

# **Emigration Potential of South African Engineers**

## **Research Report**

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**MASTERS DEGREE IN BUSINESS LEADERSHIP,**

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## **ABSTRACT**

At the time of this study, South Africa found itself in an economic growth phase. This was coupled with an acute shortage of engineers in the country, as well as in a number of foreign countries, who found themselves in similar growth phases. Foreign firms actively embarked on campaigns to recruit South African engineers to alleviate their shortage, to the detriment of the donor country.

The objective of this study is to determine the propensity of engineers to emigrate and the main drivers for this in order to provide information to craft strategies to combat and mitigate the shortage of engineers.

The research process involved the consultation of relevant local and international literature regarding the skills shortage, the extent of emigration from South Africa and the main drivers for this. Data were collected by means of self-completed questionnaires in order to gauge the sentiment of graduate engineers towards emigration. One hundred and fifteen responses were received. Key associations and relationships were then analysed.

The study found that the engineers most likely to emigrate were either in their late twenties or were older than 55. They are likely to be white males from either the public or private sector, or who are self-employed.

Approximately 10% of graduate engineers are likely to leave South Africa within a short period of time (less than one year) as they have already taken some measures in order to do so, 16% may leave within two years and 27% may leave within the next five years.

Australia is by far the most popular destination for South African engineers, followed by Canada, Europe and the United Kingdom.

The main country-related drivers causing South African engineers to consider emigration are crime and violence, confidence in the South African government and political uncertainty. The main work-related driver causing engineers to consider emigration is the policy of affirmative action.

Of the engineers with a “high” emigration potential, just over half indicated that they would emigrate permanently.

In order to at least retain existing engineers in South Africa, the factors causing them to consider emigration should be addressed. In order to increase the number of engineers in the country, more emphasis should be placed on mathematics and science at school, thereby increasing the number of candidates who qualify for admission to engineering courses. It also needs to be ensured that universities have the capacity to train the increased number of engineers required on an ongoing basis.

## **DECLARATION**

I, Paul Godfrey William Eagar, identity number 7404165025088 with UNISA student number 31841686 hereby declare that this document and the content thereof is my original work in partial fulfilment of the degree of Master of Business Leadership at the Graduate School of Business Leadership. It has not been submitted before for any degree or examination at any university. Sources of information have been referenced and acknowledged.

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Paul Godfrey William Eagar

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## CHAPTER 1

### 1. ORIENTATION

#### 1.1 Introduction

Following political reform after the 1994 elections, the South African government committed itself to eradicating the massive social, economic and political disparities resulting from its apartheid past (Van Rooyen, 2002). This resulted in a great demand for housing, sanitation, electrification, water supply and other infrastructure together with a myriad of other services which the government is still in the process of delivering. In 2003 South Africa won the right to host the 2010 Soccer World Cup, which resulted in massive construction projects, both on sports stadiums and general infrastructure. Coupled with this, construction started on the multibillion rand Gautrain infrastructure. This has resulted in construction being the strongest-growing sector of the economy with an annual average growth rate of 12.1% over 2003 to 2006 (Smith, 2008). This compares very favourably with the 2.8% in the preceding decade, but has resulted in the industry only being able to meet less than half of its skills needs (45%) (Smith, 2008).

In addition, Eskom announced plans in 2008 to spend R300 billion over the next five years to increase electricity generating capacity (Bridge, 2008). At the same time, the economy experienced a boom, particularly in the commodities sector, with the prices of gold, platinum, copper and coal reaching record highs, thus fuelling growth in the mining sector (Styan, 2008). The success of all of the above projects are dependent at least in part on the availability of skilled South African engineers.

At the same time, a number of countries experienced shortages of engineers and actively embarked on campaigns to recruit engineers from South Africa (Styan, 2008). Significant numbers of engineers have been leaving South Africa to seek employment elsewhere, although the exact number can not be accurately estimated as neither the Department of Home Affairs nor the Engineering Council of South Africa (ECSA) keep accurate records of this statistic (Styan, 2008). Johan Pienaar, registrations manager at ECSA, estimates the number of registered professional engineers emigrating annually to be in the region of 300 (Styan, 2008).

South African universities produced approximately 1 300 graduate engineers in 2007, which equates to 28 engineers per million people. This compares very unfavourably with the USA which produced 380 engineers per million people, or even with developing countries such as China which produced 225 and India which produced 95 (Sothoane, 2007). The number of graduate engineers produced per annum has been estimated by ECSA to be 1 000 fewer than that required to make up for the increased demand in engineering skills, as well as to replace those engineers who are retiring (Sothoane, 2007). This does not even take into account the number of engineers lost to the country through emigration. Even if South African schools were to produce learners which met the entry requirements to study engineering at universities, the capacity of the universities to train such a vast number of additional engineers per annum would be questionable.

The retention of medical professionals in South Africa has received attention in recent years. The South African government has implemented various strategies to retain doctors and nurses in the country with varying degrees of success (Breier and Wildschut, 2006). However, very few measures have been taken by government to attract and retain engineering skills.

This study attempts to identify which fundamental socio-political and economic drivers are directly impacting on South Africa's ability to attract and retain engineers. Any strategy aimed at addressing the shortage of engineers must start with ways in which these drivers can be addressed. Studies such as this one are critical to ascertain the underlying trends and perceptions amongst engineers with regards to migration and contribute to the foundation for developing a strategy to retain them.

## **1.2 Research objectives**

The objective of this study is to gauge the propensity of engineers to emigrate and the main drivers for this. Current literature regarding emigration and intention to emigrate does not focus specifically on the engineering discipline. With a shortage of engineers in South Africa as well as opportunities available overseas, this study attempts to identify which drivers lead to South African engineers considering working overseas rather than in their home country.

This study will contribute, at least in part, to our understanding of the situation and help to develop accurate data on the trends and perspectives of South African engineers towards international migration. The study will assist in crafting strategies to combat and mitigate the migration of South African engineers, as well as strategies to combat the general shortage of engineers.

### **1.3 Research questions**

The objectives of this study are to provide data that will contribute to answering the following research questions:

1. What is the current emigration potential amongst South African engineers?
2. Where are they most likely to emigrate to?
3. What are the typical demographic characteristics of those intending to emigrate?
4. What factors are causing South African engineers to consider emigration?
5. How likely are they to return should they emigrate?
6. What measures could be instituted to combat the shortage of engineers in South Africa?

### **1.4 Importance of the study**

The emigration of educated citizens from South Africa is becoming increasingly prevalent, and the costs to the country are extremely high (Mittner, 1999). The loss of skilled individuals has a knock-on or multiplier effect in that organisations are not able to function as efficiently as possible if suitable skills are not available, thereby resulting in them becoming less competitive. Newly qualified engineers may not be mentored and trained effectively if suitable numbers of skilled engineers are not available to perform this function. Engineers play a key role in a number of industries, such as manufacturing and mining, which earn foreign exchange for the country. A slow-down in these industries occurring as a result of a lack of engineering skills would have a knock-on effect on various service providers, such as legal and accounting firms as well as on suppliers of goods to these industries which could further stunt economic growth. Engineers are often responsible for ensuring that standards of safety and quality are implemented in the workplace. A lack of engineering skill may seriously hamper the capacity of industry to ensure that

standards are maintained. Emigration of professionals robs the country of considerable investments in training and education, particularly in the case of young engineers emigrating as the country fails to receive any appreciable return on its direct investment in educating them. The loss of upper-end consumers reduces the demand for goods and services, further resulting in a slow-down in the economy. Taxes payable to government due to the income generated either directly or indirectly through the activities of engineers would be affected by an exodus of engineering skill.

The Grant Thornton's International Business Report ranked South Africa in the top eight countries placing staff attraction and retention high on their agenda (Thornton, 2006). 61% of respondents reported that the greatest impact of staff turnover is increased operating costs followed by an increased workload for remaining staff (56%), which also absorbs the time of management and those employed in human resources positions. Other problems include loss of business orders to competitors (38%), difficulties introducing new working practices (37%), a fall in customer service standards (36%) and a fall in product quality standards (32%). This is exacerbated by emigration which results in an ever-decreasing pool of resources to replace those who have left.

Similar results were obtained by Schuster (1994) who focused specifically on emigration and the effects on an organisation and economy. He stated that emigration has detrimental effects on the sending country, individuals and organisations. The direct cost of emigration involves national issues such as the loss of professionals which play a vital role in contributing to the growth of the economy, thereby leaving the country weakened by the exodus (Schuster, 1994). In addition, as citizens leave a country, those who remain can suffer low morale and discontentment as emigration is perceived as leading to an economic downturn and associated lowered quality of life. This can lead to further negative consequences, such as low employee organisational commitment and productivity, further impacting on the economy (Schuster, 1994). On a personal level, emigration or even the contemplation of emigration can cause stress, guilt, conflict and interpersonal strain (Hartman and Hartman, 1995).

A survey conducted by Allyson Lawless, former president of the South African Institute of Civil Engineering, shows that 79 of the country's 231 local municipalities do not have civil engineers, technologists or technicians, which is impacting severely on the ability of municipalities to provide an adequate level of service (Styan, 2008).

According to the global growth consulting firm, Frost and Sullivan, Eskom will spend R300 billion over the next five years on expanding electricity capacity, but this amount may increase with government plans to accelerate some projects in an attempt to alleviate South Africa's current power crisis. Final expansion programme costs are estimated to be more than R1 trillion (Bridge, 2008). Eskom's new build program will bring 20 000 MW of additional power generation capacity on line by 2025. According to Mr. Boussougouth from Frost and Sullivan, "The South African electricity crisis could trigger an across the board deterioration in confidence for the country if the right measures are not implemented" (Bridge, 2008). The availability of engineers with suitable skills will be critical in ensuring the success of this ambitious project.

Despite that fact that there is currently a shortage of engineers, very little work has been conducted on establishing the effect that emigration could have on the availability of skilled engineers in South Africa.

South African citizens leaving the country from the international airports of Johannesburg, Durban or Cape Town were required by the Department of Home Affairs to complete a departure form indicating occupation and duration of stay, amongst other things (South Africa. Statistics South Africa, 2005.). This requirement was enforced from 1970 to 2007. These forms were then used to gauge the number of South Africans emigrating, although the accuracy of this measurement was often brought into question as these records did not correspond with the records of the receiving countries as acknowledged by Statistics South Africa. However, the Department of Home Affairs no longer requires these forms to be completing upon departure, thus making it even more difficult to estimate the number of South African engineers who are emigrating.

Similarly, ECSA does not keep a record of the number of engineers emigrating. Johan Pienaar from ECSA estimated that in the region of 300 registered professional

engineers leave South Africa every year (Styan, 2008). This is based on the number of engineers who cancel their registrations before they leave. However, not all practising engineers are registered with ECSA and those who leave may choose not to cancel their registrations.

In order to plan for future engineering skills shortages, it is imperative that the future impact of emigration be assessed and that measures be instituted to stem the exodus and to alleviate the shortage. This can only be accomplished if the reasons causing engineers to consider emigrating are fully understood.

### **1.5 Limitations and delimitations of the study**

Creswell (1994) differentiates between limitations and delimiters. He defines delimiters as narrowing the scope of a study and limitations as potential weaknesses in the study.

This study was confined to graduate and postgraduate engineers. The reasons for choosing this sample group include the following:

- Graduate and postgraduate engineers represent the highest academic level within the profession.
- Entry level requirements for studying engineering courses at South African universities are higher than those at technicons, with the result that the pool of eligible matriculants who intend studying engineering at university is diminished.
- South African engineering degrees are commonly accepted by most countries identified as preferred destinations by potential South African emigrants (Sothoane, 2007). Registration with ECSA as a professional engineer further facilitates recognition of a common standard.

As prevailing socio-economic conditions in South Africa at the time of the study were expected to have an impact on the propensity of an individual to emigrate, only those residing in South Africa at the time of the study were chosen as the sample group. The objective of the study was to quantify potential future emigration patterns and thus sentiments of those who had already emigrated were excluded from the study,



The study was confined to South African nationals only. The reasons for this are as follows:

- Foreign engineers living in South Africa are less likely to have strong ties with the country compared with nationals.
- Patriotism towards South Africa could potentially differ between nationals and foreigners and may have an impact on propensity to emigrate.
- In general, foreign nationals are able to return to their country of origin more easily than South African nationals are able to emigrate as work permits and immigration documentation is not required for foreigners returning home.

This study does not attempt to quantify the current shortage of engineers within South Africa.

Potential limitations of the study include the following:

- The measurement tools rely on the perceptions of the respondents and although every effort has been made to reliably predict emigration potential, there remains a difference between those intending to emigrate and those who will actually go.
- The decision by an individual to emigrate may be sparked by a single event (for example, a violent act of crime) even though the individual may have had a low potential to emigrate before the event occurred;
- It is possible that only those members of the sample group who feel very strongly about the subject responded, thereby influencing the representativeness of the results.
- Only those with valid email addresses were contacted. However, this is not expected to influence the results as it is fair to assume that most engineers have access to email and computers, which are important to their profession in most cases.
- This study does not take into account the number of engineers which could potentially be lost to other professions within South Africa.

This study does not intend casting judgment on the moral, ethical or legal considerations of engineering migration.

## **1.6 Outline of the research report**

The section below briefly summarises the content of each chapter of this research report.

### **1.6.1 Chapter 1 - Orientation**

This introductory chapter provides the direction and states the main focus of the study. The background to the study including the supply and demand for engineers is given. Research objectives and questions are discussed, as well as the importance of the study. The delimitations which define the boundaries of the study are discussed, as well as potential limitations relating to the research methodology chosen and representativeness of the sample.

### **1.6.2 Chapter 2 - Foundations of the study**

This section starts by describing the current state of the engineering industry within South Africa. The final part of this chapter deals with theory regarding emigration and the retention of skills.

### **1.6.3 Chapter 3 - Literature review**

This provides a general overview of the literature consulted with regards to emigration. It reports on the extent of emigration and main drivers for this.

### **1.6.4 Chapter 4 - Research methodology**

This chapter describes the research methodology used, including how intention to emigrate was measured, how the sample was selected, data collection and the measuring instruments used. It also describes how the data were analysed in order to be able to answer the research questions.

### **1.6.5 Chapter 5 - Research results**

This chapter indicates the results of the study. A number of figures are included based on the data obtained through questionnaires, which are then described and interpreted.

### **1.6.6 Chapter 6 - Discussion, recommendations and conclusion**

This chapter discusses the outcome of the study with cross references to other relevant studies. It also makes recommendations regarding retention strategies for engineers and the training of additional engineers. The conclusion summarises the findings of the study and its contribution to the existing body of knowledge regarding this subject.

There is a great need for additional information to be obtained regarding the emigration of South African engineers given the current shortage and dire consequences of not having sufficient engineering skills available. Only once the drivers causing engineers to consider emigration are properly understood, can strategies be crafted in order to combat emigration and avert potential disaster. This study will serve to provide the necessary insights required.

## **CHAPTER 2**

### **2. FOUNDATIONS OF THE STUDY**

The first part of this section reviews the current state of the engineering industry within South Africa. The second part deals with theory regarding emigration and retention of skills.

#### **2.1 Current state of the engineering industry within South Africa**

This section is meant to provide a general background to the engineering industry in South Africa. It provides a rough estimate for the number of graduate engineers practising in South Africa, provides evidence of a current shortage of engineers in the country and provides some statistics regarding the training of engineers in South Africa.

##### **2.1.1 Number of graduate engineers practising in South Africa**

The engineering sector does not have an accurate register of professionals in the country. According to information obtained from the ECSA database at the time of this study, there were 13 826 registered professional engineers with South African addresses, while the overall number of practicing engineers is estimated by ECSA to be approximately double this number (Bwalya, 2008).

According to Ravi Nayagar, the chief executive officer of ECSA in 2007, the absence of legislation that forces all practicing engineers to register has contributed to the industry's inability to accurately measure the shortage of skills within its ranks (Styan, 2008). Registration with ECSA was only a statutory requirement for engineers performing consulting work, taking responsibility for certain types of engineering work and performing functions as laid down in certain statutes such as the National Building Regulations. The Engineering Profession Act, 2000 (Act No. 46 of 2000) makes provision for identification of work of an engineering nature, which is aimed at establishing a system of compulsory registration of all persons practising their profession (Roux, 2002). Although a similar provision was contained in the previous Act (Act 114 of 1990), the significance of the new act is that government has indicated its clear resolve that such a system must be implemented and should be

put into effect as soon as possible. Government's intention is to ensure broader accountability of engineering professionals. One of the reasons why engineers were previously reluctant to register with ECSA if not forced to do so was that this would increase their personal liability which could include criminal charges being laid against them. The requirement for compulsory registration may thus influence an engineer's decision to consider emigration.

According to Johan Pienaar, registrations manager at ECSA, engineers are being poached by other industries due to their analytical skills (Styan, 2008). "Industrial engineers are being snatched from the engineering profession, mainly by the banking sector," he says. "Engineers are excellent process thinkers and are sought after in various sectors of the economy for their project management and financial management skills," comments Pienaar.

Not only does ECSA not have an accurate record on the number of engineers practicing in South Africa, but it is also not able to provide accurate data regarding the number of registered engineers who have emigrated. In October 2008, ECSA had 1 026 registered engineering professionals with overseas addresses in its database (Bwalya, 2008). However, engineers living abroad may choose not to renew their subscriptions with ECSA, which could put the number of South African engineers practicing overseas far higher.

### **2.1.2 Shortage of engineers**

Science and Technology Minister Mosibudi Mangena stated in October 2007 that South Africa was short of 1 000 civil engineers with five years' relevant experience. (Styan, 2008). Compared with the 238 civil engineers who graduated in 2002 who would by now have the relevant experience, there will be a substantial shortfall. Mangena further commented that government would be the biggest loser if the engineering skills challenge is not solved because its multibillion-rand infrastructure development plan depends on the availability of such skills.

Local water and sanitation non-governmental organisation Mvula Trust's policy and advocacy director, Laila Smith, says South Africa is suffering from a "calamitous decline" in the number of municipal civil engineers, resulting in clean water supplies

being under threat in many areas, with “dozens” of municipalities employing junior or inexperienced engineers. She believes that the country is in a state of crisis in the water sector (Naidoo, 2008). Similarly, Cape Town water and sanitation director Siphosiso Mosai says that there “are insurmountable challenges”, particularly in trying to provide water to the city’s informal areas, but that does not translate into a water sector that is in crisis. Mosai says that while the city cannot source many old, white male engineers to employ, it employs young engineers who are “up for a challenge”.

At a recent Engineering Council of South Africa workshop, it was emphasised that the maintenance and operation of water treatment facilities, particularly at municipal level, was a major challenge. A survey done by Lawless shows that 79 of the country's 231 local municipalities do not have civil engineers, technologists or technicians. There are more than 1 000 vacancies for these skills at municipalities countrywide (Naidoo, 2008).

Construction, which according to the department of finance is the strongest-growing sector of the economy at an annual average rate of 12.1 % over 2004-2006, compared to only 2.8 % in the preceding decade (1994-2003), can barely meet half of its skills needs (45%) which holds serious ramifications for the massive amount of construction which has been planned (Smith, 2008).

### **2.1.3 Attractiveness of South African engineers to foreign countries**

South African engineers registered with ECSA are automatically members of the Engineers Mobility Forum (EMF) (Hay, 2008). The purpose of this forum is to establish and maintain an international register of professional engineers. The EMF agreement is a multi-national agreement between engineering organisations in the member jurisdictions which creates the framework for the establishment of an international standard of competence for professional engineering. The academic qualifications and competence of South African professional engineers registered with ECSA are thus recognised by the engineering organisations of member countries including Australia, Canada, Hong Kong, China, Ireland, Japan, Korea, Malaysia, New Zealand, the United Kingdom and the United States of America. This increases the attractiveness of South African engineers to these countries.

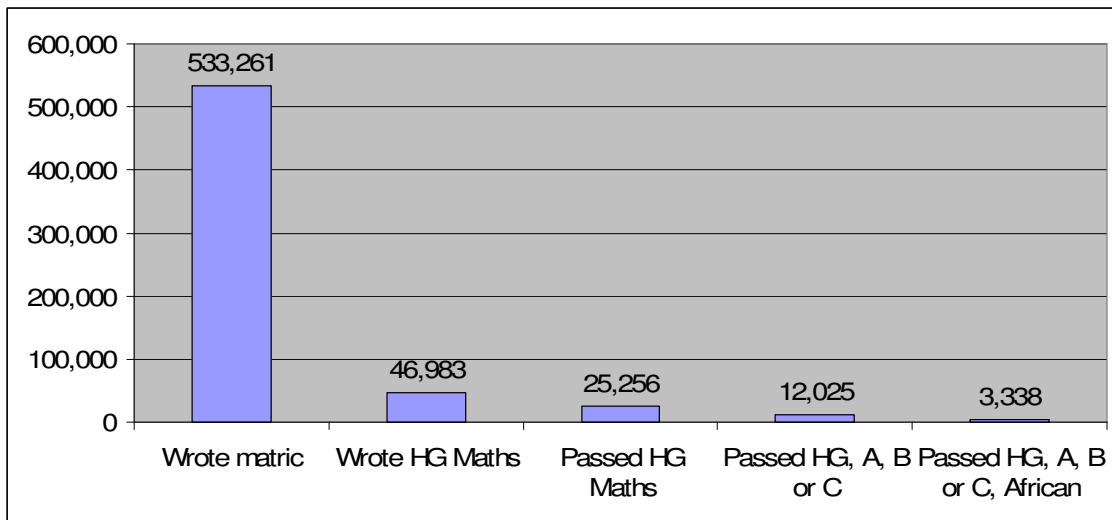
According to Hamlyn (2008), South African engineers are seen abroad as being hard-working, fitting in socially, adapting well to local conditions and having diverse

and appropriate experience making them suitable for employment in a variety of industries. This was particularly evident of South African engineers employed in Australia. In many cases, they were also prepared to work for lower remuneration compared with local employees.

#### 2.1.4 Training of engineers

The shortage of engineering skills can be attributed partly to the fact that secondary schools are not providing universities with learners who qualify to enter the profession because of poor pass rates in mathematics. Figure 2.1 indicates selected statistics for the 2007 academic year (South Africa. Ministry of Education, 2007). Of the 533 261 learners that wrote matric, only 12 025 passed mathematics with an A, B or C mark, which is considered to be the minimum requirement for those wishing to study engineering. Of those, only 3 338 were African.

**Figure 2.1: Matric mathematics statistics for 2007**



Source: South Africa. Ministry of Education (2007)

The low number of matriculants passing higher grade mathematics can be attributed in part to the lack of a sufficient number of adequately trained teachers as explained by Science and Technology Minister Mosibudi Mangena, who stated that 56% of the country's mathematics and science teachers were not properly qualified (Mgibisi, 2007). Learners who do pass higher grade mathematics have the option of following any one of a number of careers, of which engineering may not always seem the most

attractive. To make matters worse, a study conducted by the South African Institute of Electrical Engineers concluded that school grades are no longer considered a reliable measure of preparedness for university study (Styan, 2008).

South Africa is further challenged with the problem of achieving the balance between obtaining enough students, and having enough lecturers and professionals to teach and train them (Cameron, 2008). According to Lawless, there are simply not enough lecturers in the system for South Africa to meet its goal of graduating 1 000 more engineers a year than the current level of 1 300. Lecturers are reportedly swamped with work, and have become indentured 'slaves to the system' (Cameron, 2008). Lawless further states that, "Within tertiary institutions, respect for the lecturing professionals has ceased to exist. They are faced with a choice between sticking it out in academia with its modest financial rewards and many stresses, or offering their services in a workplace, that has a desperate need for engineering professionals and artisans. It is definitely not a healthy environment for them to be in." This does not bode well for the future training of engineers in South Africa.

Once students have graduated, they still need to obtain appropriate experience and be guided by a mentor in order for them to become fully fledged engineers (Cameron, 2008). However, without experienced engineers who have the time and capacity to integrate new engineers into the system, they will remain relatively ineffective. For this reason, many companies and institutions have embarked upon exercises to recruit retired engineers in order to fulfil a mentoring and training role (Cameron, 2008). Opportunities such as these exist for retired Transnet engineers to be recruited to train Gautrain engineers.

## **2.2 Theoretical foundation**

An individual must feel sufficiently motivated to emigrate before taking any action to do so. A number of motivational theories have been established to explain this behaviour, some of which will now be investigated.

### **2.2.1 Maslow's hierarchy of needs theory**

Allen (2003) cites Maslow's hierarchy of needs as the most frequently used human-needs motivational model. Maslow's theory states that there are a number of



successive levels of human needs and only once the needs at the lower level have been satisfied, will an individual endeavour to satisfy higher order needs. These levels from lowest to highest are:

Level 1: Physiological needs – these include all the basic human needs such as food, water, sanitation etc.

Level 2: Security needs – individuals need to feel that they are protected from harm, violence, disease, war and poverty. From an employment perspective, they need to feel assured of continued income and employment.

Level 3: Belonging / social needs – individuals need to feel love, acceptance and approval from others. They need to feel that they are part of a group and receive recognition from the group.

Level 4: Esteem / ego needs – these needs include self-worth, status, power, self-confidence and to be individually recognised.

Level 5: Self actualisation needs – individuals need to feel that they are challenged to achieve their full potential.

From the perspective of this study, engineers are likely to have satisfied their level 1 needs when they are able to earn enough income to be able to afford to purchase all the basic necessities for themselves and their families. The basic amenities must obviously also be available for purchase. Electricity may be considered a basic necessity by many.

Level 2 needs are satisfied when an individual feels that they live in an environment where they can be safe from harm and feel secure in their employment. This includes not being subjected to crime and violence and feeling confident that their interests will be protected in future by government. Should this not be the case, an individual would feel motivated to take action in order to satisfy this need.

Level 3 needs from an employment perspective relate to feeling part of group which shares similar ideals and work ethics where an individual is able to make a

contribution. Robbins (1998) states that in order to retain technical professionals, it is critical to ensure that they can respect and work with those who manage them. To a lesser extent, it is also important that they respect those who work with them, particularly when performance of the group is measured as a whole.

Level 4 needs are met when an engineer feels that their worth is recognised and that they are adequately rewarded for this, both financially and through receiving intangible rewards. They are also afforded a level of status which is in line with their expectation.

Level 5 needs are met when an engineer feels that they are afforded sufficient promotional opportunities and are able to reach the pinnacle of their careers. The level of technology they deal with, advanced training which they are afforded and level of challenge offered by their jobs contribute to satisfying this need.

### **2.2.2 Herzberg's two-factor theory of motivation**

Herzberg's research found that all variables that make people feel positive or negative about their work can be grouped into one of two categories, namely motivators and hygiene factors (Robbins, Odendaal & Roodt, 2003)

Herzberg relates more intrinsic factors such as achievement, recognition, work content, career advancement, responsibility and the like, to job satisfaction. On the other hand, extrinsic factors such as status, security, remuneration, supervision and the like, are related to job dissatisfaction.

According to Herzberg, removing dissatisfying aspects (hygiene factors) from a work environment will not necessarily constitute job satisfaction. Herzberg maintains that job satisfaction is a function of challenging, stimulating activities or work content, to which he refers to as motivators.

The presence of hygiene factors will not lead to a state of job satisfaction, but rather to a state of no dissatisfaction. Hygiene factors on their own could therefore not motivate employees. In order to do that, the motivators must also be present. The opposite is also true. For motivators to operate as such, the hygiene factors must be present.

### **2.2.3 The expectancy theory of Victor Vroom**

Vroom's (1964) expectancy theory, which falls into the category of process theories, considers the whole work environment and argues that individuals are motivated to work when they anticipate achieving what they expect from their jobs. Individuals who feel that no matter how hard they work, they will not reach the desired performance level are unlikely to be motivated (Open University, 2003).

### **2.2.4 The equity theory**

Adams' equity theory (Robbins, 1998) proposes that the individual still balances inputs and outcomes, efforts and rewards, but does this in comparison to others. Depending on the outcome of this comparison, they become either motivated if they perceive themselves as being awarded equitably or even over rewarded, or demotivated if they perceive inequity or under reward.

Trevor (2001) found that the effect of job satisfaction on turnover is moderated by and has a positive correlation with education, cognitive ability and occupation-specific training. This suggests that more mobile employees with high educational levels, high cognitive ability and high occupation-specific training tend not to be concerned with or affected by an economic landscape.

These arguments suggest that a link exists between motivation, job satisfaction and retention. Engineers who feel that they will not be able to attain sufficient levels of motivation or job satisfaction through employment in South Africa may decide to consider emigration.

### **2.2.5 The push-pull theory**

Theories that try to explain why people move from one country to another have been propounded. One such theory is the "pull-push" factor theory (Mattes and Richmond, 2002). According to this theory, in order for emigration to occur, there have to be "push" or negative factors in the subjects' current country of residence which cause them to move. Such "push" factors may include low salaries, scarce employment opportunities, political unrest and lack of infrastructure. On the other hand, "pull"

factors have to be present in the destination country, such as high prospects of employment, higher salaries and political stability.

“Push” and “pull” factors may exist in both the sending and receiving countries. Hence, before making a decision to move or not, the potential emigrant weighs these against each other. The effect of “push” and “pull” factors will be discussed in more detail later in this report in the light of the research findings.

Besides the “push” and “pull” factors, there are potential obstacles which influence the decision of a would-be emigrant. These obstacles may include expenses involved in relocating to another country and migration laws (Mattes and Richmond, 2003).

### **2.3 Chapter summary**

It was found that there is not an accurate record of the number of engineers practising in the country as not all engineers are forced to register with ECSA, although this may change in the near future. Forcing engineers to register may involve them being exposed to additional liability which may influence their decision to consider emigration. A number of sources revealed that there is a severe shortage of engineering skills and that South African engineers are sought after overseas. It is estimated that an additional 1 000 engineers are required to be trained per annum. However, the ability of the schooling system to produce learners with adequate abilities in mathematics and science suitable for enrolment into engineering courses at university and the capacity of engineering faculties to train these additional engineers was questioned.

Theories discussed in this section which are applicable to the subject of emigration include Maslow’s hierarchy of needs theory, Herzberg’s two-factor theory of motivation, the expectancy theory of Victor Vroom, the equity theory and the push-pull factor theory.

## CHAPTER 3

### 3. LITERATURE REVIEW

In preparing this review, literature was consulted from both local and international researchers who have written on the subject of emigration. It refers to reports from institutions such as Statistics South Africa, the Engineering Council of South Africa, the South African Institute of Electrical Engineering and the South African Institute of Civil Engineering as well as information from academic journals and popular media.

This section provides a general overview of the literature consulted with regards to emigration. It reports on the extent of emigration and main reasons for this, as well as retention strategies commonly employed.

#### 3.1 Official documenting of immigration and emigration

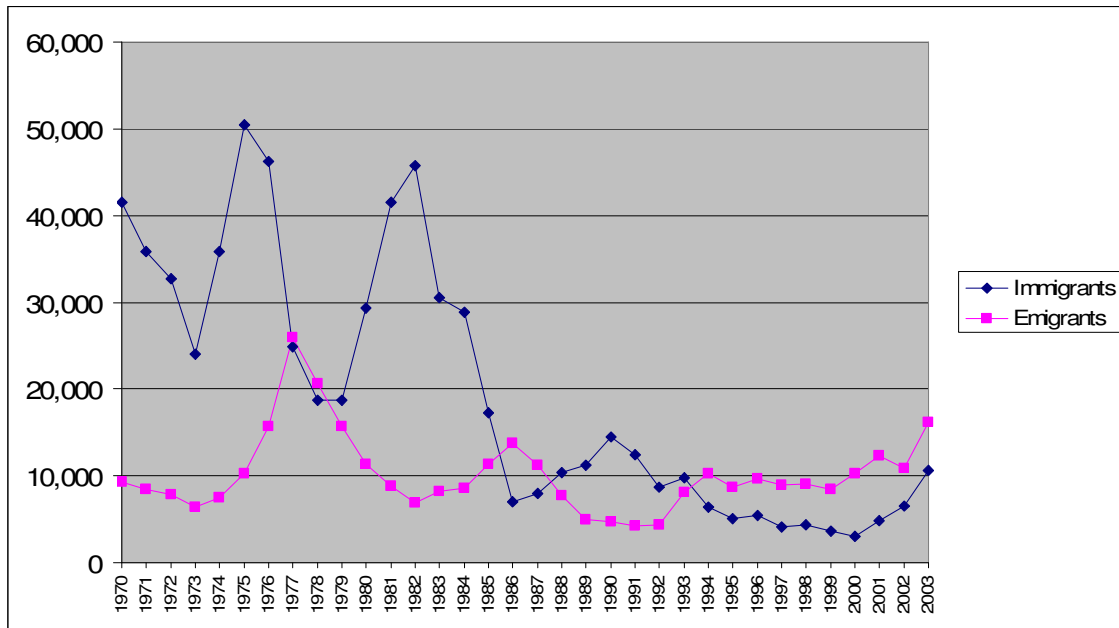
The “Documented Migration” report issued by Statistics South Africa (South Africa. Statistics South Africa, 2005) contains information relating to the number of documented immigrants and self-declared emigrants. The data for emigration is obtained from forms BI-117 which were required by law to be completed by those departing for international destinations from one of the country’s three international airports in Durban, Cape Town and Johannesburg during the period of 1970 to 2007. Only those indicating that the purpose of their travel was emigration were included in the emigration statistic. However, it was not feasible for the Department of Home Affairs to accurately verify the contents of these forms (South Africa. Statistics South Africa, 2005). A departing emigrant may not always complete the form and even if the form is completed, the intending emigrant may select a category other than emigration when indicating their purpose of travel. Even if the traveller is not intending to emigrate and indicates this on the form, they may choose to stay overseas permanently. The emigration statistic reported by Statistics South Africa therefore refers to “self-declared emigration” only, which is different from actual emigration.

The data for immigration is obtained from forms BI-55, BI807 and BI-834 which are completed by immigrants who have been approved by the Department of Home Affairs as immigrants upon their arrival in South Africa (South Africa. Statistics South Africa, 2005). Illegal immigrants are excluded from the statistics. The report also contains some information on migrants, such as age and occupation as well as destination country for emigrants.

The report is meant to be published annually. However, the last report was published in 2005 and contains information for 2003. The requirement for completing departure forms was dropped in 2007, which means that this method for gathering data regarding emigration, however crude, is no longer available.

According to the 2005 Statistics South Africa report, there have been wide fluctuations in the trends of documented immigration to South Africa. Figure 3.1 shows that there were two prominent peaks. One peak occurred in 1975 and the other in 1982. The 1975 peak was largely due to the doubling in the number of immigrants from the United Kingdom between 1973 and 1975 and to some extent, immigration into South Africa from Mozambique after the country gained independence in that year. The 1982 peak was largely due to immigration to South Africa from the United Kingdom, China and Portugal. From 1990 onwards there was a downward trend in the number of documented immigrants to SA until 2001 when the trend started increasing. In 2003 the number of documented immigrants to South Africa was 10 578, an increase of 61.6% as compared to the 2002 figure of 6 545. However, according to statistics published in the annual report of the Department of Home Affairs for the period 2006/7, a total of 266 067 illegal foreigners were deported over this period and an estimated 44 212 asylum seekers were registered (South Africa. Department of Home Affairs, 2006/7). The number of persons thus entering the country either illegally or by seeking asylum is thus likely to be much higher than the number of immigrants accounted for by the Statistics South Africa report.

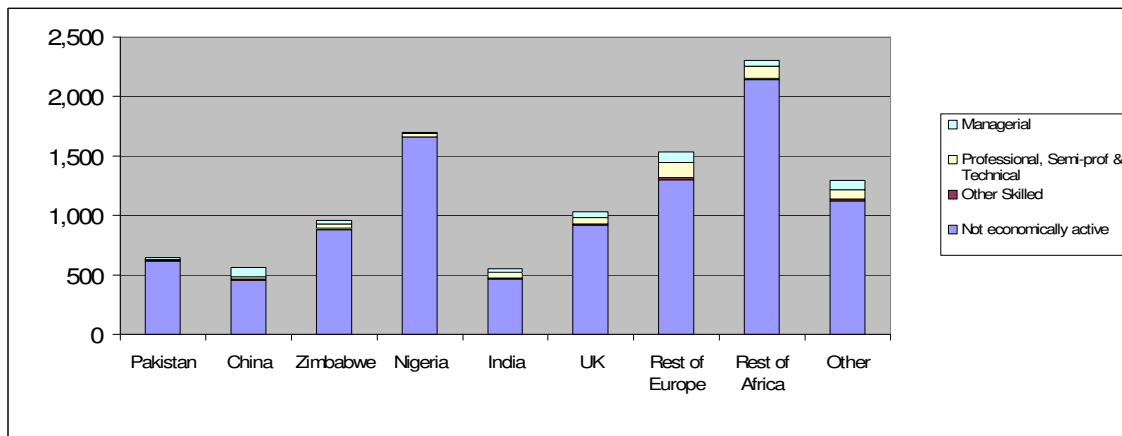
**Figure 3.1: Documented immigrants and self-declared emigrants, 1970 - 2003**



Source: South Africa. Statistics South Africa (2005)

Figure 3.2 shows the distribution of the leading source countries of documented immigrants.

**Figure 3.2: Source countries of documented immigrants to SA in 2003**



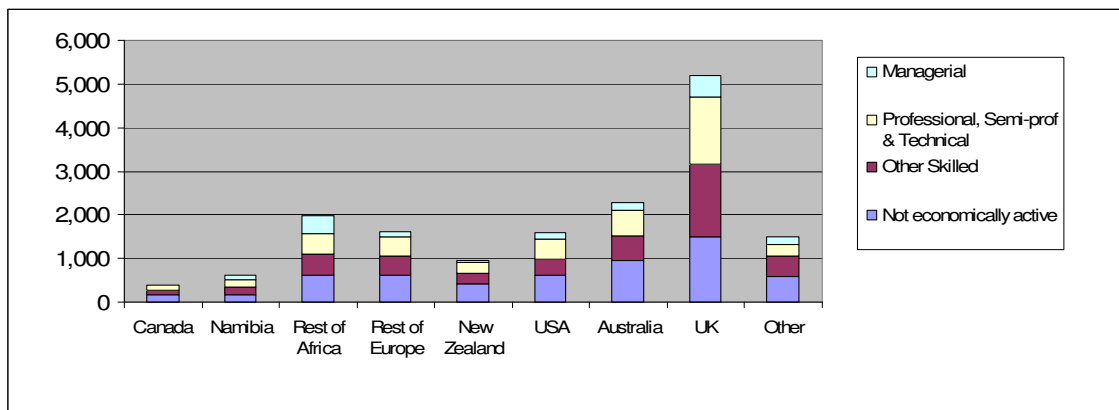
Source: South Africa. Statistics South Africa (2005)

During 2003 Nigeria was the leading source country of documented immigrants. A total of 1 698 documented immigrants (16.1%) from Nigeria came to settle in South Africa. Other leading source countries of documented immigrants were: the United Kingdom, 1 032 (9.8%); Zimbabwe, 959 (9.1%); Pakistan, 645 (6.1%); China, 561

(5.3%); India, 551 (5.2%) and Germany, 365 (3.5%). As can be seen in figure 3.2, the vast majority of documented immigrants are not economically active. The professional, semi-professional and technical immigrants to South Africa from all source countries numbered less than 500. Some of these may have been engineers, but as Statistics South Africa keeps no record of specific occupations of immigrants, an official estimate for the number of engineers immigrating to South Africa is not available.

The emigration data from 1970 to present show three major peaks. These peaks occurred in 1977, 1986 and 1994. During those peak years the leading destination country for self-declared emigrants was the United Kingdom. In the period from 1994 to 2002 the trend in self-declared emigration from South Africa to other countries has been gradual. In 2003 the number of self-declared emigrants turned out to be 48.4% higher than that of 2002. The number of self-declared emigrants increased from 10 890 in 2002 to 16 165 in 2003. However, this data is of limited value to this study as it is not current, it does not document professions separately and is not considered to be reliable.

**Figure 3.3: Destination countries of South African emigrants**



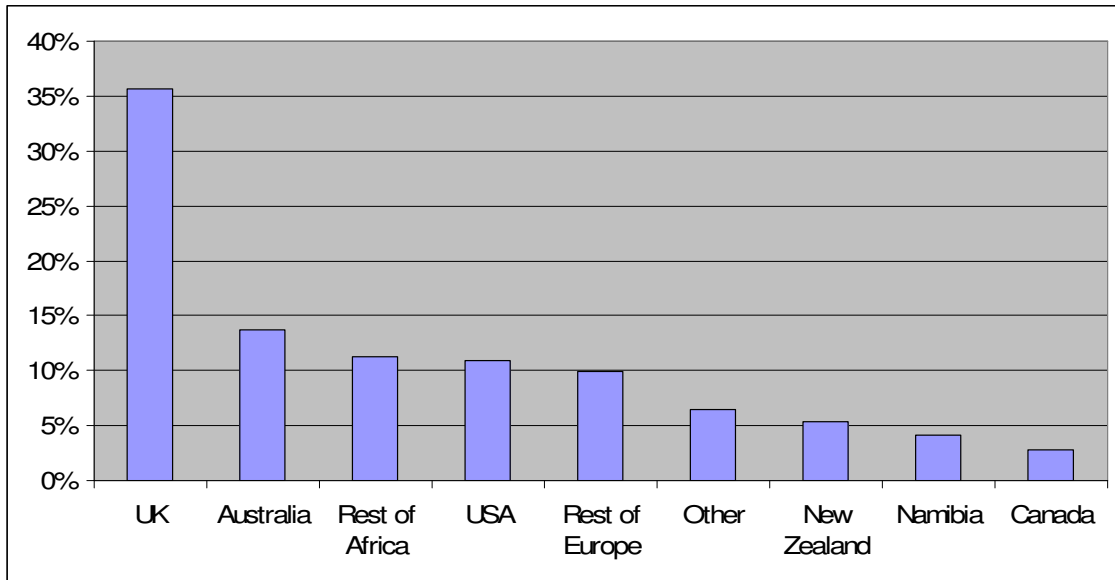
Source: South Africa. Statistics South Africa (2005)

Figure 3.3 indicates that the United Kingdom was the most popular destination country for South African emigrants. It was also the most popular destination for professional, semi-professional and technical personnel, which includes engineers. However, it is not possible to estimate what percentage of the professional and technical personnel from this data set are engineers. Also, the category of managerial personnel may include an unknown number of engineers.



Figure 3.4 indicates the proportion of South African professional, semi-professional and technical emigrants choosing various emigration destinations. This study will ascertain whether or not the destinations chosen by South African engineers emulate this distribution.

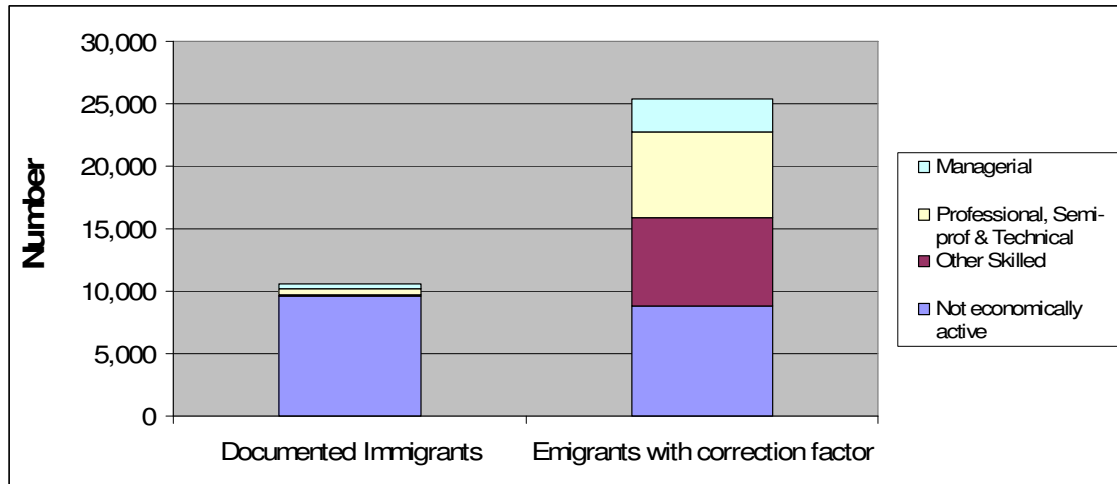
**Figure 3.4: Most popular destinations for professional, semi-professional and technical emigrants from South Africa**



Source: South Africa. Statistics South Africa (2005)

The total number of documented emigrants and immigrants for 2003 as captured in the 2005 Statistics South Africa report indicates that the number of emigrants with professional, semi-professional and technical qualifications is far greater than the number of immigrants with the same set of skills as depicted in figure 3.5. A correction factor was applied by Statistics South Africa in order to account for the discrepancy between data collected by the South African Department of Home Affairs and similar departments of overseas countries, which show a higher number of immigrants from South Africa.

**Figure 3.5: Total documented immigrants and emigrants, 2003**



Source: South Africa. Statistics South Africa (2005)

The accuracy of the Statistics South Africa data was further questioned by Van Rooyen (2001) who, using census data, found that at least one million white South Africans emigrated between 1985 and 1996. This is not consistent with the estimates of emigration numbers put forward by Statistics South Africa. This study attempts to gauge the depth of the emigration problem by gauging directly the number of engineers intending to emigrate, rather than relying on historical data which appears to be unreliable.

### **3.2 Non-official estimates of engineering emigration numbers**

Anecdotal evidence seems to indicate that South Africa is currently experiencing a large number of emigrations by skilled individuals as described below. This is partly due to a number of factors which have recently changed which could influence an individual's propensity to emigrate. These factors include the uncertain political future of South Africa, the effect that rolling electricity black-outs will have on the economy and the fact that various countries are currently experiencing shortages of skilled engineering personnel. As could be expected, there is not much in the way of current scholarly academic literature which deals with studies relating to the current socio-political and economic environment in which engineers in South Africa currently find themselves.

ECSA does not keep a record of the number of engineers emigrating. Johan Pienaar from ECSA estimated that in the region of 300 registered professional engineers leave South Africa every year (Styan, 2008). This is based on the number of engineers who cancel their registrations before they leave. However, not all practising engineers are registered with ECSA and those who leave may choose not to cancel their registrations. This is thus not considered an accurate method of gauging the number of actual engineering emigrations.

Pienaar said further that in November 2005, about 14 900 engineers were registered with ECSA. In November 2007, the number stood at 14 811 - this despite 1 300 engineers qualifying every year at South African universities (Styan, 2008). However, again, this is not a reliable estimation for the number of engineers who have emigrated. Engineers could simply just have failed to renew their ECSA membership, or they could have emigrated without cancelling their membership.

According to Seeff Properties Group's chairman, Samuel Seeff, an increased number of people contemplating emigration resulted in a flood of homes and other properties coming on to the market across the country from November 2007 to January 2008, with requests for property evaluations taking off. The reason most commonly cited for valuations and selling was emigration (Styan, 2008).

"There is no doubt that some South Africans are beginning to question their future in this country, although it is difficult to quantify the numbers involved," said Seeff, adding that the company was receiving 50 percent more inquiries compared to the same period last year.

All of the above anecdotal evidence points to an increase in the number of South Africans contemplating emigration. However, the information is of limited value in terms of this study as the numbers have not been obtained through scientific means or from reliable sources and do not distinguish between individuals from various professions contemplating emigration.

### 3.3 Intention to emigrate

A study by Mattes and Richmond (2000) conducted in 1998 amongst nationally representative skilled adults estimated that approximately 2% (30 000 adults) had a “very high” probability of leaving within the next five years and another 10% (160 000) had a “high” probability. The sample group for the study consisted of “skilled” individuals, where Mattes and Richmond defined “skilled” as those people who are vital to the functional core of a national economy. These persons had some sort of specialised training that results in superior technical competence, talent or abilities that are applied in professional occupations.

In order to calculate an index for potential to emigrate for each respondent, Mattes and Richmond (2000) looked at their average score across four key questions.

These four questions related to:

- the extent of thought given by respondents to moving to another country to live and work;
- the extent of desire to move temporarily (less than two years) and to move permanently (more than two years) to another country to live and work;
- the likelihood of moving temporarily or permanently to another country to live and work and
- commitment to emigrate.

Each of these questions had a four-point score, ranging from “a great deal / great extent / very likely” to “some / moderate” to “none at all”, with the fourth category being “don’t know”. Those who answered “a great deal / great extent / very likely” to all four questions were classified as having “very high” probability of leaving. Those who scored between 3.75 and 3.25 were classified as having a “high” probability and so on.

Once an index score was calculated for each skilled respondent, the following conclusions emerge:

- 2% of the sample fall into the “very high” category;
- 10% have a “high” emigration potential;
- 25% have a “moderate” emigration potential;
- 28% have a “low” emigration potential;

- 16% have a “very low” emigration potential and
- 20 % have “no” emigration potential at all.

Mattes and Richmond concluded that if only those skilled South Africans with a “very high” emigration potential left the country, this would translate to a potential gross loss of approximately 32 000 skilled individuals in the next five years starting in 2000, while estimating that the skilled population totalled 1.6 million.

If all of those with a “high” or “very high” potential left, the number would jump to a massive 192 000. With the margin of error, this could range from 155 000 to as high as 229 000.

A study was conducted by Mattes and Mniki (2007) amongst 4 784 postgraduate and final year undergraduate students at South African universities and technicons. Students studying engineering constituted 13% of the respondents. To measure emigration potential, the students were asked which countries they would most probably go to if they ever left South Africa. They were then asked a series of questions regarding possible movement to that country. These questions related to the extent to which they had considered the idea of emigrating, their desire to move, the likelihood of them moving and their commitment to moving. The last question was related to whether time deadlines had been set by the respondents and the lead times to their moves. Average scores to the emigration potential questions for each respondent were calculated on a scale of 0 to 3.

The study revealed that 28% of students said that they wanted to move overseas “to a great extent” for two years or more. Just over a fifth (21%) said that it was “very likely” that they would actually do this. A relatively large proportion (40%) wanted to move overseas for less than two years, stating that it was “very likely” that they would actually go. Only 3% of students had “zero” emigration potential.

The demographic characteristics for the sample revealed that South Africa’s potential skills base is more female (54%) than male (46%) and more black (48%) than white (40%), coloured or Asian (12%). This is in stark contrast to the professional engineers currently registered with ECSA, where 98% are male and 89% are white (Bwalya, 2008).

### **3.4 Factors causing engineers to consider emigration**

This paper intends to investigate the influence of two groups of factors on the intentions of engineers to emigrate. The first group relates to general living conditions in South Africa including factors such as crime, politics, level of service delivery in the public sector, level of health care available and the education system. The second group relates to the working environment in South Africa including factors such as affirmative action, prospects for promotion and the salary levels of engineers.

These factors are in line with the studies of Alkire (2004), who cited a number of “push” factors which have been identified as contributing to the decision to leave a home country. These include poor remuneration, lack of motivation, poor or dangerous working conditions, limited training opportunities, political concerns and economic difficulties. Factors which lure individuals to other countries include professional development opportunities, postgraduate training, job security, the wish to have a better lifestyle and good education for their children.

#### **3.4.1 Crime and violence**

The United Nations Office on Drugs and Crime ranked South Africa second for assault and murder per capita and first for rapes per capita. The situation with rape has become so bad that the country has been referred to as the 'rape capital of the world' (Rankin, 2005).

Total crime per capita is tenth out of the sixty countries in the dataset. Note that these statistics only compare data from approximately sixty countries, which are typically better-developed countries. Other countries not surveyed may have higher rates of violent crime, although these are usually unmeasured, disputed or incomparable.

The comparison of national crime statistics between countries is controversial since not all countries record these statistics to the same accuracy and every country has its own definition of each type of crime. In addition, the number of crimes that are

actually reported is questionable. However, many emigrants from South Africa state that crime was a big factor in their decision to leave (Van Rooyen, 2000).

The Minister of Safety and Security in 2006, Charles Nqakula, caused outrage among South Africans in June 2006 when he responded to opposition members of parliament who were not satisfied that enough was being done to counter crime, saying that those who complain about the country's crime should stop complaining and leave the country (Doherty, 2008).

According to Van Rooyen (2000), 68% of skilled South Africans who have given consideration to emigration indicated a strong desire to help build South Africa and stressed that they leave under duress because of fears for their physical safety.

Crime and violence is expected to be a major contributing factor to the loss of engineers from South Africa.

### **3.4.2 Shortage of electricity**

From December 2007 South Africans experienced a number of rolling electricity black-outs caused by the inability of the national electricity supplier, Eskom, to generate sufficient electrical power to satisfy the country's needs. Additional power generating capacity is only expected to come on line in 2012 (Bridge, 2008). This has resulted in significant loss of revenue to industry and businesses and resulted in a general lack in confidence in the government and Eskom's strategic electricity power planning (Bridge, 2008).

According to Kleynhans (2008), the trade union Solidarity maintains that the electricity supply crisis results from a shortage of skilled workers at Eskom, caused by the large-scale departure of skilled people from the company in order to make way for the appointment of previously disadvantaged individuals. The success of transformation in this parastatal was partly to blame for the current crisis, according to Kleynhans. He continued: "The problem is exacerbated by inadequate maintenance at Eskom power stations."

According to Savides (2007), the electricity shortage has led to the closing down of certain mines for a number of days per week, a slow-down in production at other

mines, moratoriums being placed on property and industrial development which would result in additional power demand being created as well as limiting economic development in many other sectors of the economy in order to stem demand.

Eden Joubert, a lawyer with Emigration Group, stated that large numbers of highly skilled South Africans, including engineers, are considering leaving the country in the wake of Eskom power debacle (Bridge, 2008). According to Joubert, this has been confirmed by a variety of sources, including estate agents, removal companies and emigration consultants.

The people inquiring about leaving South Africa were "split across the race spectrum", and many of them were highly qualified professionals who had a potential to start a new life in another country with ease, according to Joubert.

King International Movers general manager, Rolf Lamers, concurred: "Things have suddenly picked up in the export shipments. We are doing four times as many jobs as we did in January of the past year," he said (Bridge, 2008). Lamers said there was an increase in inquiries and quotations sent out to clients who said they wanted to emigrate. He said many of his clients had cited the power crisis as a major contributing factor to their decisions to leave.

Although no scholarly research has been conducted to determine the relationship between the electricity shortage and intention to emigrate, the evidence above suggest that the electricity shortage will impact negatively on long term economic growth. Engineers who are sensitive to their future prospects in South Africa would have taken cognisance of the effects which the electricity shortage could have on their careers in future and this may in turn influence their decision to consider emigration. The fact that the crisis was predicted by technical analysts several years ago and no action was taken, may cause engineers and other technical personnel to feel marginalised in the decision making process and to lose faith in those entrusted to look after the country's future economic interests (Savides, 2007). This too may result in engineers considering their options abroad.



### **3.4.3 Patriotism**

Common wisdom holds that South Africa's brain drain would be far lower if skilled South African's were more patriotic. The study by Mattes and Mniki (2007) found that most South African tertiary students actually exhibit a high degree of national identity and patriotism. Eight in ten agreed that they were proud to be called South Africans and had a strong desire to help build South Africa. There were some important differences between racial groups, with white students exhibiting far lower levels of patriotism (3.74 on a scale of 1 to 5) than black students (4.43). A study by Mattes in 2003 revealed that over 90% of adults, however, registered strong levels of national identity consistently since 1994.

The study by Mattes and Mniki (2007) showed that patriotism and strong national identity decrease emigration potential, thereby serving as a "pull" factor. The strength of patriotism as a "pull" factor will be measured against the strength of "push" factors present in South Africa.

### **3.4.4 Other country-related contributing factors**

According to Van Rooyen (2000), approximately 10% of emigrants list the state of the South African economy as a reason for leaving the country. They feel that taxes are too high, their savings are being eroded by inflation and the falling currency could result in them not being able to leave the country in future. The relatively high interest rates in comparison with most developed countries were also a cause of concern.

Van Rooyen (2000) found that 19% of emigrants give declining standards of public education and healthcare as major reasons for wanting to leave. Many children in schools had not received text books in 1999 or 2000, while teachers' salaries consumed almost 100% of the education budget, leaving little money for equipment and books. Those with children in private schools saw massive increases in fees as state subsidies were cut by 65% between 1995 and 1998. Education is thus considered to be a major contributor to the skills shortage and to emigration.

Van Rooyen also revealed that 10% of participants cite corruption and an inefficient government and civil service as contributing to emigration.

Van Rooyen did not distinguish between the responses of participants from various professions. It was also conducted amongst those who had emigrated and not potential emigrants.

The United Nations Development Index rated 174 countries in terms of their standards of living, life expectancy and educational attainment in 2006 (United Nations. Human Development Report, 2006). Canada was rated first for the previous seven years, with the United States of America fourth, New Zealand ninth, the United Kingdom fourteenth and Australia fifteenth. South Africa was rated ninety-eighth. This study will compare potential emigration destinations chosen by survey respondents with the findings of the United Nations report.

The increasing cost of living may be cited as a reason for wanting to emigrate. However, Johannesburg has been ranked as the eighth cheapest city in the world for expatriates, according to the most recent Cost of Living Standards Survey from Mercer Human Resource Consulting (Klein, 2008).

Moscow is the most expensive city, followed by London, with Asuncion in Paraguay ranked as the least expensive city for the fifth year running.

Mercer's annual Cost of Living Survey covers 143 cities across six continents and measures the comparative cost of over 200 items in each location, including housing, transport, food, clothing, household goods and entertainment.

In addition to country-related factors discussed above which contribute to emigration, there are also a number of employment-related factors which could contribute to emigration. These are discussed below.

#### **3.4.5 Affirmative action**

The main purpose of affirmative action is to correct the injustices resulting from the apartheid era (South Africa. Employment Equity Act, 1998). This is to be achieved through preferential appointments of previously disadvantaged individuals. However, this could create dissatisfaction amongst those who are not from the designated

group as their career advancement opportunities are perceived to be limited by the Employment Equity Act (Booyesen, 2005).

The following observations were made amongst white males interviewed by Booyesen (2005):

- *White males are demotivated; they just perform to maintain their jobs, they are reluctant to show initiative as it is not going to be rewarded.*
- *The careers of white males are on hold or limited. The careers of top achievers are limited, but not terminated.*
- *There is no job security for younger white males who are not yet established in a career.*

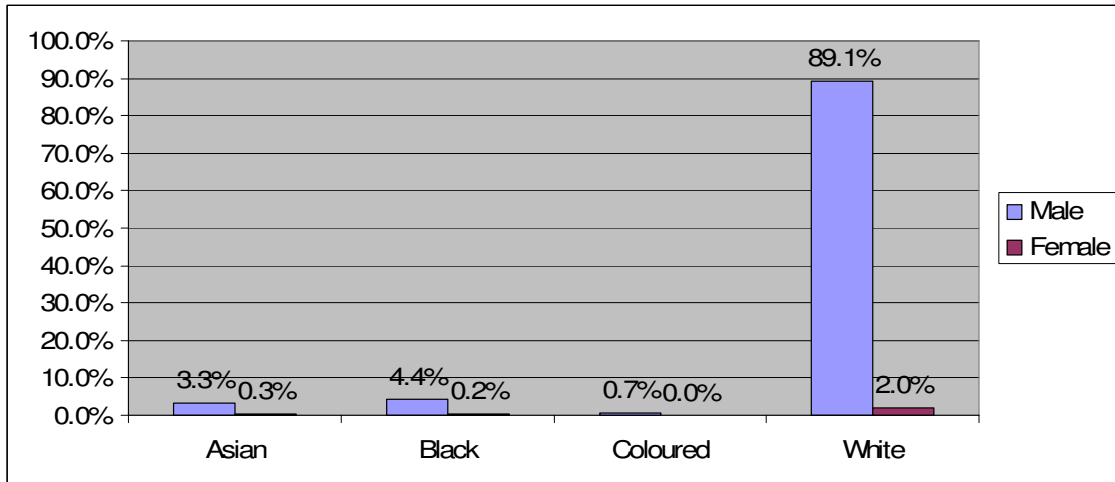
According to Copans (2008), there are severe skills shortages within South African municipalities. A study conducted by Lawless found that 79 of the country's 231 local municipalities do not have civil engineers, technologists or technicians (Styan, 2008). This is partly due to affirmative action where skilled and experienced engineers were displaced in order to make way for the appointment of previously disadvantaged individuals (Copans, 2008). Engineers who remained were faced with a challenge in that in many cases, their newly-appointed superiors were not from a technical background. According to Creighton (1990), one of the most difficult tasks faced by managers today is the manner in which they must provide direction to the highly skilled workers that they supervise. In most cases, technical staff members like to perform their work in a self-directed manner and are far more likely to feel motivated when working under the supervision of another person with similar training whose technical abilities they respect rather than under the supervision of a manager to whom they cannot relate (Creighton, 1990). Engineers in municipalities who feel dissatisfied with their management are likely to have a higher propensity to emigrate.

A study by Van Rooyen in 2000 found that affirmative action was only a minor contributor to emigration as only 10% of prospective emigrants cite it as a reason for wanting to emigrate.

The implementation of affirmative action for positions requiring the incumbent to be a registered professional engineer offers additional challenges if one considers that

over 89% of registered professional engineers in South Africa are white males (Bwalya, 2008).

**Figure 3.6: Professional engineers by race and gender**



Source: Bwalya (2008)

### 3.4.6 Salary levels of engineers in South Africa

ECSA rates for 2008 for various categories of engineers are indicated below (South Africa. ECSA fees 2008: Adjustment to fee scales 2007 to 2008, 2008):

- Category A: R1 400 per hour. Category A engineers include top practitioners whose expertise is nationally and internationally recognised as that of an expert.
- Category B: R1 200 per hour. Category B engineers include partners, sole proprietors or directors who take full responsibility for the liabilities of the engineering practise.
- Category C: R700 per hour. Category C engineers include salaried technical staff with adequate expertise and relevant experience performing work of an engineering nature and who carry the direct technical responsibility for one or more specific activities related to a project.
- Category D R500 per hour. Category D includes those performing work of a technical nature under the supervision of those contemplated in category A, B or C.

The equivalent rates paid to professional engineers could, however, be higher or lower than the rates indicated above. Whether or not an engineer perceives their salary to be fair or not would depend on which profession's average salary they are comparing it to and what their expectations are.

### **3.4.7 Future of engineering as a profession in South Africa**

The Built Environment Professions Bill has been tabled before parliament (Hamlyn, 2008). Under this bill, a body to be known as the South African Council for the Built Environment (SACBE) will be established. The purpose of the bill is to promote growth and transformation and promote and maintain the standards of education and training in the built environment profession. However, the creation of this body will see the relegation of existing councils, including ECSA, to the status of being mere professional boards. This is a complete contradiction to international best practice, in which professional bodies such as those for engineers, architects, property valuers and quantity surveyors are self-regulating (Hamlyn, 2008). This has caused a major upsurge of negative sentiment amongst the associations of professional engineers.

According to Democratic Alliance member, Sydney Opperman, "This bill also gives the Minister of Public Works far-reaching powers to arbitrarily exempt certain individuals or groups from the registration process. To compound the negative effect, the Minister of Public Works, who is not an engineer, can even intervene in the development of the engineering educational syllabuses," (Hamlyn, 2008).

The recent actions taken by the Department of Public Works seems to indicate that their regulating role is entitled to take preference over legislation relating to education and training, such as the syllabuses to be studied by engineers as well as taking preference over legislation such as the Occupational Health and Safety Act which is enforced by the Department of Labour and provides definitions for the required competency of persons allowed to perform certain duties.

The wide-ranging powers given to the minister have been justified on the grounds of the need to transform the engineering profession. According to ECSA, however, this is not necessary, as the profession has started the process of transformation without the government's interference (Hamlyn, 2008). In its submission, ECSA states that 56% of all the professional engineers registered over the past three years had been

previously disadvantaged individuals. Black professionals dominated the registration of electrical engineers by 61% between 2005 and 2008.

The sentiment towards the future of engineering as a profession in South Africa needs to be gauged amongst current engineers and the effect that this might have on their propensity to emigrate.

### **3.4.8 Logistical considerations**

A study was conducted by Mattes and Mniki (2007) amongst postgraduate and final year undergraduate students at South Africa's tertiary institutions. Although this study included survey results from students studying various disciplines and not only engineering, the results are useful and can be compared with those obtained in this study. It revealed that factors that most increase emigration potential among South Africa's future skills are logistical ones, including family encouragement and financial resources. Family in this case would include mainly parents and siblings as most students are not married with children. The financial resources which restrict a student from emigrating immediately after graduating are not expected to be a major constraint for engineers with some experience who have accumulated some measure of financial means.

### **3.4.9 Relationship between organisational commitment and intention to emigrate**

The definition of organisational commitment is, "the relative strength of an individual's identification with, and involvement in, a particular organisation" (Robbins, 1998). The construct is characterised by three related factors namely believing in and accepting the organisations goals; being prepared to exert effort on the organisation's behalf and a strong desire to remain a member of the organisation (Robbins, 1998).

Thus, organisational commitment refers to an individual's wish to be involved in the organisation. The social integration theory of emigration (Hartman and Hartman, 1995) suggests that the greater a persons involvement in an organisation, the greater the persons attachment to the society in which that organisation operates and hence

the lower their intention to emigrate. Thus, one would expect a person with a high level of organisational commitment to have a low intention to emigrate.

Miller, Haskell & Thatcher conducted a study in 2002 to assess the relationship between organisational commitment and intention to emigrate. It was found that there is a negative relationship between intention to emigrate and organisational commitment. However, this study did not measure the directionality of this relationship i.e. whether low organisational commitment caused subjects to consider emigration, or whether their intention to emigrate caused them to exhibit the traits of low organisational commitment.

This paper attempts to establish whether low organisational commitment is a contributing factor causing engineers to contemplate emigration.

The study by Miller *et al.* (2002) established that two biological variables were significantly related to intention to emigrate. These were level of education and whether or not the participants had friends who had emigrated. As graduate engineers are considered to possess a high level of education, this study will attempt to focus in more detail on contributing factors amongst a group of educated professionals.

### **3.5 Traditional retention strategies**

According to Nel (2003), in a fluid and shifting global job market, talent is a commodity to be treasured. Nel further states that employee talent will determine which companies are successful and which are not. Nel (2003) states that retention of talented workers is one of the most important challenges facing businesses these days. Michaels, Handfield & Axelrod (2001) stated that talent of employees is the key factor that differentiates a company from its competitors. Table 3.1 compares the old and new realities regarding talent according to Michaels *et al.*

**Table 3.1: The old and new business realities regarding talent**

<b>The old reality</b>	<b>The new reality</b>
People need companies	Companies need people
Machines, capital and geography provide the competitive advantage	Talented employees provide the competitive advantage
Better talent makes some difference	Better talent makes a huge difference
Jobs are scarce	Talented people are scarce
People accept the standard package which they are offered	People demand much more
Employees are loyal and jobs are long-term	People are mobile and their commitment is short term

Adapted from: Michaels, *et al.* (2001)

A study by Mattes and Mniki (2007) revealed that a range of possible government attempts to make emigration more difficult would only increase students' probability of leaving the country. Such measures could include the requirement to perform national service in return for education, such as the Department of Health currently requires from medical students, which could be extended to any number of years of service. Other measures suggested included making nationals pay tax on income earned outside of the country, severely limiting the amount of money that could be taken overseas, not allowing foreign passports to be held by nationals and entering into agreements with foreign governments to limit the immigration of skilled nationals into those countries.

### **3.6 Destination countries**

The 2005 report by Statistics South Africa discussed earlier in this study identified the most popular destination countries for South African emigrants, with the United Kingdom and Australia proving to be the most popular (South Africa. Statistics South Africa, 2005).

A study conducted by Mattes and Mniki (2007) amongst final year university students revealed that the United Kingdom was the leading preferred destination, selected by 24% of respondents. This was followed by the United States (19%), Australia (15%), Europe (7%) and Canada (5%), while 7% listed Southern Africa. There were a few



important racial differences. Black respondents were more likely to think that they would end up in North America or Southern Africa than other students. White students were more likely than others to see Australia or New Zealand as a likely destination. This study will compare its findings with those of Mattes and Mniki (2007) and attempt to explain significant variances.

### **3.7 Duration of stay**

Mattes and Mniki (2007) found that students in their final year of study with "very high" emigration potential did not necessarily want to leave permanently, although the proportion indicating that they would not return for at least five years was high (74%). A quarter of those with "high" emigration potential seem to envisage a more limited stay, with 41% of these students planning to stay for two to five years and 33% planning to stay more than five years. Most respondents with either "high" or "very high" emigration potential plan on returning to South Africa on an annual basis.

The duration of stay in a specific country may be influenced by the period of time required to obtain permanent residency or citizenship of that country. Depending on the country, permanent residents usually have the same rights as citizens except that they may not vote, stand for public office, apply for public sector or national security employment, although some countries allow this, or hold the passport of that country (Hollard, 2007). In addition, permanent residency may expire and also places restrictions on the amount of time that can be spent outside of the country. Permanent residency visas for Australia, New Zealand and the United Kingdom last up to five years from date of issue. A permanent resident must live in Canada for two years out of every five or risk losing that status. Permanent residency or "green card" visas for the USA do not expire (Hollard, 2007).

According to Hollard (2007), permanent residents may usually apply for citizenship by naturalisation after a period of residency in the country concerned. Citizenship entitles them to enjoy all benefits associated with being the citizen of a specific country, including being issued with a passport for that country. Permanent residents of Australia can apply for citizenship after living there for four years. Permanent residents of New Zealand and the United Kingdom can apply for citizenship after five years. Canadian permanent residents can apply for citizenship providing they have

lived in Canada for three out of the previous four years. Those residing in the United States of America for a period of five years may apply for citizenship (Hollard, 2007).

In order for South Africans to keep their options open with regards to ease of future mobility, the duration of their stay may be influenced particularly by the period required to obtain citizenship, which does not expire and which will allow them to move freely to and from that country should they wish to do so in future. This may be particularly evident amongst younger engineers who may be admitted readily into foreign countries on permanent residents' visas, but would like to obtain citizenship for possible future use. Those from the over 55 age group may also be interested in obtaining foreign citizenship in order to follow their emigrating offspring overseas.

### **3.8 Assets left in South Africa**

Mattes and Mniki (2007) found that 65% of students in their final year of study with "very high" emigration potential would give up all their assets in South Africa to move. This could possibly be because younger people have not yet accumulated many assets or put down firm roots of their own. Students with lower categories of emigration potential would be unwilling to give up all their assets if they had to relocate.

### **3.9 Chapter summary**

The review of literature revealed that accurate statistics regarding emigration numbers are not available. The limited information which is available indicates that the United Kingdom was the most popular destination chosen by South African emigrants by a substantial margin, followed by Australia and the rest of Africa. Evidence suggests that a large number of engineers have recently emigrated or are currently considering emigration. This section also examined a number of country and work-related factors described in the literature as being drivers for emigration. The duration of stay and factors which could influence this were investigated. This revealed that most emigrants intended to return to South Africa at some point during their lifetimes.

## CHAPTER 4

### 4. RESEARCH METHODOLOGY

It would be wrong to suggest that a single study of this nature can thoroughly address all aspects of engineering migration. This study will focus on quantifying the intention to emigrate amongst graduate engineers and identifying migration drivers specific to South African engineers. It will also suggest strategic management options open to both government and the private sector in mitigation of their impact on economic growth.

#### 4.1 Research approach

The objective of this study is to gauge the propensity of engineers to emigrate and the main drivers for this. The research problem is that current literature regarding emigration and intention to emigrate is inadequate and does not focus specifically on the engineering discipline. With a shortage of engineers in South Africa as well as opportunities available overseas, there is a requirement to identify which drivers cause South African engineers to consider working overseas rather than in their home country in order to assist in crafting strategies to mitigate the migration of engineers from South Africa.

The objectives of this study are to provide data that will contribute to answering the following research questions:

1. What is the current emigration potential amongst South African engineers?
2. Where are they most likely to emigrate to?
3. What are the typical demographic characteristics of those intending to emigrate?
4. What factors are causing South African engineers to consider emigration?
5. How likely are they to return should they emigrate?
6. What measures could be instituted to combat the shortage of engineers in South Africa?

This study is descriptive and can be classified as applied research as the emphasis is on practical problem solving (Cooper and Schindler, 2003). A quantitative rather

than qualitative approach will be used. This approach is appropriate as according to Leedy (2005), quantitative research methods should be used to answer questions regarding relationships amongst measured variables, with the purpose of explaining and predicting phenomena. The relationships between various demographic variables and indicators of intention to emigrate will be explored which will require the use of quantitative rather than qualitative research techniques.

## **4.2 Study design**

This study will attempt to gauge intention to emigrate amongst South African engineers. The goal is to draw inferences about the engineering fraternity based on responses from a sample. The study will also attempt to identify the main drivers for engineers to consider emigration. These drivers are split into two main groups, country-related factors and work-related factors. Only once the magnitude of the potential emigration problem is quantified and reasons for this identified, can retention strategies be crafted to combat emigration and the effects thereof.

An exploration study will be conducted prior to the proposed formal study in order to crystallize research questions. The method of data collection will be via a communicative survey, which is described in more detail in the following section. The design is *ex post de facto*. The researcher is not able to manipulate the variables. Care will be taken to design the questionnaire in such a manner that it does not introduce bias. The time dimension of the study is cross-sectional as it will be carried out once and represents a snapshot at a point in time. Respondents will be required to complete a questionnaire taking into account influencing factors as they stand at the time of the survey. This study could potentially be repeated at a later stage in order to ascertain whether there have been changes over time. Such future studies would be longitudinal in nature. The study is statistical as it is designed for breadth rather than depth. It will attempt to analyse responses from a large sample representative of the population in order to gauge sentiment in the general engineering fraternity. Research questions will be answered through quantitative analysis. Generalisations regarding findings will be presented based on the representativeness of the sample and the validity of the design. A case study places more emphasis on a full contextual analysis using a smaller sample. This is not considered to be appropriate for this study. The environment for the study is a field

setting as respondents will be asked to complete the questionnaire as it relates to them in their actual work environment and under their current living conditions. Laboratory conditions and simulations are not considered to be appropriate for this type of study as sentiment of engineers in their work environment is to be assessed.

A pilot test will be conducted to detect weaknesses in design and instrumentation and to provide proxy data for selection of a probability sample. It will draw subjects from the target population and simulate the procedures and protocols that have been designated for data collection.

The benefits of drawing a sample from the target population and presenting participants with a questionnaire are numerous (Cooper and Schindler, 2003):

- Low cost: A census would involve having to contact all graduate engineers within South Africa. This would result in considerable effort being expended and cost being incurred. Distributing questionnaires via email to only a sample group is considerably less effort and cost intensive. Engineers and organisations in various geographical locations can be contacted without any increase in cost.
- Greater accuracy of results: The quality of a study is often better with sampling than with a census. Cooper and Schindler (2003) suggest that sampling possesses the ability of better testing, more thorough investigation of missing, wrong or suspicious information, better supervision, and better processing than is possible with complete coverage.
- Greater speed of data collection: Interviews with participants would be time consuming. Due to the dynamic nature of the current business environment, this could result in results obtained during the beginning of the study being different from those obtained near the end. The sample size would have to be reduced to accommodate this. Questionnaires sent and received via email to and from the sample group represents an expedient manner of collecting data compared with other methodologies.
- Availability of population elements: Questionnaires will be sent via email to participants which allows them to complete the questionnaires at their convenience, with sufficient time to think about the questions, within a finite time span. Participants may be more reluctant to participate in the survey if this required setting up appointments to meet with interviewers. The vast

majority of graduate engineers are expected to be well versed with computers and have valid email addresses.

Disadvantages of using a questionnaire:

- Response rate: A lower response rate is expected when emailing questionnaires to the sample group compared with telephonic or face-to-face interviews (Cooper and Schindler, 2003). This is mainly because it is easier for someone to ignore an email than to refuse a telephonic interview or request for a face-to-face interview. Respondents will be promised a copy of the research results as an incentive to respond. Research has shown that those who are interested in the research topic are more likely to respond (Cooper and Schindler, 2003). It is suspected that most engineers will be interested in the research topic.
- Accuracy of the information: Participants are not able to question the researcher should a question be unclear to them. Pilot testing will be used to mitigate this risk by rephrasing questions which may have been unclear before finalising the questionnaire.
- Quality of the information: Interviews enable the participants to provide a more in-depth response than would be the case with a questionnaire.

Five-point Likert scales will be used predominantly to gauge the attitudes of respondents to objects of interest.

### **4.3 Sample selection**

In order for a sample to properly represent the characteristics of the population, it must be valid. Validity depends on two considerations, accuracy and precision (Cooper and Schindler, 2003). Accuracy is the degree to which bias or systematic variance is absent from the sample. Various engineering institutions will be contacted in order to obtain email addresses for graduate engineers, such as ECSA, the South African Institute of Civil Engineering (SAICE), the South African Institute of Mechanical Engineers (SAIME), the Institute of Municipal Engineers of South Africa (IMESA) and the Institute of Chemical and Metallurgical Engineers (ICME). Questionnaires will be sent to all email addresses obtained. Although there were 13 826 professional engineers registered with ECSA with South African addresses at the time of the study, the exact number of graduate engineers actually working in the

country is more difficult to quantify. ECSA has estimated the total number to be in the order of twice the number of engineers registered with ECSA.

This study will be confined to graduate and postgraduate engineers. The reasons for choosing this sample group were included in this report under section 1.5, "Limitations and delimitations of the study."

In order to determine the representativeness of the sample, the demographic distribution of respondents will be compared with that of the 13 826 professional engineers registered with ECSA who have South African residential addresses.

#### **4.4 Data collection**

As described earlier, a pilot test will be conducted to detect weaknesses in design and instrumentation and to provide proxy data for selection of a probability sample. This will involve selecting ten participants from the target population, sending questionnaires to them and asking them to comment on the clarity of the questions. Interviews will be conducted with all ten pilot test respondents to ensure that all questions were properly understood.

The purpose of the pilot study is to ensure that:

- questions are clear and easily understood;
- questions are free of ambiguity and
- questions measure what they are intended to measure

In addition, the pilot study test will measure the average time required to complete the questionnaire.

Once questionnaires have been finalised, each member of the sample group will be emailed an invitation to participate in the study, along with the relevant questionnaire. Each participant returning a completed questionnaire will be promised a copy of the study results as an incentive to respond. Anonymity will be promised to all respondents.

## **4.5 Measurement tools for intention to emigrate**

The undercurrent anxiety surrounding emigration in a country where it is so prevalent necessitates a way of measuring the extent of a person's desire to leave the country permanently. Such a measurement tool can be used to gauge the effect of various factors on intention to emigrate as well as the effect that intention to emigrate has on organisations and individuals.

Very little previous research has been conducted in this area. Miller, Haskell & Thatcher developed a scale in 2002 to assess individuals' intention to emigrate. However, this scale has only been partly validated. It includes factors drawn from literature, such as items relating to patriotism (Hartman and Hartman, 1995), the financial costs and benefits of emigrating (Carlson and Nilson, 1995), perceptions of opportunities abroad (Adir, 1995) and behavioural factors associated with emigration (Schuster, 1994). The scale utilizes a five-point Likert-type format with responses ranging from "strongly disagree" to "strongly agree". A pilot study was conducted by Miller *et al.* (2002) and a 24 items were finally retained in the scale.

Mattes and Mniki (2007) used statistical methods of factor and reliability analysis to test which indicators best helped tap the underlying concept of 'emigration potential' in a valid and reliable way. These indicators will be used in the development of the questionnaire for this study, which will form appendix 1 of this report.

### **4.5.1 Consideration of emigration**

Respondents will be asked how much consideration they had given to emigrating within the next few years, how frequently they discussed this with their friends and family and to what extent they had researched the availability of jobs, remuneration and living conditions overseas, as well as procedures involved in emigrating. Respondents will be asked to score these factors on a Likert scale of 1 to 5, with 1 indicating that no consideration had been given to emigrating, greater than 1 to 2 indicating that some consideration had been given, greater than 2 to 4 indicating that a fair amount had been given and greater than 4 to 5 indicating that a great deal had been given. The scores for the relevant questions will then be averaged in order to obtain an index for each individual indicating the extent to which they had considered



the idea. This instrument will be similar to the one employed by Mattes and Richmond (2002) in their study.

#### **4.5.2 Desire to emigrate**

Engineers will be asked to rate on a Likert scale of 1 to 5 how strong their desire to move is, with 1 indicating that they have absolutely no desire to leave, greater than 1 to 2 indicating that they have some desire, greater than 2 to 4 indicating that they have a fair amount and greater than 4 to 5 indicating that they had a great desire to leave.

#### **4.5.3 Commitment to emigrating**

Even though respondents may indicate that they have spent time considering emigration and that they have a desire to emigrate, their commitment to actually going needs to be assessed. For this reason, respondents will be asked what action they had taken towards emigrating, including whether they had applied for work permits or jobs in overseas countries and whether they had been in contact with recruitment facilitators for foreign countries.

#### **4.5.4 Overall propensity to emigrate**

Mattes and Richmond (2002) suggest that propensity to emigrate is dependent on the extent of consideration given to the idea, the desire to emigrate and commitment made to emigrating. The above results will therefore be combined into a single index intended to determine emigration potential by averaging the scores for each of the categories indicated above. On a scale from 1 to 5, the propensity to emigrate for those scoring less than 2 will be classified as “low”, 2 to 3.5 will be scored as “medium” while greater than 3.5 to 5 will be scored as “high”.

#### **4.5.5 Likelihood of returning**

The sample will then be asked a number of questions in order to gauge the likelihood of them returning to South Africa, such as intended duration of stay, whether they would apply for foreign citizenship and whether they would keep any assets in South Africa if they were to leave. All of these questions are intended to gauge the permanence of an intended move.

#### **4.5.6 Most likely destinations**

Respondents will be asked to indicate which countries they would consider emigrating to on a scale of 1 to 5, ranging from “would not consider” to “would definitely consider”.

#### **4.5.7 Factors causing engineers to consider emigration**

A number of country and work-related factors which were identified in literature as possible reasons for individuals to consider emigration will be included in the survey and attached as appendix 1 of this report. Respondents will be asked to rate these on a scale from 1 to 5, with 1 being “not a contributing factor” and 5 being a “highly significant contributing factor”. These factors will then be summarised for the group identified as having a “high” potential to emigrate.

#### **4.5.8 Factors contributing to the retention of engineers in South Africa**

Respondents will then be asked to rate a number of factors identified in the literature as contributing to the retention of individuals in South Africa on a scale of 1 to 5, with 1 being “does not contribute at all” and 5 being “is a key contributor”.

#### **4.5.9 Actions to combat the shortage of engineers in South Africa**

Lastly, respondents will be asked to rate on a scale of 1 to 5 the effectiveness of a number of possible strategies which could be taken to mitigate the shortage of engineers in the country. These factors too will be drawn from literature.

### **4.6 Research ethics**

According to Cooper and Schindler (2003), the goal of ethics in research is to ensure that no one suffers adverse consequences from research activities. All respondents will be guaranteed anonymity. The questionnaire will not require the respondent to indicate their name or the company’s name at which they are currently employed. However, respondents will be aware that certain information regarding their identity can be learnt from their email addresses by the researcher. It is hoped that the anonymity promised will result in respondents being truthful when completing the questionnaire. Respondents who feel that their completed questionnaires may be scrutinized by their colleagues or managers are less likely to enter unfavourable

responses which could possibly be career limiting to them, such as indicating that they intend to emigrate soon or that they have little confidence in management. Anonymity is thus very important.

#### **4.7 Chapter summary**

This chapter discussed the research approach that will be taken in order to gather data regarding the propensity of engineers to emigrate. A questionnaire will be sent out to a sample from the target population after conducting a pilot study to detect weaknesses in design and instrumentation and to provide proxy data for selection of a probability sample. Quantitative research methods will be used in order to answer questions regarding relationships amongst variables which will be measured, with the purpose of explaining and predicting phenomena. Measurement tools for consideration of emigration, desire to emigrate and commitment to emigrating were devised using available literature. It was established that anonymity of respondents will be important if truthful answers to the questionnaire are to be obtained from them.

## CHAPTER 5

### 5. DATA ANALYSIS

Of the 488 questionnaires which were sent to engineers with valid email addresses, a total of 115 were received back, representing a response rate of 21%. This is marginally better than the 20% expected based on previous studies of this nature and is considered satisfactory. The demographic characteristics of the respondents are considered to be representative of graduate engineers in South Africa when compared with the 13 826 professional engineers registered with ECSA and living in South Africa. Comparisons between the general demographics of the respondents and ECSA graduates are compared below in order to confirm the reliability of the sample.

The survey provided a valuable insight into the current trends and perceptions of South African engineers towards emigration. From these results, informed deductions can be made regarding what the future may hold for the engineering fraternity in South Africa.

#### 5.1 Demographics of respondents

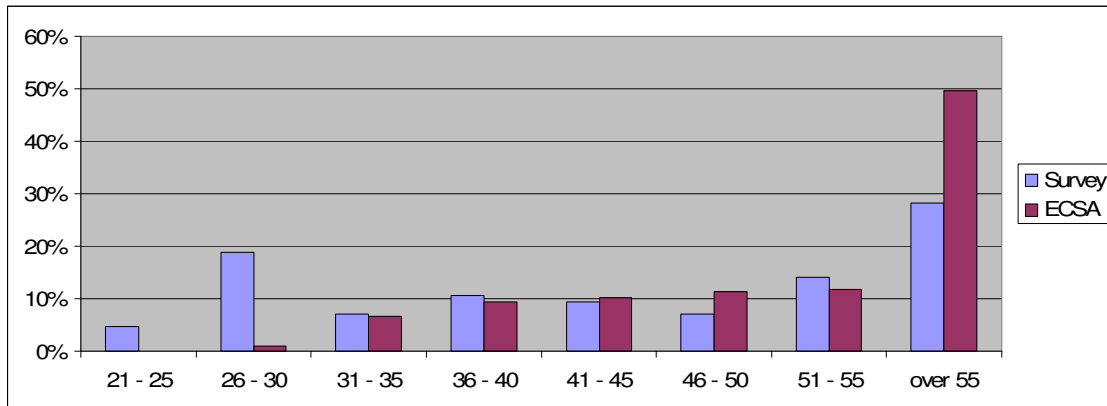
Questionnaires were sent to individuals employed in both the private and public sectors in all provinces of South Africa.

##### 5.1.1 Age

Age distribution is important in understanding who is likely to emigrate and how much experience they are likely to take with them. Figure 5.1 depicts the age distribution of all respondents, as well as the age distribution of respondents registered with ECSA.

ECSA's database revealed that approximately 50% of its members who are registered as professional engineers are over the age of 55, whilst only 28% of the respondents in the survey indicated that they were over the age of 55. This is probably due to the fact that many of the respondents over the age of 55 are no longer practising as engineers and their email addresses would not have been easily obtainable.

**Figure 5.1: Age distribution of survey respondents and ECSA members**



A large portion (19%) of the respondents were from the 26 to 30 age group, with only 1% of ECSA's registered members falling into this age category. Undergraduate engineering courses at most South African universities take a minimum of four years to complete, which means that engineers could graduate at the age of 22. However, to register with ECSA thereafter takes at least an additional three years. Young engineers may choose to emigrate before they have established strong roots in order to take advantage of opportunities overseas. This may be before they were able to register with ECSA. Many engineers choose not to register with ECSA unless they are required to do so by law due to the nature of their work. It is likely that only engineers in higher positions of authority are required to register, which means that registered engineers are likely to be older than recent university graduates. It may also be that engineers in the 26 to 30 age group have not yet been lured away from engineering by other industries, such as the banking sector.

The high proportion of respondents in the 26 to 30 age group compared with other age groups may create some degree of sample bias.

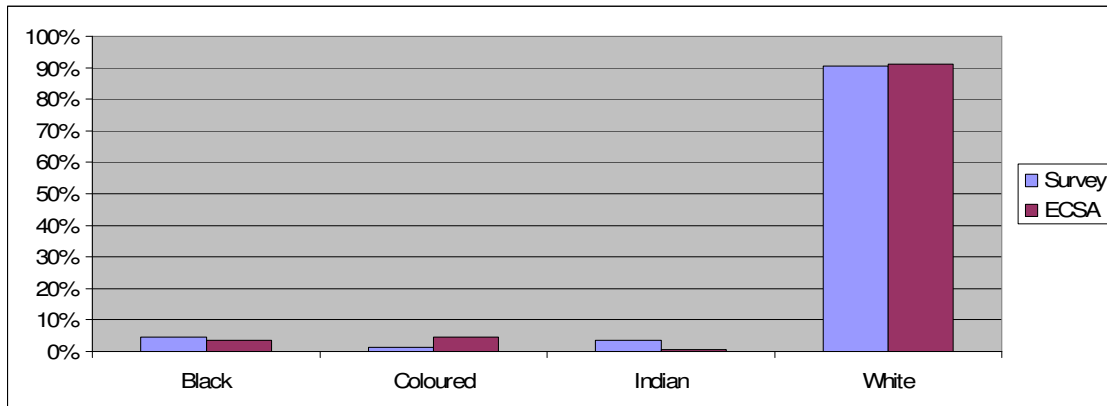
### **5.1.2 Gender**

Only 5% of respondents were female. This corresponds with the ratio of female engineers to male engineers registered with ECSA. Most female respondents were from the civil, chemical and industrial engineering disciplines, with none from the mechanical or mining engineering disciplines.

### 5.1.3 Race

Differences in the sentiments of various race groups were analysed. Figure 5.2 below indicates the number of respondents from each race group. The ratios correspond closely with the number of professional engineers from each race group registered with ECSA.

**Figure 5.2: Race distribution of respondents and ECSA members**



The overwhelming number of white male engineers (approximately 90% of the engineering population) are expected to influence the overall survey findings relating to affirmative action. As the number of respondents from each race group corresponded closely with the general population of engineers as per ECSA's data base of 13 826 engineers, the sample is considered to be representative of the engineering population.

### 5.1.4 Foreign Passport

A surprisingly large number (33%) of respondents held a foreign passport, or were able to obtain one within a short period of time. This obviously improves the mobility of these individuals. Certain individuals may choose to move overseas for the required period of time before returning to South Africa in order to qualify for foreign citizenship, thereby keeping their future options open should they wish to emigrate later.

As stated earlier, only South African nationals were included in the survey.

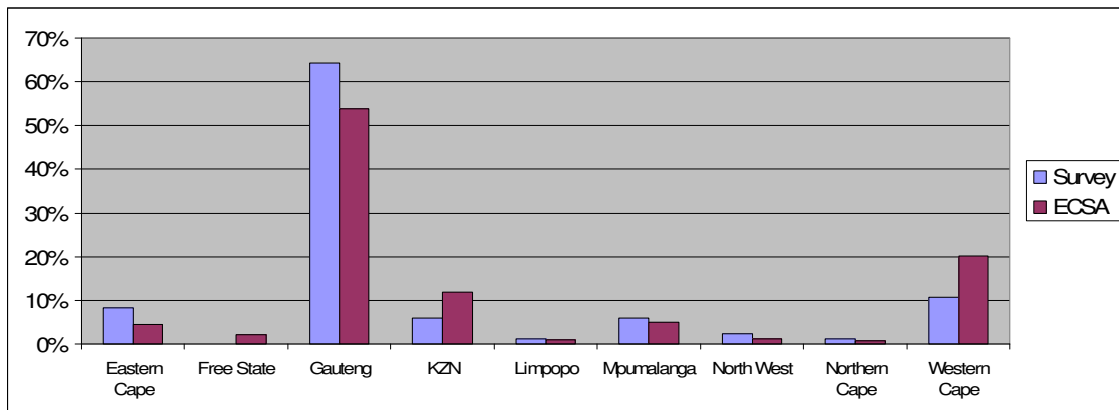
### 5.1.5 Home Language

The largest number of respondents were English speakers (56%), with 39% of respondents indicating Afrikaans as their home language. The remaining 5% of the respondents indicated Tsonga, Tswana or Zulu as their home language. No comparable statistics were available from ECSA regarding the home language of the general registered engineering population.

### 5.1.6 Geographic distribution of respondents

The geographic distribution of respondents is in line with the geographic distribution of professional engineers in South Africa, according to ECSA's database and is thus representative of engineers working in South Africa with regards to this parameter, even though there was a slightly higher number of respondents from Gauteng and lower number from the Western Cape. The geographic centre in which one works has an influence on remuneration, available opportunities and crime levels, to mention but a few of the factors which may influence emigration.

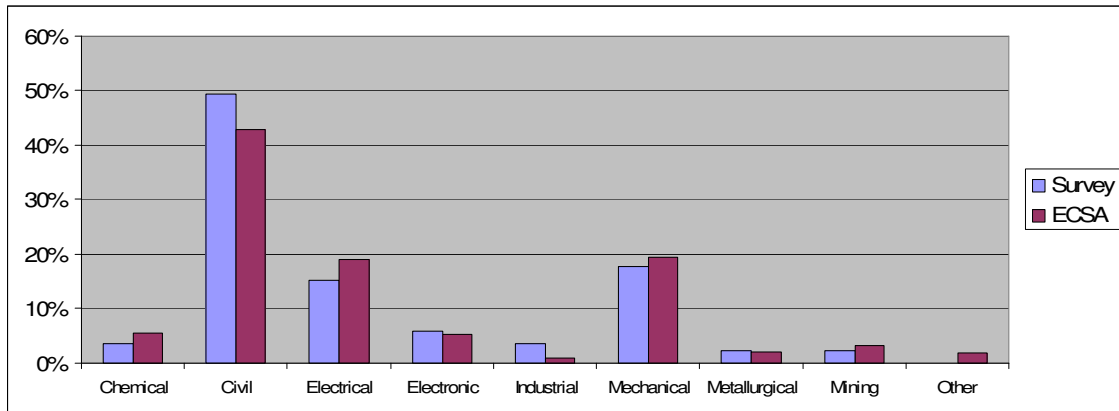
**Figure 5.3: Geographic distribution of respondents and ECSA members**



### 5.1.7 Engineering Discipline

Demand for various types of engineers is expected to vary amongst the engineering disciplines. Demand for civil engineers is high during periods of major infrastructural development, as is currently the case in South Africa as discussed earlier. This results in employment opportunities and conditions of employment varying amongst the engineering disciplines.

**Figure 5.4: Engineering discipline distribution of respondents and ECSA members**

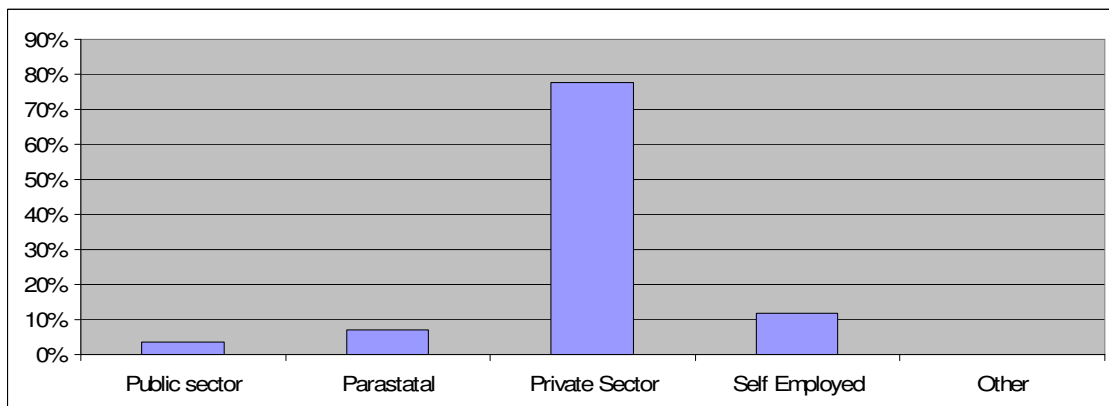


The engineering discipline distribution of respondents followed the general distribution of professional engineers registered with ECSA and can be considered to be representative of the general engineering population. Civil engineers constituted the largest number of engineers in the study with just less than 50%. Mechanical and electrical engineers were the next highest groups and constituted 18% and 16% respectively.

### 5.1.8 Employment sector

The vast majority of respondents (78%) were employed in the private sector. No data was available to indicate whether this was representative of the population. The results may be biased due to the conditions existing in this sector as compared to the public sector. Only 11% of respondents stem from the public sector and parastatals, with 11% of respondents being self-employed.

**Figure 5.5: Employment sector**

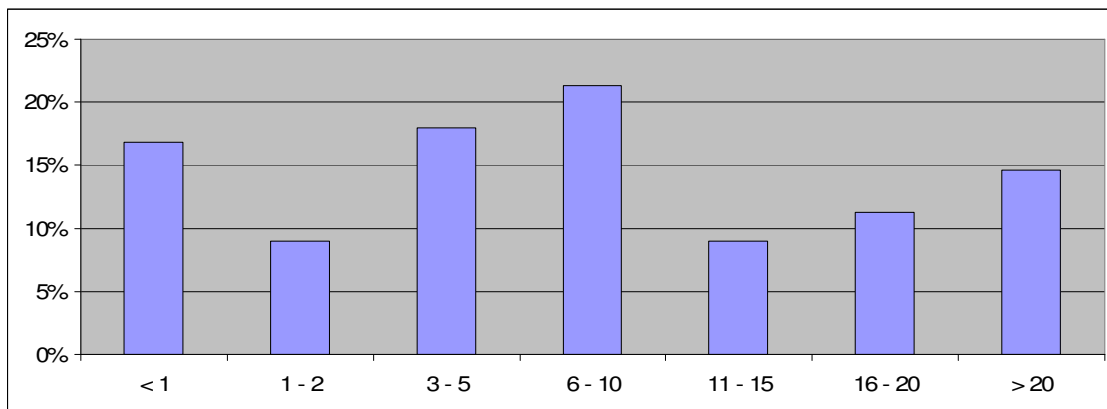




### 5.1.9 Length of service and nature of contract with employer

The length of service of each respondent with their current employer is an indication of the amount of change in the engineering industry, as well as the level of satisfaction that engineers experience working for a particular employer. As depicted in figure 5.6, a relatively large proportion of engineers (17%) had less than one years' service with a particular employer, with more than a quarter (26%) having less than two years' tenure. This appears to be indicative of a dynamic market.

**Figure 5.6: Length of service with current employer**



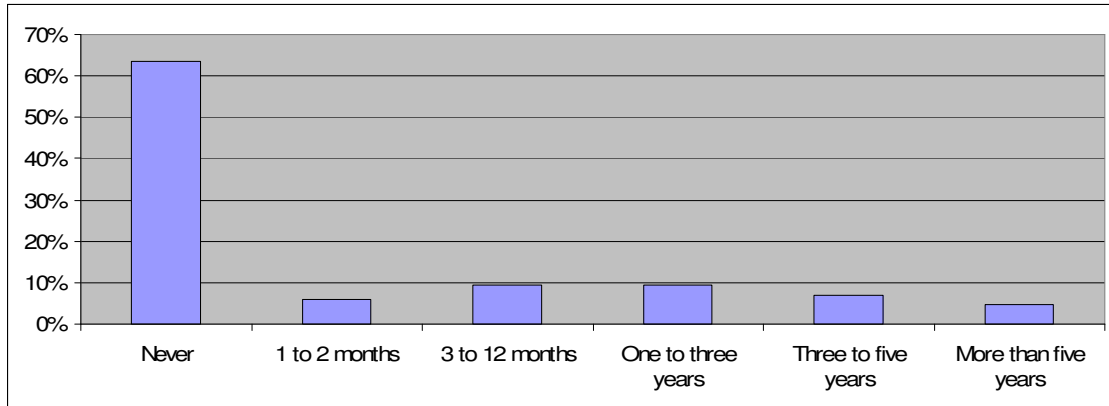
The nature of the employment contract is also expected to have an influence on the propensity of an engineer to change jobs, either to another employer within South Africa or possibly abroad. Only 6% of respondents were employed under temporary contracts. This could be an indication of the desire of employers to grant job security to employees in order to foster long-term relationships. Only during economic uncertainty or oversupply would one expect a larger proportion of employers to offer employment under short-term contracts.

### 5.1.10 Overseas work experience

More than a third (36%) of all respondents reported that they had previously been employed overseas. Of these, more than half had been employed for a period of more than one year. Previous overseas work experience is expected to enable respondents to make a more informed decision regarding emigration, as well as

providing overseas work references which could improve an individual's future career prospects both in South Africa and abroad. Those wishing to obtain foreign citizenship may choose to spend time overseas in order to attain the minimum tenure required to apply for citizenship.

**Figure 5.7: Duration of previous work experience overseas**



### **5.1.11 Family and close friends who have emigrated**

A staggering 88% of respondents indicated that they had family or close friends who had emigrated. Respondents are more likely to make informed decisions regarding emigration if they have family or close friends who they trust already living overseas who are able to offer guidance on the issue. Older respondents considering emigration may be doing so as they plan to follow their offspring who have already emigrated.

According to the survey, each respondent considering emigration would on average take two family members with them. This statistic would be useful in order to estimate the potential total population lost to the country through the emigration of engineers.

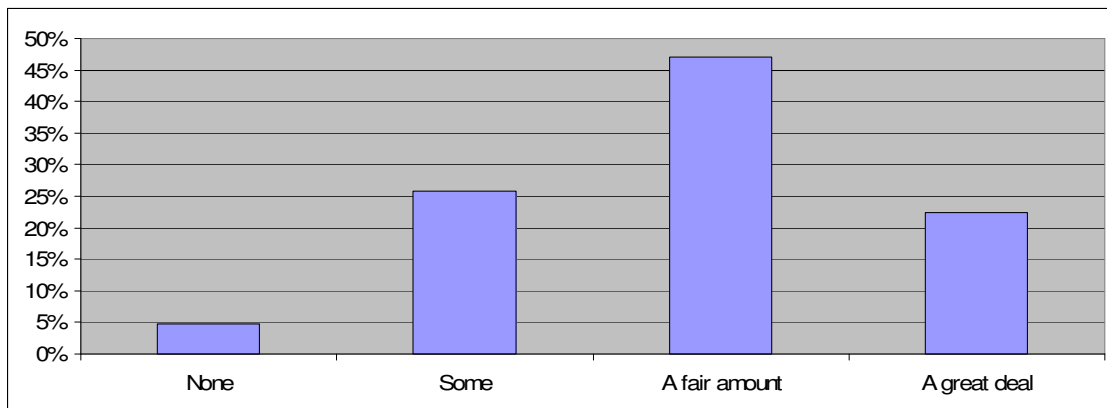
## **5.2 Propensity to emigrate**

Propensity to emigrate is determined by the extent of consideration given to the idea, the desire to emigrate and commitments made to emigrating, which are discussed below.

### 5.2.1 Consideration of emigration

Respondents were asked how much consideration they had given to emigrating within the next few years, how frequently they discussed this with their friends and family and to what extent they had researched the availability of jobs, remuneration and living conditions overseas, as well as procedures involved in emigrating. Respondents were asked to score these factors on a Likert scale of 1 to 5, with 1 indicating that no consideration had been given to emigrating, greater than 1 to 2 indicating that some consideration had been given, greater than 2 to 4 indicating that a fair amount had been given and greater than 4 to 5 indicating that a great deal had been given. The scores for the relevant questions were averaged in order to obtain an index for each individual indicating the extent to which they had considered the idea.

**Figure 5.8: Extent of consideration given to emigrating – all respondents**



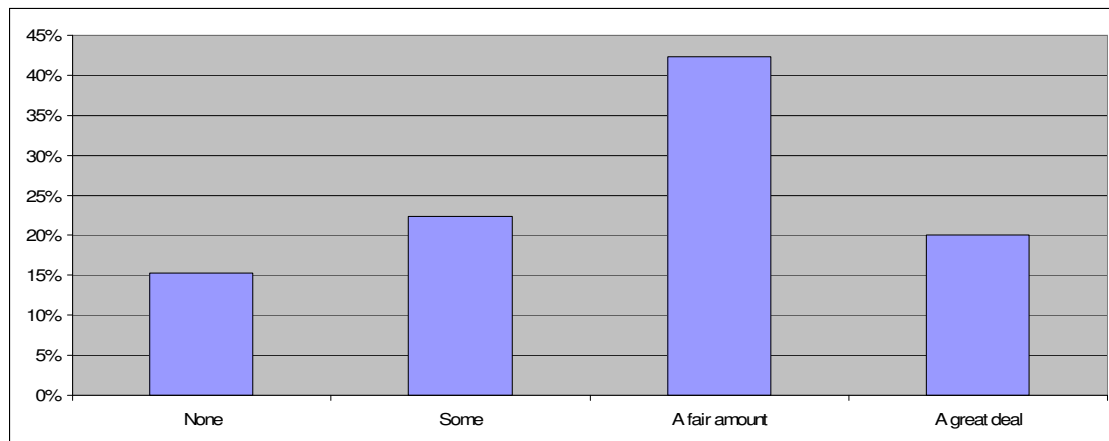
Only 5% of respondents indicated that they had given no thought to emigrating. Almost a quarter (23%) indicated that they had given a great deal of thought to emigrating.

### 5.2.2 Desire to emigrate

Engineers were asked to rate on a Likert scale of 1 to 5 how strong their desire to move is. A summary of their responses is indicated below, with 1 indicating that they have absolutely no desire to leave, greater than 1 to 2 indicating that they have some desire, greater than 2 to 4 indicating that they have a fair amount and greater than 4 to 5 indicating that they had a great desire to leave. The results are fairly consistent

with the extent of consideration given to emigrating, with the exception that more respondents had no desire to emigrate (16%) compared with the number who had not considered emigration (5%). Similar proportions of those who had considered emigration “a fair amount” and a “great deal” also had similar desires to emigrate.

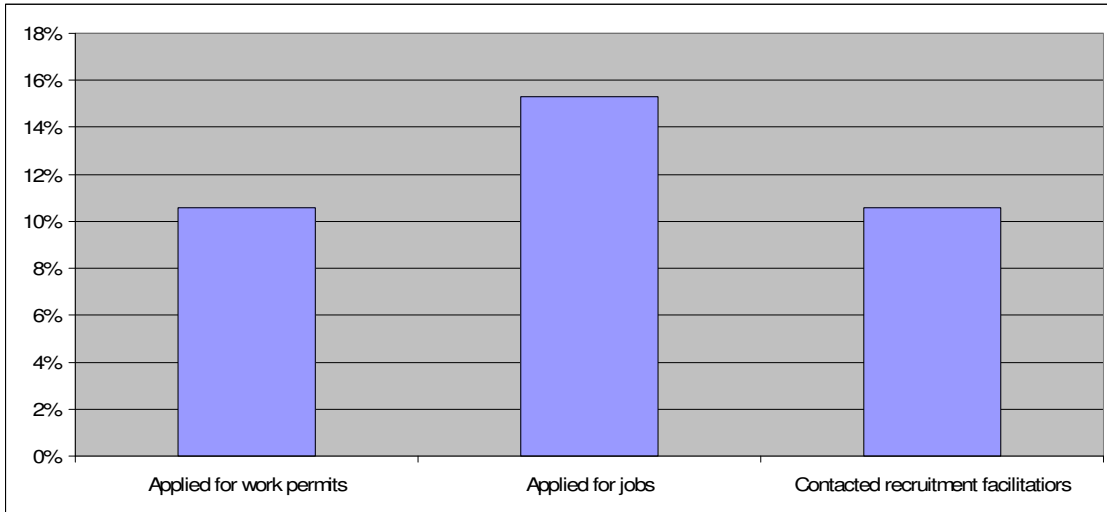
**Figure 5.9: Desire to emigrate**



### **5.2.3 Commitment to emigrating**

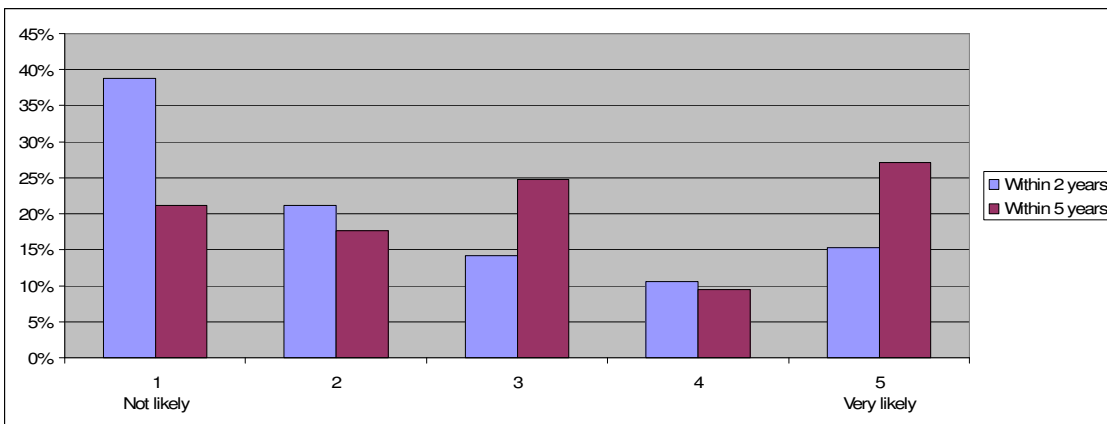
Even though respondents may have indicated that they have spent time considering emigration and that they have a desire to emigrate, their commitment to actually going needs to be assessed. For this reason, respondents were asked what actions they had taken towards emigrating, including whether they had applied for work permits or jobs in overseas countries and whether they had been in contact with recruitment facilitators for jobs in foreign countries. Results are indicated in figure 5.10. It is worth noting that some countries require that one obtain a job offer before a work permit is granted, depending on the type of work permit applied for. This could explain why more respondents had applied for jobs than work permits. The group of respondents indicating that they have applied for work permits and jobs or had contacted recruitment facilitators represents the group most likely to emigrate within a short period of time.

**Figure 5.10: Actions taken towards emigration**



Respondents were also asked how likely they were to emigrate within the next two years and within the next five years.

**Figure 5.11: Likelihood of emigrating within the next two years and the next five years**

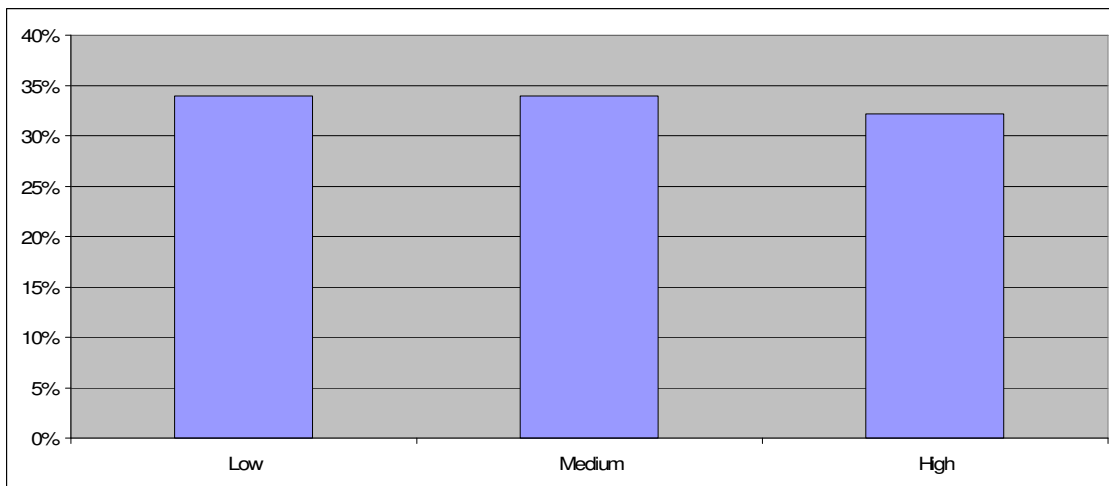


More respondents are likely to emigrate within the next five years compared to within the next two years. However, it would seem that those who considered it very likely that they would emigrate within the next five years (27%) have not yet fully researched the idea and do not all yet have a great desire to emigrate when compared with those statistics.

### 5.2.4 Overall propensity to emigrate

Mattes and Richmond (2002) suggest that propensity to emigrate is dependent on the extent of consideration given to the idea, the desire to emigrate and commitments made to emigrating. The results indicated above were combined into a single index intended to determine emigration potential. This was done by calculating the average of the scores (1 to 5) for the extent of consideration given to emigrating, the desire to emigrate and commitments made to emigrating. On a scale from 1 to 5, the propensity to emigrate for those scoring less than 2 was classified as “low”, 2 to 3.5 was scored as “medium” while greater than 3.5 to 5 was scored as “high”.

**Figure 5.12: Overall propensity to emigrate**

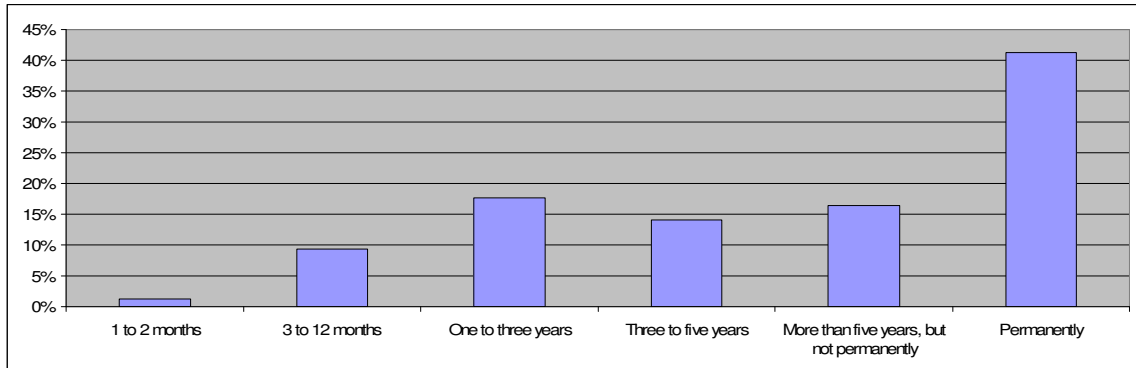


### 5.3 Likelihood of returning to South Africa

The sample was asked for what period of time they would want to leave South Africa if emigrating. Following United Nations criteria, a period of more than two years' absence is classified as emigration. However, some engineers may still wish to return to South Africa after living and working in another country for a longer period of time. Thus, what would be considered by international standards as a permanent move, and thus emigration, might not be equivalent to a permanent loss of engineers from South Africa. However, the longer one resides in a new country, the lower the probability of returning home.

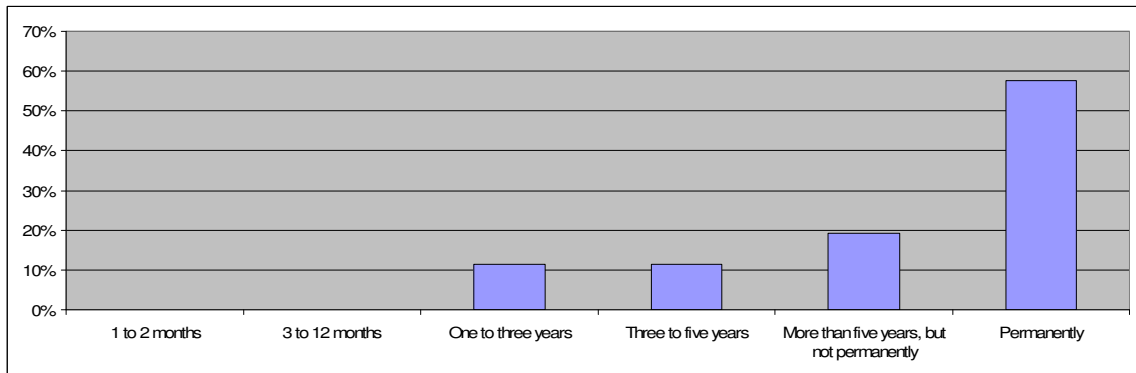
Figure 5.13 indicates that only 42% of all respondents would emigrate permanently.

**Figure 5.13: Duration of stay for sample group**



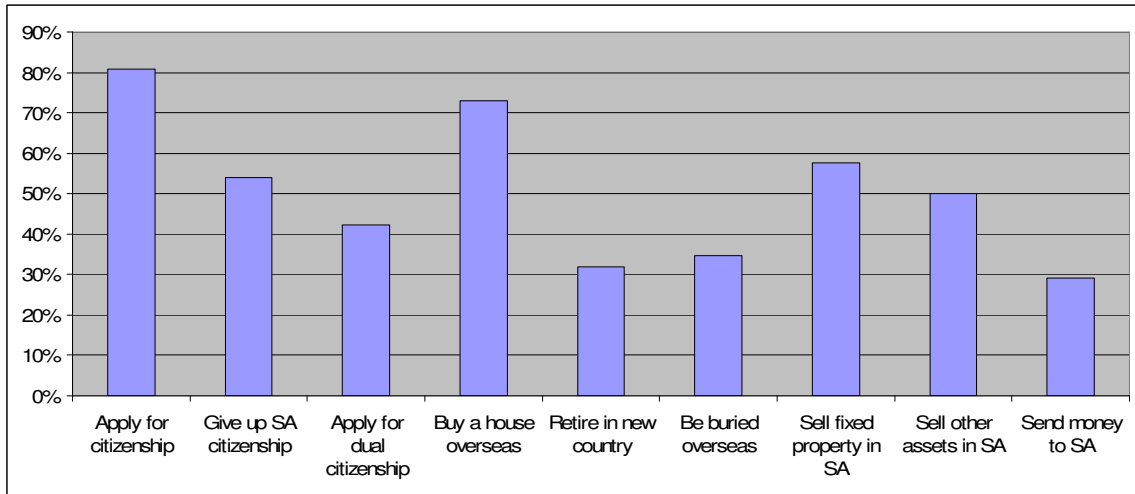
The intended duration of stay for the sample group with a “high” propensity to emigrate was longer, with more than 58% indicating that they intended to move permanently.

**Figure 5.14: Duration of stay for sample group with “high” propensity to emigrate**



Respondents were asked to indicate on a scale of 1 to 5 how likely they were to take various actions which are indicative of the permanence of their stay, with 5 indicating that their stay will be more permanent and 1 indicating that the stay may be temporary. Results from the “high” emigration potential group are indicated in figure 5.15.

**Figure 5.15: Factors influencing permanence of stay**



When asked how likely it was that they would apply for citizenship in their new country of residence, 81% of respondents indicated that they would definitely do so. There are various benefits to be gained in obtaining foreign citizenship if one intends to live overseas as explained earlier in section 3.7 of this report. This is therefore a strong indicator of whether a person intends to emigrate permanently or would like to keep their options open as commented upon earlier.

Respondents were asked whether they would be willing to give up their South African citizenship when emigrating. Only 54% of respondents from the group with a “high” propensity to emigrate indicated that they would be willing to do so. Fewer than half (42%) said that they would apply for dual citizenship. This indicates that most of those emigrating would like to keep their options open with regards to which countries they could easily move to and work in in future.

The sample group was asked whether they would consider purchasing a house in their new country of residence if they could afford to do so. Almost three quarters (73%) of respondents said that they would definitely do so. This may be as a result of the inclination of South Africans to own property rather than to rent it. Nevertheless, this is an indication of the degree to which they would be willing to put deep roots down.



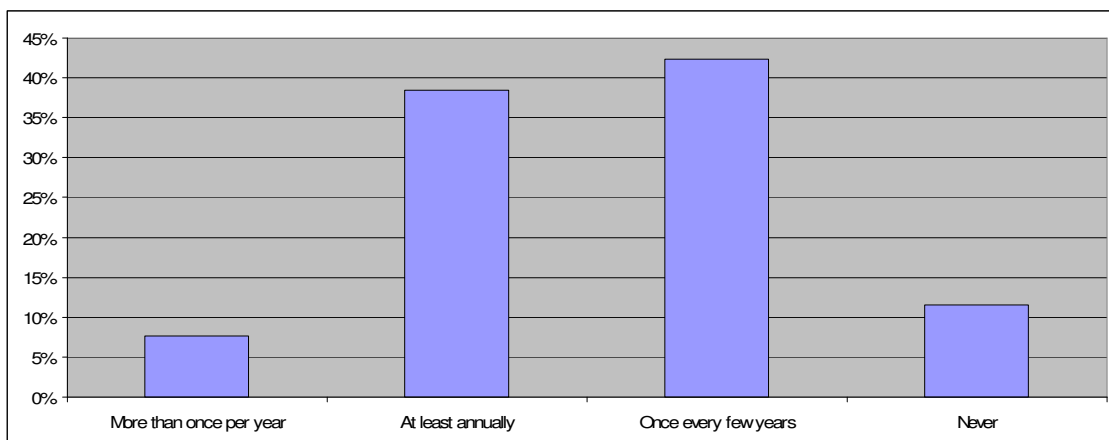
Only 31% of respondents from the “high” group who were asked whether they would like to retire in their new country of residence indicated that they would definitely do so. This is a further indication that most of those with a high propensity to emigrate intend to return to South Africa at some time before retiring. This is contrary to what one might expect given that fact that the vast majority of respondents expected conditions to worsen or at best stay the same in South Africa in future.

Just over a third (35%) of respondents from the “high” group who were asked whether they would like to be buried overseas indicated that they would like this. This is an indication that in the long term, most potential emigrants intend to return to South Africa at some point in time. Obviously the living and working conditions encountered overseas will influence this decision to a large extent.

More than half (58%) of potential emigrants from the “high” group indicated that they would sell all their fixed property in South Africa if they were to emigrate. Similarly, 50% indicated that they would sell all their other assets too. This is an indication of willingness to pull out roots in South Africa upon emigrating.

In order to determine whether potential emigrants would maintain ties with South Africa if they were to emigrate, they were asked whether they intend to send money to South Africa. 29% of respondents said that they would definitely do so. Also, when asked how often they intend to return to South Africa, only 12% of the “high” emigration potential respondents indicated that they never intend to return.

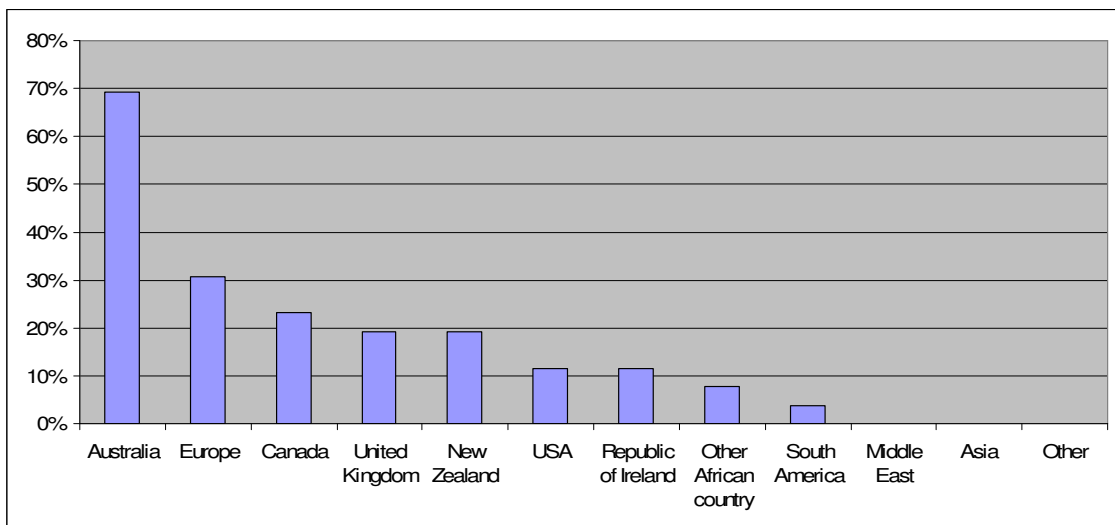
**Figure 5.16: Frequency of intended visits to SA from “high” potential emigration respondents**



## 5.4 Most likely destinations

Respondents were asked to indicate whether they would consider emigrating to a selection of countries. Note that participants were able to indicate that they would consider emigrating to more than one country, which means that the sum of the percentages is not necessarily 100%.

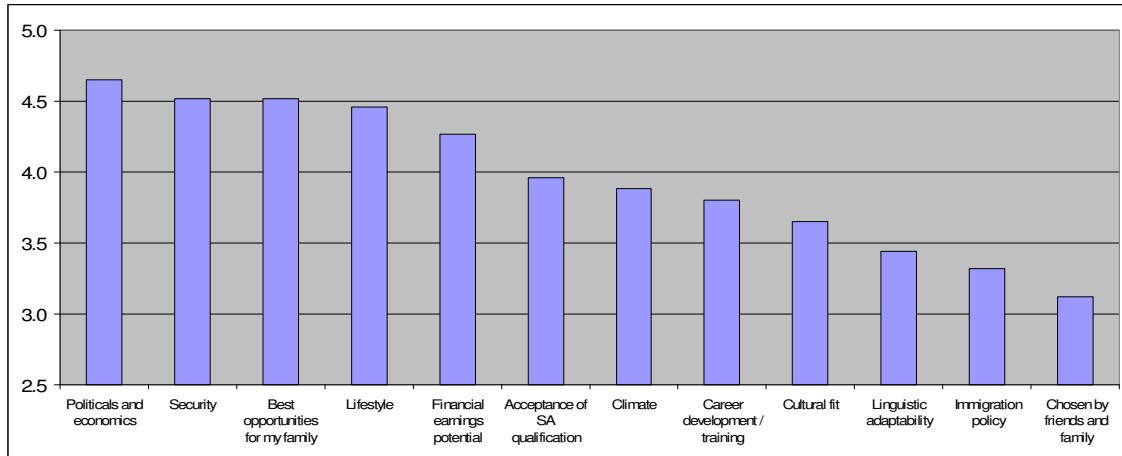
**Figure 5.17: Most likely destination for engineers with “high” emigration potential**



Australia was the most popular destination chosen by a substantial margin, with 69% of respondents indicating that they would definitely consider it as a destination country, followed by Europe, Canada and the United Kingdom.

The sample was asked to rate the importance of a number of criteria relating to a host country when selecting an emigration destination, with 1 being “not important” and 5 being “very important”. The results from the “high” group are indicated in figure 5.18.

**Figure 5.18: Importance of criteria for choosing a destination country**

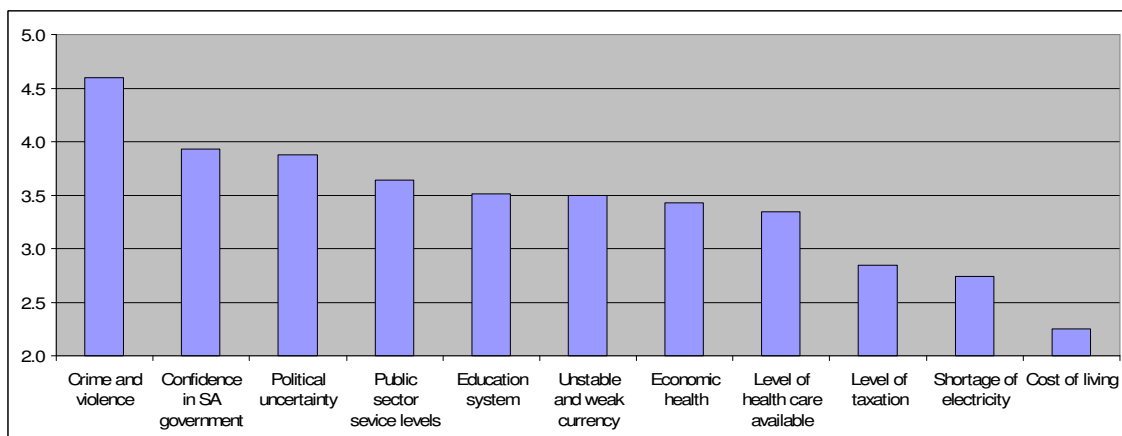


It is not surprising that the importance of a stable political and economic environment and security ranked top as these were the factors which most engineers considering emigration cited as the most important reasons for doing so.

### 5.5 Factors causing engineers to consider emigration

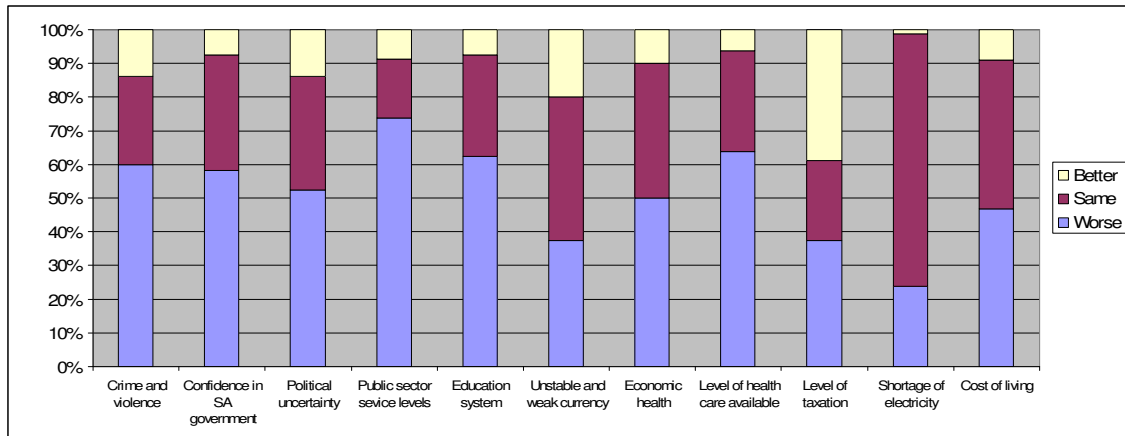
The sample was asked to rate the importance of the contribution of a number of criteria relating to general living conditions in South Africa in their decision to consider emigration on a scale of 1 to 5, with 1 being “not a contributing factor” and 5 being a “highly significant contributing factor”. As the answers from white respondents differed from those of black, coloured and Indian respondents, these are indicated separately.

**Figure 5.19: Country-related conditions causing engineers to consider emigration – white respondents**



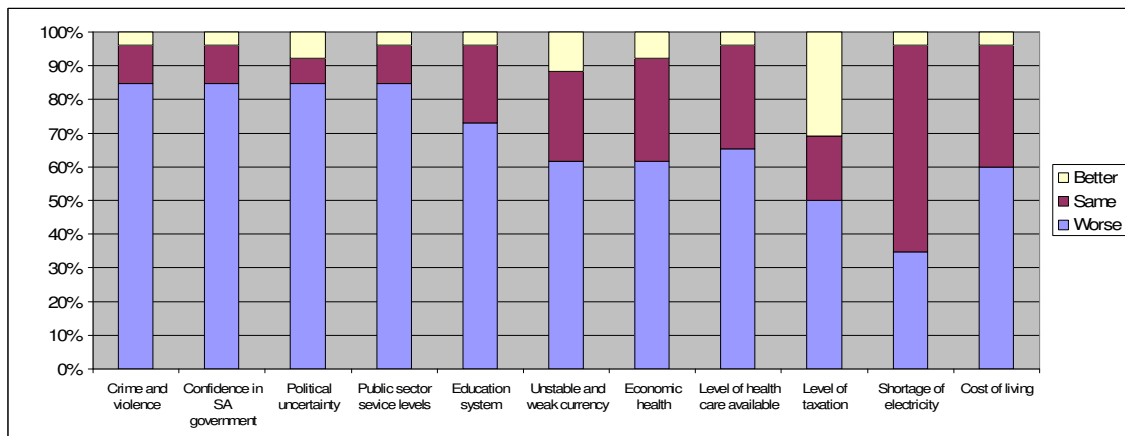
The sample were also asked whether they felt that these factors would get better, stay the same or get worse. Results for white respondents are indicated in figure 5.20.

**Figure 5.20: Expected changes in country-related factors causing engineers to consider emigration – all white respondents**



Respondents with a “high” emigration potential were far more pessimistic about the future and indicated in the figure 5.21.

**Figure 5.21: Expected changes in country-related factors causing engineers to consider emigration – white respondents with “high” emigration potential**

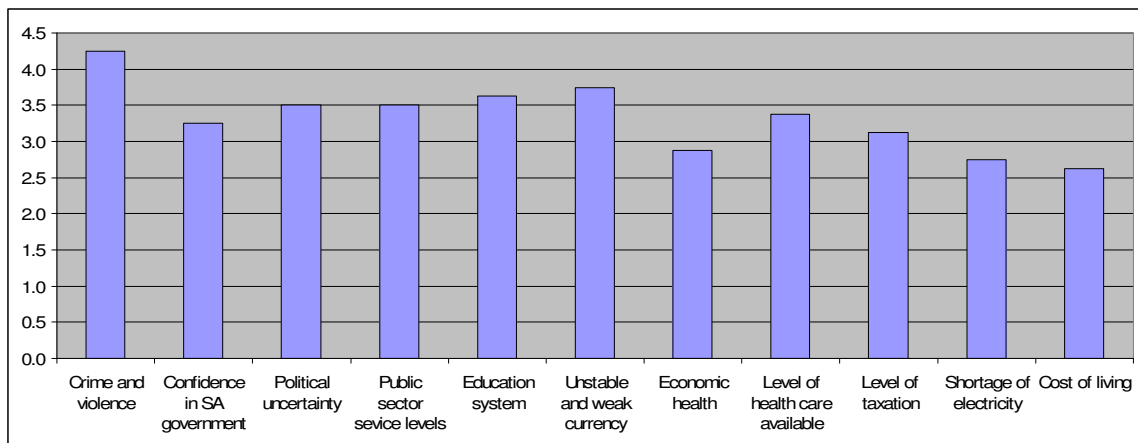


This paints a very bleak picture. With the possible exception of the current electricity shortage, the vast majority of respondents felt that the selected criteria would worsen

considerably in future, or at best, stay the same. Very few respondents were optimistic that conditions would improve in South Africa.

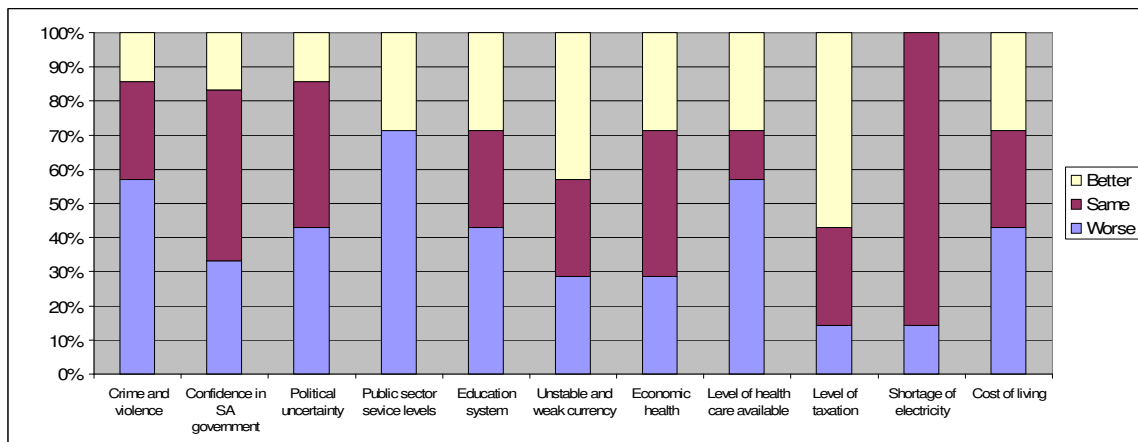
The results for black, coloured and Indian respondents are indicated in figure 5.22.

**Figure 5.22: Country-related conditions causing engineers to consider emigration – black, coloured and Indian respondents**



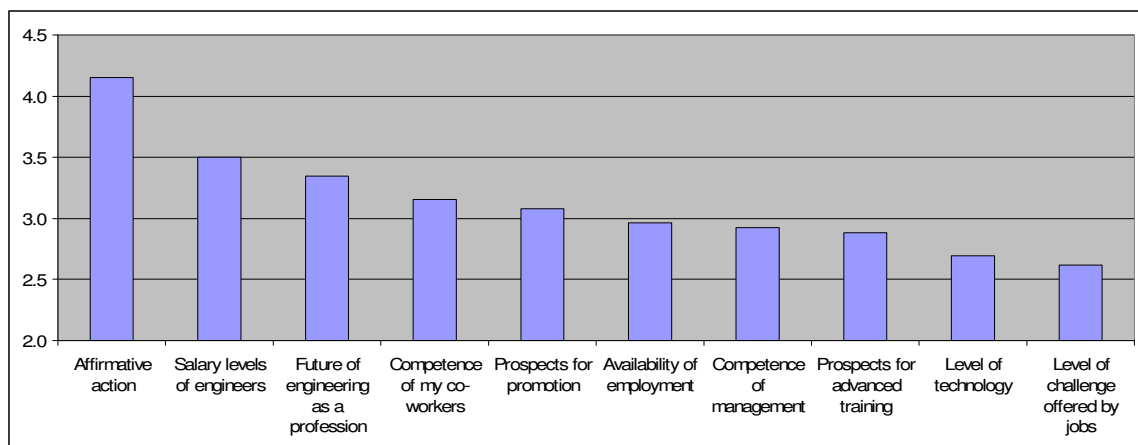
It is interesting to note that the views of previously disadvantaged respondents differed from those of the other respondents regarding the future outlook for South Africa. In general, this group appeared to be more optimistic regarding the future outlook for South Africa. Results from black, coloured and Indian respondents are indicated in figure 5.23.

**Figure 5.23: Expected changes in country-related factors causing engineers to consider emigration – black, coloured and Indian respondents**



In order to determine the role that work-related factors have in causing engineers to consider emigration, the sample were asked to rate a number of factors from 1 to 5, with 1 being “not a contributing factor” and 5 being a “highly significant contribution factor”.

**Figure 5.24: Work-related conditions causing engineers to consider emigration – white respondents**

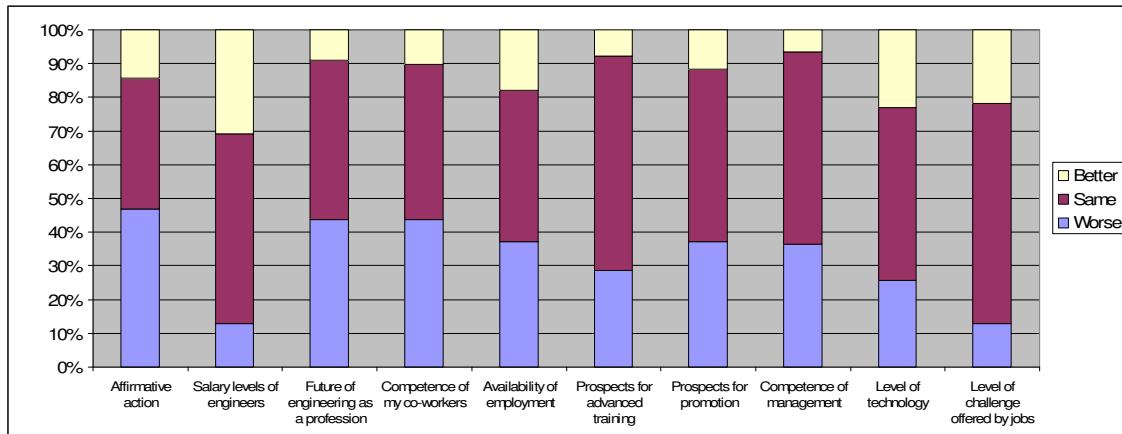


Amongst white respondents, affirmative action was given as the most predominant reason for considering emigration by a substantial margin. Interestingly, “prospects for promotion” was rated significantly lower as a contributing factor, even though this is likely to be influenced by the policy of affirmative action.

On average, engineers were far less dissatisfied with their conditions of employment compared with general living conditions in South Africa as reflected by the lower average scores.

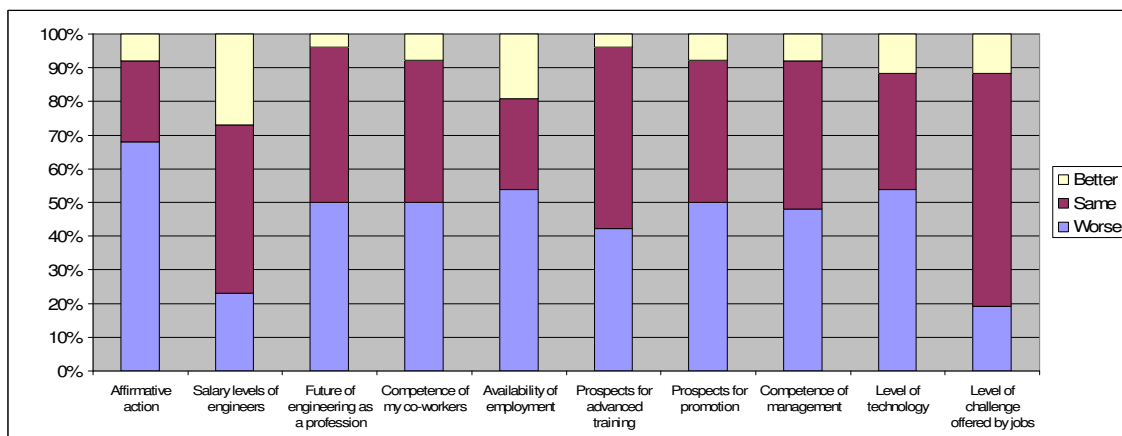
The sample was asked whether they expected these work-related factors to get better, stay the same or get worse in future. The results for all white respondents are indicated in figure 5.25.

**Figure 5.25: Expected changes in work-related factors causing engineers to consider emigration – all white respondents**



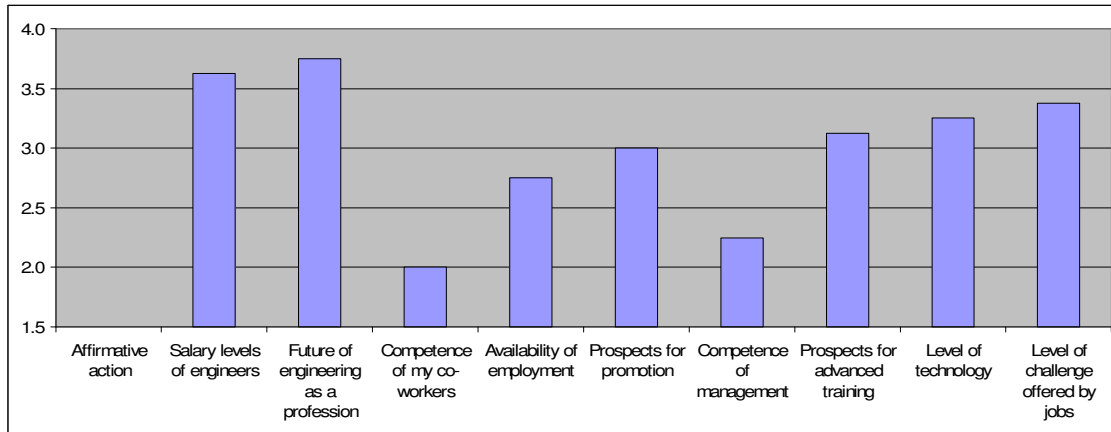
With the exception of the salary levels of engineers and level of challenge offered by jobs in South Africa, respondents expected work-related factors to deteriorate more than improve. Although the “high” emigration potential group were more pessimistic regarding the future work place conditions as indicated in figure 5.26, the difference between the “high” group and the entire sample group was not as pronounced as for country-related factors.

**Figure 5.26: Expected changes in work-related factors causing engineers to consider emigration – white respondents from “high” emigration potential group**

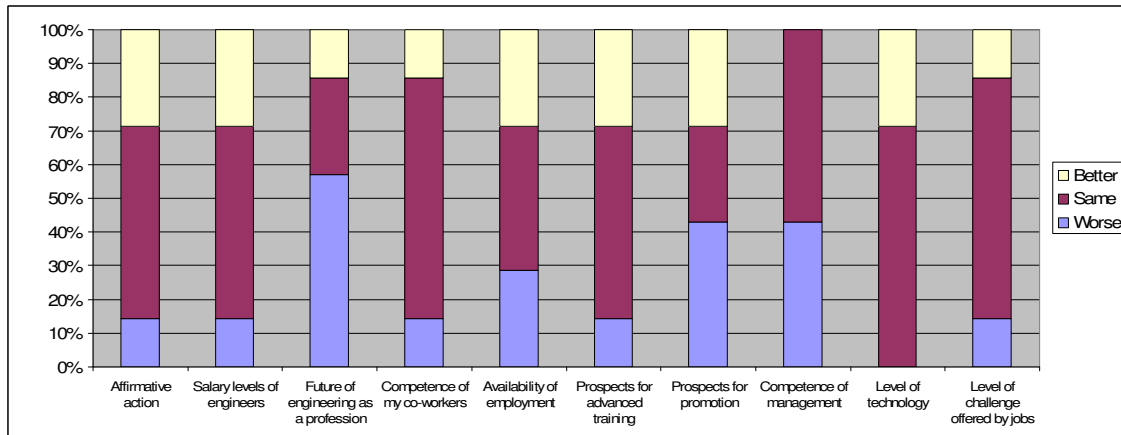


The responses from black, coloured and Indian respondents differed from those of white respondents as indicated in figure 5.27, the most obvious difference being the role of affirmative action.

**Figure 5.27: Work-related conditions causing engineers to consider emigration – black, coloured and Indian respondents**



**Figure 5.28: Expected changes in work-related factors causing engineers to consider emigration – black, coloured and Indian respondents**



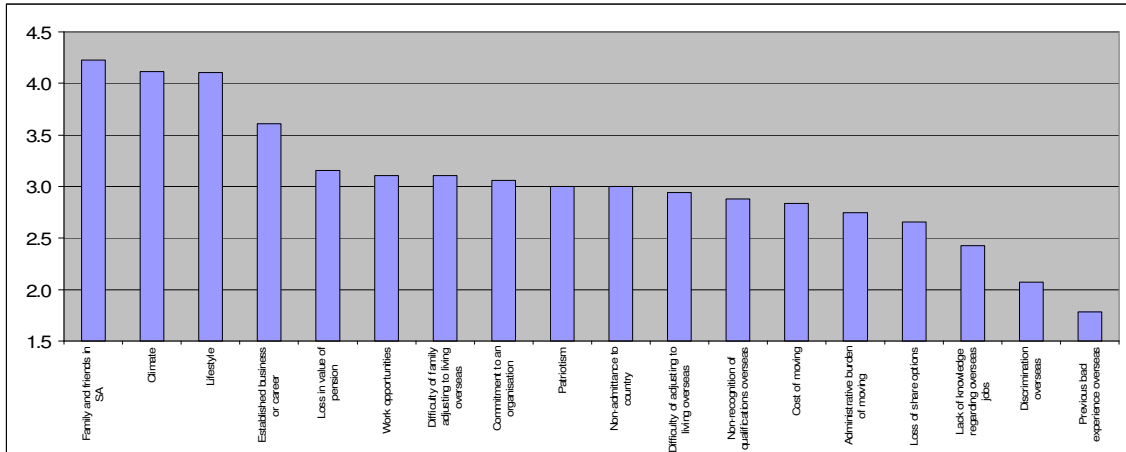
In general, black coloured and Indian engineers were far more optimistic about the future of their work environment than white engineers.

## 5.6 Factors contributing to the retention of engineers in South Africa

Engineers were asked to rate a number of factors which in their opinion contributed to the retention of engineers in South Africa, with 1 indicating that the factor “does not contribute at all” and 5 indicating that it is a “key contributor”. The results are indicated in figure 5.29.



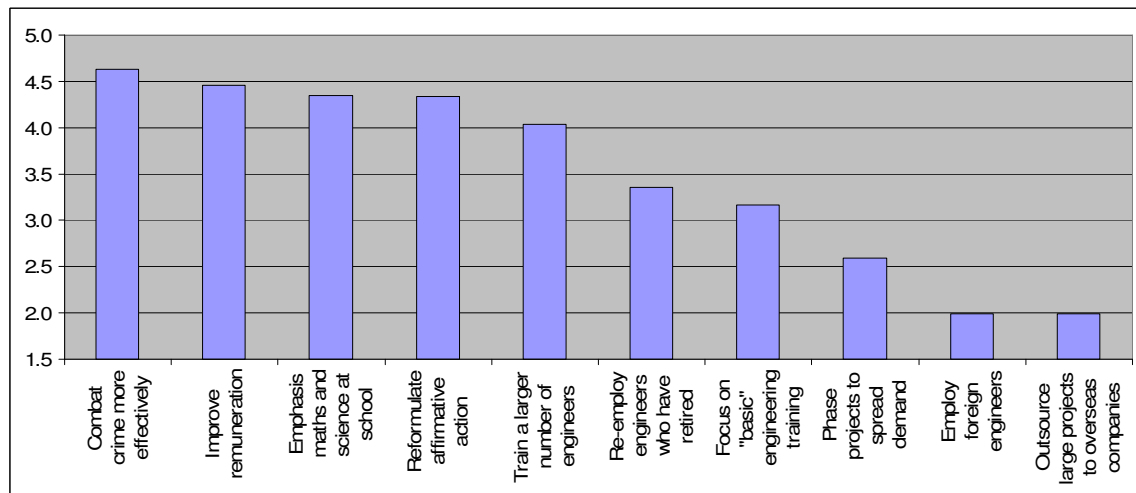
**Figure 5.29: Factors contributing to the retention of engineers in South Africa**



Family and friends living in South Africa was cited as the reason most likely to keep engineers from emigrating, followed by the climate and lifestyle.

The sample group was asked to rate the effectiveness of a number of measures which could be taken in order to combat a shortage of engineers in South Africa. The results are indicated in figure 5.30.

**Figure 5.30: Predicted effectiveness of various actions to combat the shortage of engineers in South Africa**



Taking action against the factor most commonly cited for causing engineers to consider emigration ranked the highest, namely combating crime more effectively. Improving remuneration and reformulating the policy of affirmative action were the

most prominent work-related factors which could be addressed in order to retain existing engineers.

Placing more emphasis on mathematics and science at school was cited as an effective method of increasing the potential pool of learners which could be admitted to study engineering. However, it needs to be ensured that the capacity of universities to train an increased number of engineers on an ongoing basis is sufficient. This may include having to improve the remuneration packages of lecturers in order to attract more of these highly qualified individuals to this profession as suggested by Lawless (Cameron, 2008).

Actions least likely to combat the shortage of engineers effectively were related to employing foreign engineers or outsourcing large projects to foreign engineering companies.

## **5.7 Chapter summary**

In summary, 115 responses were received from the 488 questionnaires emailed to the sample. The demographic characteristics of the respondents were compared with those of the professional engineers registered with ECSA. It was found that the respondents were representative of the general professional engineering population in South Africa. Results revealed that 32% of respondents had a “high” propensity to emigrate, with 34% having a “medium” propensity and also 34% having a “low” propensity. From the group identified as having a “high” emigration potential, 58% indicating that they intended to move overseas permanently. Australia was found to be the most popular emigration destination by a substantial margin. Crime and violence was cited as the most important country-related factor causing engineers to consider emigration, whilst the policy of affirmative action was cited as the most important work-related factor. In general, white respondents were pessimistic about the future and expected conditions to worsen in the country, whilst black respondents appeared to be more optimistic. Family and friends living in South Africa was cited as the reason most likely to keep engineers from emigrating, followed by the climate and lifestyle. Respondents felt that crime should be combated more effectively, remuneration for engineers should be improved and more emphasis should be placed on mathematics and science at school in order to dissuade engineers from emigrating and to increase the number of engineers being trained.

## CHAPTER 6

### 6. DISCUSSION, RECOMMENDATIONS AND CONCLUSION

#### 6.1 Introduction

This chapter presents an analysis and discusses the research results obtained in chapter 5, before coming to a conclusion and offering recommendations. It starts by first examining the challenges encountered when collecting and analyzing the data. The results of the analyses will be discussed against the research questions posed.

#### 6.2 Data collection challenges

Data collection posed challenges in that the questionnaire enabled respondents to include variables other than those specified for:

- most likely destinations;
- country and work-related factors causing them to consider emigration;
- factors contributing to the retention of engineers in South Africa and
- actions to combat the shortage of engineers in South Africa.

The statistical analysis was simplified by grouping similar variables in certain areas of analysis.

#### 6.3 Demographic characteristics of those most likely to emigrate

As stated earlier, ECSA's database revealed that approximately 50% of its members registered as professional engineers are over the age of 55, whilst only 28% of the respondents to the survey indicated that they were over this age. This is probably due to the fact that many of the respondents over the age of 55 are no longer practising as engineers and their email addresses would not have been easily obtainable.

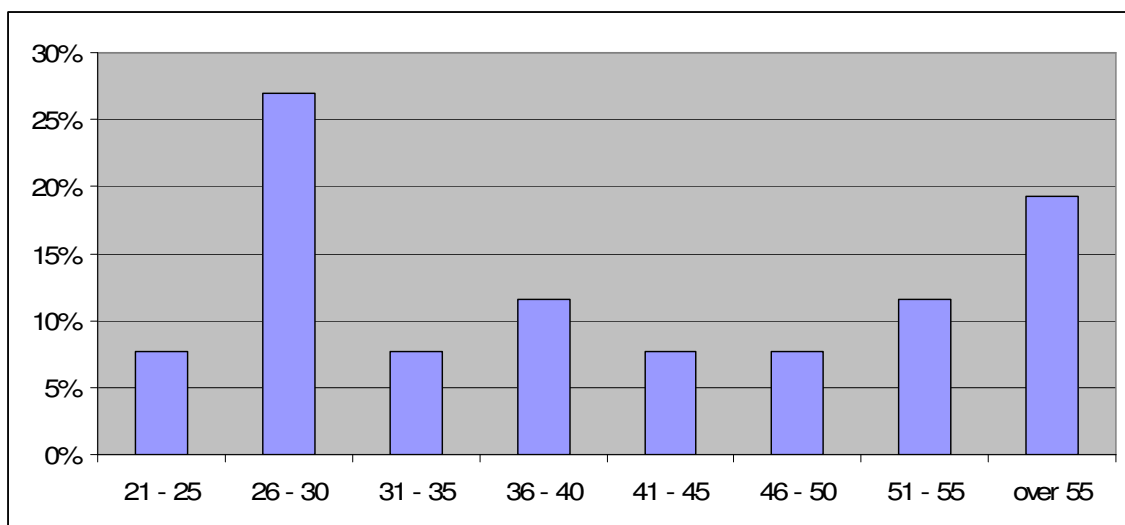
What is of great concern is the large proportion of engineers over the age of 55 who are possibly not still practising as engineers. In fact, almost a quarter (23%) of ECSA members registered as professional engineers are over the age of 70. If one assumes that two thirds of ECSA members in South Africa are still practising

engineers and that only half of the total number of graduate engineers in South Africa are registered with ECSA, then the total number of practicing graduate engineers in the country would be 18 434, a number far lower than the 30 000 estimated by ECSA.

The research question relating to the typical demographic characteristics of those engineers most likely to emigrate can be answered as follows:

The age group for respondents with the highest emigration potential was 26 to 30 as depicted in figure 6.1. This group represents those who have some work experience, but may not yet have put deep roots down. They are also less likely to have onerous work or family responsibilities to take into account, particularly those without offspring, compared with their older colleagues. This corresponds with the findings of Mattes and Mniki (2007) who found that younger adults are more likely to emigrate than older ones. However, the next highest age group for emigration potential after the 26 to 30 age group was the over 55 age group. This group typically represents the group who would find it most difficult to find employment within South Africa, but also have the most experience. Anecdotal evidence also suggests that this group, especially white males, are frequently targeted for early retirement in order to make way for previously disadvantaged individuals.

**Figure 6.1: Age distribution for “high” emigration potential candidates**



A quarter of the female respondents fell into the “high” emigration potential category compared with 34% of males. As only 5% of respondents were female, the reliability of this finding may be questioned.

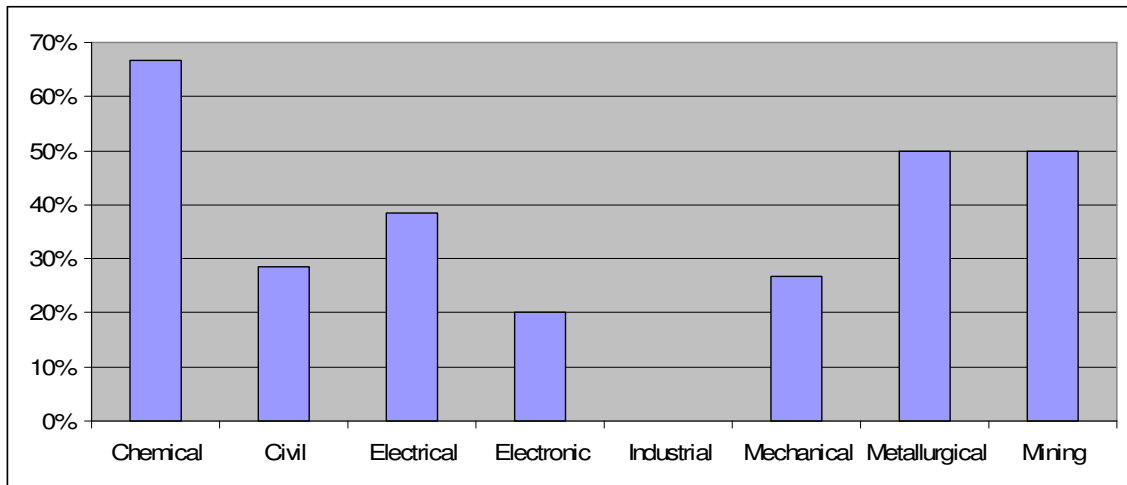
White respondents were most likely to emigrate, followed by Indian, coloured and black respondents, with only 11% of black respondents having a “high” potential to emigrate. This result seems to be influenced by the policy of affirmative action, which was cited by white respondents as being the leading work-related factor causing them to consider emigration. Indian, coloured and black respondents also seemed far more optimistic regarding the future of living conditions in the country as well as their conditions of employment.

Just less than a third (31%) of respondents from the “high” emigration category held foreign passports or were able to obtain them within a short period of time. This indicates that having access to a foreign passport has very little impact on propensity to emigrate considering that 33% of all respondents surveyed held foreign passports.

Amongst white respondents, home language seems to have a negligible impact on propensity to emigrate, with 31% of English speakers having a high potential to emigrate, compared with 30% of Afrikaans speakers. This corresponds with the findings of Van Rooyen (2000), which indicated that similar numbers of English and Afrikaans speakers were emigrating in contrast to earlier studies which showed that emigrants were predominantly English-speaking.

The proportion of engineers from each engineering discipline with a “high” potential to emigrate is indicated in figure 6.2. Note that due to the relatively small sample size, this statistic may not be entirely representative of the population.

**Figure 6.2: Proportion of engineers in each discipline with a “high” potential to emigrate**



Chemical engineers showed the highest emigration potential with 67% of respondents falling into the “high” category.

There were no major differences in the proportion of engineers with a “high” propensity to emigrate amongst the various employment sectors, except for those employed by parastatals where a smaller proportion of individuals had a high propensity to emigrate. This can be explained in part by the fact that 62% of black, Indian and coloured respondents were employed by parastatals and this demographic group was shown earlier to have a lower propensity to emigrate.

**Figure 6.3: Proportion of engineers with “high” emigration potential from various employment sectors**

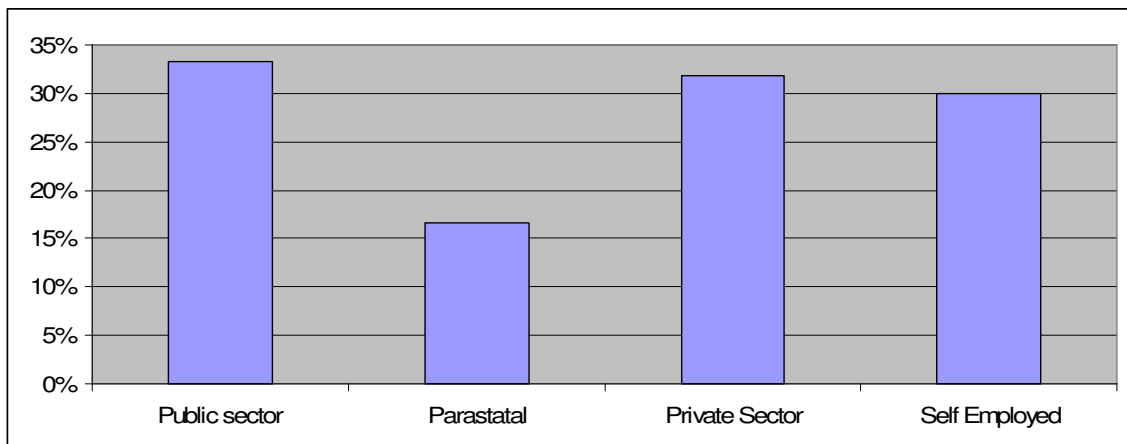
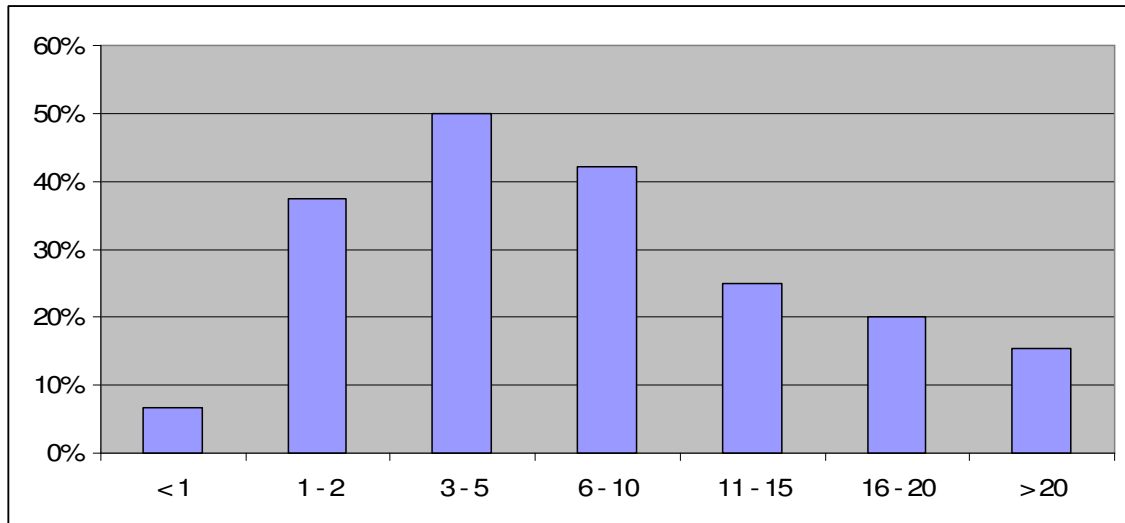


Figure 6.4 indicates that the highest number of individuals with a high potential to emigrate are likely to have 3 to 5 years' service with their current employer.

**Figure 6.4: “High” emigration potential versus length of service with current employer**



Of those with a “high” emigration potential, 92% have close friends and family who have emigrated, while 88% of all of those surveyed have close friends or family who have emigrated. As such a large portion of respondents had close friends or family who have emigrated, this parameter can not be reliably related to emigration potential.

The overwhelming number of white male engineers (approximately 90% of the professional engineering population) is an indication of the challenges that the industry faces with regards to transformation. The fact that the vast majority of potential emigrants stem from this group does not bode well for future engineering skills shortages.

#### **6.4 Current emigration potential amongst South African engineers**

Emigration potential is determined by the extent of consideration given to the idea, the desire to emigrate and commitments made to emigrating. These are discussed below.

The survey enquired regarding the degree of thought given by engineers to leaving South Africa. It is safe to assume that those who have not thought about the matter have no potential to move for the time being. Thus, this question helped define the pool of South African engineers who might conceivably leave.

The pool is a large one, with only 5% of respondents indicating that they have not given any thought to leaving, 26% indicating that they have given “some” thought to leaving, 47% indicating that they have given leaving a “fair amount” of thought and 22% indicating that they have given leaving “a great deal” of thought. The proportion of engineers who have given thought to the idea of emigrating (95%) is larger than the proportion of the skilled population who indicated that they had done so during the survey conducted by Mattes and Richmond (2002) amongst skilled individuals, who found that only 69% had considered the idea of emigrating to any extent. This may be due to the fact that changes in the socio-economic environment have worsened in general since 2002, or that the engineering fraternity are more likely to emigrate than other skilled individuals.

While only 16% of the population indicated that they had no desire to leave at all and 20% indicated a great desire to leave, certain respondents indicated that although they actually did not want to leave, they felt that they had to for various reasons. Intention to emigrate may thus not be linked directly to desire to emigrate. The study conducted by Mattes and Richmond in 2002 amongst skilled individuals revealed that 18% of respondents expressed a great desire to leave. The results of this study are consistent with the study of Mattes and Richmond.

Even though respondents may have indicated that they have spent time considering emigration and that they have a desire to emigrate, their commitment to actually going needed to be ascertained before an overall intention to emigrate index was obtained. More than 10% of respondents indicated that they had taken some action towards emigrating. This group represents those most likely to emigrate within a short period of time. Obviously not all of those who have applied for work permits, jobs or contacted recruitment facilitators will actually emigrate though.

Just over a quarter of respondents (27%) indicated that they were very likely to leave within the next five years. This number is far higher than the 12% of skilled



respondents in the 2002 Mattes and Richmond study. Also, the proportion indicating that it is very likely that they will leave within the next two years (16%) is far higher than in the Mattes and Richmond study (5%). This could indicate that either conditions have changed since the 2002 study, or that engineers are more likely to emigrate than other skilled individuals.

By combining the above information in order to answer the research question, it can be deduced that approximately 10% of graduate engineers are likely to leave within a short period of time (less than one year), 16% may leave within two years and 27% may leave within the next five years.

## **6.5 Destination countries**

Australia was by far the most popular choice as a destination country, with 69% of “high” emigration potential candidates indicating that they would definitely consider emigrating to this country if they were to go. Australia was followed by Europe (31%), Canada (22%) and the United Kingdom (19%). This is in contrast to a comparable study conducted by Mattes and Mniki (2007) amongst university students, which indicated that 40% of students considering emigration would choose to go to Europe, 24% to the United Kingdom and only 15% to Australia. This is also in stark contrast to the official emigration statistics from Statistics South Africa which indicate that the United Kingdom is by far the most popular destination country for South Africans (36%) with only 14% choosing Australia, which is the next most popular destination (South Africa. Statistics South Africa, 2005).

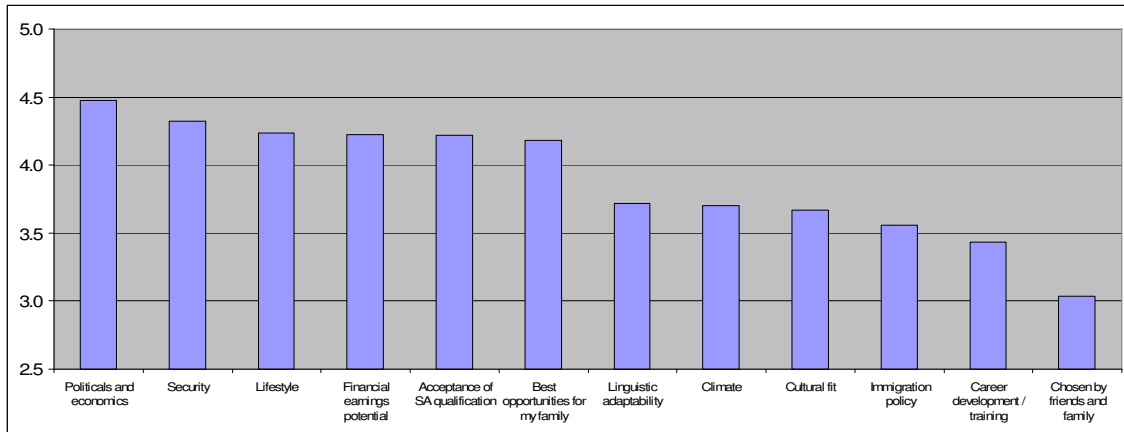
The findings of this study are also in contrast to the United Nations Development Index rating, which ranked Canada as the best country in the world in which to live for the previous seven years, with the United States of America fourth, New Zealand ninth, the United Kingdom fourteenth and Australia only fifteenth (Klein, 2008). This may be due to employment opportunities currently offered in Australia.

It is interesting to note that there were some racial differences. Black engineers favoured Canada, the USA and the United Kingdom over Australia. This is consistent with the study conducted by Mattes and Mniki (2007) which indicated that

black students were more likely to move to North America than anywhere else, while white students were more likely to move to Australasia.

The criteria used by engineers in choosing a destination country are examined more closely by referring to figure 6.5.

**Figure 6.5: Importance of various criteria for choosing a destination country**



It is not surprising to note that a stable political and economic environment and security scored highest as crime and violence, confidence in the South African government and political uncertainty were cited at the most important country-related factors causing engineers to consider emigration. Lifestyle, financial earnings potential, acceptance of South African qualifications and best opportunities for other family members also scored high. A number of factors scored significantly lower, including linguistic adaptability, climate, cultural fit, immigration policy, career development and training opportunities, as well as the destination chosen previously by friends and family who have emigrated. Most of these criteria can be researched and would be known entities to potential emigrants, thus representing limited risk. However, most of these criteria are not unique to engineers and do not explain why engineers are more likely to choose Australia as an emigration destination. The popularity of this destination may be associated with employment opportunities.

## **6.6 Factors causing engineers to consider emigration**

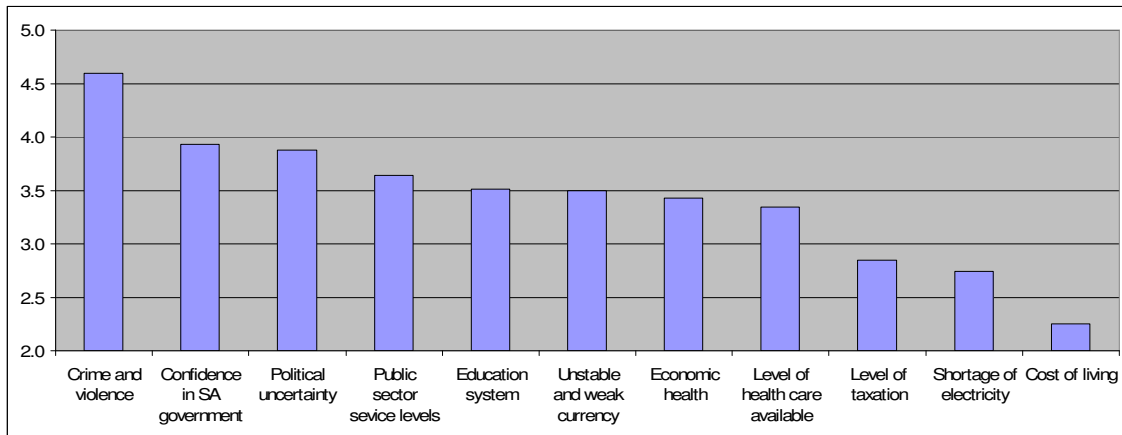
Two groups of factors were examined in order to determine the role of each in causing engineers to consider emigration. The first group consists of country-related factors, while the second consists of work-related factors.

### 6.6.1 Country-related factors

Crime and violence was cited as being the most predominant county-related driver resulting in engineers considering emigration as depicted in figure 6.6. Level 2 of Maslow's hierarchy of needs deals with an individual's need to feel that they are protected from harm, violence, disease, war and poverty (Allen, 2003). Individuals strive to satisfy their lower order needs before moving onto higher order needs. The fact that engineers do not feel safe from crime and violence in South Africa seems to drive them to consider emigration in order to satisfy their level 2 needs.

Results also revealed that respondents were not confident that their future needs would be looked after by government and that political uncertainty weighed heavily on their minds, thus further detracting from them being able to satisfy their level 2 need for security.

**Figure 6.6: Country-related conditions causing engineers to consider emigration – white respondents**



Respondents' lack of confidence in public sector service levels means that they do not feel that their level 1 needs may be fully secured in future. These relate to the provision of water, sanitation and other basic utility needs. The shortage of electricity, which was included as a separate item, was a cause of concern, but was not as influential as concerns over public sector service levels. This does not correspond with the claims of Eden Joubert, a lawyer with Emigration Group, who stated that large numbers of highly skilled South Africans, including engineers, are

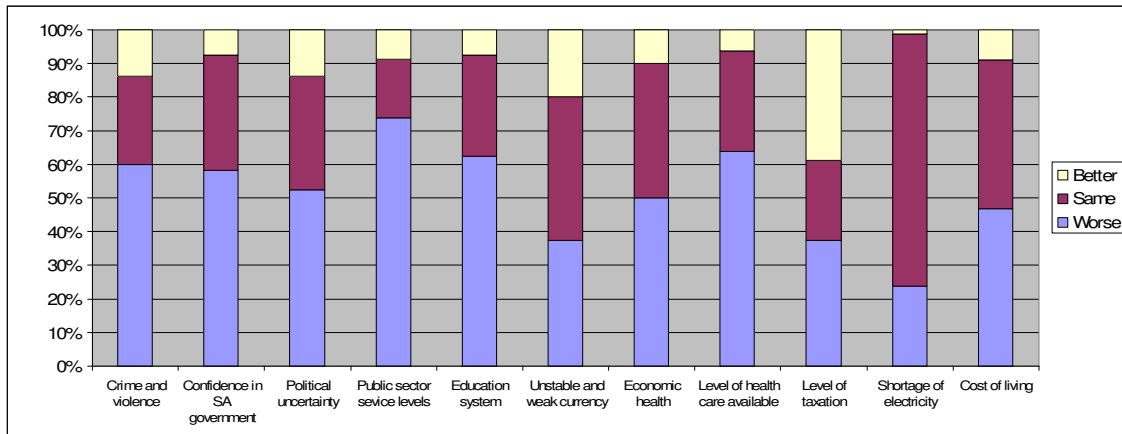
considering leaving the country in the wake of the Eskom power debacle (Bridge, 2008). This may be due to the fact that Joubert's claims were made during the first half of the year when power blackouts were prevalent and the survey was only conducted in the fourth quarter, when the situation had improved somewhat due to a reduction in unplanned downtime. Some engineers may have regarded the lack of competent technical staff at Eskom to conduct maintenance or execute projects as an opportunity when responding to the questionnaire.

According to Maslow, lower-order needs which are not satisfied lead to an individual taking more decisive action in order to satisfy them compared with higher order needs (Allen, 2003). It therefore makes sense that crime and violence, lack of confidence in government, political uncertainty and poor levels of public sector service are strong country-related drivers causing engineers to consider emigration in order to satisfy their lower-order needs.

According to the push-pull theory, there are positive or "pull" factors as well as negative or "push" factors associated with living in any particular country (Mattes and Richmond, 2002). In order for emigration to occur, the "push" factors in the subjects' current country of residence must outweigh the "pull" factors in that country. In addition, the "pull" factors in a prospective county of residence must be stronger than the negative or "push" factors associated with that country. There are clearly some very strong "push" factors in South Africa, with crime and violence being the most important driver. "Pull" factors include friends and family living in South Africa, the lifestyle, good climate and patriotism. However, for those considering emigration, the "push" factors clearly outweigh the "pull" factors associated with living in South Africa.

The fact that most respondents had a pessimistic view regarding whether these "push" factors would improve as depicted in figure 6.7 results in them feeling forced to take corrective action in line with Maslow's theory.

**Figure 6.7: Expected changes in country-related factors causing engineers to consider emigration – all white respondents**

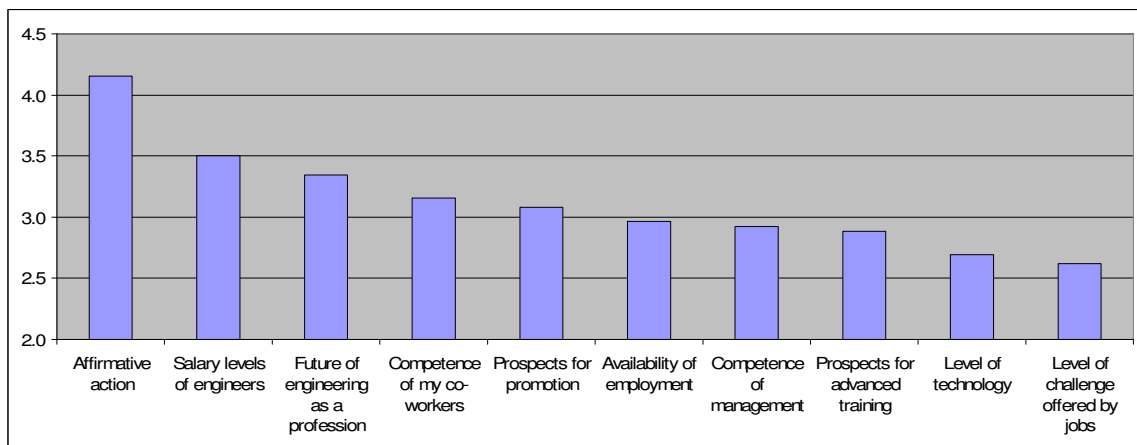


The fact that most preferred destinations chosen by potential emigrants scored much higher than South Africa in the United Nations Development Index rating (Klein, 2008) confirms that the “pull” factors in these countries are stronger than what they are in South Africa.

### 6.6.2 Work-related factors

Affirmative action was given as the most predominant reason for considering emigration by a substantial margin, partly due to the fact that 90% of respondents were white males.

**Figure 6.8: Work-related conditions causing engineers to consider emigration – white respondents**



In terms of Maslow's theory, affirmative action impacts upon an individual's level 3 needs, which refer to the need of an individual to feel that they belong to a certain group and receive recognition from the group (Allan, 2003). White males may not feel this sense of belonging or that their worth is being recognised. This is evident from the large number of respondents over the age of 55 who have a high potential to emigrate and cite affirmative action as the predominant work-related cause for this.

Level 4 needs include self-worth, status, power, self-confidence and to be individually recognised. These needs may also be frustrated due to affirmative action as individuals may feel that they are not being recognised for their hard work, skills and commitment through being afforded increased power and status.

Level 5 needs refer to the needs of individuals to feel challenged in order to reach their full potential. In an organisational environment, this includes having challenging job assignments and promotional opportunities, which may be frustrated due to affirmative action.

Vroom's (1964) expectancy theory considers the whole work environment and argues that individuals are motivated to work when they anticipate achieving what they expect from their jobs. Individuals who feel that no matter how hard they work, they will not reach their desired level within the organisation are unlikely to be motivated (Open University, 2003). Those who feel that they will not be rewarded due to affirmative action policies, may feel demotivated by their current work environment, which could lead to them considering taking some form of action to rectify this.

Adams' equity theory proposes that the individual still balances inputs and outcomes, efforts and rewards, but does this in comparison to others (Robbins, 1998). Depending on the outcome of this comparison, they become either motivated if they perceive themselves as being awarded equitably or even over rewarded or demotivated if they perceive inequity or under reward. Affirmative action may have an impact on this as white individuals may not feel that they are being treated equitably.

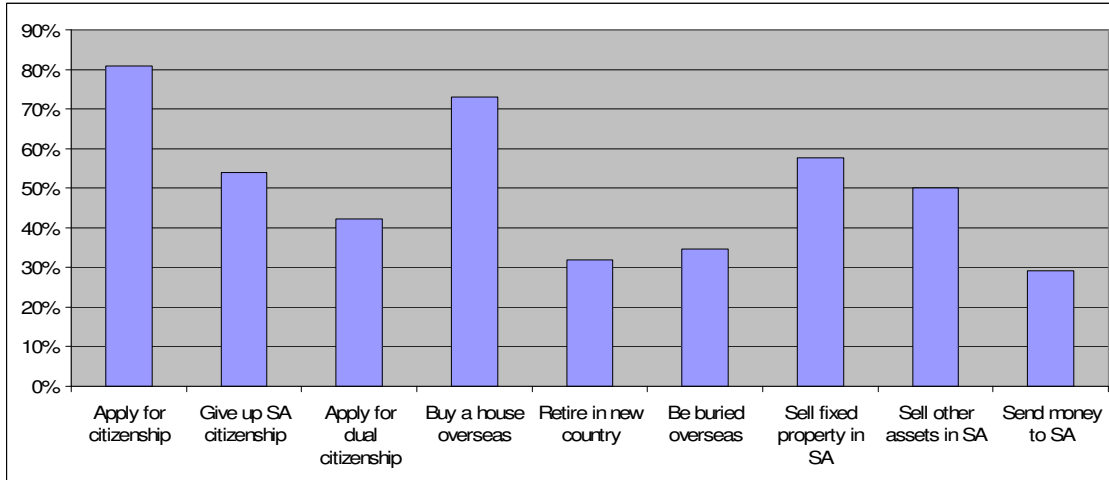
According to Van Rooyen (2000), a poll conducted by the Sunday Times in 1998 found that affirmative action was only a minor contributor to emigration as only 10% of prospective emigrants cited it as a reason for wanting to emigrate. This is in contrast to the findings of this study. Details regarding the sample and anonymity of responses and other ethical considerations which may have had an impact on the results of the study, were not discussed by Van Rooyen. However, the Employment Equity Act was only passed in 1998 and would have taken a period of time to properly implement. For an adequate number of suitable affirmative action candidates to be available to fill certain engineering positions, teaching of mathematics and science at schools needed to have been improved, suitable candidates admitted to university and individuals afforded an adequate period of employment thereafter in order to gain sufficient experience. It would be fair to assume that this process could take ten years before the full effects of affirmative action would be felt by those from the non-designated group.

The lack of prospects for promotion were also cited as a reason for engineers to consider emigration, but with a far lower score. Even though engineers were frustrated by affirmative action, they were less concerned regarding their prospects for promotion.

## **6.7 Likelihood of returning**

A number of questions were posed to the sample to gauge the possibility of them returning should they choose to emigrate. The study found that 58% of respondents with a "high" emigration potential intended to emigrate permanently. Most of these would apply for foreign citizenship, be prepared to give up South African citizenship, buy a house in their new country of residence and sell all fixed property in South Africa as depicted in figure 6.9. These are all indicative of a move which is more permanent than temporary. However, prevailing circumstances in an emigrant's new host country and how the individual adapts to these are expected to play a dominant role in determining whether or not an emigrant returns to South Africa.

**Figure 6.9: Factors influencing permanence of stay**

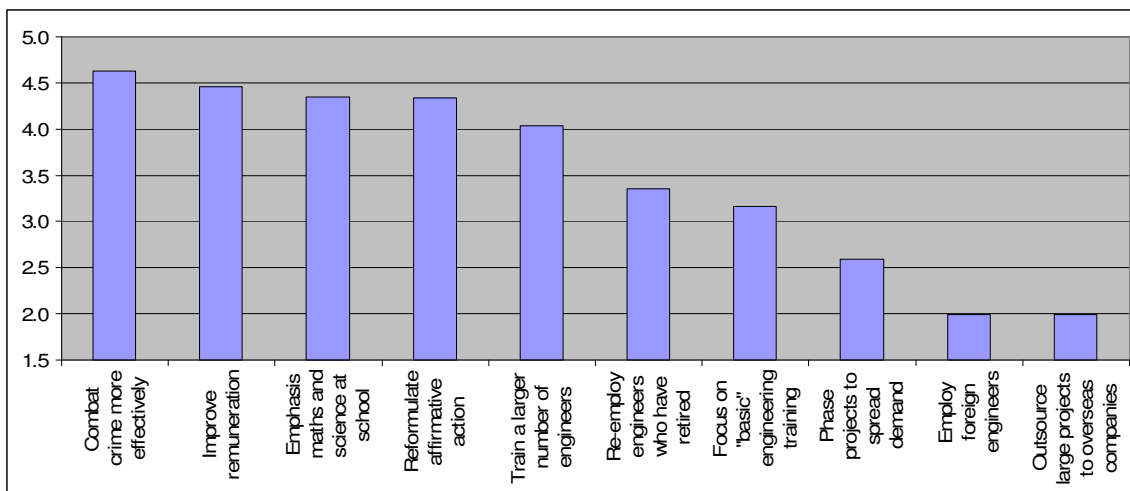


### 6.8 Recommendations to combat the shortage of engineers in South Africa

The same reasons causing engineers to consider emigration were cited most frequently as those which needed to be addressed in order to retain them as depicted in figure 6.10.

Respondents indicated that in order to retain engineers, more needed to be done to combat crime more effectively. By improving remuneration packages to engineers, they would be discouraged from changing professions to those with better pay packages.

**Figure 6.10: Predicted effectiveness of various actions to combat the shortage of engineers in South Africa**





In order to increase the number of learners leaving school who qualify for acceptance to an engineering course at a South African university, more emphasis needs to be placed on mathematics and science at school. This will only be possible if more teachers are employed at schools with appropriate training. Secondly, it needs to be ensured that universities have the capacity to train an increased number of engineers by increasing the attractiveness of remuneration packages to teaching staff amongst other things and ensuring that sufficient teaching facilities exist. This would make it possible to train a larger number of engineers.

As discussed earlier, one of the most difficult tasks faced by managers today is the manner in which they must provide direction to the highly skilled workers that they supervise. In most cases, technical staff members are intense individuals who like to perform their work in a self-directed manner and are far more likely to feel motivated when working under the supervision of another technically-trained person whose technical abilities they respect rather than under the supervision of a manager to whom they cannot relate. It thus needs to be ensured that those managing engineers command their respect in order to avoid causing dissatisfaction amongst engineers.

Most respondents felt that the policy of affirmative action should be reformulated in order to provide more opportunities to those not from the designated group, which would encourage them to stay in South Africa.

Respondents indicated that they did not feel that employing foreign engineers or outsourcing large projects to foreign engineering companies were an effective means of combating the engineering shortage. The fact that in 2006, only 194 entry permits were granted to foreigners with scarce skills to practise in South Africa by the Department of Home Affairs, even though the quota system allows for 47 600, also indicates that South Africa seems unable or unwilling to attract skilled foreigners (South Africa. Department of Home Affairs, 2006/7).

## 6.9 Conclusion

The findings of this research study are summarised below.

South African engineers most likely to emigrate are either in their late twenties or are older than 55. They are likely to be white males from either the public or private sector, or who are self-employed. There is no difference in propensity to emigrate between English and Afrikaans speakers. A higher proportion of chemical, metallurgical and mining engineers are likely to emigrate than any other engineering discipline.

Approximately 10% of graduate engineers are likely to leave South Africa within a short period of time (less than one year) as they have already taken some measures in order to do so, 16% may leave within two years and 27% may leave within the next five years.

Australia is by far the most popular destination for South African engineers, followed by Europe, Canada and the United Kingdom.

The main country-related drivers causing South African engineers to consider emigration are crime and violence, confidence in the South African government and political uncertainty. This is in accordance with Maslow's hierarchy of needs theory, as engineers are contemplating emigration in order to satisfy their pressing lower order needs. Most white respondents are pessimistic regarding the future of South Africa, whilst black respondents appear to be more optimistic.

The main work-related driver causing engineers to consider emigration is the policy of affirmative action. However, prospects for promotion was a less significant driver.

Of the engineers with a "high" emigration potential, just over half indicated that they would emigrate permanently.

In order to alleviate the shortage of engineers, the factors causing them to consider emigration should be addressed. In order to increase the number of engineers in the country, more emphasis should be placed on mathematics and science at school,

thereby increasing the number of candidates who qualify for admission to engineering courses. It also needs to be ensured that universities have the capacity to deal with the increased number of graduate engineers required.

Further research can be conducted on this subject at a later time in order to determine whether there has been a change in the sentiment of engineers regarding emigration.

Unless drastic action is taken in order to stem the exodus of engineers from South Africa and to train significantly higher numbers of engineers, the country may be forced into the unenviable position of wanting to embark on ambitious expansion projects, but being unable to do so due to a lack of engineering resources. The effect on the economy of being unable to expand or even just to maintain current infrastructure and industry could be devastating when the knock-on effects of a shortage of engineering skills are considered. This study has identified that the possibility exists that a far larger number of engineers are currently considering emigration than was previously assumed, which could have a severe impact on the economy if they were to leave.

## CHAPTER 7

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# APPENDIX 1: Questionnaire for Engineers

## Questionnaire for Engineers

All responses will be kept confidential

If you would like the results of the study to be sent to you, please indicate your email address here:

Please return via email to: [eagarp@ael.co.za](mailto:eagarp@ael.co.za)

Please mark the relevant block with an "x"

### Demographics

1 Age	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50	51 - 55	over 55				
2 Gender	Male	Female										
3 Race	Black	Coloured	Indian	White	Other							
4 Nationality	RSA	Other										
5 Do you hold a foreign passport or are you able to obtain one within a short period of time?	Yes	No										
6 Home language	Afrikaans	English	Ndebele	Northern Sotho	Sotho	Swati	Tsonga	Tswana	Venda	Xhosa	Zulu	Other [specify]
7 South African province in which you work	Eastern Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape			
8 Engineering discipline	Chemical	Civil	Electrical	Electronic	Industrial	Mechanical	Metallurgical	Mining	Other (specify)			
8b Highest engineering qualification												
9 Current employer	Public sector	Parastatal	Private Sector	Self Employed	Other (specify)							
10 Nature of contract with employer	Permanent	Temporary contract										
11 Length of service with current employer [years]	< 1	1 - 2	3 - 5	6 - 10	11 - 15	16 - 20	> 20					
12 Have you ever been employed overseas before?	Yes	No										
13 If so, for how long?	1 to 2 months	3 to 12 months	One to three years	Three to five years	More than five years							
14 Do you have family or close friends who have emigrated?	Yes	No										
15 If you were to emigrate, indicate the number of family members who would emigrate with you	0	1	2	3	4	5	6	>6				

### Propensity to Emigrate

	None at all / no / low / infrequently 1	2	3	4	A great deal / definitely / very / frequently 5
16 How much consideration have you given to emigrating from South Africa within the next few years?					
17 How frequently do you discuss emigration with your family and friends?					
18 To what extent have you researched the availability and remuneration of jobs overseas?					
19 To what extent have you researched the living conditions in one or more overseas countries?					
20 Have you researched the procedures involved in emigrating?					
21 How strong is your desire to move overseas?					
22 Are you more likely to emigrate now than you were three years ago?					
23 Have you applied for work permits for a foreign country?					
24 Have you applied for jobs overseas?					
25 Have you been in contact with recruitment facilitators?					
26 How likely is it that you will move within the next 2 years?					
27 How likely is it that you will move within the next 5 years?					

**Likelihood of returning to South Africa**

	1 to 2 months	3 to 12 months	One to three years	Three to five years	More than five years, but not permanently	Permanently
28 If you are considering living abroad, how long would you do so for?						

	Not at all / none 1	2	3	4	Definitely / All 5
29 If you were to emigrate, is it likely that you would apply for citizenship / permanent residence in your destination country?					
30 Would you be willing to give up South African citizenship if you were to emigrate?					
31 Would you apply for dual citizenship if you were to emigrate?					
32 Would you consider buying a house in your new country of residence if you could afford to do so?					
33 Would you like to retire in your new country of residence?					
34 Would you like to be buried in your new country of residence?					
35 If you were to emigrate, would you sell your fixed property in South Africa?					
36 If you were to emigrate, what proportion of your other assets would you keep in South Africa?					
37 If you move overseas, is it likely that you will send money to South Africa?					

	More than once per year	At least annually	Once every few years	Never
38 If you were to emigrate, how often will you return to South Africa for a visit				

**Most likely destinations**

	Would not consider 1	2	3	4	Would definitely consider 5
39 If you are considering emigration, where would you consider emigrating to?					
40 Any African country other than South Africa					
41 Asia					
42 Australia					
43 Canada					
44 Europe					
45 Middle East					
46 New Zealand					
47 Republic of Ireland					
48 South America					
49 United Kingdom					
50 USA					
51 Other 1 (specify):					
52 Other 2 (specify):					
53 Other 3 (specify):					

	Not important 1	2	3	4	Very Important 5
54 If you are considering emigration, please rate the following criteria according to their importance when selecting an emigration destination:					
55 Financial earnings potential					
56 Stable political and economic environment					
57 Lifestyle					
58 Climate					
59 Cultural fit					
60 Career development / training opportunities					
61 Security					
62 Linguistic adaptability					
63 Acceptance of South African qualification					
64 Best opportunities for my family					
65 Emigration destination previously chosen by friends and family					
66 Ease of emigrating to country with regards to immigration policy					

**Factors causing engineers to consider emigration**

	Not a contributing factor 1	2	3	4	Highly significant contributing factor 5
65a If you are considering emigration, please score the following possible reasons for this. Please also indicate whether you expect these factors to get worse, stay the same, or get better.					
66a Country-related factors					
67a Level of crime and violence in South Africa					
68a Shortage of electricity					
69a Economic health of South Africa					
70a Political uncertainty in South Africa					
71a Confidence in the South African government					
72a Cost of living in South Africa					
73a Level of service delivered by the public sector					
74a Level of health care available					
75a Level of taxation					
76a Education system in South Africa					
77a Unstable and weak currency					
78a overseas					
79a Desire to join friends and family living overseas					
80a Other 1 (specify):					
81a Other 2 (specify):					
82a Other 3 (specify):					

Will these factors get worse, stay the same or get better?

	Get worse	Stay the same	Get better
65b			
66b			
67b			
68b			
69b			
70b			
71b			
72b			
73b			
74b			
75b			
76b			
77b			
78b			
79b			
80b			

If you are considering emigration, please score the following possible reasons for this. Please also indicate whether you expect these factors to get worse, stay the same, or get better.		Not a contributing factor 1	2	3	4	Highly significant contributing factor 5
<b>Work-related factors</b>						
81a	Affirmative action					
82a	Availability of employment opportunities in South Africa					
83a	Salary levels of engineers in South Africa					
84a	Level of challenge offered by jobs in South Africa					
85a	Level of technology in South Africa					
86a	Prospects for promotion in South Africa					
87a	Prospects for advanced training					
88a	Future of engineering as a profession in South Africa					
89a	Dissatisfaction with the competence of my co-workers					
90a	Dissatisfaction with the competence of management					
91a	Remuneration packages offered overseas					
92a	Prospects of being promoted overseas					
93a	Desire to work for a specific company overseas					
94a	Desire to gain international experience					
95a	Other 1 (specify):					
96a	Other 2 (specify):					
97a	Other 3 (specify):					

Will these factors get worse, stay the same or get better?

	Get worse	Stay the same	Get better
81b			
82b			
83b			
84b			
85b			
86b			
87b			
88b			
89b			
90b			
91b			
92b			
93b			
94b			
95b			
96b			
97b			

**Factors contributing to the retention of engineers in South Africa**

In your opinion, which factors contribute to the retention of engineers in South Africa?		Does not contribute at all 1	2	3	4	Is a key contributor 5
100	Family and friends living in South Africa					
101	Lifestyle					
102	Climate					
103	Patriotism					
104	Work opportunities					
105	Established business or career					
106	Commitment to a specific organisation					
107	Potential loss in value of pension					
108	Loss of share options					
109	Cost of moving to another country					
110	Discrimination against foreigners in overseas countries					
111	Administrative burden of moving to another country					
112	Non-admittance to preferred country due to regulations					
113	Non recognition of qualifications by preferred country					
114	Previous bad experience in another country					
115	Lack of knowledge regarding international opportunities					
116	Difficulty of adjusting to living in a foreign country					
117	Difficulty of family adjusting to living in a foreign country					
118	Other 1 (specify):					
119	Other 2 (specify):					
120	Other 3 (specify):					

**Actions to combat shortage of engineers in South Africa**

In your opinion, what should organisations and government do to mitigate the shortage of engineers in the long term?		Not an effective means of combating shortage 1	2	3	4	Is a very effective means of combating shortage 5
121	Combat crime more effectively					
122	Place more emphasis on mathematics and science at school					
123	Train a larger number of engineers					
124	Improve attractiveness of remuneration packages					
125	Employ engineers from foreign countries (e.g. China, India)					
126	Re-employ engineers who have retired					
127	Outsource large projects to overseas companies					
128	Phase introduction of new projects to spread demand for engineers out over a longer period of time					
129	Focus on "basic" training for graduate engineers to increase number of graduates					
130	Reformulate policy of affirmative action to create more opportunities for those not from the group designated as previously disadvantaged					
131	Other 1 (specify):					
132	Other 2 (specify):					
133	Other 3 (specify):					