Potential emigration of engineers within a large mining organisation: An explanatory study

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ABSTRACT

South Africans leaving their country of birth is not a new phenomenon. South Africa currently has a large shortage of engineers and the fact that engineers are seeking better opportunities abroad is worsening the skills shortage in South Africa. Engineers form a vital part of any manufacturing, design, supply or production entity and leave a large setback if a skilled, experienced engineer decides to emigrate. Official statistics from self-declared emigrants showed that 601 engineers out of the total 16,165 self-declared emigrants left the country in 2003. This figure can be double the given number of 601 if the multiplication factor of 2.0 is taken into consideration for people that do not complete the emigration forms at the airports.

The focus of this study was to investigate the emigration potential of the skilled engineer along with the factors that might lead to emigration, and were classified into three distinctive groups, namely, economic, political and social. These aspects are generally referred to as "push" factors that drive people out of the country such as racism, crime and violence; as well as "pull" factors that attract people such as better work opportunities, better salaries and better education.

An electronic survey questionnaire was used to determine the emigration potential of the engineers within a large mining organisation. The respondents had to indicate their emigration potential as well as the major factors that would contribute to them leaving South Africa. The overall measured potential for emigration within the specific mining organisation was significantly low. Only twenty percent of respondents agreed that they are planning to emigrate within the next five years and only two percent within the next year. Forty-six percent of respondents agreed that they would rather like to work in another country for only a few years than to emigrate permanently. Various reasons could have lead to the contradicting low measured emigration potential within this specific

organisation. Literature has proven that there is a significant relationship between intention to emigrate and organisational commitment. Results also showed that emigration potential tend to increase the better the engineer is qualified; with the emigration potential amongst electrical and mechanical engineers higher than all other disciplines. Crime and violence were the number one factor impacting the respondent in terms of potential emigration.

OPSOMMING

Suid Afrikaners wat hul tuisland verlaat is nie 'n nuwe verskynsel nie. Suid Afrika het tans 'n groot tekort aan ingenieurs en die feit dat ingenieurs beter werksgeleenthede in die buiteland soek vererger die arbeid tekort toestand van die land. Ingenieurs vorm 'n belangrike deel van enige vervaardigings, ontwerp, verskaffing of produksie entiteit en elke keer as 'n ingenieur met baie ondervinding besluit om te emigreer veroorsaak dit 'n groot terugslag. Offisiële statistiek van self-verklarende emigrante toon aan dat 601 ingenieurs uit 'n totaal van 16,165 self-verklarende emigrante die land verlaat het in 2003. Hierdie syfer kan egter dubbel die gegewe wees as 'n vermenigvuldigings faktor van 2.0 in ag geneem word vir persone wat die land verlaat sonder om die emigrasie vorms by lughawes te voltooi.

Die fokus van hierdie studie was om die emigrasie potensiaal van ingenieurs te ondersoek saam met die faktore wat mag lei tot emigrasie. Hierdie faktore was geklassifiseer in drie groepe naamlik ekonomie, polotiek en sosiaal. Aspekte wat emigrasie beinvloed word na verwys as "wegstoot" faktore wat persone uit die land uitdryf soos rasisme, misdaad en geweld; asook "trek" faktore wat perone na die ander land trek soos beter werksgeleenthede, beter salarisse en opvoeding.

'n Elektroniese vraelys was gebruik om die emigrasie potensiaal van die ingenieurs te meet binne 'n groot mynbou organisasie. Die ingenieurs moes hul emigrasie potensiaal aantoon asook watter faktore hul die meeste sal beinvloed om te emigreer. Die totale emigrasie potensiaal wat gemeet was binne die spesifieke organisasie was laag gewees. Slegs twintig persent van respondente het gevoel dat hul dalk binne die volgende vyf jaar kan emigreer en slegs twee persent binne die volgende jaar. Ses-en-veertig persent van die ingenieurs het aangetoon dat hul eerder sal verkies om in 'n ander land vir 'n paar jaar te werk as om permanent te emigreer. Verskeie redes kon gelei het tot die lae gemete

emigrasie potensiaal binne hierdie organisasie. Literatuur toon dat daar 'n duidelike verband is tussen intensie om te emigreer en organisasie toewyding. Resultate uit die studie het ook getoon dat die emigrasie potensiaal toeneem hoe beter die ingenieur gekwalifiseer is; asook dat die emigrasie potensiaal van elektriese en meganiese ingenieurs die hoogste is van al die dissiplienes. Geweld en misdaad het getoon as die nommer een faktor wat ingenieurs beinvloed in terme van potensiele emigrasie.

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LIST OF KEY TERMS

- Potential emigration
- Engineers
- Brain drain
- Skills migration
- Skills shortage

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CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT

1.1 INTRODUCTION

South Africa has the world's highest brain drain and worst skills shortages of 55 studied countries, with its productivity plummeting. South Africa is also ranked last on infrastructure, internet costs, health problems, availability of qualified engineers and life expectancy. With South Africa's large mining capabilities and infrastructure, mining companies are largely affected by the country's skills shortage (IMD World Competitiveness Yearbook, 2007:7).

The skills shortage is felt in highly skilled and specialised professions such as engineering. The Engineering Council of South Africa (ECSA) estimates that South Africa currently needs somewhere in the vicinity of 4,000 to 5,000 engineers on an urgent basis, and the need is increasing rapidly to about an estimate of 10,000 engineers by 2010. Levels of artisan training had dropped from around 30,000 registered artisan apprentices in 1975 to an estimated 3,000 in 2006. This crisis is inflated by the deficiencies in the present education systems with low number of pupils with mathematics and science marks high enough to study engineering (ECSA, 2007:7; Institute of Professional Engineering Technologists, 2008:2; South African Department of Education, 2007:15).

The concern is that engineers fill a large segment of senior positions in the South African mining environment, and when these engineers emigrate it leaves a large setback in the mining sector. ECSA estimates that more than 300 qualified engineers leave South Africa every year (based only on professional engineers

registered with them); and that with only around 1,200 engineers qualifying every year at South African universities. Additionally, South Africa has only 45 engineers per million people compared to USA with 380 engineers per million people, China 225 and India 95 (ECSA, 2007:7; McKechnie, 2008:1).

1.2 DEFINITIONS

The following terms are commonly used in the literature in collaboration with the current research topic, and therefore defined:

- **Emigration**
  Emigration is defined as the departure of a person from the country of which he/she has citizenship to another with the intention of acquiring permanent residence abroad and usually, but not always, with the intention of relinquishing the rights and duties of the former home country's citizenship. The act when a person leaves one country in order to settle in another country can be, in short, defined as emigration (Scruton, 1982:144).

- **Immigration**
  Immigration into a country can be defined as a person moving from a foreign country with the intention of settling in the new country of destination (Du Preez, 2002:80).

- **Migration**
  Migration can take place internally within a country with people moving from one area to another in search of better living conditions (Du Preez, 2002:80).

- **Brain Drain**

  The emigration of skilled people is known as *brain drain* and implies a depletion of skilled people who are vital to the functional core of a national economy (McDonald & Crush, 2000:5).

- **Engineer**

  For this study an *engineer* is seen as any employee who obtained either a degree or technical diploma in engineering (all disciplines) at any accredited tertiary education college, technicon or university.

1.3 PROBLEM STATEMENT

With the shortage of engineers rising to extreme highs, action will have to be taken in order to stop engineers from leaving the country. New ventures and growth opportunities, especially in the mining industry, enhance the need for professional engineers day by day. The scarcity of engineers is mainly caused by the continuous emigration of engineers, and the lack in producing enough new engineers at academic institutions Academic institutions are just not sending enough qualified student into the industry, and the current shortage of proper *high* quality schooling is not helping to improve the current situation (Calldo & Du Plooy, 2008:3).

Factors that are causing engineers to leave their home country include better working opportunities abroad, better monetary value for their profession, less crime, less violence, corruption and affirmative action. The result of a shortage of skilled engineers is that South African companies are feeling the consequence of incapable, inefficient staff, making their businesses ineffective and non competitive (Calldo & Du Plooy, 2008:4; Manik, 2007:58-60; Mattes & Richmond, 2000:26-34; Myburgh, 2004:126).

1.4 RESEARCH OBJECTIVES

The research goal of this study is summarised in a primary objective and secondary objectives.

1.4.1 Primary objective

The primary objective of this study was to determine the emigration potential of engineers within a large South African mining company.

1.4.2 Secondary objectives

The specific secondary objectives of this study were to:

- Establish the reasons that might lead these engineers to emigration.
- Determine if the obtained empirical results correspond with previous literature in terms of reasons that might lead engineers to emigrate.

1.5 RESEARCH METHODOLOGY

The research study consists of a literature review and an empirical study.

1.5.1 Literature study

In order to obtain appropriate literature and facts, the following sources were used in the literature study in order to gain more information regarding emigration of engineers:

- Published articles, collected journals and press reports;
- Statistics and information from Statistics South Africa, ECSA and Governmental Institutions; and
- Text books and research studies.

1.5.2 Empirical design

An empirical survey by means of a structured questionnaire were utilised in order to support the objectives of the study which was to determine the potential emigration and the reasons that might lead engineers to emigration.

1.5.2.1 Sample frame

The research population consisted of qualified engineers from a large mining company in South Africa, which comprises various plants/mines in the country. The population size is in the proximity of 150 qualified engineers in various fields. Due to the sensitiveness of the nature of the study, the name of the company is not mentioned in the report.

1.5.2.2 Participants

Questionnaires were sent to all engineers in the organisation. The participants that completed the questionnaires constituted the sample size, with a number estimate of between 100 to120 people that participated. The requirements for the

sample participants were only that they had to be a qualified engineer (diploma or degree).

1.5.2.3 Measuring instrument and statistical analysis

One of the most efficient and practical ways to collect data, especially data that might be gathered by the participants' opinions or approaches to a subject, is through a well structured questionnaire (Cummings & Worley, 2005:116-117); therefore, a well structured electronic questionnaire was used as measuring instrument for this research. The questionnaire method is a good option due to its effectiveness with a widespread geographical sample size, as the engineers are situated at various plants/mines in North West, Gauteng and Mpumalanga. The questionnaire was drawn up in order to determine the engineers' emigration potential and to evaluate the probable reasons that might lead the engineers to emigrate. The data collected from the survey were statistically analysed by using Statistical Package for the Social Sciences Incorporated (SPSS Inc., Version 16, 2008). Means and standard deviations (descriptive statistics) were calculated in order to analyse the data, and the reliability of the measuring instruments were tested by the use of Cronbach alpha coefficients.

1.6 LIMITATIONS / ANTICIPATED PROBLEMS

Future limitations or constraints that were identified could be:

- The generation of a functional, structured, electronic questionnaire system to gather all the relevant data from respondents.
- The challenge to obtain enough completed questionnaires back from all the engineers, resulting in a small sample size.
- Gathering sufficient reliable emigration statistics from reliable resources. (A lot of emigration statistics are not factual but estimates.)

1.7 CHAPTER DIVISION

The layout of the study is depicted below:

- **Chapter 1**: This chapter consists of the introduction, problem statement and the research objectives and methodology used to determine the emigration potential along with the probable reasons that might lead managers to emigration.

- **Chapter 2**: Chapter 2 is in an article format and consists of a literature study and research methodology whereby the researcher compiled a questionnaire to gather all required data. The chapter also includes the results from the survey, evaluated in relation with the literature reviewed along discussions and recommendations about the obtained results.

- **Chapter 3**: This chapter consists of all the conclusions drawn from the results of the survey. The chapter also presents the limitations and recommendations for further research.

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CHAPTER 2

POTENTIAL EMIGRATION OF ENGINEERS IN A LARGE MINING ORGANISATION: AN EXPLORATORY STUDY

ABSTRACT

The skills shortage and brain drain has become one of the dominant realities within the South African economy. South Africa currently has a large shortage of engineers and the fact that engineers are seeking better opportunities abroad is worsening the skills shortage of professionals. The focus of this study was to investigate the emigration potential of the skilled engineer along with the factors that might lead him to emigration, and were classified into three distinctive groups, namely, economic, political and social. These aspects are generally referred to as "push" factors that drive people out of the country such as racism, crime and violence; as well as "pull" factors that attract people such as better work opportunities, better salaries and better education. Official statistics by Statistics SA obtained from self-declared emigrants showed that 601 engineers left the country in 2003. This figure can even be double the given amount if the multiplication factor of 2.0 is taken into consideration for people that do not complete the forms at the airport (Statistics South Africa, 2005:3).

An electronic survey questionnaire was used in order to obtain quantitative data from the engineering population within a large mining organisation. Only 46 engineers responded to the survey request, with the presumption for the low return rate being that the engineers might have felt victimised when conveying their attitude about leaving their country or company. This corresponds to the low rate of emigrants completing the emigration forms at the airport before they leave because they might have the fear of being victimised.

The overall measured potential for emigration within the specific mining organisation was significantly low. Only twenty percent of respondents agreed that they are planning to emigrate within the next five years and only two percent within the next year. Forty-six percent of respondents agreed that they would rather like to work in another country for only a few years than to emigrate permanently. Various reasons could have lead to the measured emigration potential within this specific organisation being lower than what were expected, taking into consideration that there is a significant relationship between the intention to emigrate and organisational commitment.

Results obtained from the study showed that emigration potential tends to increase the better the engineer is qualified, with the emigration potential amongst electrical and mechanical engineers higher than all other disciplines. The social construct had the highest impact on potential emigration with crime and violence being the number one factor impacting the respondents in terms of potential emigration.

2.1 INTRODUCTION

Over the last couple of decades, emigration and "brain drain" has become a large concern and a much researched topic (Myburgh, 2004:122; Meyer, Brown & Kaplan, 2000:13; Ericsson, 2003:1; Nduru, 2004:2). The phenomenon is increasing annually and is having a great effect on the country's business growth, while worsening the current skills shortage significantly. Forty-one percent of South Africa's privately held businesses cite the availability of a skilled workforce as the biggest constraint to business growth (Thornton, 2009:2). The question arises why do these citizens leave, how does the majority of skilled South African employees feel about emigration, and what is the potential for emigration?

The aim of this study was to investigate the emigration potential of the skilled engineer along with the reasons that might lead him to emigration. Engineers form a vital part of any manufacturing, design, supply or production entity and leave a large setback if a skilled, experienced engineer in a specific field takes on the emigration route. Furthermore, this literature review served to investigate and determine the current emigration context and statistics in South Africa; and also to gain information from previous literature that investigated the emigration potential of South Africans. The literature studied specifically focused on the current engineer shortage in the country, while observing the why's and how's in terms of the engineer's emigration potential.

Various references can be found in the literature about the general aspects of emigration, but topics in terms of a measuring tool to determine the emigration potential of an individual is scarce (Miller, Haskell and Thatcher, 2002:16). Miller *et al.* (2002:16) investigated the relationship between the intention to emigrate and organisational commitment by creating an Intention to Emigrate Scale; although it only linked the potential to emigrate to the commitment of an employee to its organisation. It was established that a significant relationship

exists between the intention to emigrate and organisational commitment; and that people are more likely to emigrate if they have a university qualification and/or friends that have settled abroad (Miller *et al.,* 2002:16).

For the purpose of this study, emigration was defined as the departure of a person from the country of which he/she has citizenship to another with the intention of acquiring permanent residence abroad and usually, but not always, with the intention of relinquishing the rights and duties of the former home country's citizenship (Scruton, 1982:144).

An engineer is seen as any employee who obtained either a degree or technical diploma in engineering at any accredited tertiary education college, technicon or university. Engineers from all fields or disciplines were examined in the study.

2.2 LITERATURE STUDY

In the context of investigating the potential emigration of engineers, the scope of South African emigration in terms of brain drain, engineer shortage and push-and-pull factors were examined.

2.2.1 Scope of South African emigration

There are various opinions regarding accurate emigration figures from South Africa. The accuracy of the official emigration statistics in South Africa of particularly skilled people has been increasingly questioned by journalists and academics (Meyer *et al.*, 2000:2). Each few years Statistics South Africa declares the number of emigrations, but these figures are a large under-representation of the actual emigrations. For instance, Statistics South Africa published that 60,000 South Africans emigrated between 1996 and 2001, while the Council for Scientific and Industrial Research (CSIR) expressed that this

value is largely understated, based on data they collected from the top five emigration destination countries' figures (Bornman, 2005:387).

In 1994, South African figures showed 2,900 emigrants to the United Kingdom, while British figures showed more than 8,000 emigrants entering their country (Anon., 1998:12). Researchers at the University of Cape Town also expressed that the brain drain is more significant than government admits and that there is a significant underestimation. Their study tallied 41,496 professional emigrants from South Africa between 1989 and 1997 – almost four times more than the official figure of 11,255 (McClelland, 2002:793).

A 1999 study on emigration by Fourie and Joubert (1998:119) produced similar evidence of an underestimation of between three to four times, which they refer to as the 'multiplication factor'. They proved that the New Zealand authorities counted 3,3 times as many South African emigrants arriving in New Zealand between mid-1994 and mid-1995 as official South African statistics (1,123 vs. 3,712). Australian statistics also showed that three times the number of South African emigrants arrived than that which Statistics South Africa recorded in 1997 to 1998 (1,405 vs. 4,281) (Fourie & Joubert, 1998:119). Statistics South Africa declared and confirmed this discrepancy in a comparative assessment they compiled and stated that the total difference between their self-declared emigration numbers of only the five leading destination countries versus the census data of the specific five countries are 117,447 up to 2001 (Statistics South Africa, 2005:10). The five leading destination countries in order of number of emigrants are United Kingdom (UK), United States of America (USA), Australia, New Zealand and Namibia (see Table 2.1).

Table 2.1: Top 10 emigration destinations (2003)

2003 Top 10 Emigration Destinations		Total	Prof., Semi-Prof. & Tech.	% Total
1	UK	5632	1628	34.8%
2	Australia	2276	591	14.1%
3	USA	1598	472	9.9%
4	New Zealand	966	229	6.0%
5	Namibia	617	180	3.8%
6	Canada	400	118	2.5%
7	UAE	353	65	2.2%
8	Germany	329	77	2.0%
9	Botswana	273	67	1.7%
10	Netherlands	249	59	1.5%

Source: Statistics South Africa (2005:59)

The top ten emigration destinations (76%-80% of all emigration destinations) for 2003 are depicted in Table 2.1. Sixty two percent (62%) of all emigrants in 2003 travelled to either the UK, USA or Australasia (Top 4) (Statistics South Africa, 2005:59).

Taking all the above-mentioned statistics and studies into consideration, it clearly indicates that the discrepancies are not a once-off abnormality and that it follows the same pattern in several counties. A conclusion can be drawn that the scale of emigration is at least twice as great as the South African emigration statistics. This conservative value of 2.0 will be used as the 'multiplication factor' for future references and calculations (Bornman, 2005:387, Fourie & Joubert, 1998:119). The main reason for the discrepancy in self-declared and actual emigration figures is that emigrants tend to cut paper work when filling out forms at South African airports, eliminating the risk of troubles regarding unpaid debt or tax issues, and seem to retain a "psychological anchor" when not acknowledging that they are emigrating, should they want to return home later (Van Rooyen, 2000:29). Additionally, no official governmental figures include the many young South Africans who never officially emigrate, but simply leave the country a few years after graduating and never return (McClelland, 2002:793).

The latest official statistics from Statistics South Africa (2005:3) stated that the self-declared emigrants (who completed emigration forms at airports) from 2003 was 48.4% higher than in 2002, with a total number of self-declared emigrants increasing from 10,890 in 2002 to 16,165 in 2003. Multiplying this number with the purported 'multiplication factor' of 2.0, predicts that the number of actual emigrants in 2003 were in the region of 32,000 (Statistics South Africa, 2005:3).

2.2.2 Brain drain

The concern for South Africa is that most emigrants are skilled or highly skilled, causing a large skills loss and brain drain from the country. 'Brain drain' implies a depletion of skilled people who are vital to the functional core of a national economy (McDonald & Crush, 2002:6). Surveys show that South Africa's greatest weaknesses in terms of competitiveness are the scarcity of skills and labour market rigidity. Official American statistics show that 77% of all South African emigrants entering the United States of America have a tertiary education (Van Rooyen, 2000:37). The situation is worsened by the fact that uneducated/ economically-inactive immigrants enter the country, while highly educated people leave the country. During 2003, out of the 10,578 persons granted permanent immigration status, only 9.6% were economically active, while 65% of the total emigrants were economically active (Statistics South Africa, 2005:17).

In 2003, 65% of all emigrants leaving the country were either a skilled professional, semi-professional or had held technical occupations. These professions include doctors, engineers, architects, accountants, lecturers, teachers and various other occupations. If emigrants in managerial positions are added, the total escalates to 76% (12,268) of emigrants leaving the country that were either in managerial positions, a professional, semi-professional or technical skilled occupant (Statistics South Africa, 2005:3). This means that looking at the discussed emigration figures of an estimated 32,000 emigrants

each year more than 20,800 skilled professionals/semi-professionals in South Africa, leave their skilled occupation each year to move abroad (McClelland, 2002:793).

Due to the fact that most emigrants are highly skilled, the country has an immense financial loss in terms of education cost, employee turnover, training cost and loss of experienced skills. In 1997, it was calculated that due to emigration there was a loss of R800 million in internal revenue and R2 700 million losses in Gross National Product (GNP) (Bornman, 2005:387). Furthermore, it is estimated that the financial loss to South Africa due to emigration has been more than R30 billion in "lost human capital" from 1997 to 2002 (McClelland, 2002:793). It is stated that eight working opportunities are lost with the emigration of one skilled professional from South Africa, with an estimated three million jobs been lost due to the brain drain over the last decade (Lebenya, 2007:1, Bornman, 2005:387).

The loss of skills is even greater if executives and top management of companies emigrate. In 1997 and 1998, 10% of overall personnel turnover was a result of emigration, while 6% to10% of middle management and 11% of top management who resigned from their companies, gave emigration as the reasons (Van Rooyen, 2000:119).

2.2.3 Engineer shortage in South Africa

With the focus on the potential emigration of engineers, the facts regarding the current emigration of engineers, the extent of the shortage and the reasons behind the engineer shortage in the country were explored.

2.2.3.1 Emigration of engineers facts

Table 2.2 depicts the latest figures from Statistics South Africa in terms of engineers emigrating. The figures are broken down into the various engineering fields, including an "unspecified" group as well. Take in mind that this is official self-declared statistics as received at South African airports. A total of 601 engineers emigrated in 2003, which is an increase of 65% from 2002. The total of 601 engineering emigrants depicted in Table 2.2 below is alarming, especially if we multiply this figure with the 'multiplication factor' of 2.0 (derived in Chapter 2.2.1), ensuing that up to 1,200 engineers have emigrated in 2003. It is also seen that with the increase in total emigrants of 48%, the total professional, semi-professional and technical emigrants also increased by 44% from 2002 to 2003 (Statistics South Africa, 2005:3).

Table 2.2: Emigration of engineers

Engineers Emigration (Self-declared)	2002	2003	Increase (2002→2003)
Industrial/Production	31	90	190%
Chemical	5	7	40%
Electrical & related	7	16	129%
Mechanical	3	7	133%
Metallurgical	0	1	-
Mining	0	29	-
Civil & related	16	25	56%
Unspecified engineering	328	426	30%
Total Engineering (A)	**390**	**601**	**54%**
Total Professional, Semi-prof. & technical (B)	7334	10540	44%
Total Emigrants (C)	10890	16165	48%

Source: Statistics South Africa (2005:3)

The Engineering Council of South Africa confirmed the large emigration of engineers by stating that up to 300 qualified engineers leave South Africa every year (based on the engineers who cancel their registration with ECSA before

they emigrate), and that the number could even be higher. While more engineers are registering with ECSA every year, the database is not growing at the same pace due to emigration of professional engineers (ECSA, 2007:7)

It is confirmed from Table 2.2's self-declared figures that it is almost double ECSA's figure. ECSA's statistics could have been a large contributor in adding fact/figures in tracing South Africa engineers going abroad, but various problems are encountered when wanting to take these data into consideration:

- Not all engineers in South African are members of ECSA (estimated less than 40%).
- ECSA engineers that decide to emigrate do not necessarily have to cancel their membership, and many in fact do not cancel their membership.
- ECSA engineers might be working abroad, but only on a project or for a few years and did not actually immigrate to the country where they are currently working in.

The fact is clear that a large number of engineers emigrate from the country; but a few questions are raised:

- What is the extent of this engineer shortage, and
- What are the main reasons for the engineer shortage?

2.2.3.2 Engineer shortage extent in South Africa

The current engineer shortage in the country could be described as follows:

- The Engineering Council of South Africa (ECSA) estimates that South Africa currently needs somewhere in the vicinity of 4 000 to 5 000 engineers on an urgent basis; and the need is increasing rapidly to about an estimate of 10 000 engineers by 2010 (ECSA, 2007:17).
- According to Eskom's 2007 annual report, it needs 6,200 engineers, technicians and artisans over the next five years, of which 470 of the 6,200 are engineers (Calldo & Du Plooy, 2008:3).

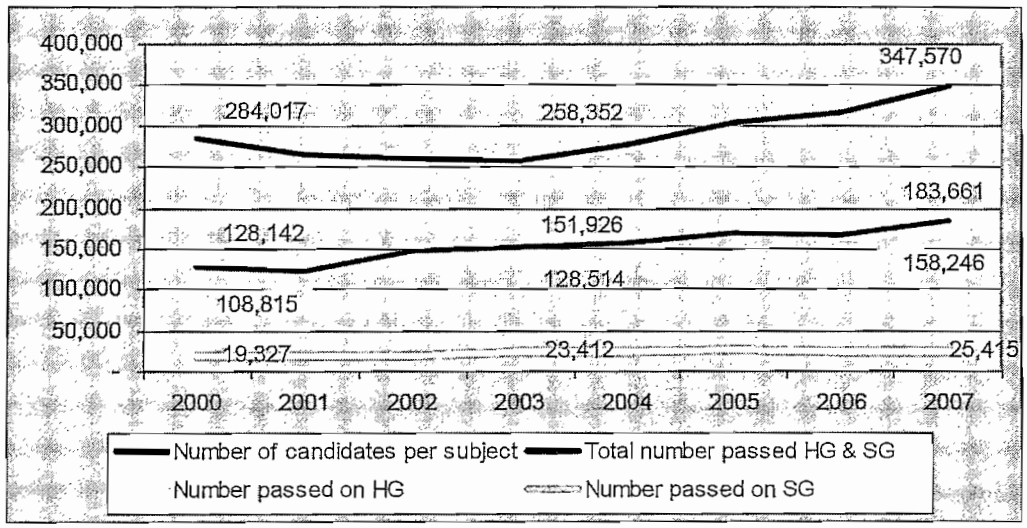
- A local municipality's survey done by the South African Institute of Civil Engineers (Saice) showed that 79 of the country's 231 (34%) local municipalities do not have civil engineers, technologists or technicians, and it confirmed that there are more than 1,000 vacancies for these positions at municipalities countrywide. The survey also reported that there are currently less than three civil engineers for every 100,000 people in South Africa (Calldo & Du Plooy, 2008:4).

2.2.3.3 Main reason for the engineer shortage

Besides the effect the emigration of engineers has on the country's shortage of engineers, the largest other factor that is contributing and worsening the current status is education. The education system just isn't producing enough students with maths and science higher grade (HG) to further their studies to universities into occupations like engineering. In 2006, only 4,77% students (overall) passed mathematics on HG, and 5,63% passed science on HG. In 2007, these figures declined to 4,50% for students who passed mathematics on HG and 4,98% for science on HG (South African Department of Education, 2007:15).

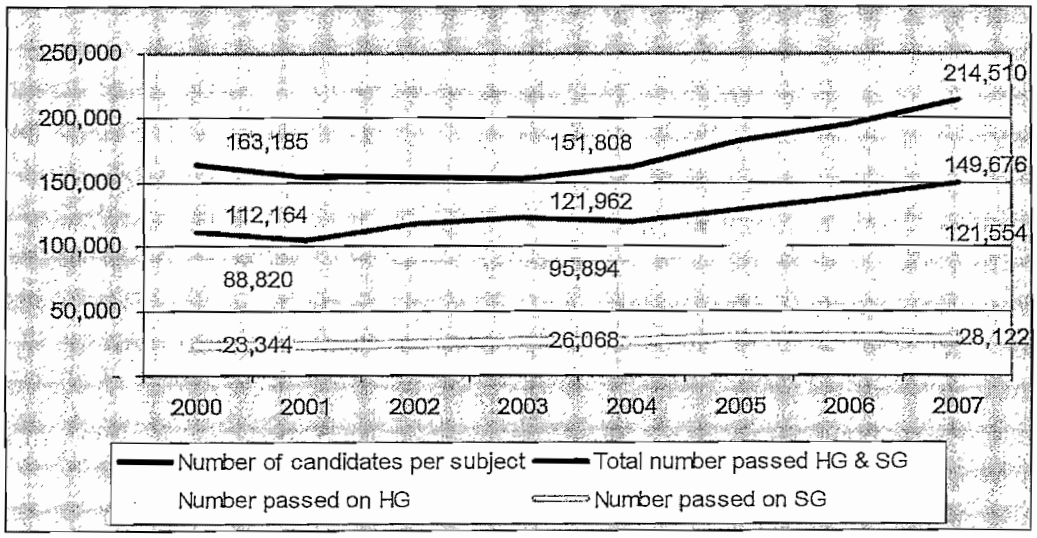
If one only looks at the students who passed maths and science on HG out of the total number of students who had mathematics and science on HG, it is seen that students who passed maths on HG declined from 7,2% in 2006 to 6,9% in 2007, while the students who passed science on HG declined from 15% in 2006 to 13% in 2007.

Figure 2.1: Mathematics – Senior certificate examinations results



Source: Calldo & Du Plooy (2008:6)

Figure 2.2: Science – Senior certificate examination results

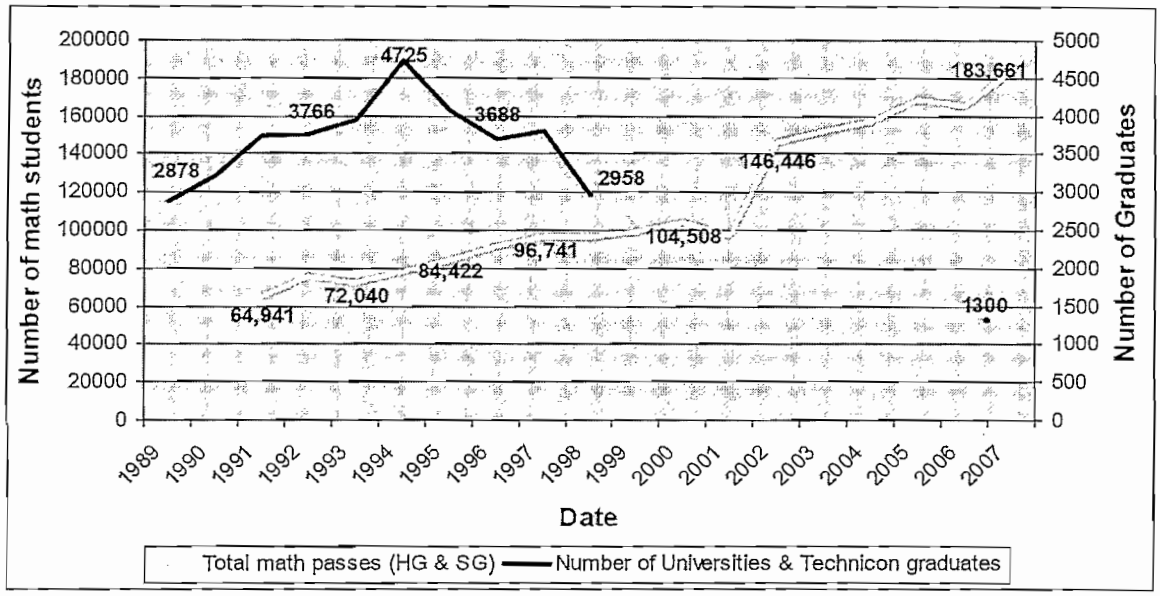


Source: Calldo & Du Plooy (2008:6)

The total number of candidates for maths increased dramatically from 2000 to 2007, but the candidates passing it on HG (which is most relevant and required

for engineering) is barely increasing over the years (6.9% in 2007). The same scenario is seen in Figure 2.2 where the number of candidates of science is only increasing slightly with the increase of candidates, but dropping in percentage from 15% in 2006 to 13% in 2007.

Figure 2.3: Mathematics passes and engineering graduates



Source: Calldo & Du Plooy (2008:7)

Figure 2.3 illustrates that the total math passes are increasing, but the amount of engineers qualifying at South African universities declined sharply from 1994 down to a number of 1,300 in 2007. This trend might exemplify that the quality standards and/or difficulty of mathematics (and science) might have decreased compared to 15 years ago in South Africa.

2.2.4 Emigration push-and-pull factors

Various reasons are known and elaborated by in literature about the proposed reasons why people (including engineers) leave the country. Numerous studies have used push-and-pull factors to identify the reasons why people decide to migrate (Manik, 2007:58-60; Mattes & Richmond, 2000:26-34; Myburgh, 2004:126). Literature also argues the question whether it is negative push factors such as crime, violence and affirmative action that push people away, or pull factors such as better job opportunities and material gains that lure residents from their home countries (Mattes & Mniki, 2007:42). The third and most likely option is that it is neither one or the other, but rather a combination, integration and build-up of push-and-pull factors that convince people to pursue the emigration process.

Van Rooyen (2000:72) depicts in his studies that emigrants are motivated by the following number of 'push/pull' factors to emigrate:

- 60% of emigrants regard crime as the major reason for wanting to emigrate.
- 19% of emigrants cite concern for their children's education as the major reason for leaving.
- 15% stated that they were looking for better quality of life, and 14% wanted better prospects in general.
- 20% were concerned about healthcare, and 10% cited the government, economy and affirmative action as major reasons for emigrating.

The most common reasons known as push/pull factors are elucidated in the following:

- **Monetary value**: Better working and business opportunities are in many cases the main factor that persuades workers to move abroad, especially professionals in high and skilled positions. This means that higher monetary values are added to their profession or occupation and they feel

that their skills are being optimised. Recruiting agencies and large companies abroad are even luring the émigrés with huge sign-on bonuses, homes and covering the costs of moving abroad (Mattes & Mniki, 2007:42).

- **Violence and crime**: South Africans are collectively brutalised by a wave of crime (rapes, house break-ins, hijacks, corruption) that borders on anarchy and by one of the highest murder rates in the world. The reality is that emigrants are overwhelmingly leaving the country because of crime, mostly if they have been personally touched by crime and violence (Van Rooyen, 2000:75). In most cases, crime and violence are the 'final straw incident' in a persons' pending-decision-mind about emigration; where the victim then decides that this was now the deciding factor that he is going to leave the country (Bornman, 2005:388). Émigrés search for countries that are safe, especially for the sake and future of their children and family. These social factors such as violence and racism are one of the major motives towards emigration from South Africa (Oosthuizen & Ehlers, 2007:16).

- **Affirmative action:** Qualified skilled individuals who are affected by affirmative action easily see emigration as a way out of a corrupt environment. These individuals generally feel that their skill/profession is not being valued, and they generally seek for posts abroad. Survey results based on a national survey undertaken by the Southern Africa Migration Project confirmed that 83% of skilled whites are widely opposed to the government's affirmative action policy while only 20% of skilled Africans expressed similar views (McDonald & Crush, 2002:40).

- **Economical instability:** The South African economy is often seen as one of the most important reasons for emigration (Bornman, 2005:388). Taxes and interest rates are too high, savings are eroded by inflation and that the

South African currency lock them in South Africa by turning their money and life savings into worthless papers (such as in Zimbabwe's case). It becomes more and more expensive to emigrate as the rand weakens; especially when large assets (like houses and businesses) are to be established abroad. Interest rates in most developed countries are as low as 1% to 5% (Van Rooyen, 2000:101). About 10% of emigrants listed the perilous condition of the country's economy as the most important reason for leaving the country (McDonald & Crush, 2002:63).

- **Better future for children abroad:** The subject of a better future for emigrants' children plays a major role as a pulling factor to their destination countries. Numerous developed first-world countries provide free, high standard education and healthcare to all their citizens. Emigrants thus feel that their children are safer and that after their education, that they will have better work opportunities in their new country of residence. A study conducted amongst South African emigrated doctors indicated that 50% of respondents agreed that better schooling opportunities for their children played a large role in their decision to leave the country (Bezuidenhout, Joubert, Hiemstra, & Struwig, 2009:214)

- **Aids & falling standards**: Standards in terms of education, health care and social welfare are deteriorating; while the unemployment rate is creeping up year after year. Falling standards, mismanagement, incompetence and the Aids pandemic with a global decline in morality and values are issues making South Africans considering emigration, desperate and concerned about their future. South Africa is currently experiencing one of the most severe Aids epidemics in the world. At the end of 2007, there were approximately 5.7 million people living with HIV in South Africa, and almost 1,000 Aids deaths occurring every day (Joint United Nations Programme on HIV/Aids, 2008).

2.2.5 Emigration potential

This study focuses strongly on determining the emigration potential of the individual. It involves a sample that has not left the country but who may have intentions of doing so, so as to examine the effects of the uncertainty surrounding the contemplation of emigration. It is important to note that the potential to emigrate does not necessarily mean that an individual will eventually immigrate.

A survey of the Sunday Times conducted in 1998 showed that 74% of professional people in South Africa were thinking of emigrating (Taitz, 1998:13). Another survey of 725 respondents done by the Institute for Democracy in South Africa (Idasa) suggested that 69% of skilled professionals had considered leaving South Africa and that 28% had a big desire to leave, but that only 20% were very likely to leave (Van Rooyen, 2000:34). A 2000 Business Industry Survey conducted among 3,250 businesses found that 41% of South African business leaders and managers would leave the country if offered a good job abroad (Van Rooyen, 2000:117).

A survey intended to determine the emigration potential of employees showed that there is a significant relationship between the intention to emigrate and organisational commitment, and that people are more likely to emigrate if they have a university qualification and/or friends that have settled abroad. In this study of a sample of 105 employees from a single South African organisation, two biographical variables were found to be significantly related to Intention to Emigrate, namely the 'level of education' and 'whether or not the participants had friends who had emigrated' (Miller *et al.*, 2002:16).

Mattes and Mniki (2007:25) studied the emigration potential amongst a sample of 4,748 postgraduate and final year students at South Africa's tertiary educational institutions. A valid and reliable index of emigration potential was created and they found slightly higher levels than those measured by identical questions in

previous surveys of skilled adult South Africans. This study was different than many others by the fact that they did not examine negative push factors such as crime and the country's bad condition in various contexts, but they examined the casual factors that may increase or decrease emigration potential by five different 'theoretical families' of explanations. Firstly, a series of demographic variables were measured to see whether emigration potential is primarily a function of a student's place in the social structure (for example, is a student shaped simply by their racial or ethnic background, their gender or their socio-economic status?). Secondly, a set of measures related to social identity were developed, specifically examining national identity and patriotism. Thirdly, the impacts of a wide range of economic evaluations were evaluated, which includes the student's expectations of their future in South Africa, compared to their most likely destination. Fourthly, a series of factors related to experience and information about emigration and the outside world were tested; meaning that the question arises whether students with more contact with émigrés or who gather more information about emigration are more likely to leave. Finally, they examined the role of logistical factors to determine to what extent emigration is related simply to the ability to move.

Results from the study revealed that the factors that most increase emigration potential among South Africa's future skills base were simply whether or not students feel that their families would encourage or discourage their decision to move. Students' perceptions about the fortunes of those who have already moved were the second strongest set of predictors; particularly the belief that émigrés lead better lives abroad. Relative economic assessments and national identity have approximately equal impacts on emigration potential, though they work in the opposite directions. The belief that family prospects would be better in a student's most likely destination increases emigration potential, while a sense of patriotism and strong national identity decrease emigration potential. Furthermore, the results showed that the more one seeks information from the internet about the living conditions and job opportunities abroad and regularly

travels internationally, the greater one's probability of emigrating (Mattes & Mniki 2007:41).

2.3 RESEARCH METHODOLOGY

In view that the mining company has a large geographical area (North West, Gauteng and Mpumalanga), an electronic survey-based research design was the best suitable option for the study. Due to the sensitiveness of the nature of the study, the name of the company is not mentioned in the report. The study research consisted of an extended literature study and a survey-based empirical research.

2.3.1 Literature study

The literature study was utilised in order to obtain as much information, statistics and data about the topic of emigration, emigration potential and reasons for emigration in order to form the theory of the subject. Computer-based research articles, books and official statistics were mostly utilised. Prior research articles on the same topic-type were also examined. All theory and literature were gathered in order to obtain suitable information to be analysed and compared against the findings of this research.

2.3.2 Empirical research

The research made use of an electronic survey with the questionnaire being emailed to the correspondents. This was done in order to obtain quantitative data of the research topic from the specific chosen population within the mining organisation. Questionnaires were sent to 130 management level engineers in the organisation (Sample = 130) of which 46 completed questionnaires (35%) were received back. The presumption for the low return rate might be that the

engineers felt victimised when conveying their opinion about leaving the country or company. This corresponds to the low rate of emigrants completing the emigration forms at the airport before they leave because they might have the fear of being victimised.

2.3.3 Measuring instrument

An electronic questionnaire was used as the appropriate measuring instrument in order to determine the engineer's emigration potential. The questionnaire comprised four sections:

- A - Background information (Biographical information)
- B - Potential emigration (General)
- C - Factors impacting emigration
- D - Circumstances comparison

Section A covered the background or biographical information that was used to obtain information about the respondent which related to his/her age, gender, marital status, race, type of engineering qualification, postgraduate qualification and engineering discipline. This section was also utilised to determine if the engineer was a member of ECSA and whether the engineer would cancel his/her ECSA membership if he/she plans to emigrate.

Section B measured the potential emigration as well as other factors that influence the mindset or opinion about emigration. Section B was broken down into seven constructs derived from literature named Potential Emigration in general, Monetary Value, Quality of life, Patriotism, Family Matters, Information/Knowledge and Logistics.

Section C evaluated to what degree various factors in South Africa (such as black economic empowerment, crime and racism) will impact their decision to leave. Section D evaluated how the respondent thought their present

circumstances, in respect of the same factors in Section C, compare with those in their country of destination. Section C and D were broken down into three constructs namely Political, Economical and Social aspects.

A 5-point Likert scale was used in the survey questionnaire; each section with different headings to choose from.

2.3.4 Data analysis

The data collected from the survey were statistically analysed by using the Statistical Package for the Social Sciences Incorporated (SPSS Inc., Version 16, 2008). Means and standard deviations (descriptive statistics) were calculated in order to analyse the data effectively. The reliability of the questionnaire constructs measuring instruments were tested by the use of Cronbach alpha coefficients.

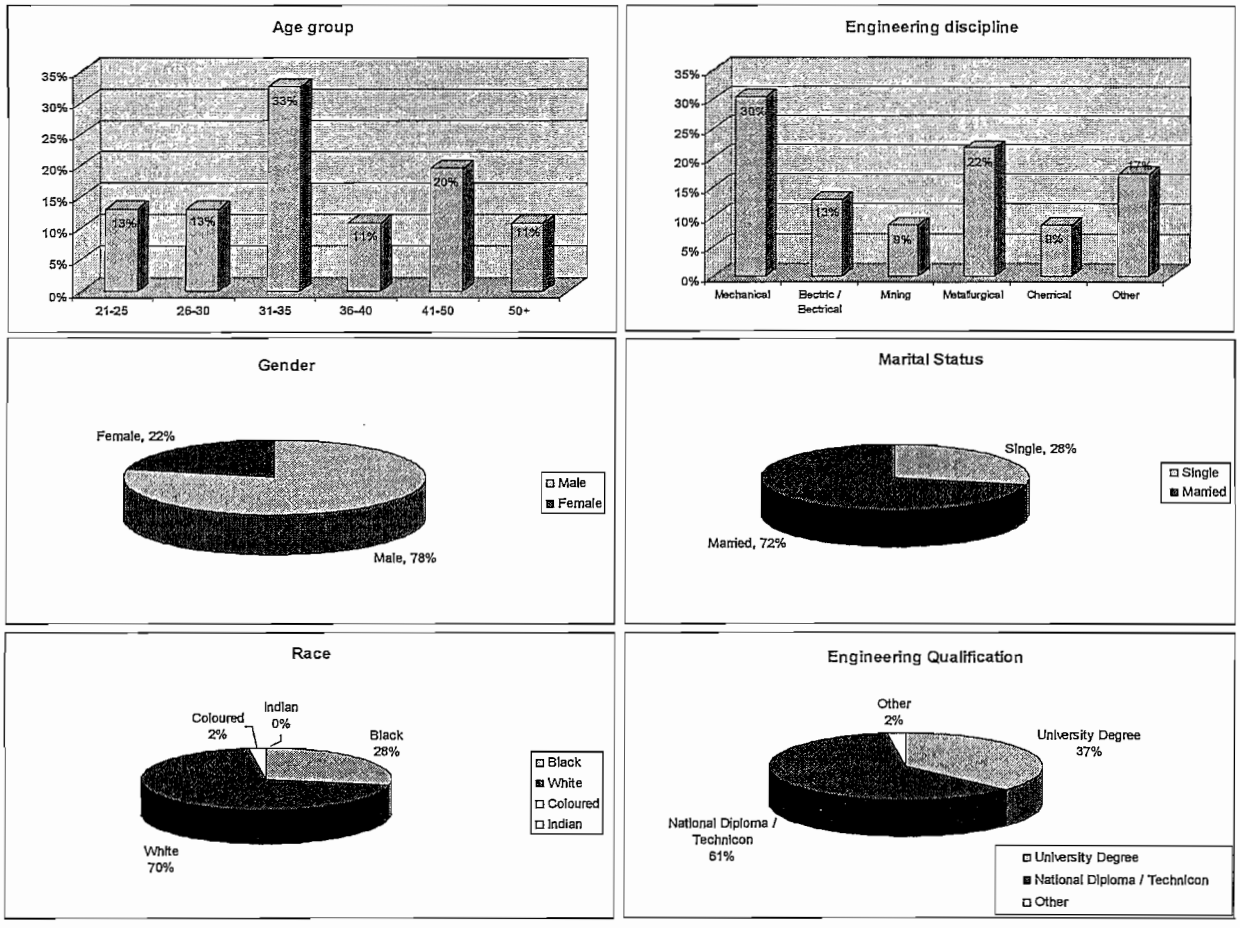
T-tests were done to determine the various differences between age groups, race, engineering qualification, post graduate qualification and engineering discipline for the variables directly presenting the emigration potential.

2.4 RESULTS

2.4.1 Survey respondents

Figure 2.4 below shows the respondents' background or biographical information that was covered in Section A of the questionnaire. This information is important as various groups of people may tend to agree upon specific matters.

Figure 2.4: Respondents' background / biographical information – Section A



Thirty three percent of the respondents were men (78%) between 31-35 years of age, 72% married and 70% white. Most of the respondents (61%) obtained their engineering qualification from a technicon (National Diploma), with 41% having a post graduate qualification as well. The majority of engineers in the survey were mechanical and metallurgical engineers (30% and 20% respectively), with only 17% of the respondents being members of ECSA.

2.4.2 Reliability of the constructs

Cronbach alpha coefficients were calculated in order to test the internal consistency between the items of the measuring instrument. Reliability means that the scale should consistently reflect the construct it is measuring. An instrument, such as a questionnaire, that produces the same scores every time it is used under the same conditions has a high reliability.

Table 2.3 shows the Cronbach alpha of the major constructs in the study, namely the emigration potential of the engineer and the factors that will most impact them to emigrate. The calculated Cronbach Alpha values are all above 0.8; which shows that all the construct scales are reliable and acceptable (Field, 2007:668).

Table 2.3: Cronbach alpha's

Construct	Cronbach Alpha
Emigration Potential	0.832
Factors Impacting Emigration: - Political - Economical - Social	 0.813 0.892 0.919

2.4.3 Descriptive statistics

Descriptive statistics techniques and methods were used to evaluate the emigration potential along the various factors that impact the engineer's decision to emigrate.

2.4.3.1 Potential emigration measured (Section B)

Figure 2.5: Results: Potential emigration – Section B

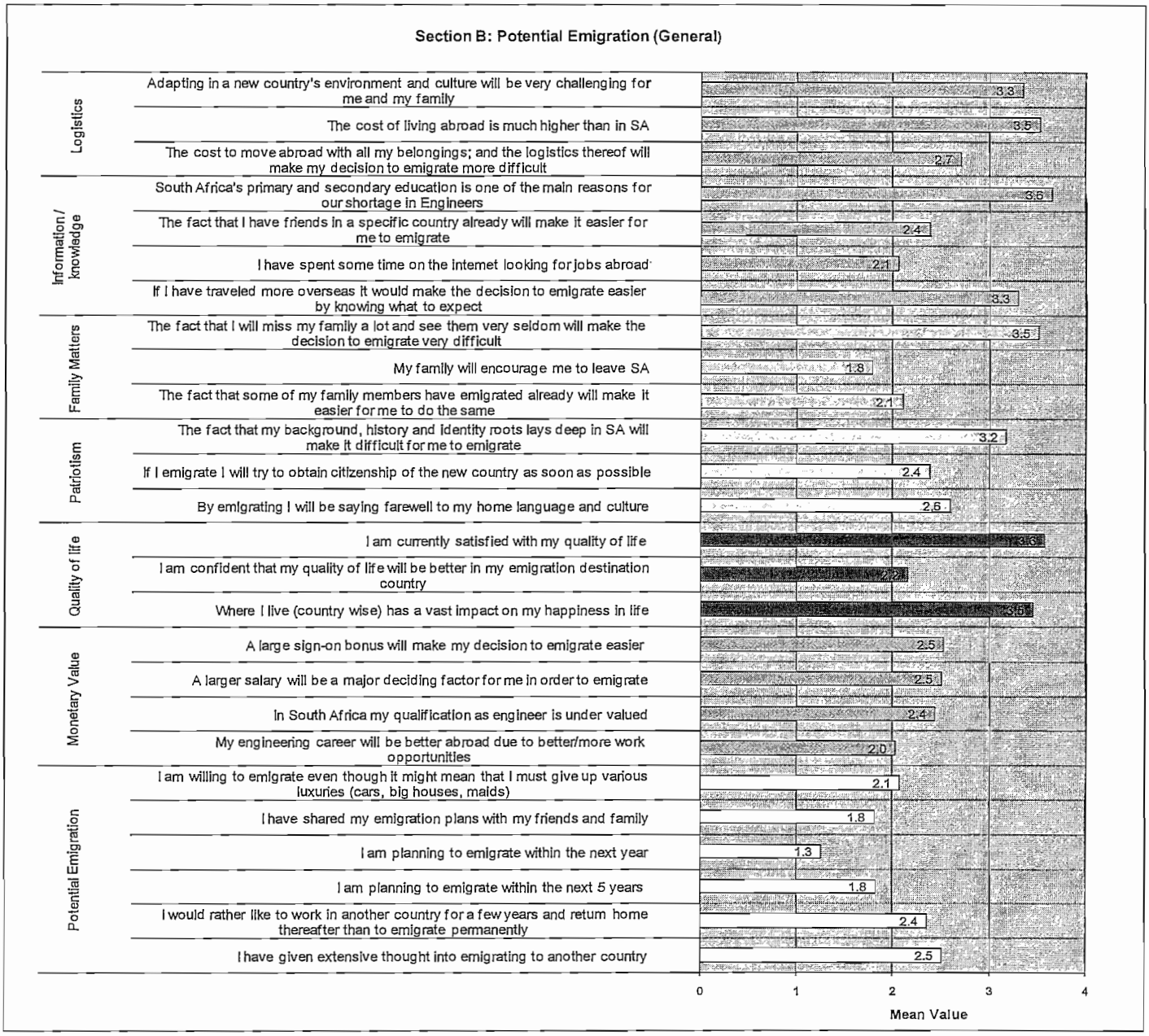


Table 2.4: Section B: Summary

Construct	Mean	Standard Deviation
Logistics	3.19	1.18
Information / knowledge	2.85	1.44
Family matters	2.46	1.52
Patriotism	2.72	1.40
Quality of life	3.06	1.37
Monetary value	2.38	1.36
Potential emigration (General)	1.97	1.49

It is clear from the figure and the table above that the overall emigration potential is low. The questions directly correlated to determine the emigration potential showed an average mean of 1.86. The high mean in terms of quality of life and logistics confirm the low emigration potential due to respondents being satisfied with their current quality of life question (highest mean of 3.6) and of the opinion that the logistics and cost thereof to move abroad is very high. Also correlating to the low emigration potential is the construct regarding family matters; results confirm that their families will not encourage a decision to emigrate.

Figure 2.5 shows the complete results of all the respondents for Section B of the survey which evaluated the potential emigration along with various factors affecting their mindset regarding emigration. The seven constraints of Section B are indicated by the seven different colours in the graph.

2.4.3.2 Profile of Potential Emigration Construct in terms of various groups

Although it is clear from Table 2.4 that the overall emigration potential is low, it is meaningful to scrutinise the Potential Emigration Construct in terms of various groups such as age, race, qualifications and engineering disciplines.

Figure 2.6: Potential emigration in age groups

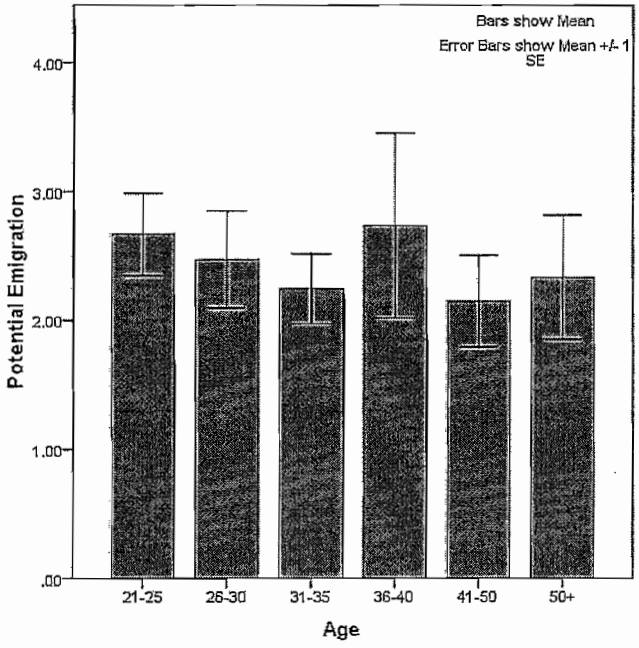


Figure 2.6 depicts the potential emigration of the engineers in their specific age groups. It is evident from the trend that the emigration potential declines from age 21 to 35, with the highest value at age 36 to 40.

Figure 2.7 depicts the emigration potential broken down into various race and qualification groups. The emigration potential of whites are a little bit higher than the black or coloured race groups; emigration potential of university degree qualified engineers are higher than those that qualified at a technicon with a diploma in engineering. Engineers with a post graduate qualification tend to have a quite significant higher emigration potential than those without any.

Figure 2.7: Potential emigration in race and qualification groups

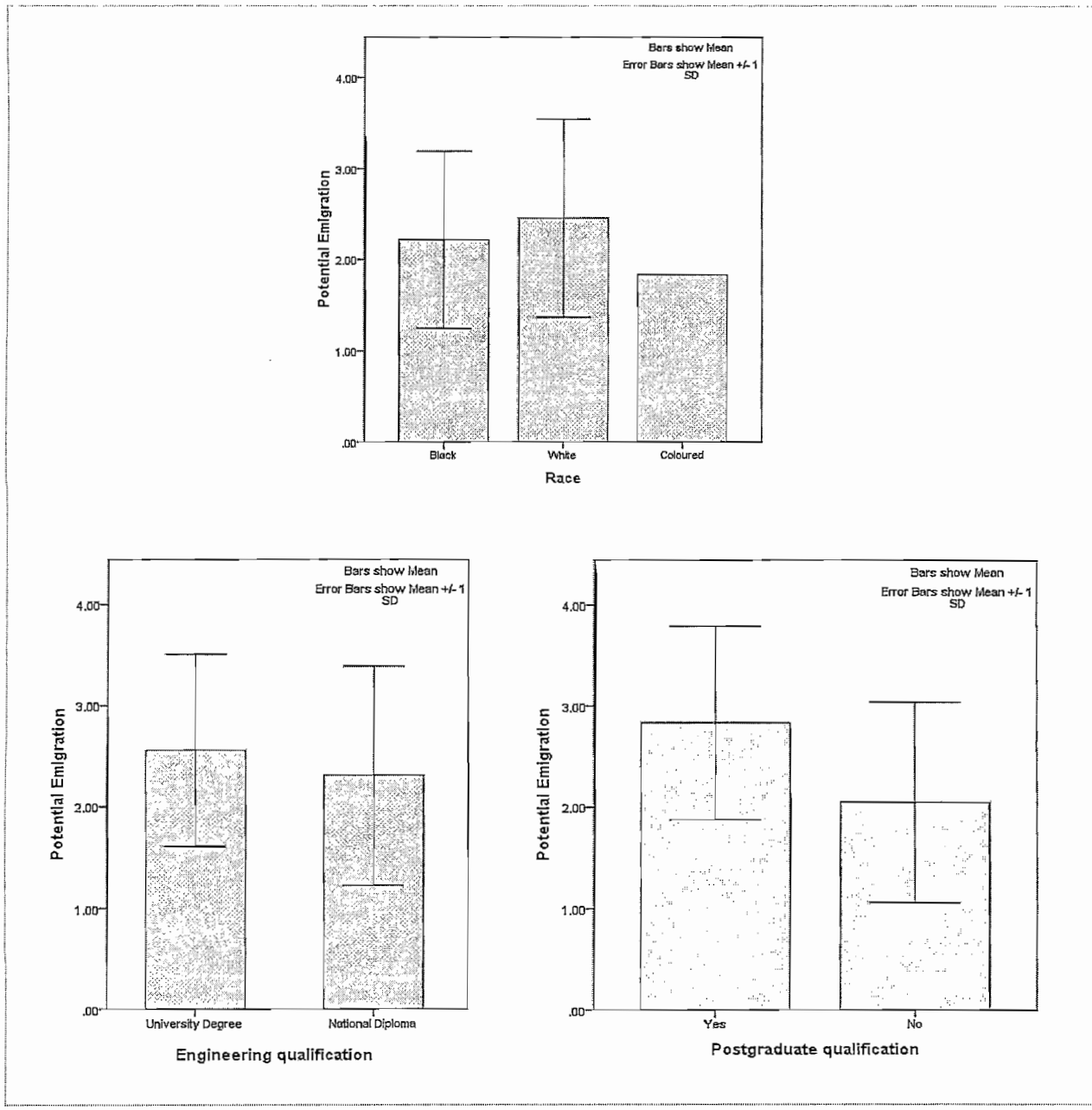


Figure 2.8: Potential emigration in engineering qualification groups

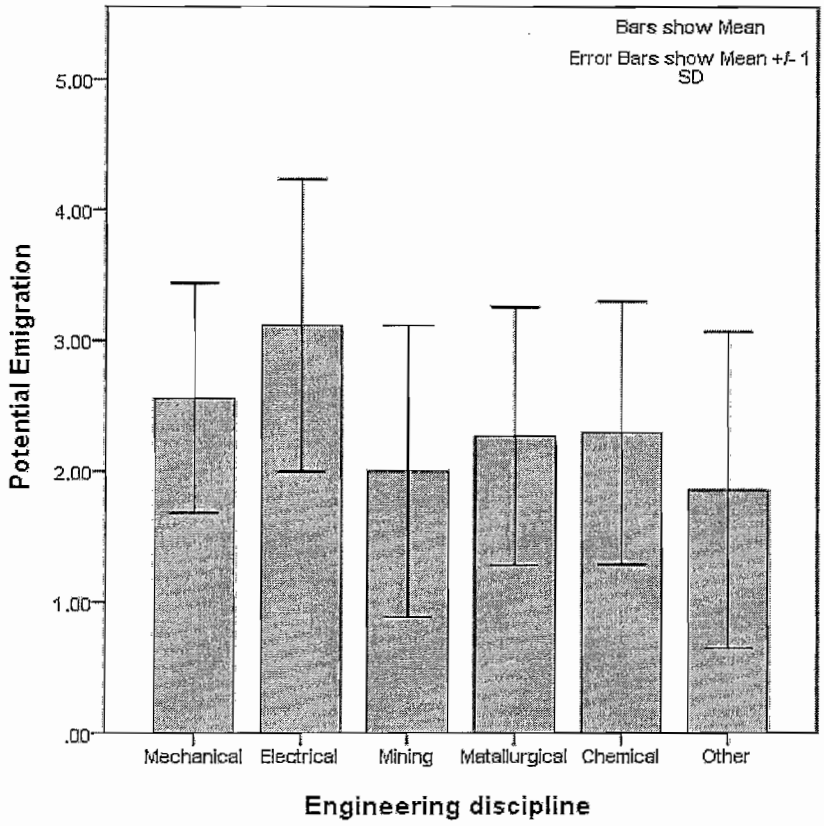


Figure 2.8 illustrates the potential emigration of engineers in their various disciplines. It is significant to observe the higher emigration potential amongst mechanical and electrical engineers compared to the other disciplines.

2.4.3.3 Factors impacting emigration (Section C)

Figure 2.9 depicts the intensity certain factors influence the respondent's decision to leave the country. It is clear that the Social construct has by far the highest impact (Mean = 3.38). The reason for this is the strong response against personal safety/ family security, crime and violence.

Table 2.5: Section C: Summary

Construct	Mean	Standard Deviation
Social	3.38	1.31
Econornical	2.50	1.13
Political	2.58	1.33

Figure 2.9: Factors impacting emigration potential

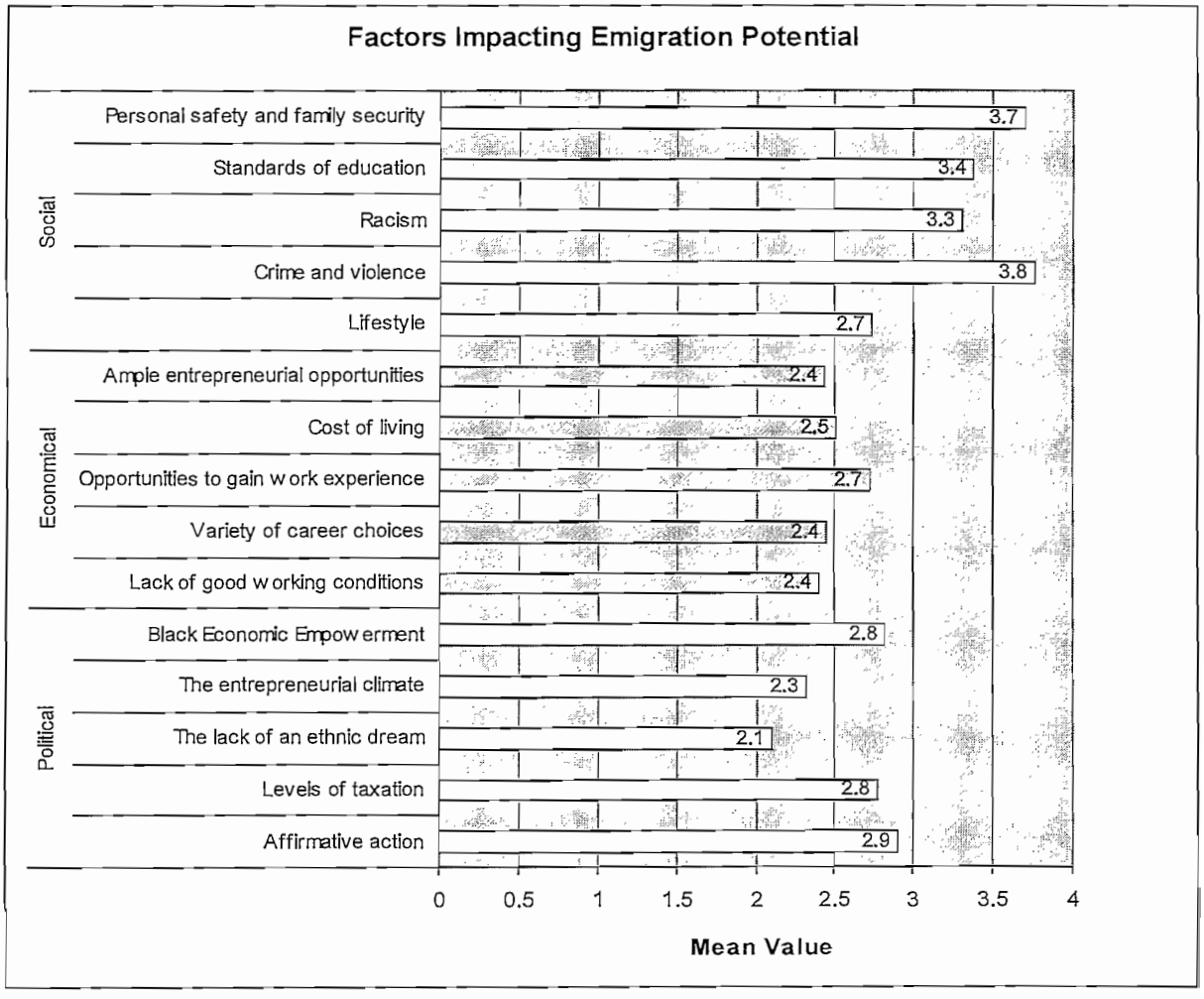


Table 2.6 ranks the 15 emigration potential factors (as given in the questionnaire) in order of most significant impact to less significant. Crime and violence,

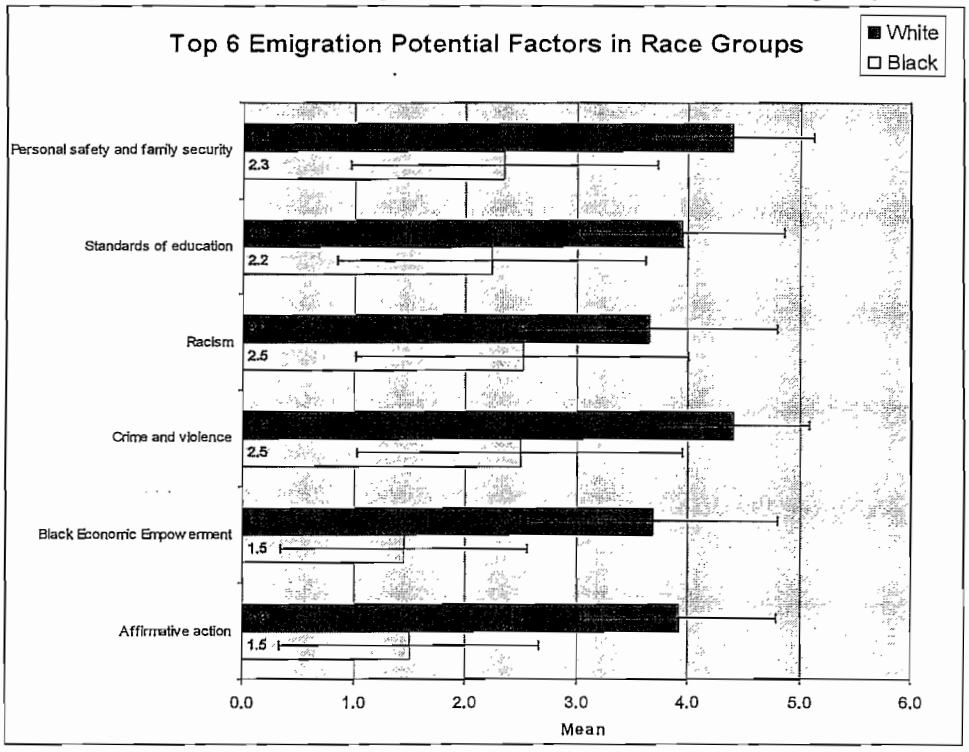
personal safety and family security, standards of education, racism, affirmative action and black economic empowerment are the top six constraints.

Table 2.6: Emigration potential factors ranked

Ranked Nr.	Factor
1	Crime and violence
2	Personal safety and family security
3	Standards of education
4	Racism
5	Affirmative action
6	Black economic empowerment
7	Lifestyle
8	Levels of taxation
9	Opportunities to gain work experience
10	Cost of living
11	Lack of good working conditions
12	Variety of career choices
13	Ample entrepreneurial opportunities
14	The entrepreneurial climate
15	The lack of an ethnic dream

The biographical aspect that showed the biggest impact if compared to the results of the emigration potential factors were race; thus race was scrutinized and depicted in Figure 2.10 in terms of the emigration potential factors. Figure 2.10 splits the top six emigration potential factors as perceived from the results into the two major race groups namely black and white.

Figure 2.10: Top 6 emigration potential factors in race groups



2.4.3.4 Circumstances comparison (Section D)

Figure 2.11 describes the opinion on how the respondent, through his present circumstances, in respect of the specific factors compared with those in his country of destination (or any other country). High values show that the engineers are content with their current country and that South Africa is better now than in the country of destination. Figure 2.11 supports the low emigration potential by confirming that most of the respondents feel that their current lifestyle in South Africa is better than in the country of destination.

Figure 2.11: Circumstances comparison

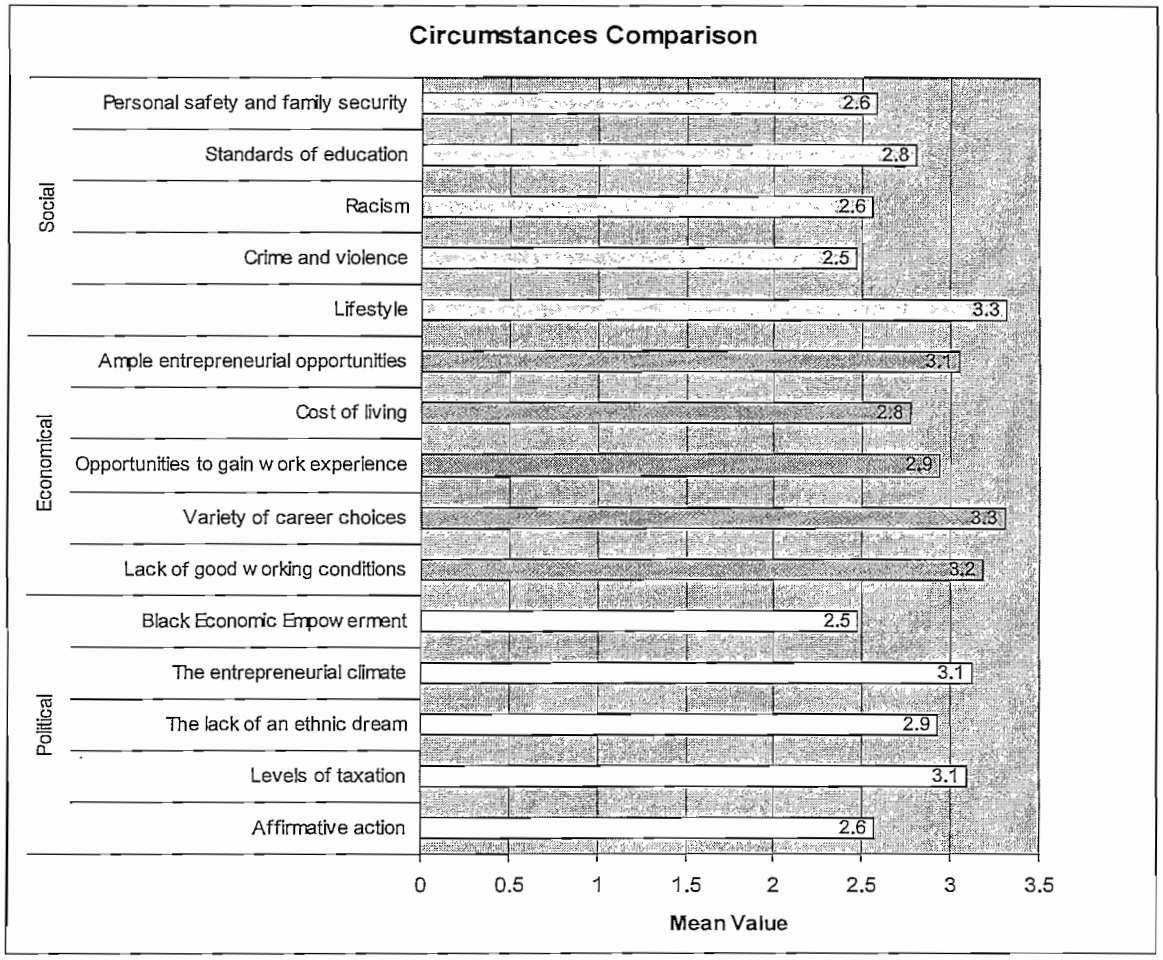


Table 2.7: Section D: Summary

Construct	Mean	Standard Deviation
Social	2.74	1.29
Economical	3.05	0.86
Political	2.84	1.14

2.5 DISCUSSION

In this study, engineers that took part in the study had to indicate their emigration potential as well as the major factors that would contribute to them leaving South Africa. Official statistics observed in the literature study showed 601 of the total 16,165 self-declared emigrants for 2003 were engineers; which can be even higher taking the multiplication factor of 2.0 into consideration (Statistics South Africa, 2005:3). In order to measure the potential emigration seven major constructs were derived from literature and measured. These constructs show similarity to potential emigration measurement methods used in previous studies (Mattes & Mniki, 2007:41; McDonald & Crush, 2002:32; Miller *et al.*, 2002:16).

In order to evaluate the factors impacting potential emigration in the country, three constructs named political, social and economical constructs were measured. The engineer respondents also had to compare their present circumstances in South Africa with those of their destination country and had to rank them on a 5-point scale between "much worse now than in other country", "worse now", "the same as in other country", "better now than in other country" and "much better now than in other country".

The calculated Cronbach's alpha coefficients for emigration potential and factors impacting emigration (Table 2.2) indicated internal consistency between the items of the measuring instruments. All coefficients were above the required 0.8 which show high reliability and consistency.

Figure 2.5 depicted the overall emigration potential results along with the average mean of each emigration potential construct in Table 2.3. It is visible from Figure 2.5 and Table 2.3 that the overall emigration potential of the engineers is significantly low. The mean value of 1.97 that measured the emigration potential in general had the lowest mean of all the constructs. Only twenty percent of respondents agreed that they are planning to emigrate within

the next five years and only two percent within the next year. This shows that the engineers do not have the desire to emigrate easily (or soon) and might indicate that the engineers are content and satisfied with their current work and way of life. Forty six percent of respondents agreed that they would rather like to work in another country for only a few years than to emigrate permanently. There can be numerous reasons why the emigration potential within this specific organisation is lower than expected. Organisational culture, management, salaries and bonuses, recognition, benefits and various other aspects can all play a role in the attitude towards leaving the company. Literature confirms that there is a significant relationship between intention to emigrate and organisational commitment (Miller *et al.*, 2002:16).

Results also showed high means in terms of respondents' quality of life and the opinion that logistics are a factor to consider before emigration. This supports the low potential emigration in view that the engineers are currently satisfied with their quality of life. Also correlating to the low emigration potential is the construct regarding family matters; results confirmed that their families will not encourage a decision to leave the country. It is also interesting to observe the low mean in terms of "have spent time looking for jobs abroad" (Information/Knowledge) which also confirmed the fact that the majority of respondents are content with their current circumstances and quality of life.

It is noteworthy to scrutinise the potential emigration of various groups such as age, race, qualifications and engineering groups in order to see the various viewpoints in terms of the attitude towards emigration. From Figure 2.6 it is evident that the emigration potential declines from age 21 to 35, presumably becoming less as the engineer settles in his career, obtains a more senior position, gets married and/or has children.

It is noticed from Figure 2.7 that the emigration potential of whites are a little bit higher than the black or coloured race groups; emigration potential of university degree qualified engineers are higher than those that qualified at a technicon (diploma in engineering); and engineers with a post graduate qualification tend to have a quite significant higher emigration potential than those without. The assumption can be made that the emigration potential increased the higher/better the engineer is qualified. The emigration potential amongst electrical (specifically) and mechanical engineers resulted to be higher than the other disciplines (Figure 2.8).

One of the other major objectives in the study was to determine the factors that influence the engineers the most in terms of considering emigration. Figure 2.9 depicted the various levels certain factors influence the respondent's decision to leave the country. The Social construct had by far the highest impact on their potential emigration (Mean = 3.38), which included aspects of personal safety/ family security, crime and violence. Crime and violence were the number one factor that influenced respondents. This confirms previous literature that stated that crime and violence are the biggest motives towards emigration (Oosthuizen & Ehlers, 2007:16; Van Rooyen, 2000:167), especially after a person or his family has been a direct victim of crime or a violence incident (Bornman, 2005:388).

Table 2.5 ranked all 15 emigration influential factors, while Crime and violence, Personal safety and family security, Standards of education, Racism, Affirmative Action and Black Economic Empowerment were the top six factors. It is interesting to observe the large difference in mean values of the top six potential emigration factors when split into black and white race groups. On average, the difference between black and white race groups in mean values amongst the top six factors is +/- 2.0. The reasons for this discrepancy in results in terms of race might indicate the opposition of whites against black economic empowerment and affirmative action, and the support thereof of the Africans as beneficiaries.

In comparing the respondents opinion on their present circumstances, compared with those in their country of destination, results showed average means, thus elaborating that circumstances in South Africa is not much worse than in other popular emigration countries. The highest mean amongst the circumstances comparison was amongst the economic construct, which depicts that respondents feel that South Africa's economical situation have strengthened in comparison to other first-world countries.

2.6 RECOMMENDATIONS

The large skills shortage in the country is directly worsened by the large outflow of highly skilled individuals, whereby engineers are amongst these. Although respondents in this study (from a specific mining organisation) do not show a large potential to emigrate, the reasons why South African engineers leave their country of birth should still be addressed.

2.6.1 Skills shortage

The shortage in engineers contributes to the overall skills shortage in the country. Seventy percent of respondents in this study agreed that South Africa's education is one of the main reasons for our shortage in engineers. The country's education system is not producing enough students with high marks in mathematics and science in order to further their studies in occupations like engineering. The number of engineers qualifying each year at tertiary institutions is much too low in order to relieve the current engineer demand in the country. The skills shortage should thus be addressed in its roots, namely the education system. Once the country's education is on standard, focus should be on how to increase the number of students enrolling for engineering, and ensuring that all engineering diplomas and degrees are on world standard.

Furthermore, there must be a drive from national government and companies to lure South African engineers that have left South Africa back to their country of birth. Engineer expatriates could be incentivised or receive tax benefits if they are willing to return and invest their skills and knowledge back into South Africa.

2.6.2 Factors impacting emigration

One of the major reasons why highly skilled engineers leave South Africa is the political and social climate in the country. The top six factors as identified by this study that need urgent attention in order to minimise the number of current emigrations were Crime and violence, Personal safety and family security, Standards of education, Racism, Affirmative action and Black Economic Empowerment. The intricacy is that all these matters are interlinked with various social and political aspects in the country such as Aids, poverty, moral values and unemployment. The focus thus should be on a global upliftment of the country, starting at unemployment and poverty and raising all standards of living.

2.6.3 Engineers under-valued

In order to keep engineers in South African companies, employers should make engineers feel wanted and valued for their qualification, skills and position. Good salary packages and bonuses should reflect the appreciative attitude from employers to employees. Lucrative salaries might also lure engineers from other countries to South Africa. Retention schemes and/or sign on bonuses could also be an option to assist in keeping skilled engineers from leaving South African companies. Government could also focus on mandatory bursaries from companies by paying and investing in students in order to increase the number of engineers qualifying each year at our institutions.

2.6.4 Summary

It is likely that the engineer shortage in the country will persist unless engineers are more valued. Government, educational institutions and companies employing engineers will have to work together in order to decrease the shortage of engineers. The entrepreneurial climate in the country should also be addressed in order to create opportunities for engineers to start their own businesses that will eventually create work and contribute to the economy.

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CHAPTER 3

LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS

3.1 INTRODUCTION

This chapter contains conclusions, limitations and recommendations of the study based on the findings of the literature study and empirical study.

3.2 LIMITATIONS

3.2.1 Limited sample size of engineers

The study only focused and based conclusions on 46 engineer respondents who participated in the survey. The presumption for the low return rate was made that the engineers felt victimised when conveying their outlook about leaving the country.

3.2.2 Limited geographical scope of the study

The study focused only on engineers within one specific large mining organisation, which covered areas of North West, Gauteng and Mpumalanga. This is a large limitation in the sense that the findings of the study cannot be taken as a general representation of all engineers in the country. Each geographical area, company and business sector or industry where the engineers find them in may play a role.

3.3 RECOMMENDATIONS

In order to increase the overall reliability of the study in terms of all engineers in South Africa, further studies are recommended with a bigger sample size that covers various companies, industries and geographical areas. Studies specifically amongst engineers who have already emigrated would also be recommended in order to obtain information in terms of what influenced the engineers to emigrate.

A further recommendation is that local government must emphasise a drive to attract South African engineers that had emigrated, back to the country. Engineers that have gained vital experience and knowledge abroad can implant it back into South Africa.

The standard of South African education should be a large focus area in order to improve the skills crises. Careers such as engineering should be encouraged in schools in order to ensure that students achieve good marks in specifically maths and science. Bursaries from large companies could assist financially for students that achieve good marks but do not have the money to study engineering. These bursaries must be emphasised by government and incentives to companies that sponsor large amounts of money to bursaries should be investigated. Future studies evaluating the education of the country in order to focus on the engineer shortage could be significant.

Although the potential emigration from this specific company showed to be low, the statistics of the engineers leaving the country is still clear. The country is still losing valuable skills when engineers seek better jobs abroad. Regardless of globalisation and the world becoming smaller, all in power will have to be done to keep this country's engineers from emigrating. This will be to the benefit of the

country's economy, businesses and entrepreneurs; eventually leading to the creation of more job opportunities for all.

3.4 CONCLUSIONS

The primary objective of this study was to determine the emigration potential of engineers within a large mining organisation, as well as the factors that will influence them into emigration. The literature study identified various aspects regarding the current skills and engineering shortage in the country, along with various studies regarding factors that influenced people to emigrate.

The following conclusions have been reached on the basis of the empirical research findings in this study:

- The overall measured potential for emigration within the specific mining organisation was significantly low.
- Only 20% of respondents agreed that they are planning to emigrate within the next five years and only 2% within the next year.
- 46% of respondents agreed that they would rather like to work in another country for only a few years than to emigrate permanently.
- Emigration potential tends to increase the better the engineer is qualified.
- The highest emigration potential was amongst electrical and mechanical engineers.
- Crime and violence along with personal safety and family security were the main factors impacting potential emigration.
- Emigration potential tends to decline from age 21 to 35.
- Potential emigration of whites is higher than those of coloureds or blacks.
- Respondents' opinions are that circumstances in South Africa are not much worse than in other popular emigration countries.

APPENDIX A

QUESTIONNAIRE

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POTENTIAL EMIGRATION OF ENGINEERS QUESTIONNAIRE

South Africa has the world's highest brain drain and worst skills shortages of 55 studied countries. The skills shortage is in particular experienced in highly skilled and specialised professions such as engineering. The Engineering Council of South Africa (ECSA) estimates that South Africa currently needs somewhere in the vicinity of **4 000** to **5 000** engineers on an urgent basis; and the need is increasing rapidly to about an estimate of **10 000** engineers by 2010.

The latest official statistics from StatsSA Documented Migration Report of 2003 reports that the total number of self-declared **engineering** emigrants as received at South African airports were **601 engineers** in 2003, which is an increase of **65%** from 2002. It is proven in literature that the actual number of emigrants are about **2.5 times** more than the official self declared statistics due to the fact that all emigrants do not complete all necessary paperwork at airports when they leave (immigration figures from foreign countries prove this discrepancy). This predicts that the actual number of **engineer emigrants** in 2003 were in the region of **1500 engineers**. Take into consideration that approximately only **1,200 engineers** qualify every year at South African universities.

This study challenges to measure the emigration potential of engineers as well as to determine the reasons that lead engineers to potential emigration.

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Note: All responses are confidential and neither the individual nor the organisation would be identified in any report or release.

SECTION A: BACKGROUND INFORMATION

A01	Name (Optional):	

A02	Indicate your age group	○ 21 - 25	○ 26 - 30	○ 31 - 35	○ 36 -40	○ 41 - 50	○ 50 +

A03	Indicate your gender	○ Male	○ Female

A04	Marital status:	○ Single	○ Female

A05	Indicate your race	○ Black	○ White	○ Coloured	○ Indian

A06	Indicate your engineering qualification	○ University Degree
		○ National Diploma / Technicon
		○ None

A07	Any postgraduate qualification?	○ Yes	○ No
	Please specify if Yes:		

A08	Indicate your engineering discipline	
		○ Mechanical Engineering
		○ Electrical / Electronic Engineering
		○ Mining Engineering
		○ Metallurgical Engineering
		○ Chemical Engineering
		○ Other (please specify):

A09	Are you a member of ECSA (Engineering Council of South Africa)?	○ Yes	○ No

A10	Will you cancel your ECSA membership if you emigrate?	○ Yes	○ No

SECTION B: POTENTIAL EMIGRATION

Use the following key to indicate your preference. Please select the number which best describes your opinion about a specific question in terms of if / as if your were contemplating emigration:

(1=Strongly disagree, 2=Slightly disagree, 3=Neither agree nor disagree, 4=Slightly agree and 5= Strongly agree)

		Strongly disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Strongly agree
Potential Emigration						
B01	I have given extensive thought into emigrating to another country	○ 1	○ 2	○ 3	○ 4	○ 5
B02	I would rather like to work in another country for a few years and return home thereafter than to emigrate permanently	○ 1	○ 2	○ 3	○ 4	○ 5
B03	I am planning to emigrate within the next 5 years	○ 1	○ 2	○ 3	○ 4	○ 5
B04	I am planning to emigrate within the next year	○ 1	○ 2	○ 3	○ 4	○ 5
B05	I have shared my emigration plans with my friends and family	○ 1	○ 2	○ 3	○ 4	○ 5
B06	I am willing to emigrate even though it might mean that I must give up various luxuries (cars, big houses, maids)	○ 1	○ 2	○ 3	○ 4	○ 5

Monetary Value						
B07	My engineering career will be better abroad due to better/more work opportunities	○ 1	○ 2	○ 3	○ 4	○ 5
B08	In South Africa my qualification as engineer is under valued	○ 1	○ 2	○ 3	○ 4	○ 5
B09	A larger salary will be a major deciding factor for me in order to emigrate	○ 1	○ 2	○ 3	○ 4	○ 5
B10	A large sign-on bonus will make my decision to emigrate easier	○ 1	○ 2	○ 3	○ 4	○ 5
Quality of life						
B11	Where I live (country wise) has a vast impact on my happiness in life	○ 1	○ 2	○ 3	○ 4	○ 5
B12	I am confident that my quality of life will be better in my emigration destination country	○ 1	○ 2	○ 3	○ 4	○ 5
B13	I am currently satisfied with my quality of life	○ 1	○ 2	○ 3	○ 4	○ 5
Patriotism						
B14	By emigrating I will be saying farewell to my home language and culture	○ 1	○ 2	○ 3	○ 4	○ 5
B15	If I emigrate I will try to obtain citizenship of the new country as soon as possible	○ 1	○ 2	○ 3	○ 4	○ 5
B16	The fact that my background, history and identity roots lays deep in SA will make it difficult for me to emigrate	○ 1	○ 2	○ 3	○ 4	○ 5
Family Matters						
B17	The fact that some of my family members have emigrated already will make it easier for me to do the same	○ 1	○ 2	○ 3	○ 4	○ 5
B18	My family will encourage me to leave SA	○ 1	○ 2	○ 3	○ 4	○ 5
B19	The fact that I will miss my family allot and see them very seldom will make the decision to emigrate very difficult	○ 1	○ 2	○ 3	○ 4	○ 5
Information / knowledge						
B20	If I have traveled more overseas it would make the decision to emigrate easier by knowing what to expect	○ 1	○ 2	○ 3	○ 4	○ 5
B21	I have spent some time on the internet looking for jobs abroad	○ 1	○ 2	○ 3	○ 4	○ 5
B22	The fact that I have friends in a specific country already will make it easier for me to emigrate	○ 1	○ 2	○ 3	○ 4	○ 5
B23	South Africa's primary and secondary education is one of the main reasons for our shortage in Engineers	○ 1	○ 2	○ 3	○ 4	○ 5
Logistics						
B24	The cost to move abroad with all my belongings; and the logistics thereof will make my decision to emigrate more difficult	○ 1	○ 2	○ 3	○ 4	○ 5
B25	The cost of living abroad is much higher than in SA	○ 1	○ 2	○ 3	○ 4	○ 5
B26	Adapting in a new country's environment and culture will be very challenging for me and my family	○ 1	○ 2	○ 3	○ 4	○ 5

SECTION C: FACTORS IMPACTING EMIGRATION

Please indicate to what degree the following factors in South Africa will impact your decision to leave?

(1=Very low degree, 2=Low degree, 3=Medium degree, 4=High degree and 5= Very high degree)

		Very low degree	Low degree	Medum degree	High degree	Very high degree
C01	Political (in general):	1	2	3	4	5
C02	Affirmative action	1	2	3	4	5
C03	Levels of taxation	1	2	3	4	5
C04	The lack of an ethnic dream	1	2	3	4	5
C05	The entrepreneurial climate	1	2	3	4	5
C06	Black Economic Empowerment	1	2	3	4	5
C07	Economical (in general):	1	2	3	4	5
C08	Lack of good working conditions	1	2	3	4	5
C09	Variety of career choices	1	2	3	4	5
C10	Opportunities to gain work experience	1	2	3	4	5
C11	Cost of living	1	2	3	4	5
C12	Ample entrepreneurial opportunities	1	2	3	4	5
C13	Social (in general):	1	2	3	4	5
C14	Lifestyle	1	2	3	4	5
C15	Crime and violence	1	2	3	4	5
C16	Racism	1	2	3	4	5
C17	Standards of education	1	2	3	4	5
C18	Personal safety and family security	1	2	3	4	5

Any other factors not listed above (Please specify):

SECTION D: CIRCUMSTANCES COMPARISON

How do you think do your present circumstances, in respect of the following factors, compare with those in your country of destination (or any other country):

(1=Much worse now than in other country, 2=Worse now, 3=The same as in other country, 4=Better now than in other country, 5=Much better now than in other country)

		Much worse	Worse	Same	Better	Much better
D01	**Political (in general):**	○ 1	○ 2	○ 3	○ 4	○ 5
D02	Affirmative action	○ 1	○ 2	○ 3	○ 4	○ 5
D03	Levels of taxation	○ 1	○ 2	○ 3	○ 4	○ 5
D04	The lack of an ethnic dream	○ 1	○ 2	○ 3	○ 4	○ 5
D05	The entrepreneurial climate	○ 1	○ 2	○ 3	○ 4	○ 5
D06	Black Economic Empowerment	○ 1	○ 2	○ 3	○ 4	○ 5
D07	**Economical (in general):**	○ 1	○ 2	○ 3	○ 4	○ 5
D08	Lack of good working conditions	○ 1	○ 2	○ 3	○ 4	○ 5
D09	Variety of career choices	○ 1	○ 2	○ 3	○ 4	○ 5
D10	Opportunities to gain work experience	○ 1	○ 2	○ 3	○ 4	○ 5
D11	Cost of living	○ 1	○ 2	○ 3	○ 4	○ 5
D12	Ample entrepreneurial opportunities	○ 1	○ 2	○ 3	○ 4	○ 5
D13	**Social (in general):**	○ 1	○ 2	○ 3	○ 4	○ 5
D14	Lifestyle	○ 1	○ 2	○ 3	○ 4	○ 5
D15	Crime and violence	○ 1	○ 2	○ 3	○ 4	○ 5
D16	Racism	○ 1	○ 2	○ 3	○ 4	○ 5
D17	Standards of education	○ 1	○ 2	○ 3	○ 4	○ 5
D18	Personal safety and family security	○ 1	○ 2	○ 3	○ 4	○ 5

Any other factors not listed above (Please specify):

Thank you for your contrubution

- END -