayed in South Africa for another couple of years but the Zimbabwe situation and flashing lights in South Africa were the main factors that made me decide to leave when I did... [Problems identified] incompetent police force (no transport because the Police officers have taken the B-cars home as a company car and are busy doing*

*their grocery shopping in it)...the deterioration of hospitals, roads becoming more pot holed. Traffic lights not working. Taxi drivers being a law unto themselves. Friend being stabbed, shot and Hi-jacked. Being robbed three times in two weeks. Being robbed at least once every two years. It is unsafe to take your dogs for a walk these days.'*

Based on the findings, the political-socio-economic environment plays a role in engineers wanting to leave South Africa. Crime, cited as one of the main factors pushing people from South Africa, is problematic. However, it is beyond the control of the Refinery. If it were possible for the Refinery to monitor the social well-being of their employees, such as the engineers, it may help Engen to be more proactive in dealing with the potential loss of engineers to external factors such as crime. The problem, however, is that the Refinery does not have much influence at the national level regarding perceptions of the political-socio-economic environment. However, I suggest that understanding these perceptions from their employees' perspective will help management at the Refinery to better determine and understand the turnover of staff at the Refinery.

In the section below, I focus on the issue of supply. In chapter 2, I noted that supply is a serious issue.

#### **4.2.4 Supply**

The vacancy duration approach (Haskel & Martin, 1997), as outlined in chapter 2, is a method employed to assess the shortage in the labour market. Unfilled engineering vacancies at the refinery '*only started about three years ago [2004] when the boom in the Petrochemical industry started picking up*' (Respondent K, Interview 11, Sept/Oct 2007). This, as suggested earlier, could be explained by the increased demand for engineers as a result of the increase in capital development and expansion projects in the Petrochemical industry, worldwide. Prior to this period, '*there were always sufficient numbers of engineers...but demand has increased so much that it*

*has caused a shortage...it's been really tough'* (Respondent I, Interview 9, Sept/Oct 2007). Respondent K (Interview 11, Sept/Oct 2007) openly stated that *'vacancies can exist [at the Refinery] anything from six months to a year'*. It has proven difficult for the Refinery to recruit engineers at the *'right quality levels'* for the unfilled positions (Respondent K, Interview 11, Sept/Oct 2007).

Most respondents argued that the high vacancy duration periods at the Refinery are due to the lack of supply (referring to experienced engineers) in the local labour market.

According to Respondent M (Interview 13, Sept/Oct 2007), *'...in the Petrochemical industry it takes longer [recruiting the required engineer]...you will find that when you put an advert out, you will get a hundred CVs of which only three might meet the minimum criteria for the position...however after the interviews most times these candidates do not stand a chance...when you do find a potential candidate, they then have psychometric testing, followed by a full analysis...to determine their strengths and weaknesses in order to put them in the right areas'*. So, what supply-side factors contribute towards the skill shortage of engineers in this labour market?

In the literature, it is argued that the low output levels of engineering graduates from educational institutions over the years have strongly contributed to the current shortage of skilled professionals in South Africa (Steyn & Daniels, 2003; Lawless, 2000; Daniels, 2007). The focus on supply is a result of four main issues.

Firstly, it is due to the increase in the demand for engineers, locally and globally. Engineers, as I explained earlier, have responded positively to the higher salary packages offered. In addition, they are capitalising on the shortage situation. Therefore, part of the shortage is of experienced engineers in the local labour market.

However, the second issue is that there are '*not enough students going to university to study science, maths (etc)...it's not the done thing in this country...*' (Respondent Q, Interview 17, Sept/Oct 2007). Thus the shortage in the local labour market is not only of experienced engineers, but also university graduates entering the market.

However, the low output levels are not enough to explain the shortage of engineers. This takes us to the third issue. Garrett (1991), Viljoen (1991), and van Zijl (1991) writing in the early 1990s, commented on the poor output levels of engineering graduates since the 1970s and 1980s, concluding that enrolment levels were relatively low during this period; a situation no different from the present. Although Crush *et al.* (2000) argue that industry is satisfied with the new local graduate recruits, evidence from my study suggests that they '*lack the general understanding of the industry as a whole. The newly qualified engineers' technical abilities are lacking. Their precision in calculations, professionalism, and knowledge is weak. This is not good. Students need to at least be able to do the calculations 100%, their experience will develop when they enter the industry, but the basic foundations of their engineering knowledge needs to be of high quality*' (Respondent K, Interview 11, Sept/Oct 2007). This supports the findings reported by the National Advisory Council of Innovation (NACI) South Africa (2001) '*Human Capital and the South African Knowledge Base*', 'that enrolments at higher education institutions...were relatively static in an already weak academic system.'

A fourth issue, my findings suggest, is that there is a significant gap between the teaching materials provided at the higher education institutions and the innovative direct movement forward by industry itself. The reasons for this are twofold. First, it is argued that there is a gap between industry requirements of graduates (level of standards and knowledge) and the teaching materials and standards provided to engineering graduates. This according to the respondents is problematic. Respondents also suggested that the gap is due to the fact that experienced and highly

knowledgeable engineering staff (and the industry as a whole) are not involved closely in the educational context.

Many respondents were of the view that industry needs to get more involved in academic institutions. Engineers interviewed, particularly those in a management role, argued that newly-graduated engineering students are not satisfying industry standards. Respondent K (Interview 11, Sept/Oct 2007) explained that although a number of newly qualified graduates will be interviewed for various open positions within the Refinery, the majority will not qualify in terms of industry standards and therefore will not be accepted.

However, the problem does not stop there. *'Unfortunately'* they may not necessarily be accepted due to the institutions from which they obtained their degree(s). Concerns with the 'state of affairs' within departments and within universities around South Africa were raised by a number of respondents. Respondent H (Interview 8, Sept/Oct 2007) argued, *'I know that the mechanical engineering department at UKZN is going through a current crisis due to a large loss of staff – going to industry...the high turnover of staff and the poor replacements of these individuals is a concern to us as industry...the credibility of these students is [therefore] questionable to us.'* Engineering students entering the Petrochemical industry need to be of the highest calibre. The universities that they are graduating from need to come highly recommended. Top companies from across all industries compete for the 'best' engineering graduates from around the country. However, these graduates need to come from the best universities (which have high reputations for quality, integrity, uniformity and ethics).

#### A way forward

A solution, discussed with Respondent H (Interview 8, Sept/Oct 2007), is that industry and in particular senior engineers from the Refinery need to become more actively involved at various levels and niches within the engineering educational

parameters. Furthermore, as suggested by Respondent H (Interview 8, Sept/Oct 2007), Engen engineering staff could assist institutions by evaluating course content and co-lecture some courses that are made available. In this way the knowledge gap between institutions and industry can be reduced. It is evident that the dynamics of the skill shortages in a labour market are interconnected. What happens in the external, impacts on the internal labour market. I will illustrate this point explicitly in the second section of this chapter. I will demonstrate how the nature of the internal environment can have a bearing on the external environment within the skills shortage context.

As an alternative approach, Respondent P (Interview 16, Sept/Oct 2007), referred to Engen Refinery's parent company, PETRONAS (based in Malaysia). PETRONAS was invited by the Malaysian government to set up a university - Universiti Teknologi PETRONAS (UTP), established on January 10, 1997<sup>32</sup>. This alternative is, however, very costly and is a long-term solution. The problem, as argued by Respondent H (Interview 8, Sept/Oct 2007), within the local context is that the work environment (typical of the South African context) is too rigid, which does not allow for senior engineering staff to be involved more actively with educational institutions. This is problematic. However, I argue that such an approach allows for institutional tuition materials and industry knowledge and needs to be considered.

Based on the fact that young 'junior' engineers rate career development and job opportunities highly it can be recommended that cross-postings within PETRONAS (the parent company of Engen Refinery) be considered. This could provide greater opportunities for junior engineers to gain international experience, and they would then return to the Refinery with this experience after a certain period of time.

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<sup>32</sup> [Http://www.utp.edu.my/theUniversity/](http://www.utp.edu.my/theUniversity/)

This alternative approach can help to bridge the gap between industry and the skill shortage situation in the long term, and help institutions cater more effectively for technical changes in industry's requirements. From the interviews, it was clearly evident that there are a significant number of engineers at the Refinery who are passionate about the work they do, passionate about education, and passionate about helping South Africa develop and strengthen the supply of newly-qualified graduates to the local industry. Although there is a significantly high demand for experienced engineers it is important to note that there is a significantly high demand for top quality graduates entering the labour market. In my view, industry will need to take the initiative to bridge this gap.

#### Overview of external labour market to Engen

To summarise, the most widely understood argument used to explain the shortage of engineers is that of the external factors: brain-drain, increased demand and inefficient supply. However, the question asked here is does the brain-drain debate provide enough evidence to suggest this is the reason for the shortage of engineers in the local labour market? The brain-drain debate does not explain why skilled employees, such as engineers, leave an organisation but do not leave the local labour market (South Africa). The problem with this perspective I suggest is that it tends to ignore the dynamics of the internal labour market factors. In order to investigate the dynamics that underline the shortage of engineers for the Refinery, the section below will examine the internal factors contributing to the shortage.

### **4.3 Internal labour market factors**

The central argument of this dissertation is that to understand the skills shortage of engineers, a distinct knowledge of the internal and external nature of each labour market in which the shortage is being experienced must be produced. In the section below I examine the internal labour market factors. Focusing on the indepth study of the internal experiences of engineers working at the Refinery, this section focuses on the following sub-sections:

- Remuneration;
- Employment Equity and Affirmative Action;
- Career Development;
- Job Satisfaction.

### **4.3.1 Remuneration**

*'Picture 10 of us wanting to leave saying that we want double our salaries, I mean you can just picture how that would affect Engen'* (Respondent M, Interview 13, Sept/Oct 2007).

The majority of the respondents argued that the increase in demand for engineers within the engineering skill shortage context (worldwide) has been favourable for engineers. Neoclassical economists, such as Lazaer and Stiglitz, as I explained in chapter 2, have tended to argue for profit-maximising solutions to efficiency problems. As an immediate (main) solution, organisations have responded to the 'war talent' by offering higher salary packages. I argue that this strategy to retain current skilled engineers and/or to recruit other skilled engineers to the Refinery has only leveraged the problem temporarily. It is evident that engineers have become highly sought after which has resulted in a greater remuneration bargaining leverage with their current or prospective employers. This has resulted in highly competitive salary packages being offered by companies as a means of addressing the skill shortage of engineers. All 12 'exit engineers' interviewed acknowledged that the move from Engen Refinery increased their financial earnings.

However, an overwhelming majority of the respondents stated that remuneration was not a primary factor for employment decisions. Career development, job satisfaction and work environment are considered as important as remuneration. Interestingly, 25 out of 32 respondents argued that remuneration is not the only factor that keeps them in their current positions or encourages them to take up positions elsewhere. This is in direct contrast to the explanations provided by these respondents to explain why they

felt that other engineers had left the Refinery. Nevertheless, all respondents were of the opinion that engineers who leave the Refinery do so in order to earn more money.

A number of concerns have been raised within the remuneration context:

***a.) South African industry is less competitive than international players***

Although Engen and South African refineries in general, have made great strides in improving remuneration levels as a retention/recruitment strategy, the problem is that these refineries are not able to compete with the salary packages offered by overseas companies. *‘Considering that there is a high demand for the skills internationally, the local industry is slow in devising strategies to retain its engineers. If we as the SA Petrochemical industry are to retain our skill, we need to start competing according to international standards.’* (Respondent AA, Interview 1, May 2008). Zondi (Interview 1, November 2007) argued that *‘this is a country-wide problem...salaries are growing* [the demand for higher salaries is growing as a result of the skill shortage situation]. In chapter 2, I outlined Myburgh’s (2004) argument that real wage differentials between South Africa and the destination country are considered a strong driving (push) factor, encouraging skilled engineering professionals to leave the country to earn a higher salary.

It is argued that higher wage rates can conceivably lead to higher productivity (Ehrenberg & Smith, 1985, McConnell *et al.* 2006). However, increased salaries, as argued by Zondi (Interview 1, November 2007) do not necessarily result in increased output levels: *‘...productivity levels and efficiencies [at the individual and company level] are not growing accordingly. The trend to load salaries is expensive; especially for local companies and local industry... it is not generating more for the Refinery.’* The trend to load salaries for particular key skilled engineers at the Refinery as part of a retention strategy has proved problematic. I argue that this goes against the *efficiency wage theory* outlined in chapter 2, which suggests that the output levels of employees are not only determined by remuneration rates.

At the Refinery increased salary packages have proved beneficial in the retention of some key skilled engineers (Zondi, Interview 1, November 2007), but have not served to encourage engineers to 'exert more effort' (Tilly and Tilly, 1998: 84). According to Respondent Q (Interview 17, Sept/Oct 2007), '*...from an employee's perspective, it's great that they [employers] are paying more. I mean I could go to SAPREF and get paid 15% more and then I could go to SASOL and do the same if I wanted...I mean more pay for employees is good...the shortage is good from the employee's perspective...but in the longer term, the fact that we are actually paying over the top for many of our engineers is making us [Engen Refinery] non-competitive which is not doing the industry any good. And that's just going to get worse...*'

***b.) The lack of consistency - Remuneration as part of retention strategy***

Respondent I (Interview 9, Sept/Oct 2007) stated '*Salary is a secondary issue; it's not that much of an issue. But if you give someone an increase in the middle of the year and you didn't give me, then I have a problem. That had been an issue with me some time ago, as they [another engineer at the Refinery] got an increase and I didn't get an increase – that they [Engen] told me that I was the highest earning...this results in a snowball effect...as I ended up going for interviews with other companies in the local industry...this was the only way I could get them [Engen] to sort out the problem.*'

Strategies to retain the current cohort of engineers through higher wages have failed. Engineers have become highly sought after, and therefore have a greater bargaining leverage over the current/potential employer. This is problematic, as not all engineers are able to negotiate the same salary packages. At the Refinery 'the lack of consistency regarding revised salary packages as a retention strategy' has resulted in a significant number of internal grievances amongst engineers.

***c.) Future financial insecurity***

My findings further suggest that the issue of *financial security or rather financial insecurities* have given rise to serious concerns for engineers, primarily from their 40s onwards. At present these engineers (both male/female and across all races) are driven to earn more money. This is fuelled by the need to invest more money in savings for the future. *‘Senior engineers reaching retirement...the driving force is not poor working conditions, it is the need to retire with more money...these guys really have the knowledge of running the Refinery’* (Respondent D, Interview 4, Sept/Oct 2007).

Within this context, it became evident that engineers who considered moving abroad did so to secure their long-term financial security *vis-à-vis* their pensions. Upon further investigation, these respondents explained that working abroad was seen as a great opportunity to earn more money in a shorter period of time. Many stated that money earned was in US Dollars (a stronger currency to the ZAR) and tax free. *‘I was clearing R18 000 per month after tax when I left Engen compared to R80 000 per month now. Also being paid in Dollars.’* (Respondent JJ, Interview 10, February 2007).

This allowed them to save more of their current monthly earnings towards their investments and savings accounts. *‘The local remuneration structures, competitiveness with offshore remuneration packages, that’s not a local phenomenon – that’s all over’* (Respondent F, Interview 6, Sept/Oct 2007). *‘Obviously you can’t compare remuneration as it would be quite high...and if you were to come table that in front of Engen it would probably be a salary higher than the GM...GM stated that if guys move and unfortunately even if you are a key guy, if you want it and are dead set on the move, they [Engen] can’t do anything about it – they [Engen] can’t meet all those high salaries, it would mean Engen would have to shut down’* (Respondent M, Interview 13, Sept/Oct 2007).

The findings suggest that the engineers over 40 are sceptical about the efficiency of their retirement savings. Many question whether they will be able to maintain a comfortable lifestyle once they have retired. *‘Over the last 10-15 years, the change from pension funds has increased financial insecurities. We are finding that as we are getting older, we are starting to worry about how much money we will be retiring with. You cannot get more money working here in South Africa – so you have to try to get paid in a foreign currency [Dollars/Pounds]. This I believe is one of the most significant factors driving experienced, well qualified engineers not only from Engen, but from the South African industry as a whole’* (Respondent Q, Interview 17, Sept/Oct 2007).

Results from the Retirement Fund industry’s benchmark study from Sanlam Employee Benefits (SEB), showed that employees and employers are contributing less to retirement. Some standout findings from the survey indicated that only 30% of members think they will have enough to live on when they retire, and more than 80% felt that retirement savings were in actual fact the most important need for them. Furthermore, the average South African is uncertain about the future of the retirement landscape in South Africa. In addition, the SEB survey showed that employer contributions declined from 10% in 2006 to 9.5% in 2008, while employee contributions dropped from 6% to 5.5% during the same period. In total, the average contribution to retirement funds declined from 11.5% in 2006 to 10.9% in 2008.

#### **4.3.2 Employment Equity and racial transformation**

*‘My philosophy about transformation...don’t promote me for the sake of promoting me, give me the skill that I need. Give me the opportunities for a fair level of play...’* (Respondent I<sup>33</sup>, Interview 9, Sept/Oct 2007)

Given South Africa’s history of enforced racial segregation and current efforts to redress historical imbalances, it is important to consider the racial profiles of the

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<sup>33</sup> A black male engineer employed at the Refinery at the time of the interview.

various respondents. My study shows different perceptions amongst white, black and Indian groups. With some discomfort I use the following racial classifications to denote the different population groups used in this study: black<sup>34</sup>, coloured, Indian and white.

As highlighted in chapter 2, *racism and affirmative action* give unfair comparative advantages to black job seekers (Crush *et al.*, 2000; Bhorat *et al.*, 2002; Barker, 2007). This is considered as a strong driving factor from the local labour market. These arguments suggest that white engineers are dissatisfied with transformation efforts. However, evidence from my study shows that it is not only white engineers who are dissatisfied.

The need for transformation within the Refinery (and the local labour market) is well supported by the Refinery and its employees. Respondent GG (Interview 7, June 2007), an Indian male engineer commented, '*In the early years there was institutional racism (Apartheid) [at the Refinery] which fell away before changes took hold in the country.*' However, as Respondent D<sup>35</sup> (Interview 4, Sept/Oct 2007) explained, '*Engen has come a long way [Affirmative Action and employment equity] in terms of levelling the playing field of black engineers...previously the [racial] dynamics at the Refinery were different...it was predominantly white...and most of the managers were white.*' This is '*important within the South African context.*' (Respondent D<sup>36</sup>, Interview 4, Sept/Oct 2007).

Efforts towards transformation have not been easy for the Refinery. According to Respondent K (Interview 11, Sept/Oct 2007) a female Indian engineer, '*there is every intention within the Refinery management to make sure that there is no*

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<sup>34</sup> The term 'black' in this study is not used to refer to the collective of Indian, coloured and African respondents. Instead in this study if deemed necessary I will refer to each racial profile of the respondent(s).

<sup>35</sup> Male Indian engineer.

<sup>36</sup> Black male engineer.

*discrimination...but it doesn't always come through as that...the policies [at the Refinery] have their place, there's no question of that...but there is a problem in terms of how we implement these policies.'* Respondent I (Interview 9, Sept/Oct 2007), a black male engineer strongly argued that *'Policies are policies and that's where they end. The implementation of policies is something else...'*

Amongst my respondents there was no disagreement regarding the need for transformation within the industry and the Refinery. Furthermore, the evidence shows that the levels of dissatisfaction are not seated within one racial category of respondents. In other words it is not a racial ('black' versus 'white') issue. The problem identified is not the issue of the philosophy behind transformation. The problem is the implementation of the related policies and the actions taken towards achieving transformation at the Refinery which has resulted in aggrieved engineers, some of whom have left the Refinery as a result. In the following sections I will outline these responses.

Part of the problem, it is argued, is that *'local government legislation has been viewed to place constraints on industry'* (Respondent C<sup>37</sup>, Interview 3, Sept/Oct 2007). Respondent B (Interview 2, Sept/Oct 2007), a male Indian engineer, like many other respondents in this study does not view transformation negatively at all. Efforts towards implementing 'transformation' at the Refinery has proved to be problematic, however. This has presented different levels of dissatisfaction amongst the engineers.

In the main the issues that came to the fore were threefold. Firstly, on the whole, *gender and age did not play a role* in engineers wanting to leave the Refinery (Respondent P, Interview 16, Sept/Oct 2007; Respondent S, Interview 19, Sept/Oct 2007). In fact, all female respondents acknowledged that it was the level of experience in the Petrochemical industry that determined the level of respect and responsibility you received from your colleagues and others within the Refinery. The

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<sup>37</sup> Indian male engineer.

male respondents also stated that gender was not an issue. The issue was predominantly your capability to do the work, your determination as an individual and your eagerness within the Refinery.

However '*subtle constraints*' with regards to transformation efforts and gender equity in the workplace became evident during some of the interviews. According to Respondent S (Interview 19, Sept/Oct 2007), a female Indian engineer, '*you would think it was obvious that competing with others as a non-white female [Indian female] you would be able to benefit from these opportunities [transformation]...but sometimes the reality is that a black woman or even a black male will get ahead of you [promotion]*'. Furthermore, Respondent P (Interview 16, Sept/Oct 2007), a black female engineer, stated '*...it's not a case that because you are a woman... you won't get the job...[However] there is no proper balance in terms of job opportunity [referring to the transformation issues]*.' Therefore, one can argue that race is still considered more important than gender equity in the workplace.

It is clear from the interviews that the inefficient and inconsistent implementation of transformation and equity policies within the Refinery are resulting in different levels of dissatisfaction amongst the racial categories of engineers.

The second issue relates to the acceleration of certain engineers through the system. It is argued that '*some people [black engineers] are moved at a faster pace through the system*' (Respondent B<sup>38</sup>, Interview 2, Sept/Oct 2007). However, Respondent EE<sup>39</sup> (Interview 5, March 2008), a black male engineer argued, '*there was too much rhetoric on the EE front [at Engen] and nothing was happening. The number of African engineers in senior positions was non-existent; it was too biased to other racial groups. The company was not committed to the policy of equity but just lip service.*' However, on the other hand, Respondent Q (Interview 17, Sept/Oct 2007), a

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<sup>38</sup> Male Indian engineer.

<sup>39</sup> Used to work at Engen. At the time of the interview was working at another refinery in South Africa.

white male engineer argued, ‘...It’s really annoying when you’ve been doing a job for a really long time...doing it extremely well...but they just put somebody in an equivalent job...he’s [referring to a black engineer] got the same pay as you if not more [and has less experience].’

Thirdly, the issue of transparency with regards to transformation was strongly evident in this study. Most respondents indicated that the implementation of these policies was proving to be more difficult for industry due to fewer experienced engineers being available. As a result industry has to employ the next most highly experienced available candidate to fill vacant positions. However, due to the skill shortage, the majority of the respondents mentioned that refineries throughout South Africa are not in a position to ensure that they have the right number of black engineers required at present. Refineries are faced with two major problems. (1) They have to fill vacant positions, and (2) they have to fill these positions with ‘black engineers’ to meet transformation requirements. As a result, refineries find that unfilled engineering vacancies remain unfilled for extended periods of time as the ‘preferred’ candidates for these positions are not necessarily available. Respondent I (Interview 9, Sept/Oct 2007), a black male engineer argued:

*‘...there’s one question that has been raised especially when it comes to transformation itself – it can be bit of a sore thing to some people...it’s the tendency to promote black people who aren’t competent in their jobs, and most people just sit and look at this guy and wonder how he got there in the first place. I even ask ‘why is he here?’ You have certain characters which you question [doubt] why they are appointed to certain positions – most people [engineers in question by colleagues such as respondent I] will think that they are good enough. You can do the work if you are outspoken, if you believe that something is right, or that something needs to be done in a certain way to not compromise another way – and then all those things are past. Some people sit here and work hard and they look up and say look at the people that are there...clearly from the beginning I do not fit. I work hard, etc...but I’m still not moving anywhere...and people start saying the transformation issues, the transformation issues and incompetence. And this is why transformation tends to get a bad name on it. Maybe others are seeing something that we are not seeing. But the guy*

*gets put in for representation – the guy is supposed to be an expert and he doesn't know anything. You really wonder how does this thing happen?'*

Respondents had different perceptions of this point. Many felt that the skills shortage situation is fuelled, in part, by the unintended consequences of transformation policies. Majority of the white respondents in this study believed that the demand for engineers, outside of the South African labour market, is not racially based. It is a matter of knowledge, qualification, experience and most importantly the ability to do the job. However, within South Africa the dynamics of transformation are critical to understand. Respondent O (Interview 15, Sept/Oct 2007), a male Indian engineer, argued that *'what happens [locally] is that people [black engineers] will move from company to company and that also creates gaps.'* According to Respondent D (Interview 4, Sept/Oct 2007), a Indian male engineer,

*'Affirmative Action is a big issue. We have seen a lot of junior black engineers come through the ranks very quickly, overtaking some of the seniors (with more skills)...they have been short of the skills needed, which has been a big issue for most of the engineers here [Engen Refinery]. I think that has been one of the biggest issues, and I think that this is something throughout the whole Petrochemical industry with the black engineers...there is a huge demand for black engineers...they are so marketable now, they can pick and choose the jobs they want [in the local labour market]...at my level, I don't think that I can do that very easily right now, but probably if I was a black person, it would be much easier.'*

Respondent R (Interview 18, Sept/Oct 2007), a white male engineer, argued, *'[most black engineers go to] PetroSA due to higher salaries...the one guy I knew left Engen and went to work for NATREF. He wasn't there long and they got a better job offer (salary package) at PETROSA. So a lot of them [black] just go after the offers...Within South Africa, there are a lot of offers out there for them [black engineers]...they can move around very freely within the South African Petrochemical industry [based on shortage of engineers and increased demand for black engineers in the local labour market].'*

Respondent O (Interview 15, Sept/Oct 2007), an Indian male engineer, argued that, *'what happens [locally] is that people will move from company to company and that also creates gaps. Like SAPREF then they will go to MOSGAS...[a] further factor contributing towards this mobility is BEE/EE as there is a big demand for certain groups [black engineers] and experienced engineers...which contributes to the high turnover rates. The industry [South Africa Petrochemical industry] is not that big...we only have four refineries.'*

Engineers working abroad stated that they left South Africa due to career progression 'barriers' that formed as a result of empowerment policies. Respondent JJ (Interview 10, February 2008), a white male engineer, argued that, *'I love Africa. But...We are not wanted here [not speaking about the Refinery but Africa in general]. Not even as a worker in Angola. We are despised even though we have the skills and ability they need to make things happen and work. And to help them develop themselves.'*

Interestingly, Respondent EE (Interview 5, March 2008) a black male engineer who has left the Refinery, argued that at Engen *'African engineers were seen but not heard. No feeling of being accepted. Never was good enough.'*

These responses indicate that the over ambitious goals of Government's transformation policies and goals in South African industry as a whole are constricting the skills market further, driving competition for skilled black engineers in the current skills shortage context. White engineers, and to a lesser extent Indians and coloureds, are no longer in as much demand as their black counterparts.

The situation however is problematic on two accounts: firstly, within the local labour market, industries have to recruit skilled black engineers. The problems include poaching and the salary premium required to retain the skilled black engineers. Secondly, in many instances the poached and/or recruited black engineer does not necessarily qualify in relation to the number of years and direct related working experience within the Petrochemical industry. According to Raleigh Maesela (the president of the South African Black Technical and Allied Careers Organisation), as

cited in Mgibisa, *Fin24.com*, Oct 2007) ‘the skills shortage crisis has historical origins’.

The frustrations expressed by respondents were, however, not confined to race. Colin Ngubane\*<sup>40</sup> explained that in the engineering profession,

*‘an engineer needs to firstly qualify at the tertiary level. However, the qualification of an engineer is just the starting point. At the tertiary level, an engineering student develops an understanding of the basics of engineering. Unlike other professions, in engineering, the first five years of working in the Petrochemical industry – you are still regarded as a junior engineer (in-training). In other professions, five years would be considered valuable experience. In the Petrochemical, due to its highly technical, complex and its intense processes and protocols this is not the case. 10 -15 years engineering training and working experience in the Petrochemical industry is the benchmark in which an engineer is considered to be of value in the associated processes. It’s only between 15 -25 years of experience, is an engineer then considered to be senior enough in this industry.’*

From the interviews it became clear that the ‘talent war’ within South Africa is significantly incentivised by the transformation situation. The constituencies of transformation provide the benchmarks (requirements for the number of black skilled employees to be employed in organisations). This forces industry to focus on prioritised recruitment processes. In South Africa this is the desperate search for black engineers to fill vacant posts within the refineries around the country. The problem I argue is that in most situations, racial connotations associated with transformation results in misconceptions, namely that certain race groups are in opposition to transformation in South Africa. For example, as outlined in chapter 2, Crush *et al.* (2000) argue that skilled whites are widely opposed to affirmative action policy (83%) while only 20% of skilled blacks express similar views. Crush *et al.* (2000) conclude that transformation (the righting of past wrongs) clearly has little resonance for whites. However, evidence from my study clearly illustrates that this situation of transformation is frustrating for black, white, Indian and coloured

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<sup>40</sup> Name has been changed for confidentially purposes. Colin has 35 years of training and working experience in the local and global oil, gas, and petrochemical industry.

engineers within the South African labour market. I argue that the issue is not one of race as portrayed in the media and literature.

The other problem is that the incentive to obtain accreditation is so high, that companies compromise the recruitment process by appointing black engineering professionals, not all of whom have the required levels of experience and expertise. In such instances, any engineer at this stage of their career would normally be categorised as ‘an engineer-in-training’. Thus refineries would be risking their reputation by placing an engineer in a position that requires a higher level of experience and competencies.

All white, Indian and coloured respondents expressed their frustration with these appointments. At Engen as an example, it was commented in an interview that the problem lies in the fact that:

*‘there is also the dissolution of many that they are doing all the hard work and they are not getting a suitable differential above the others who come in and who can’t actually do the job with the level of expertise and the long term thinking that they can. It’s really annoying when you’ve been doing a job for a really long time, you doing it extremely well, but they just put somebody in. in an equivalent job, he’s got the same pay as you if not more. But this is happening all over the country. Mosgas are paying something like R3 million for some of these people. I mean it’s ridiculous.’*

The outcome is that white middle-aged engineers resign and find work overseas. The driving force is compliance issues. Engineers in this study reported that at the operating level (Refinery), across the country, the remaining experienced engineers are not only having to ‘do their own work, they are having to mentor and manage newly appointed engineering graduates, in addition to micro-managing the lesser experience ‘black engineers’ who have not quite gained sufficient working experience to be appointed at such high level positions.’

As for the black engineers, they want to be appointed equally in comparison to their engineering counterparts/colleagues (Respondent I, Interview 9, Sept/Oct 2007). They do however feel that redress of the past apartheid system needs to take place. The problem however, is that 'once a black engineer is appointed purely on merit, they feel that their colleagues doubt their value, worth and abilities' (Respondent I, Interview 9, Sept/Oct 2007). And as a result, some commented that they then constantly have to prove themselves worthy of the position.

On the global scale the 'talent war' is based on experience and specialty alone. Therefore, I argue that one of the major factors driving a white engineer abroad is related to an insecure financial future (namely for retirement). Indian and coloured engineers will tend to stay. For black engineer, the motivation and incentive is not to move abroad. It is to stay within South African industry. They in fact benefit in two ways: firstly the shortage of engineers has resulted in higher remuneration packages. Secondly, these shortages plus the need for black engineers has resulted in large remuneration packages (as well as retainer and retention packages) for these engineers, greater than that of their colleagues. This is despite the fact that they may have fewer years experience, or less specialities than those engineers currently working within the refineries around the country.

#### **4.3.3 Career Development and Training**

Remuneration, as I explained earlier, is not of primary importance to the engineers in this labour market. Career development, job satisfaction and the nature of the work environment are equally important. This was strongly evident in each interview. According to Respondent B (Interview 2, Sept/Oct 2007), *'I'd leave if I was bored of the challenges here [at the Refinery]'*. Respondent C (Interview 3, Sept/Oct 2007) commented, *'the challenging job keeps me here at the Refinery [Engen]'*. Respondent O (Interview 15, Sept/Oct 2007), *'Where I work depends on the opportunities...there are a lot of opportunities to move within the company [Engen Refinery] with this type of industry.'*

### Limitations for experienced engineers

Working in the South African labour market proved to be a limitation towards career development for some engineers. In discussion, ‘exit engineers’<sup>41</sup> argued that working overseas not only provided them the opportunity to earn more money, but it also allowed them opportunities for greater international exposure, allowing them to get involved in bigger projects than available in South Africa. According to Respondent KK (Interview 11, February 2008), ‘*In a company the size of Engen there are limited career opportunities...and that is why I left the Refinery.*’ The problem working in South Africa, according to these engineers, is that they were getting limited exposure to best practice in comparison to refineries internationally. Outlined earlier, my findings indicated that white male engineers would be more likely to leave South Africa. This was due to a combination of limited career development opportunities and transformation in the local Petrochemical industry which they felt excluded them from the opportunities that were available locally.

Despite this, it is important to note that my findings also suggest that career development and growth is not only an important aspect for white male engineers. Career development is an important factor for all races and genders in this study.

### So what is the plan?

An important finding was that there is ‘*no [clear] succession plan at the Refinery*’ (Respondent C, Interview 3, Sept/Oct 2007). Considering the fact that my findings suggest Career Development is a significant factor, the lack of a succession plan is a problem. Engineers need to know the progression plan at the Refinery. Many engineers, like Respondent N (Interview 13, Sept/Oct 2007) ask: ‘*How do I progress? How to I become a better engineer? I can’t be an Engineer-in-Training the whole time.*’ According to Respondent I (Interview 9, Sept/Oct 2007), ‘*You don’t just want to stay in one job...you want to be promoted to Senior Specialist*

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<sup>41</sup> Those working abroad as well as those who used to work abroad but have returned to South Africa.

*positions...* (Respondent I, Interview 9, Sept/Oct 2007); *'experience is always performance-driven...with a tracking plan linked to your succession plan'* Respondent C, Interview 3, Sept/Oct 2007). Furthermore, Respondent I (Interview 9, Sept/Oct 2007) argued, *'as you progress there needs to be some kind of responsibility – you will start with a R100 000 project...and then you'll eventually you will be responsible for projects that cost millions...these won't just come to you...these have to come when the company must be-able to have the confidence to engage in the individual...at the end of the day you should be able to say that you can ensure that you can do this.'*

There are perceptions that there are limited career opportunities at the Refinery due to *'the absence of a well-structured succession plan'* (Respondent C, Interview 3, Sept/Oct 2007). As a researcher, I was concerned with the high number of engineers stating that there is no succession plan. However, Respondent M (Interview 13, Sept/Oct 2007) stated that he had *'a clear succession plan which is market remunerated.'*

Respondent M (Interview 13, Sept/Oct 2007) further stated that he had approached Management at Engen stating that *'...I'm not market remunerated'*. It was then explained that Engen have had to respond to this, as *'there was a lot of movement [engineers in the labour market] probably jumping [from employer to employer for opportunities of increased salary packages]* (Respondent M, Interview 13, Sept/Oct 2007). *'But the response has been too slow...it has been too reactive.'* (Respondent K, Interview 11, Sept/Oct 2007).

As mentioned above, the lack of a succession plan is problematic. According to Respondent M (Interview 13, Sept/Oct 2007), *'you leave because you are not being paid enough or that the company doesn't have a succession plan for you.'* It was further argued that *'if the company shows interest in you...you going to show interest in the company and more interest in your work...so you will want to know how you*

*can improve your work...so obviously the question is, Does the company see growth in me...?...What is my five year plan in terms of my succession plan? Does the company have this?...If you don't have a good succession plan and if you are not properly remunerated...people will leave.'* (Respondent M, Interview 13, Sept/Oct 2007).

#### Management/Technical Ladder – Engen's reactive response

Engen's response to engineers leaving or wanting to leave the Refinery *'has been slow'* (Respondent K, Interview 11, Sept/Oct 2007). One strategy has been the implementation of a Management and Technical ladder (referred to as 'the ladder' here onwards). The management-ladder follows a line-function leadership. The plant is organised according to the various line functions, such as Chemical, Mechanical, Electrical and Control engineering disciplines. Those on the 'management ladder' assume line-management functions within one of these particular divisions. According to Respondent K (Interview 11, Sept/Oct 2007), the ladder is not a new strategy for industry, but has taken time to be established at the Refinery. Findings suggest that the implementation of the Management and Technical ladder at the Refinery has been problematic.

Respondents argued, that the 'management ladder' allowed for promotion and progression within the Refinery at a faster pace than if one was on the technical ladder. The slow rate of promotion on the 'technical ladder', it was argued, meant that these engineers had no real benefits compared to those on the management ladder. It was argued that *'there is a lack of technical training provided at the Refinery... therefore being on the technical ladder is quite frustrating'* (Respondent K, Interview 11, Sept/Oct 2007). Respondent E (Interview 5, Sept/Oct 2007) argued that *'not enough is provided [technical training] to climb the technical ladder...this is impacting on the technical field in the Refinery and the industry.'*

Respondent K (Interview 11, Sept/Oct 2007) argued that even *'where engineers are more suited to the technical ladder [in other words, have great technical skill and ability], they tended to follow the management ladder [as a result of the difficulties of being on the technical ladder] because these engineers would be in a position where they would see their colleagues climbing the ladder [management ladder] a lot faster.'* This results in engineers switching from the technical ladder to the management ladder and therefore a gap in that particular technical area of skill within the Refinery occurs.

#### Newly qualified graduates

There was general consensus that the Refinery has done an excellent job in recruiting young graduates, however, many questioned the Refinery's training plan for these newly appointed junior engineers.

*'I think we [Engen Refinery] do put a whole lot of emphasis on training...I think what we [Engen Refinery] don't do adequately is keep involved with the training ground for the new people [newly qualified graduates] coming in ...we [Engen Refinery] don't necessarily limit people from training, but we don't have structured training programmes...so you know its up to the individual to go out and find the training programme and get them in...and because the Petrochemical industry in South Africa is smaller to that of the United States or anywhere else...you find we do not have enough training ground for resources...it is like this country-wide '* (Respondent K, Interview 11, Sept/Oct 2007)

Earlier in this chapter, my findings indicated that there is a shortage of 'top quality' newly-qualified graduates entering the Petrochemical industry. It was further suggested that the majority of newly-qualified engineering graduates' technical abilities, precision in calculations, professionalism and knowledge is weak. Furthermore, there is a significant gap between the industry requirements of graduates and the teaching materials and standards provided to engineering students. This situation is problematic for the Refinery.

The problem with the quality of supply

*'We [Engen Refinery] have got young engineers which are really falling short...they are not being utilised properly, so everyone views that they are junior engineers so you can't really give them responsibility...but if you give them responsibility and there is guidance, then they should be able to do the job...you can boost their self-esteem and in that way they will want to do more...they [Engen Refinery] really don't have a structured approach to phase them from graduate to professional engineering...this is lacking.'* (Respondent P, Interview 16, Sept/Oct 2007). However according to Respondent N (Interview 14, Sept/Oct 2007), training *'has been a big lack at the Refinery...I think that there is a trade-off because some of the companies are good at offering training, but that's probably where it ends...you may have all the training that you need but it doesn't mean anything...I do not want to say that Engen has not been good, they have definitely been good, but it does leave some uncertainty...the where, what and how?[after training].'*

How can the quality improve without a structured training programme?

The Refinery provides on-the-job training for all levels of engineers, including young, newly employed engineers. However, there are no structured training programmes for young engineers employed at the Refinery. It was argued that such programmes are crucial for the career development of the young engineers. The consequence is that young engineers are not exposed to crucial parts of the engineering profession which is a requirement. This hinders their professional development and growth. The criticism was aired by Respondent J (Interview 10, Sept/Oct 2007), *'some want to hold onto their knowledge as they feel that if they give anything away they may become irrelevant in the future.'*

In addition, it was argued that engineers within the local labour market need to be supported to develop the necessary skills, knowledge and experience based on international standards. *'The engineers from our Malaysia are unbelievable. The*

*amount of training and intensity of their work is very progressive. That is why they have the ability to develop leading engineers in this field. We on the other hand, are trying to meet the high demands at the plant-level due to the decreased level/number of highly qualified and experience engineering colleagues’.* (Respondent P, Interview 16, Sept/Oct 2007)

The problem is that career and training opportunities at the Refinery are not as extensive as those that are locally-based but operate internationally. Projects that are currently being completed overseas are not necessarily being undertaken in South Africa (as argued in 4.2.2 above). Respondent S (Interview 19, Sept/Oct 2007) said, *‘we are not a SASOL growing at 20-30% per annum where you getting new business entities and facilities forming all the time. We are pretty much a ‘sustain’ business type and more gradually create capacities and profitability. It [the Refinery] is not large scale extensions and expansions that give you these on-building opportunities.’* A few respondents pointed out that other companies with greater international links have a larger budget for people development and provide staff with international exposure. *‘You don’t get boxed into one area, unlike my experience in refineries in South Africa.’* (Respondent P, Interview 16, Sept/Oct 2007).

#### **4.3.4 Job [Dis]satisfaction**

*‘...there were resignations of some senior engineers and that was because of some serious frustrations... job frustrations.’* (Respondent D, Interview 4, Sept/Oct 2007)

The high turnover of experienced engineers has left the remaining engineers to work in an environment that *“is being crippled by the inexperienced engineers that are continuously demanding higher salaries”* (Respondent Q, Interview 17, Sept/Oct 2007).

The more senior and experienced engineers felt high levels of frustration with the current work situation [shortage of engineers] due to the increased levels of pressure

and work-related stress. All the senior engineers interviewed indicated that the increased employment of young and less experienced engineers (in other words recently qualified engineers) has been stressful. There are significant numbers of young trainees on site. It was suggested that in order for junior engineers to conduct their jobs more effectively the entire workforce should be given the necessary training and mentoring so they can understand the expectations and ways to stay motivated at work. In essence they are referring to the absence of a coaching and mentoring programme. Most large organisations would have such support structures for their staff.

For the engineers at the Refinery, this increased influx of inexperienced engineers into the Refinery increases their own workload and stress levels at work. As Respondent K (Interview 11, Sept/Oct 2007) stated,

*'I can't keep working like this. My interest is the technical work itself, not managing and constantly chasing after these young engineers that clearly have no interest in the work at all. Times have changed...these young engineers are more interested in their emails and sitting behind their desks all day instead of getting their hands dirty and getting involved with everything that relates to the engineering profession. This Refinery is a great opportunity for these young engineers to learn and gain more experience. The Petrochemical industry itself is highly intensive compared to other industries. It's frustrating to see how these young engineers are only interested in chasing salaries, and not being passionate about the work they do.'*

In addition, it was argued that, *'I don't believe there is a crisis [skill shortage]...the problem at the moment is that young engineers that are currently qualifying and entering into the Petrochemical industry are not of the standards that we require...it is proving difficult to get these graduates up to speed and get them involved in industry related work. We are constantly having to spend a lot of our time, during working hours, monitoring [micro-managing] these inexperienced young engineers. I don't enjoy micro-managing people.'* (Respondent K, Interview 11, Sept/Oct 2007).

Furthermore, it was often said that junior colleagues (engineers in training) are continuously distracting themselves by constantly negotiating their way through loop holes in the system, allowing them to get more money with minimal results returned to the company. At Engen, engineers overall are being put under pressure to get results from an under-skilled and unmotivated workforce. This is impacting significantly on their levels of job satisfaction and is increasingly contributing towards decisions to leave the Refinery, preferably for another employer (petrochemical) in the local labour market.

#### **4.4 Conclusion**

During 2003/2004 Engen Refinery experienced a net loss of experienced skilled engineers with a total of 45 experienced engineers (across the Chemical, Mechanical, Electrical and Control engineering disciplines) leaving the Refinery during this period. The net loss of highly experienced, qualified engineers to the Refinery particularly during 2003/2004 raised serious concerns as to why this situation had developed.

Much of the existing literature and explanations, as I argued in chapter 2, tend to be focused and over-reliant on external labour market factors for analysis, explanation and understanding of skill shortages, *vis-à-vis* the brain-drain debate, issues of supply, increases in demand, and the socio-economic-political factors. Although the engineering skills shortage is a global and local phenomenon, it is important to understand the external and internal labour market dynamics to adequately address the issues contributing to the skill shortage in an organisation. In this dissertation, I have argued that the external factors do not sufficiently explain the current shortage of engineers at Engen.

In this chapter I attempted to understand the shortage of engineers by focusing on the experiences of engineers working at Engen Oil Refinery. In reality, as I explained in

the beginning of this chapter, the external and internal factors are interrelated which makes it difficult to disentangle one from the other.

My examination of the external and internal experiences of engineers working at the Refinery revealed that there has been a significant increase in the global and local demand for engineers, due to the increase in economic capital expansion and development projects worldwide. The shortage of skilled experienced engineers has resulted in favourable incentive packages offered by both local and global organisations. It is these increased incentive packages, many argue, that are resulting in the net loss of engineers from organisations such as the Refinery.

However, my findings suggest that this is differentiated. White, Indian and coloured engineers are more likely to work abroad. Black engineers, on the other hand, are less likely to move abroad to work and are more likely to stay within the South African labour market. This is a result of the increased demand for black engineers in the local labour market. The findings further suggest that the increased demand for black engineers locally is driven by transformation efforts in the South African Petrochemical Industry. The findings indicate that black engineers are more likely to move from company to company, locally, than their white, Indian and coloured colleagues who are more likely to move from company to company but globally.

Further to this, remuneration is not the only determinant that 'lures' employees into employment. A key finding suggested that factors such as career development, work environment and job satisfaction were equally important. For some (mainly white male engineers), working in South Africa has proved limiting for their career development. Working overseas has provided these engineers with the opportunity to earn more money as well as the opportunity for greater international exposure, allowing them to get involved in bigger projects than those available in South Africa. However, career development and growth, as my findings indicated, are important factors for all races and genders.

The lack of a succession plan and an effectively-implemented 'Technical and Management Ladder' is resulting in perceptions that there are limited career opportunities at the Refinery. In addition, my findings suggested that despite Engen's efforts to recruit a number of newly-qualified engineering graduates: (1) the shortage of 'top quality' newly-qualified graduates entering the Petrochemical industry; (2) the weak technical ability, precision in calculations, professionalism and knowledge of these engineers; and (3) the significant gap between the industry requirements of graduates and the teaching materials and standards provided to engineering students are serious challenges faced by the Refinery. This problematic situation is worsened by the lack of a structured training programme for newly-qualified graduates employed at the Refinery. The consequence is that these young engineers are not exposed to crucial elements of the engineering profession.

The high turnover of experienced engineers has left those remaining to work in an environment with increased levels of pressure and work-related stress. This often results in high levels of frustration and job dissatisfaction. The pressure to get results from an under-skilled and unmotivated workforce impacts significantly on engineers' levels of job satisfaction. This is contributing towards engineers' decisions to leave the Refinery.

In this chapter I have illustrated that the equal understanding of the external and internal dynamics provides evidence that external factors *vis-à-vis* the brain-drain debate, issues of supply, increases in demand, and the socio-economic-political factors are not the only contributing factors towards a skills shortage in an organisation.

# CHAPTER FIVE

## Conclusion

The concern about skill shortages is worldwide. Many countries, South Africa included, are increasingly concerned with the skill shortage situation. The shortage of skills is viewed as one of the most critical barriers to future and current economic developments, worldwide. One of the most affected high-skilled professions has been engineering.

Focusing on the South African context, I explained in chapter 1 and 2 that skill shortages have given rise to various debates and speculations over the causal factors. Much of the existing literature and explanations for the skills shortage, I argued in chapter 2, tends to focus on the external labour market [vis-à-vis the brain-drain debate, issues of supply, increases in demand, and socio-economic-political factors] for an analysis, explanation and understanding of skill shortages. The problem with this, as I suggested in chapter 4, is that it is limiting as it tends to ignore the dynamics of the internal labour market. Therefore, my dissertation raised the question: ‘What are the specific labour market dynamics that underline the shortage of *engineers* in the *Petrochemical Industry* in the *South African* context?’

I answer this question through my central argument (outlined in chapter 2) that understanding the reasons behind a skills shortage requires a distinct knowledge of the internal and external nature of each labour market where a skills shortage is being experienced. Thus as I discuss in chapter 1 and 2, while it is important to understand the external labour market, it is equally important to consider the internal labour market to better identify and understand the specific dynamics that underline a skills shortage in an organisation and industry.

Using Engen Refinery as a case study, in an attempt to determine the specific labour market dynamics that underline the shortage of engineers in the

Petrochemical industry. I focused on the in-depth study of the experiences of engineers working at the Refinery. As I explained in chapter 1, the Refinery was an ideal location for such a study as: (a) It is situated in the hub of Durban's south-industrial basin, operating within the local and global markets for refining oil; and (b) during 2003/2004, the Refinery experienced a net loss of 45 experienced engineers (an average of 2 per month over the two year period).

As I demonstrate in this study the dynamics that underline the skill shortage of engineers in the Petrochemical Industry in the South African context are manifold. Skill shortages are a consequence of dynamics in both the external and internal labour market. These I have argued are interrelated.

The main issues that contribute to the skills shortage at Engen are:

Firstly, there is a highly competitive 'talent-war' being fought between employers globally and locally. At one level the South African shortage is part of that dynamic. Yet the way in which it is experienced here has its own twist given South Africa's racially discriminating past. This has upped the demand for engineers substantially. In South Africa the recent explosion in construction has resulted in a high demand for engineers, particularly black engineers. Black engineers thus move from employer-to-employer taking advantage of the various opportunities presented locally. In the global market, the demand for experienced engineers is high. White male engineers, who given their years in the industry fit the bill, are increasingly taking the opportunities presented to them in the global market.

Secondly, despite full support for the philosophy of employment equity, the unequal implementation of employment equity policies in industry and organisations is problematic. The skills shortage is fuelled by the unintended consequences of transformation policies. Regardless of their race or gender, engineers in South Africa feel that unequal employment equity practises limits their career development. For white engineers they felt the implementation of the policies often hinders their development, while black engineers feel it casts

aspirations on their ability. Career development is one of the most important factors for engineers. Therefore, those who do feel aggrieved by the transformation process will leave either the organisation, and/or the local labour market.

A third significant contributor to the shortage relates to supply. The Petrochemical industry in South Africa is small in comparison to global petrochemical markets. Its ability to orchestrate an increased 'pull' of engineering graduates to this industry is therefore limited. The supply of qualified graduates to the labour market is problematic as: (1) There is and has been a shortage of 'top quality' newly qualified engineers entering the Petrochemical industry and majority of these graduates are weak. (2) The credibility of a number of engineering departments within higher educational institutions in South Africa is questioned by industry. This is impacting on the employers' perception of the standard of qualification of some graduates when recruiting. (3) Industry agrees that the course content in engineering degrees is outdated. Thus the knowledge that engineers graduate are taught during their degrees does not meet the expectation of industry. Therefore, not only is there a 'talent war' for experienced engineers, but a 'talent war' exists for top-quality engineering graduates entering the labour market.

A fourth significant factor is that of the internal environment of an organisation. Operating in an environment with a shortage of experienced engineers is complicated. This contributes significantly towards a frustrating work environment. The pressure to obtain optimum output levels despite the shortfall of experience and the increase in the employment of younger lesser-experienced engineers remains. The 'problematic' supply of newly qualified graduates complicates the shortage of experienced senior engineers in an organisation. The shortage of senior engineers is impacting on (a) the experiential learning, and (b) mentoring opportunities required for these graduates to develop.

The dynamics of the internal labour market is a limitation to one's career development. The increased workload and unequal opportunities internal to the

organisation is resulting in high levels of frustration (job dissatisfaction) and work related stress. As a result, a higher turnover of senior experienced engineers to organisations is experienced. This meant that a majority of engineers were only too eager to take advantage of better opportunities available.

In a market like South Africa where there is a significant increase in capital expansion and development projects the demand for skilled expertise will rise. This demand if great enough will result in a shortage of supply in that labour market. Compounding this increase in demand there is a long lead time in supplying engineers to the labour market.

As indicated there are differentials in each labour market<sup>42</sup>. These differentials depend on who the engineer is and the opportunities available in the labour market (factored by these differentials). While the shortage of engineers in the labour market is beyond the control of the Refinery, it is what is happening within the Refinery that 'pushes' those engineers to take advantages of the opportunities available. Therefore, we can see that the dynamics of skill shortage in a labour market are not only a result of external labour market factors, but is a result of the interrelated dynamics of both the external and internal labour market.

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<sup>42</sup> For example, in South Africa race and gender are important variables; while globally 'experience' counts more.

## REFERENCES

- Addleson, M, F Pretorius, and R Tomlinson. (1989). *'Industrial Trends and Prospects in Natal-KwaZulu: Region E'*, Natal Town and Regional Planning Report Volume 72, Pietermaritzburg: Natal Town and Regional Planning Commission.
- Allan, G (1991). *'Qualitative research'*. In Allan, G. and Skinner, C. (eds). (1991). *Handbook for research students*. Falmer, London.
- Anon., 2000. Growth accelerates in CIS, E. Europe in 2000. *Fin24.com*, 14 November 2000,[Online]. Available at:  
[http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]
- Anon., 2005. Govt calls on expats to help. *Fin24.com*, 8 December 2005, [Online]. Available at:  
[http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]
- Anon., 2006. Skills scarce for Africa Oil. *Fin24.com*, 30 June 2006, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 April 2008]
- Anon., 2007. Shocking SA Skills Figures. *Fin24.com*, 5 July 2007, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]
- Anon., 2007. Skills dearth hits India too. *Fin24.com*, 18 October 2007, [Online]. Available at: [accessed 21 April 2008)
- Anon., 2007. SA Skills in deep trouble. *Fin24.com*, 20 June 2007, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]
- Anon., 2008. No 'magic cure' for South Africa's critical skills shortage. *Civil Engineering*, January 2008, Vol 16, No 1, pp 51.
- Babbie, E & Mouton, J (2005). *The practise of Social Research*. South African Edition, Oxford University Press Southern Africa.
- Bailey, T (2003). Skills migration. In *HSRC Human Resources Development Review 2003: Education, Employment and Skills in South Africa*. Cape Town: HSRC Press.

- Barker, F (1983). *'n Ontleding van die problematiek van mannekragtekorte in Suid-Afrika*. Unpublished D.Com. thesis. Pretoria: University of South Africa.
- Barker, F (2007). *The South African Labour Market: Theory and Practise*. Fifth Edition. Van Schaik Publishers.
- Beck, U (2000). *The Brave New World of Work*. Cambridge: Polity Press
- Bell, J (1999). *Doing your research project*. Third Edition. Open University Press
- Berg, I. (1971). *Education and Jobs: The Great Training Robbery*. Boston: Beacon.
- Berger, P & Luckmann, T (1967). *The Social Construction of Reality: A Treatise on the Sociology of Knowledge*. Hamondsworth: Penguin.
- Bezuidenhout, A (2002). 'An evaluation of Industrial Policy Perspectives in the South African context'. Discussion document prepared for the Trade and Industry Chamber NEDLAC.
- Bezuidenhout, A (2002). 'An Overview of South African White Goods Manufacturing Industry: Issues for Industrial Strategy'. *NUMSA Sector Jobs Summit Project Electronic and Electrical Engineering Study*. January: Durban.
- Bezuidenhout, A (2002). 'The Workplace and Post-Colonial Tranistions: a study of a sector of the engineering industry in South Afirca, Swaziland and Zimbabwe. Annual Workshop of the Crises States Programme, 14-18 July 2003. University of Witwatersrand.
- Bhorat, H, Meyer, J, & Mlatsheni, C (2002). 'Skilled Labour Migration from Developing Countries: Study on South and Southern Africa'. International Migration Papers 52. International Migration Programme. International Labour Office: Geneva.
- Bhorat, H, Lundall, PG, Rospabe, S (2001). *The South African Labour Market in a Globalising World: Economic and Legislative Considerations*. Cape Town: Development Policy Research Unit, University of Cape Town.
- Bressen, M. (1988). 'Insights on site: research into construction project organisation'. In Bryman, A (ed). (1988). *Doing research in organisations*. Routledge, London.
- Bridget, S & Lewin, C (2005). *Research Methods in the Social Sciences*. London: Sage.
- Bryman, A (1988). *Quantity and quality in social research*. Unwin Hyman. London.
- Cahuc, P. & Zylberberg, A. (2004). *Labour Economics*. The MIT Press, Cambridge, Massachusetts.
- Callaghan, G. (1997). *Flexibility, Mobility and the Labour Market*. Ashgate, England.
- Campbell, D & Stanley, J (1966). *Experimental and quasi-experimental designs for research..* Chicago: Rand McNally. In Babbie, E & Mouton, J (2005). *The practise of Social Research*. South African Edition, Oxford University Press Southern Africa.

Carrels, M (2005). 'Exodus of SA skills doubles in six years'. *Cape Argus*, November 27, 2005: 3. Available at <<http://www.iol.co.za>>

Carrington, WJ, & Detragiache, E (1999). 'How extensive is the Brain Drain?' *Finance and Development quarterly magazine on the IMF*, June 1999, Volume 36, Number 2. Available at <<http://www.imf.org/external/pubs/ft/fandd/1999/06/carringt.htm>>

Cohen, M, & Zaidi, M. (2000). 'Global Skills Shortages', *Economic Outlook for 2001*, Department of Economics, Ann Arbor: MI: University of Michigan, pp 206-226.

Cohen, M, & Zaidi, M. (2002). *Global Skills Shortages*. Edward Elgar Publishing Ltd.

Crompton, R & Jones, G. (1988). 'Researching white collar organisations: why sociologists should not stop doing case studies'. In Bryman, A. (ed). (1988).

Daniels, R (2007). *Skills Shortages in South Africa: A Literature Review*. Report prepared for JIPSA. DPRU Working paper 07/121.

Denscombe, M (1998). *The Good Research Guide*. Open University Press: Buckingham.

Doeringer, P. and Piore, M. (1971). *Internal Labour Markets and Manpower Analysis*. D. C. Heath

Fedderke, J, Henderson, S, Mariotti, M & Vaze, P (2001). Changing Factor Market Conditions in South Africa: The Labour Market – A Sectoral Description of the Period 1970 – 1997. Johannesburg: University of Witwatersrand.

Freeman, R. (1988). 'Labour Markets', *Economic Policy*, 6 April, pp 63-80.

Freeman, R, & Katz, L (1991). 'Industrial Wage and Employment Determination in an Open Economy', in Abowd, J & Freeman, R, eds, *Immigration, Trade, and Labour Markets*, Chicago: University of Chicago Press, pp 235-259.

Freeman, R. (1993), 'Labor markets and institutions in economic development', *American Economic Review*, Vol.83 No.2, May, pp. 403-8.

Freeman, R. (1998). War of the Models: Which Labor Market Institutions for the 21st Century? *Labour Economy*, Vol. 5, pp. 1-24.

Findlay, A. (2000). In Zachary, G. (2000). 'The Global Battle – People Who Need People: With Skilled Workers in High Demand, Employers are Hunting Them Down – No Matter Where They Live', *Wall Street Journal*, 25 September, R8.

Glaser, B & Strauss, A. (1967). *The discovery of grounded theory*. Aldine, Chicago. Illinois.

Gordon, D, Edwards, R, & Reich, M. (1982). *Segmented Work, divided workers: the historical transformation of labour in the United States*. Cambridge: Cambridge University Press.

Govender, S (2006). 'Tuks rises to call for more engineers'. *Pretoria News*, October 16 2006: 4. Available at <<http://www.iol.co.za>>

Gule, K. (2004). '*Exploration of Social Unionism in the Context of Neo-liberalism: Investigation into Engen strike of 2001 as a focal point for emerging politics in Wentworth and Social Unionism*'. CCS Grant Report, 2004, University of KwaZulu-Natal, Centre for Civil Society.

Hamlyn, M (2007). 'Mboweni alert to dangers of rapid growth'. *The Mercury: Business Report*, March 28 2007: 4.

Handel, G (1991). *Case Study in family research*. In Feagin, J.R. (eds), A case study for the case study 9pp. 244 – 268). Chapel Hill: University of Hawaii Press.

Haskel, J & Martin, C (1993). The Causes of Skill Shortages in Britain. *Oxford Economic Papers*, New Series, Vol. 45, No. 4, (Oct, 1993), pp 573 – 588. Published by Oxford University Press. Available at" <http://www.jstor.org/stable/2663705> . Accessed on: 22 July 2008.

Held, D, McGrew, A, Goldblatt, D, and Perraton, J (1999). *Global Transformations: Politics, Economics and Culture*. Polity and Stanford University Press.

Held, D, McGrew, A, Goldblatt, D & Perraton, J (2000). 'Global Transformations: Politics, Economics and Culture', in *Politics at the Edge: The PSA Yearbook 1999*, edited by C. Pierson and S. Tormey, Macmillan, 2000, pp. 14-28.

Hesse-Biber, S & Leavy, R (2006). *The Practise of Qualitative Research*. Oxford.

Hutton, W & Giddens, A (2000). *Global Capitalism*. New Press.

Independent Online (2000). 'Chemical engineer'. *Independent Online*, June 16 2000. Available at <<http://www.iol.co.za>>

Independent Online (2001). 'Engineering needs well-trained draughtsmen'. *Cape Times*, October 22 2001. Available at <<http://www.iol.co.za>>

Independent Online, (2006). 'Education-economy link seldom planned for'. *Independent Online*, December 12 2006. Available at <<http://www.iol.co.za> >

Independent Online, (2007). 'Affirmative action leads to brain drain'. *Independent Online*, February 01 2007. Available at <<http://www.iol.co.za> >

Inggs, M (2000). 'Taking the world of engineering to SA's black women'. *Business Report*, June 11 2000. Available at <<http://www.busrep.co.za>>

#### [International Labour Organisation Review \(1996\)](#)

Intenational Labour Organisation (2001b) World of employment report 2001: life at work in the information economy. Geneva: International Labour Organisation. In Barker, F (2007). *The South African Labour Market: Theory and Practise*. Fifth Edition. Van Schaik Publishers

- Jacks, M (2007). 'Jipsa plans to produce 50 000 artisans by 2010'. *The Mercury: Business Report*, March 27 2007: 1.
- Jenkins, R (2006). 'Globalisation and the Labour Market in South Africa'. *Journal of International Development*, 18: 649-664.
- Jessop, B (1995). *The Regulation Approach, Governance and Post-Fordism, Economy and Society*. Blackwell Publishing.
- Kaplan, D & Maxwell, J.A. (1994). 'Qualitative Research Methods for Evaluating Computer Information Systems'. In Anderson, J.G., Aydin, C. E. & Jay, S.J (eds). *Evaluating Health Care Information Systems: Methods and Applications*. Sage, CA.
- Kaplan, D. (1997). 'Reversing the Brain Drain: The Case for Utilising South Africa's Unique Intellectual Diaspora'. *Science, Technology and Society*, 2: (2): 386-406. Available at: <http://sts.sagepub.com>
- Knorr-Certina, K. (1981). *The micro-sociological challenge of macro-sociology: towards a reconstruction of social theory and methodology*. In Knorr-Certina, K and Cicourel, A. (eds). (1981). *Advances in social theory and methodology: toward an integration of micro – and – macro sociologies*. Routledge & Kegan Paul, London.
- Lawless, A. (2005). *Numbers and Needs: Addressing imbalances in the civil engineering profession*. South African Institute of Civil Engineering.
- Leedy, P (1997). *Practical Research Planning and Design*. 6<sup>th</sup> Edition. Prentice Hall: New Jersey.
- Leuvenink, P., 2001. Emigration hits companies hard. *Fin24.com*, 8 November 2001, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]
- Marshall, F. R., King, A.C, & Briggs, C.M. (1980). *Labour Economics*. Homewood, Illinois: Richard D. Irwin.
- Meyer, C (1983). *Clinical social work in the eco-systems perspective*. New York: Columbia University Press. In Babbie, E & Mouton, J (2005). *The practise of Social Research*. South African Edition, Oxford University Press Southern Africa.
- Miles, M & Huberman, A (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks: Sage.
- Mitchell, J. (1983). 'Case and situation analysis'. *Sociological Review*. Vol. 31. No. 2, pp 187 – 211.

Mlambo – Ngcuka (2007). 'SA needs scarce skills' *Independent Online*. February 01 2007. Available at <<http://www.iol.co.za>>

Moleke, P (2004). 'The state of the labour market in contemporary South Africa'. In Buhlungu, S (et al) *State of the Nation: South Africa 2003-2004*. Human Sciences Research Council Press.

Moleke, P (2005). 'Review of Labour Markets in South Africa: Education and Training.' In *Labour Markets and Social Policy*, HSRC.

Moleke, P (2006). 'The state of labour market deracialisation' in Buhlungu, S (et. al.) *State of the Nation: South Africa 2005 – 2006*. Human Sciences Research Council Press.

Motsoeneng, T., 2008. Skills dearth hurts SA firms: South Africa. *Fin24.com*, 12 March 2008, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 12 September 2007]

Mouton, J (2001). *How to succeed in your Master's and Doctoral Studies*. A South African Guide and Resource Book. Pretoria: Van Schaick Publishers.

Morris, M, J Barnes, and N Dunne. (1998). 'Globalisation and the restructuring of Durban's industry'. Paper presented at the City of Durban Research project conference, University of Natal, July.

Munck, R (2002). *Globalisation and Labour: the new 'Great Transformation'*. Zed Books: London and New York.

Naidoo, S. (2007). 'Boom begins to bite'. *Sunday Times*, March 11 2007: 6. Available at <<http://www.iol.co.za>>

Nicholson, Z. Du Plessis, H. & Davids, N (2007). 'Petrol Chaos spreads'. *Cape Argus*, August 5 2007: 1. Available at <[http://www.iol.co.za/index.php?click\\_id=13&set\\_id=1&art\\_id=vn20070806124032245C768652](http://www.iol.co.za/index.php?click_id=13&set_id=1&art_id=vn20070806124032245C768652)>

NRF, (2002). 'Brain-drain and –gain in South Africa: Who lose, who gains?'. *National Research Foundation*, June 30 2002. Available at <<http://www.nrf.ac.za/news/braindrain.stm>>

Paper delivered in the eighth World Congress on Environmental Health held at International Convention Centre in Durban, 22-27 February 2004. Emission Reductions at Engen Refinery in South Durban (Website).

Parker, D. (2000). 'Refinery Lubricates Local Labour Market'. *Daily News*, December 14 2000. Parthasarathi, A & Scott, C (2006). 'Recirculation may solve the brain drain'. *Cape Argus*, June 07 2006: 14. Available at <<http://www.iol.co.za>>

- Quintal, A (2006). 'SA needs astronomers and structural engineers'. *Pretoria News*, February 13 2006: 4. Available at < <http://www.iol.co.za> >
- Quintal, A & Webb, B. (2007) 'Manuel stands firm in equity debate'. *The Cape Times*, March 02 2007: 1. Available at <<http://www.iol.co.za>>
- Research conducted by the Institute for Black Research (2003). 'Report on the Socio-Economic Conditions of Residents of Merebank and Wentworth'.
- Ridout, R., 2007. Skills Shortage 'misunderstood'. *Fin24.com*, 3 May 2007, [Online]. Available at: [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-25\\_2043555](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2043555) [accessed 30 September 2007]
- Robson, C (1993). *Real World Research*. Blackwell: Oxford.
- Rodrik, D (1997). *Has Globalisation Gone Too Far?*, Washington, DC: Institute for International Economics.
- Rose, H, (1991). 'Case Studies'. In Allan, G & Skinner, C (eds). (1991). *Handbook for research students*. Falmer, London.
- Runyan, W.M. (1982). Rationality and non-rationality in militant collective action. *Sociology Theory*, 7 (Fall), 145 – 60.
- Rupert, J (1978) 'Structured Labour Markets, Worker Organisation and Low Pay'. *Cambridge Journal of Economics*, Vol. 2, No. 1, March 1978, pp 17-36.
- Ryoo, J & Rosen, S (2004). 'The Engineering Labour Market'. *Journal of Political Economy*, Vol. 112, No. 1, pp110-140.
- Sachs, J (1997). 'Nature, Nurture and Growth', *The Economist*, 343 (8021), pp 19-22.
- Saint – Paul, G (1996). *Dual Labour Markets: A macro-economic perspective*. The MIT Press Cambridge, Massachusetts.
- SAPA (2007). 'Fuel workers mull new wage offer'. August 6 2007. Available at: < [http://www.mg.co.za/articlePage.aspx?articleid=315904&area=/breaking\\_news/breaking\\_news\\_business/](http://www.mg.co.za/articlePage.aspx?articleid=315904&area=/breaking_news/breaking_news_business/) >
- SAPA (South African Press Association) (2008). 'Refinery fires cost Engen R200m'. *Fin24.com*, January 15 2008. Available at: < [http://www.fin24.com/articles/default/display\\_article.aspx?Nav=ns&ArticleID=1518-24\\_2252287](http://www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-24_2252287) >
- Silverman, D (2001). *Interpreting Qualitative Data*. 2<sup>nd</sup> Ed. Newbury Park: Sage.
- Somavia, J (2006). 'Changing Patterns of the World of Work', *International Labour Conference, 95<sup>th</sup> Session*, 2006. International Labour Office: Geneva. Report I (C) of the Director-General.

- Staff Reporter (2006). 'SA needs 1000 new engineers a year'. *Cape Argus*, September 12 2006: 16. Available at <<http://www.iol.co.za>>
- Steyn, G & Daniels, R (2003). Engineers and technicians. Chapter 24 in *HSRC Review: Scarce Skills*.
- Strydom, P. D. F (2003). Work and employment in the information economy. *South African Journal of Economics*. Vol 71, No. 1, March. In Barker, F (2007). *The South African Labour Market: Theory and Practise*. Fifth Edition. Van Schaik Publishers
- Tilly, C & Tilly, C (1994). 'Capitalist Work and Labor Markets'. In *The Handbook of Economic Sociology*. Neil J. Smelser & Swedberg, R, eds. Princeton, N.J.: Princeton University Pp. 283-312.
- Tuner, B. (1981). 'Some practical aspects of qualitative data analysis: one way of organising the cognitive processes associated with the generation of grounded theory'. *Quality and Quantity*. Vol. 15. No.3. pp 225 – 247.
- Valodia, I (1999). Trade Policy and Industrial Development in Durban. *In Transformation* 39.
- Watson, I (1993). Life History Meets Economic Theory: The experiences of three working-class women in a local labour market. In *Work, Employment and Society*. Vol. 7, No. 3, pp 411- 435.
- Wiley, D, Root, C, and Peek, S. (2002) Contesting the Urban Industrial Environment in South Durban in a Period of Democratisation and Globalisation. In *(D)urban Vortex: South African City in Transition* eds. Freund, B. and Padayachee, V. UND Press, Pietermaritzburg.
- Wray, Q (2007). 'Jipsa many invite failure by setting the skills bar too high'. *The Mercury: Business Report*, March 27 2007: 2.
- Yessel, R. (1999). 'Skills shortages in the South African labour market – HSRC Study'. *Human Sciences Research Council Media Release*, August 25 1999. Available at <<http://www.hsrc.ac.za>>
- Yin, R. (1984). *Case study research: design and methods*. Sage. Beverly Hills, California.
- Yin, R. (1994). *Case Study research: design and methods*. London: Sage
- Zachary, G. (2000). 'The Global Battle – People Who Need People: With Skilled Workers in High Demand, Employers are Hunting Them Down – No Matter Where They Live', *Wall Street Journal*, 25 September, R8.

### ***Interviews***

Book, Sally, involvement in the engineering education/training, Durban, September 2007.

Govender, Des, Engineer, Durban, September 2007.

Ngubane, Colin, Extensive experience in the local and global oil and gas industry, Durban, May 2008.

Pienaar, Johan, Registration Manager, Engineering Council of South Africa, April 2008.

Respondent A, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent AA, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 29 May 2008.

Respondent B, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent BB, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 29 May 2008.

Respondent C, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent CC, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 10 April 2008.

Respondent D, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent DD, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 20 February 2008.

Respondent E, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent EE, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 6 March 2008.

Respondent F, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent FF, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 10 April 2008.

Respondent G, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent GG, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 25 June 2008.

Respondent H, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent HH, Engineer, former employee at Engen Refinery, currently working and living in Australia, 26 March 2008.

Respondent I, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent II, Engineer, former employee at Engen Refinery, working at another refinery in South Africa, 27 February 2008.

Respondent J, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent JJ, Engineer, former employee at Engen Refinery, currently working in Angola and living in Australia, 20 February 2008.

Respondent K, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent KK, Engineer, former employee at Engen Refinery, currently working in Angola and living in South Africa, 27 February 2008.

Respondent L, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent LL, Engineer, former employee at Engen Refinery, working in another refinery in South Africa, 20 May 2008.

Respondent M, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent N, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent O, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent P, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent Q, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent R, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent S, Engineer, Engen Refinery, Sept/Oct 2007.

Respondent T, Engineer, Engen Refinery, Sept/Oct 2007.

Smith, Howard, Operations, Petrochemical Industry, Durban, October 2007. Zondi, Thabani, HR Manager, Engen Refinery, Wentworth, November 2007.

# APPENDICES

## APPENDIX A

### Interview Schedule September 2007

1. Whilst at Engen, have you been head-hunted before, or approached by an overseas firm/refinery to go work for them?
  - What incentives were you offered?
  - Why did you choose to stay?
  - What keeps you at the refinery?
  - What would make you leave the refinery?
  - 1.1. If not, have you ever considered to leave the refinery to work abroad?
    - What factors influence your decision to enter the global labour market?
2. What constraints do you/have you experience(d) with regard to your career advancement(s)?
  - Race
  - Qualifications
  - Age/gender
  - Training
  - Career aspirations
  - Transformation policy eg: EE, AA, BEE
  - Flexibility/ inflexibility??
3. What types of frustrations and constraints/limitations have you encountered within the Petrochemical industry as a whole?
  - What are the limitations, problems and constraints that you are confronted with at the refinery presently?
4. At present there is increasing concern for the increased international demand for professionals ie: engineers, and its impact on developing countries such as SA. What types of constraints do you feel that engineers are being faced with that are causing them to leave Engen and the local petrochemical industry?
  - Where do you think that these engineers are going?
  - Is it horizontal movements (within the industry, locally); or vertical (in SA but diff industry); or abroad?
5. What has been the refinery's response to engineers leaving the refinery?
  - Do you think this is the correct response?
  - What could they do better to stop this?
6. Did you have difficulty registering with ECSA?
  - What were these difficulties?

- Have you heard of other people having difficulties (newly qualified engineers)?
7. Why do you think recently qualified engineers do not register with ECSA?
    - Where do you think that these unregistered qualified engineers go? And Why?
  8. With regard to the Petrochemical sector in general, and your area of expertise in particular, what global networks have you established?
  9. Are there times when there are unfilled engineering vacancies? And how long do these vacancies exist?
    - Is this a shortage at Engen only, or within the industry as a whole?
    - What factors are contributing to the skills shortage 'crisis'? (economic, policy, global competition?)

10.) DEMOGRAPHIC/BIOGRAPHICAL INFORMATION					
<b>Gender</b>	Female	Male			
<b>Age</b>					
<b>Race</b>	Black	Coloured	White	Indian	
<b>Marital Status</b>	Single	Married	Divorced	Separated	Living in partnership
<b>Citizenship</b>					
<b>Home Language</b>					
<b>Level of Study</b>	BEng	Honours	Masters		
<b>Qualifications</b>					
<b>Year Graduated</b>					
<b>No. years at Engen</b>					

APPENDIX B

Email self-completion questionnaires 2007

SECTION 1: BIOGRAPHICAL DETAILS			
This section should take 3 minutes to complete			
1.1	Gender		
1.2	Age		
1.3	Marital Status		
1.4	Race		
1.5	Citizenship		
1.6	Home Language		
1.7	Highest Level and Type of Qualification		
1.8	Which year did you graduate?		
1.9	Which year did you join Engen?		
1.10	Which year did you leave Engen?		
1.11	Total number of years at Engen?		
End of Section 1			

SECTION 2: HISTORY			
This section will take approximately 5 minutes to complete			
		YES	NO
2.1	Are you a registered Professional Engineer?		
2.1.1	If yes, with whom?		
2.2	How did you find your first job?	Graduate recruitment company	
		Personal Contacts	
		Contract whilst doing internship	
		Advert	
		Blind Application	
		Other, please specify:	
2.3	When did you start work after graduating from your engineering degree?	Immediately	
		> 6 months	
		6 –12 months	
		< 12 months	
		< 1. 5 years	
2.4	How many years have you worked to-date? (since you qualified)	⇒	
2.5	How many companies/organisations have you worked at since you qualified?	⇒	
2.6	What is the shortest period that you have stayed in one company?	⇒	

2.7	What is the longest period you have stayed in one company?	⇒	
2.8	How many jobs did you have before working at Engen?	⇒	
2.9	How many jobs have you had since you left Engen Refinery?	⇒	
<b>End of Section 2</b>			

**SECTION 3: INTERNAL/EXTERNAL FACTORS FOR LEAVING**

This section will take approximately 10 minutes to complete

3.1	What internal factors to Engen refinery contributed towards your decision to leave the refinery?
3.2	Were there any factors that you feel hindered your career advancement(s) at Engen? If so, please explain.
3.3	What factors contributed towards your decision to leave the refinery based on external factors? (ie: political, social, economic, etc.)
3.4	Where did you go after you left the refinery? (In other words, did you leave the country? Or did you stay in SA but worked at another company?)
3.5	What incentives were you offered by your new firm that contributed towards your decision to leave the refinery?
3.6	How did Engen respond to your decision to leave the refinery?
<b>End of Section 3</b>	

**SECTION 4: PETROCHEMICAL INDUSTRY**

This section will take approximately 10 minutes to complete

4.1	Would you agree that there is a current shortage of engineers within: <ul style="list-style-type: none"> <li>- The SA labour market</li> <li>- The Global Labour market?</li> </ul>
4.2	What types of frustrations/limitations and constraints have you encountered within the Petrochemical industry as a whole?
4.3	At present there is increasing concern for the increased international demand for professionals ie: engineers, and its impact on developing countries such as SA. What types of constraints do you feel that engineers are being faced

	with that are causing them to leave Engen and the local (South African) petrochemical industry?
4.4	What has been your personal experience in relation to the shortage of engineers?
<b>End of Section 4</b>	

<b>SECTION 5: WORKING ABROAD</b>	
Only to be completed if you have worked out of South Africa. This section will take approximately 10 minutes to complete	

5.1	Did going abroad improve your financial situation? In what way?
5.2	How has your decision to move and work abroad benefited you in relation to your career?
5.3	How has your decision to move and work abroad benefited your personal life?
5.4	What factors contributed towards your decision to leave South Africa? Do you ever plan to return?
5.5	Were you headhunted by an overseas firm or was your decision to leave initiated by yourself?
5.6	What factors, if presented to you (at the time you were leaving the refinery) would you have made you reconsider your decision to leave the refinery and move abroad?
<b>End of Section 5</b>	

## APPENDIX C



**School of Sociology and  
Social Studies  
Faculty of Humanities,  
Development & Social  
Sciences**

F173 Memorial Tower Building  
Durban, 4041  
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### INFORMED CONSENT FORM

#### **Title of Research:**

'Bottlenecks and constraints within the local labour market for Engineers in the Petrochemical Industry Sector: A case study of Engen Refinery – Wentworth.'

#### **Aims of this research:**

This research aims to identify and examine key labour market constraints for engineers that are contributing towards the declining trend of professional engineers in the local labour market of the Petrochemical industry. The current situation of skills shortages, especially that of engineering, is important to understand as this is a vital sector where the retention of scarce skills is problematic. This research will focus on the declining trend of professional engineers since 1994 at Engen Refinery – Wentworth. The location of the refinery as the research site is ideal for this type of research as it is situated in the hub of Durban's south-industrial basin, operating within both the local and global markets of refining oil. This study is will firstly identify the constraints for engineers within the local labour market, and secondly, will develop an understanding of these constraints so as to ensure that this skills shortage does not present limitations to the future supply and demand of the local labour market.

#### **Your participation in this research:**

In order to achieve the main objectives of this research: current and previously employed engineers, since 1994, of Engen; and particular 'key informants' have been identified to participate in this research. All participation is voluntary. Each respondent at any stage

may withdraw his or her participation in this research. The decision to withdraw from this research will not result in any form of disadvantage to each participant.

All data gathered for this research will be secured and stored by the researcher. All respondents personal information and participation will be secured and kept solely for the use of this research only, and will not be made available to any other person(s), requesting this information, under no circumstances.

Your participation in this research, and the signed/consented agreement between yourself and the researcher, will be acknowledged. Confidentiality and anonymity of all participants in this research will be protected and respected. Any further presentations, and publications of any materials requiring further anonymity and confidentiality of each participant will be understood clearly at the start of each interview. This is to ensure that your participation in this research is protected. If any further concerns are raised by the participant, in relation to the content of their involvement in this research, revisions will be done in order to correct any mistaken identity within this research. In addition, your responses gathered for the purpose of this research will be acknowledged and represented as 'the respondent' within the forms of the finished thesis, oral presentations and any other forms of publications.

The use of any written, audio or video recordings will be brought to the respondent's attention before the start of each interview. Each participant has the right to decline to use of these data gathering tools. Following this, each respondent's participation is voluntary, and are free to withdraw from this research at any stage, for any reason.

**Researcher Info:**

Name: Kelley Rowe  
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Email: [rowe@ukzn.ac.za](mailto:rowe@ukzn.ac.za)  
Fax: +27 31 260 1239  
Current Qualifications: Bachelor of Social Sciences (Honours)  
Research dissertation: Requirement for partial fulfilment of **Masters of Social Science (IOLS)**  
Student of: The University of KwaZulu-Natal, Howard College.  
Department: Industrial, Organisational, and Labour Studies.

**Further Contacts:**

Research Supervisor: Ms Debby Bonnin (PHd)  
Email: Bonnin@ukzn.ac.za

**DECLARATION (to be read and signed by each respondent)**

I.....(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

**SIGNATURE OF PARTICIPANT**

**DATE**

.....

.....

APPENDIX D



RESEARCH OFFICE (GOVAN MBEKI CENTRE)  
WESTVILLE CAMPUS  
TELEPHONE NO.: 031 – 2603587  
EMAIL : [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za)

29 AUGUST 2007

MS. K ROWE (202511611)  
SOCIOLOGY & SOCIAL SCIENCES

Dear Ms. Rowe

**ETHICAL CLEARANCE APPROVAL NUMBER: HSS/0499/07M**

I wish to confirm that ethical clearance has been granted for the following project:

"Bottlenecks and constraints within the local labour market for Engineers in the Petrochemical Industry  
Sector: A case study of Engen Refinery – Wentworth"

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years

Yours faithfully

  
MS. PHUMELELE XIMBA  
RESEARCH OFFICE

cc. Post-Graduate Office (Lyn Marriott)  
cc. Supervisor (Dr. DR Bonnin)

Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville