

UNIVERSITY OF KWAZULU-NATAL

THE IMPACT OF SKILLS SHORTAGES  
ON CLIENT SATISFACTION  
AT STEWART SCOTT INTERNATIONAL  
IN KWAZULU-NATAL

2006

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**THE IMPACT OF SKILLS SHORTAGES  
ON CLIENT SATISFACTION  
AT STEWART SCOTT INTERNATIONAL  
IN KWAZULU-NATAL**

**by**

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## EXECUTIVE SUMMARY

A persistent theme over the past year in public discussion has been the state of skills in the South African economy and society (DoL, 2003:1). The DoL (2005:55) further states that the issue of "scarce skills" has become a key government priority. It is now generally accepted that skills shortages in key occupational areas are hindering future economic growth (DoL, 2005:55).

Within the civil engineering industry in South Africa recent studies have found that there has been a slow decline in the number of civil engineering professionals since the seventies and early eighties; all sectors in the industry have reported staff shortages, particularly of experienced mid-career professionals; staff utilisation rates are over 90% on average and in excess of 100% in many firms and there is a critical shortage of experienced civil professionals responsible for production work (Lawless, 2005 and SAACE, 2005).

Some of the reasons cited for the skills shortages and skills gaps include poor quality of both secondary and tertiary education, inadequate training provided by employers, the overall unattractiveness of civil engineering due to relatively lower salaries being paid as compared to other professions and working conditions and emigration (for various reasons).

The primary aim of the study was to investigate the impact skills shortages have had on client satisfaction within Stewart Scott International (SSI), a multi-disciplinary engineering consultancy firm, in KwaZulu-Natal. Thereafter, from the findings of the research, identify specific areas of dissatisfaction (from SSI's clients' perspective) and develop short to medium term strategies to better manage the situation, it being noted that addressing the root causes of skills shortages and skills gaps requires long term interventions. The research also sought to assess from SSI's clients' whether they believed any decline in their satisfaction levels was as a result of skills shortages in the industry. The data collection instrument used in the study was a structured questionnaire. Questionnaires were sent to clients with whom SSI had been doing business with for at least five years.

The study found three areas of concern in SSI's quality of service (which clients' believed were as a result of skills shortages), viz SSI's approach to work, SSI's creativity in proposed solutions and SSI's approach in dealing with problems in relationships with clients. The findings of the

research are similar to the findings of the NACI ( 2003) in SA and Mills and Treagust (2003) in Australia. The study further found empirical evidence to support the hypothesis that the levels of skills and levels of client satisfaction are related.

The research found that:

- There has been a decline in SSI's approach to work
- There has been a decline in SSI's creativity in proposed solutions
- There has been a decline in the manner and time frames SSI deals with problems in relationships

The following are recommended:

- More efficient use of resources (short-term)
- Coaching and training initiatives be reviewed and formalised (short-term)
- Develop a new skills management specification (medium-term)

## DECLARATION

I hereby declare that this dissertation is entirely my own work, except where due reference has been made. The work has not been submitted for a degree to any other institution.

A handwritten signature in black ink, appearing to be 'a John', written in a cursive style.

**D:** a John

## **ACKNOWLEDGEMENTS**

I would like to thank SSI for funding my studies and granting me permission to conduct the research within the firm and with its clients.

To Wendy Christison who expertly typed this report under extreme pressure, I express my sincere gratitude.

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## LIST OF ABBREVIATIONS

AAEE	:	Australasian Journal of Engineering Education
ASSA	:	Actuarial Society of South Africa
CHE	:	Council on Higher Education
CSS	:	Central Statistical Services
DfES	:	Department of Education and Skills
DoE	:	Department of Education
DoL	:	Department of Labour
DST	:	Department of Science and Technology
ECSA	:	Engineering Council of South Africa
HRD	:	Human Resources Development
HSRC	:	Human Sciences Research Council
ICE	:	Institution of Civil Engineers (UK)
MIG	:	Municipal Infrastructure Grant
NACI	:	National Advisory Council on Innovation
NESS	:	National Employers Skills Survey
NPHE	:	National Plan for Higher Education
NQF	:	National Qualifications Framework
PDI's	:	Previously Disadvantaged Individuals
PIG	:	Provincial Infrastructure Grant
PMU	:	Project Management Unit
SAACE	:	South African Association of Consulting Engineers
SAICE	:	South African Institution of Civil Engineering

SAIRR	South African Institute of Race Relations
SAQA	South African Qualifications Authority
SCE	Senior Certificate Examination
SETAs	Sector Education and Training Authorities
SSI	Stewart Scott International
SSVs	Ski 11-shortage Vacancies
Stats SA	Statistics South Africa
TBVC	Transkei, Bophuthatswana, Venda and Ciskei
UNAIDS	United Nations Programme on HIV/AIDS

## **CHAPTER 1 : INTRODUCTION**

The primary aim of the study was to investigate the impact skills shortages have had on client satisfaction within Stewart Scott International (SSI) in KwaZulu-Natal.

SSI is a multi-disciplinary engineering consultancy firm with offices in all major cities in South Africa and in other countries within Africa. The majority of its shares are owned by DHV, a multi-disciplinary global engineering consultancy firm based in the Netherlands. SSI's main clients within South Africa include National, Provincial, District and Local spheres of government, Eskom, Spoornet, Water Utilities and private sector organisations.

### **1.1 Background**

A persistent theme over the past year in public discussion has been the state of skills in the South African economy and society (DoL, 2003:1).

The DoL (2005:55) further states that the issue of "scarce skills" has become a key government priority. It is now generally accepted that skills shortages in key occupational areas are hindering future economic growth (DoL, 2005:55).

One of the main conclusions from a study conducted by the HSRC (2003) on the Mobility of R&D Workers was that it is important for business, government, higher education institutions and science councils to realise that South Africa is faced with a strong resource constraint surrounding highly skilled individuals and that affected sectors and institutions will have to address this issue in their policy formulation and planning initiatives.

In a study conducted by NACI (2003: 67) entitled "The Potential Impact of Skills Shortages on the Innovative Capacity of Major Capital Engineering Projects", it was found that the challenge of skills shortages is urgent and cannot be left to actions by one party alone. The study further concluded that if the challenge is not efficiently and effectively addressed, the role of innovation in contributing to economic growth, international competitiveness and improved quality of life could be seriously impaired (NACI, 2003: 67).

The above discussion presents an overview of the extent of skills shortages in South Africa. Within the civil engineering industry in South Africa the following have been reported:

- There has been a slow decline in the number of civil engineering professionals since the seventies and early eighties.
- All sectors reported staff shortages, particularly of experienced mid-career professionals.
- In consultancy practices staff utilisation rates are over 90% on average and in excess of 100% in many firms.
- There is a critical shortage of experienced civil professionals responsible for production work (Lawless, 2005: 3).

## **1.2 Justification for Research**

Saunders *et al* (2000: 13) suggest that your research topic must be something you are capable of undertaking and one that excites your imagination. They further suggest that capability also means that you must be reasonably certain of gaining access to data you might need to collect.

The researcher is employed at Stewart Scott International (SSI) in one of its offices in KwaZulu-Natal in a senior management position and as such is acutely aware of the importance of gaining and retaining clients. Cottle (1990: 9) points out that the reawakening of service-consciousness among consumers has important implications for professionals. He further points out that clients are becoming more demanding of good service, and if you don't give it to them, someone else will (Cottle, 1990: 9).

Various studies have been carried out recently, including those by the NACI (2003), HSRC (2003), Lawless (2005) and DoL (2005) which all highlight the general shortages of skilled workers within South Africa. Those studies further argue reasons for the skills shortages and recommendations for addressing the problem. Coupled with South Africa now being a global player, the ability to gain and retain clients is of utmost importance for business survival.

SSI, in many ways, may be classified as a "traditional" civil engineering firm with a proven track record in South Africa and neighbouring countries in Africa in which it works. The firm is recognized for its strong technical capability developed over a number of years but, like most "traditional" civil engineering firms (and indeed professional service firms in general)

did not place much emphasis on marketing, partly due to applicable legislation at the time, but largely due to engineers being uncomfortable with the concept of marketing.

As stated previously, there have been a number of studies carried out recently which quantify the skills shortages, suggest possible causes of the problem and also make recommendations for rectifying the situation. The intention of this report is to document some of the findings of those studies, briefly unpack marketing for service organisations, gauge the current levels of satisfaction of SSI's clients, identify problem areas and suggest interventions that SSI can implement to manage the impact of skills shortages on client satisfaction, largely in the short to medium term.

As Lawless (2005: 4) points out, the current buzz words (in the civil engineering industry) are "scarce skills" and "skills gaps", the effects of which the researcher encounters on a daily basis within SSI.

### **1.3 Statement of the Problem**

The reality of the researcher's working environment is that there is a skills shortage with respect to suitably experienced employees in various positions which, the researcher feels, is impacting on the quality of service the firm is providing to its existing clients. From the various texts the researcher has reviewed, it appears that skills shortages are a national and international problem. The researcher is thus of the view that the firm that best manages the situation will benefit the most.

The various studies previously mentioned have argued that addressing the skills shortages, due to the causes, is long-term. By understanding the perceptions of clients with regard to their levels of satisfaction with the technical quality and other service attributes of the firm, the researcher suggests that specific strategies may be formulated to improve client satisfaction levels in the short and medium term.

### **1.4 Research Question**

The research question is:

- What is the impact of skills shortages on client satisfaction at SSI in KwaZulu-Natal.

## **1.5 Research Objectives**

The research objectives are to:

- establish current levels of client satisfaction
- establish (from clients) whether there has been a decline in their satisfaction levels from five years ago
- establish whether clients believe that any decline in satisfaction levels is as a result of skills shortages in the industry

## **1.6 Scope of the Study**

The study will be undertaken from a sample of SSI's existing clients within KwaZulu-Natal, whom the firm has been working with for at least the last five years. The study will further be confined to the civil engineering component of the firm in the fields of water, sanitation, transportation and industrial activities to ensure that the size of the study is manageable.

## **1.7 Overview of Report**

This chapter dealt with the motivation for the study, statement of the problem, the research question, the research objectives, scope of the study and significance of the study.

Chapter 2 reviews literature on service industries (as SSI essentially offers a service to its clients), to illustrate characteristics of services, as opposed to goods, and the marketing challenges encountered by firms providing a service. The section also explores customer satisfaction, and the measurement thereof, and service quality.

Chapter 3 investigates skills shortages in general by reviewing applicable literature and the relationships between skills shortages and productivity growth and workforce skills and quality, using previous studies.

Chapter 4 reviews literature on skills shortages in the civil engineering industry globally (briefly) and more especially within South Africa. The extent of skills shortages is also explored in this chapter.

Chapter 5 describes the research methodology, including the research design, population, sampling, the research instrument design and testing and data analysis process.

Chapter 6 presents, interprets and briefly discusses the findings of the research.

In Chapter 7 the findings of the research are discussed together with the conclusions. Chapter 8 contains recommendations based on the findings as well as suggested future research.

## CHAPTER 2 : MARKETING IN SERVICES ORGANISATIONS

### 2.1 Introduction

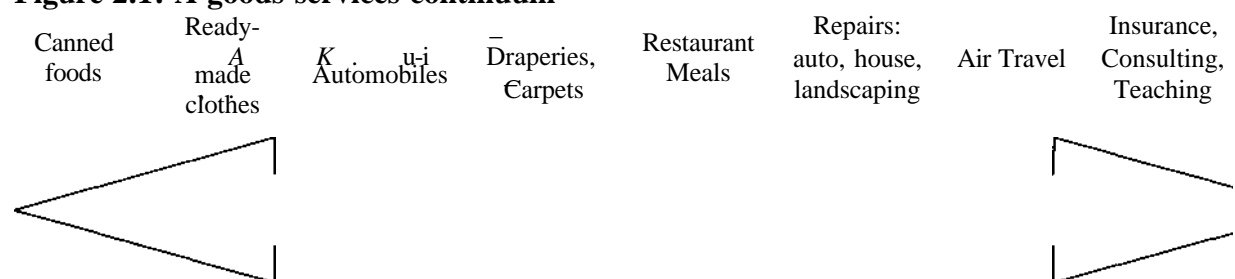
To survive, every professional firm must satisfy three goals of "service, satisfaction and success" (Maister, 1993: 3). Management of a professional firm requires a delicate balancing act between the demands of the client marketplace, the realities of the people marketplace (the market for staff), and the firm's economic ambitions (Maister, 1993:3).

According to Moodie and Cottam (1999: 1), there are particular problems and challenges for those managing an organisation whose major activity is providing some type of service, as, for the customer there may be little evidence, in advance, of what to expect. The service provider has often to produce the service under the watchful gaze of customers, and at the end, both parties may fail to agree on what constitutes quality service (Mudie and Cottam, 1999:1).

Etzel *et al* (2001: 292) argue that virtually all services require supporting goods (you need an airplane to provide air transportation service), and goods require supporting services (to sell even a shirt or a can of beans calls for at least a cashier's service). They further suggest that a company may well sell a combination of goods and services ... and therefore suggest that, it may be helpful to think of every product as a mix of goods and services located on a continuum ranging from mostly goods to mostly services (Etzel *et al*, 2001: 292).

The continuum suggested by Etzel *et al* (2001) is provided in Figure 2.1 and suggests that SSI is located at the "mostly services" end of the continuum.

**Figure 2.1: A goods-services continuum**



**Source: Etzel *et al* (2001: 293)**

The next section defines services and seeks to explain the unique characteristics of services as opposed to pure goods.



## 2.2 Defining Services

Stanton *et al* (1992: 510) define services as "separately identifiable, intangible activities that are the main object of a transaction designed to provide want-satisfaction for customers". They further state that supplementary services that support the sale of tangible goods are excluded.

Woodruffe (1995:20) argues that whichever means of classifying services is used, and whether or not there is agreement that the unique characteristics of services really present unique distinctions, ultimately both physical goods and services provide benefits and satisfactions - both goods and services are 'products' or offerings.

According to Kotler (2003: 446) services have four major characteristics that greatly affect the design of marketing programs: intangibility, inseparability, variability and perishability. These characteristics are briefly illustrated below:

### *Intangibility*

According to Kotler (2003: 446) unlike physical products, services cannot be seen, tasted, felt, heard or smelled before they are bought. The person getting a face-lift cannot see the exact results before the purchase, and the patient in the psychiatrist's office cannot know the exact outcome (Kotler, 2003:446).

Kotler (2003: 446) further suggests that to reduce uncertainty, buyers will look for evidence of the service quality. They will draw inferences about quality from the place, equipment, communication material, symbols and price they see (Kotler, 2003:446).

Due to this intangibility feature of services, Stanton *et al* (1992: 513) suggest that a company's promotional programme must portray the benefits to be derived from the service, rather than emphasizing the service itself.

### *Inseparability*

According to Kotler (2003: 447), services are typically produced and consumed simultaneously, which is not true of physical goods, which are manufactured, put into inventory, distributed through multiple resellers, and consumed later. He further suggests that if a person renders the service, then the provider is part of the service and because the client is

also present as the service is produced, provider-client interaction is a special feature of services marketing (Kotler, 2003: 447).

Stanton *et al* (1992: 513) point out that due to this inseparability nature of services, direct sale is the only possible channel of distribution and a seller's services cannot be sold in very many markets.

#### *Variability (Heterogeneity)*

Because they depend on who provides them and when and where they are provided, services are highly variable, for example, some doctors have an excellent bedside manner, others are less patient with their patients (Kotler 2003: 448).

Stanton *et al* (1992: 514) suggest that it is impossible for a service industry or even an individual seller of services to standardize output, and that each "unit" of the service is somewhat different from other "units" of the same service.

As a result of this variability feature of services, Stanton *et al* (1992: 514) argue that service companies should therefore pay particular attention to the product planning stage of their marketing programme, and that, from the beginning, management must do all it can to ensure consistency of quality and to maintain high levels of quality control.

#### *Perishability*

Kotler (2003: 449) points out that services cannot be stored and the perishability of services is not a problem when demand is steady, however, when demand fluctuates, service firms have problems. For example, public transportation companies have to own much more equipment because of rush-hour demand than if demand were even throughout the day, also some doctors charge patients for missed appointments because the service value existed only at that point (Kotler 2003: 449).

Stanton *et al* (1992: 514) however point out that there are some notable exceptions to the generalization regarding the perishability and storage of services, such as, in health and life insurance, for example, the service is purchased and then held by the insurance company (the seller) until needed by the buyer or the beneficiary.

They further suggest that the combination of perishability and fluctuating demand offers product-planning, pricing and promoting challenges to service company executives (Stanton *et al*, 1992:514).

This section illustrated the uniqueness of services and highlighted the challenges in providing a consistent level of service. The next section looks at a framework for marketing strategy formulation.

### **2.3 Marketing Strategy**

Stanton *et al* (1992: 514) suggest that the growth in services has generally not been due to marketing developments in service industries but rather to changes in the economy, and, that traditionally, executives in service companies have not been marketing-oriented. They further claim that service companies have lagged behind sellers of goods in accepting the marketing concept and have generally been slow in adopting marketing techniques (Stanton *et al*, 1992: 514).

In developing marketing strategy there are essentially two tasks:

- The selection of target markets; and
- The formulation of an appropriate marketing mix to serve those target markets (Woodruffe, 1995: 22).

Further, according to Woodruffe (1995: 22) the market can generally be divided into the consumer sector and organisational users, and, within each of these sectors there are likely to be a number of segments which need to be researched and evaluated before decisions can be made about selecting target segments. When attractive segments have been identified, the Services Marketing Manager must develop an appropriate marketing mix for each segment selected, with each of the elements of the mix being finely tuned to best meet the needs of individual segments (Woodruffe, 1995: 22).

Woodruffe (1995) stresses the importance of the role that people play in services marketing, in view of the inseparability and interactive nature in providing services and suggests the concept of internal marketing.

A brief discussion of the marketing concept, marketing mix and internal marketing follows.

### *The Marketing Concept in Services Marketing*

Stanton *et al* (1992: 514) suggest that the intangibility of services creates more difficult marketing challenges for service sellers than for sellers of goods, as, in many service industries (particularly professional services), the sellers think of themselves as producers or creators and not as marketers of the service. ... They do not think of themselves as business people.

Woodruffe (1995) argues that there can be little argument, however, that despite the differences between the marketing of physical products and services marketing, the underlying concepts and management decisions are much the same:

- Marketing-driven organisations, whether in the manufacturing or service sectors, must have an intimate knowledge of the market in order to identify unfilled market needs and provide a marketing offering which will meet those needs, thereby satisfying both the customer and the organisation's objectives.
- Market research, marketing planning, and the development of a set of marketing mix tools are equally important in services marketing and the marketing of physical goods (Woodruffe, 1995: 13).

According to Kotler (2003: 19), the marketing concept holds that the key to achieving its organisational goals consists of the company being more effective than competitors in creating, delivering and communicating superior customer value to its target markets. Kotler (2003: 19) further suggests that the job is not to find the right customers for your product, but the right products for your customers.

Kotler (2003: 20) further argues that the marketing concept takes an outside-in perspective, in that it starts with a well-defined market, focuses on customer needs, coordinates all the activities that will affect customers, and produces profits by satisfying customers.

### *Marketing Mix*

Hollensen (2003: 333) suggests that success requires a sustainable strategy that is differentiated from competitors, and further suggests that a higher probability of success can be achieved if the marketing mix is arranged so that it is unmatched by competitors.

Hollensen (2003: 115) further suggests that the company modifies the marketing mix to accommodate the demands expressed by consumers and, the more successful it is in matching its marketing mix with expressed and latent demands in the market, the greater the possibility is that customers will buy the company's products now and in the future.

Woodruffe (1995: 125) suggests that physical goods and services can be looked at in terms of benefits offered, as well as features and specific attributes associated with those benefits ... and ... can be broken down into a number of levels relating to customer need-satisfactions, benefits and features, typically as follows:

- The *core benefit* satisfies the need/solves the problem.
- The *expected service* reflects standards required or expected by the customers to satisfy their needs.
- The *augmented service* is the way in which service providers fine-tune the marketing mix to differentiate their service and make it stand out from the competition.

Woodruffe (1995: 126) proposes that, in marketing mix terms, it is often the special aspects of the service mix which can contribute to the augmented service. The inseparable nature of services, for example, means that service quality is often closely linked to the people element of the mix, and perceptions of service quality often depend also on consumer's judgements about the surroundings in which the service is offered - the physical evidence - and the promptness of the service - the process (Woodruffe, 1995: 126).

The marketing mix elements (or components) and examples of marketing mix variables, which Woodruffe (1995) suggests can be adjusted to help differentiation, are shown in the following Table 2.1:

**Table 2.1: Marketing Mix Elements and Marketing Mix Variables**

<b>Marketing Mix Elements (components)</b>	<b>Marketing Mix Variables</b>
<b>Product (service)</b>	Superior quality Well known/trusted brand image Unusual or additional features Extended guarantees The 'unique sales proposition' Tangibilisation
<b>Price</b>	'Value added' Special discounts Preferential credit terms
<b>Promotion</b>	Innovative advertising campaigns Loyalty promotions, e.g. frequent flyer offers Special offers Direct mail PR, sponsorship
<b>Place</b>	Extensive availability More outlets than competitors Innovative methods, e.g. telephone banking Careful selection of quality channels
<b>People</b>	Highly trained staff Better customer care Greater efficiency Personal attention Specialist skills
<b>Process</b>	Advances in technology, e.g. automated queue systems, cash dispensers Fast response times
<b>Physical evidence</b>	Comfortable surroundings Superior decor Qualifications Evidence of professional standing - membership of professional bodies Strong, recognisable corporate image - staff uniforms, house style Supporting literature, documentation High quality 'tangibles'

Source: Adapted from Woodruffe (1995:127)

Finally, Woodruffe (1995: 128) cautions that long-term success and survival, however, mean far more than developing a marketing mix for a differentiated service offering. To keep up with changes in consumer trends and new technologies, or to cope with new technologies, service organisations need continuously to review and develop their service offering (Woodruffe, 1995: 128). Woodruffe (1995: 128) further argues that the range of services offered - the service portfolio - should always be monitored and new services introduced or existing ones withdrawn at the right time.

### *Internal Marketing*

According to Woodruffe (1995: 85), the concept of internal marketing has its origins in conventional marketing theory and the marketing concept itself, which addresses employees - the internal market within an organisation whose participation and role is recognized as being critical to levels of service quality and delivery. Internal marketing is a means of involving staff at all levels in effective marketing programmes by enabling them to understand their role within the marketing process (Woodruffe, 1995: 85).

Woodruffe (1995: 86) defines internal marketing as treating with equal importance the needs of the internal market - the employees - and the external market through proactive programmes and planning to bring about desired organisational objectives by delivering both employee and customer satisfaction.

Rafiq and Ahmed (2000, cited in Hollensen, 2003: 242) define internal marketing as a planned effort using a marketing-like approach to overcome organisational resistance to change and to align, motivate and inter-functionally co-ordinate and integrate employees towards the effective implementation of corporate and functional strategies in order to deliver customer satisfaction through a process of creating motivated and customer-orientated employees.

According to Kotler (2003: 23), internal marketing is the task of hiring, training and motivating able employees who want to serve customers well. He goes further to suggest that internal marketing must precede external marketing, as it makes no sense to promise excellent services before the company's staff is ready to provide this (Kotler, 2003: 23).

Woodruffe (1995: 87) suggests that the four most important areas within the organisation's internal environment which are essential to an internal market programme can be described as:

- Motivation
- Co-ordination
- Information
- Education

Based on the above, the importance of a highly motivated and efficient workforce is critical to the quality of service provided. The section also discussed factors to take into consideration in marketing strategy formulation and how the marketing mix variables can be used in differentiation. The next section explains the importance of retaining clients and building long-term relationships.

## **2.4 Relationship Marketing**

Relationship marketing has been defined as a data-driven, quantifiable marketing tool, and is driven by a desire to keep customers loyal (Mudie and Cottam, 1999: 258). The practice of relationship marketing relies on an organisation's ability to identify, target, communicate and reward valuable customers.

According to Hollensen (2003: 202), the simplest reason why firms seek to develop ongoing relationships with their customers is that it is generally much more profitable to retain existing customers than continually seek to recruit new customers to replace lost ones. In essence this new approach means a focus on long-term interactions between a marketer and its customers, instead of a short-term transactional approach (Hollensen, 2003: 202).

Relationship marketing is the process of identifying and establishing, maintaining, enhancing, and when necessary terminating relationships with customers and other stakeholders (Gronroos, 1996:7, cited in Hollensen, 2003: 202).

Cottle (1990: 176) suggests that, though the relationships between professionals and their clients only begins when the sale is made, such relationships intensify once the buying decision has been made ... once the actual service commences, professional services can continue for weeks, months or even years. He further suggests that the quality of the



relationship determines whether clients will seek the professional again the next time they need professional services (Cottle, 1990: 177).

Cottle (1990: 177) goes on to suggest that traditional marketing gets the client in the door the first time; relationship management keeps the client coming back again and again.

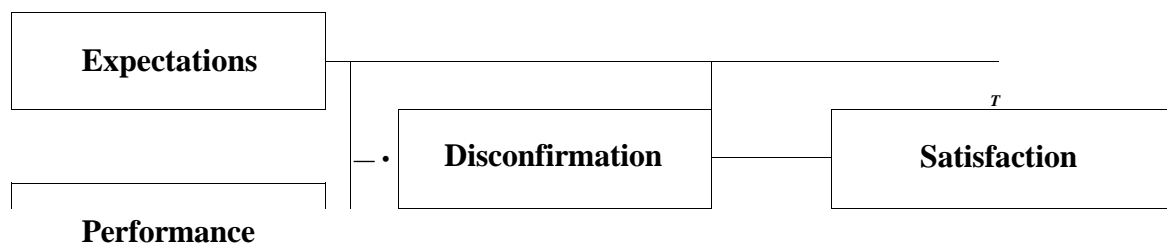
The next section discusses customer satisfaction and ways of achieving customer satisfaction.

## 2.5 Customer Satisfaction

According to Mudie and Cottam (1999: 253), complete or total customer satisfaction is a goal that more and more service companies are striving to achieve.

Oliver (1977: 480-486 cited in Mudie and Cottam, 1999: 254) suggests that the model used to explain the occurrence of satisfaction is known as the expectancy-disconfirmation model (see Figure 2.2).

**Figure 2.2: Expectancy-Disconfirmation Model of Consumer Satisfaction**



**Source: Oliver (1977, cited in Mudie and Cottam, 1999: 255)**

In explaining the Model in Figure 2.2, Mudie and Cottam (1999: 254) suggest that satisfaction is dependent on the customer's expectations, and their perceptions of performance exceeding those expectations. They further suggest that, to secure satisfaction, management need not (and indeed should not) focus exclusively on improving its performance and that resources should also be devoted to managing customer expectations (Mudie and Cottam, 1999: 254).

Further, according to Mudie and Cottam (1999: 15), expectations are formed prior to usage of the service and perceptions are the customer's evaluation of the service. They also suggest that after the service has been consumed, customers compare the perceived service with the expected service and if the perceived service meets or exceeds the expected service, the customer is satisfied (Mudie and Cottam, 1999: 15).

Kotler (2003: 255) suggests that whether the buyer is satisfied after purchase depends on the offer's performance in relation to the buyer's expectations, and, in general, satisfaction is a person's feelings of pleasure or disappointment resulting from comparing a product's perceived performance (or outcome) in relation to his or her expectations. If the performance falls short of expectations, the customer is dissatisfied, if the performance matches expectations, the customer is satisfied, and, if the performance exceeds expectations, the customer is highly satisfied or delighted (Kotler 2003: 61).

Peters and Austin (1985, cited in Mudie and Cottam, 1999: 255) state that: "Managing expectations is all about under-promising and over-delivering".

According to Etzel *et al* (2001: 308), service quality is particularly difficult to define, measure, control and communicate. Yet in services marketing, the quality of the service is the key factor in determining a firm's success (Stanton *et al*, 1992: 518).

Desimone *et al* (2002: 338) suggest that service quality is how well the organisation responds to the customer's needs after the product or service is delivered. It can be viewed as an attitude based on the customer's perceptions of performance (Nowak and Washburn, 1998, cited in Desimone *et al*, 2002: 338). This can be measured by noting things such as service response time, service backlog and customer satisfaction ratings (Desimone, *et al*, 2002: 338).

However elusive it may be to define the concept of service quality, management needs to understand one thing: *quality is defined by the customer and not by the producer-seller of a service* (Stanton *et al*, 1992: 519).

**Figure 2.3: The Superior Service Quality Equation**

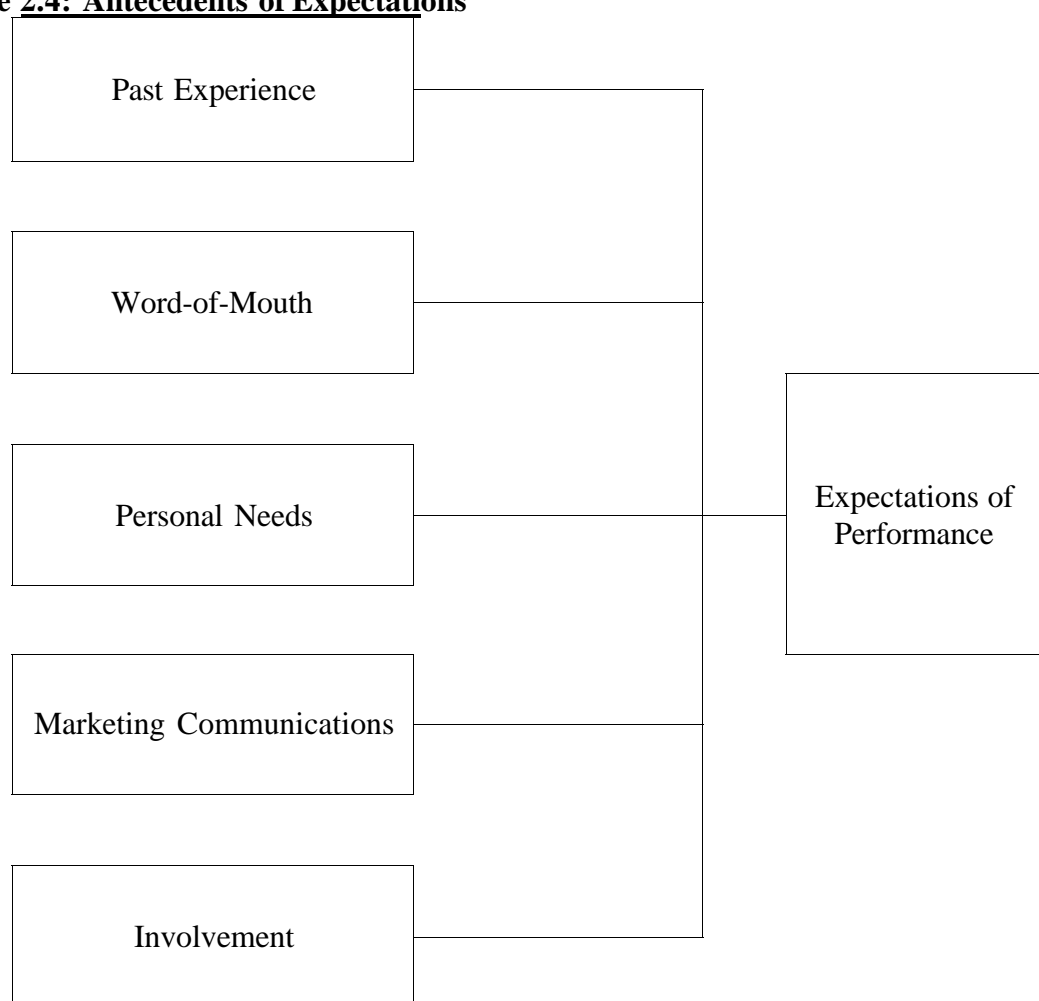


**Source: Adapted from Cottle (1990: 23)**

The Superior Service Quality Equation shown in Figure 2.3 suggests that, when you meet clients' expectations, perception and expectations are equal and clients grade your service quality as satisfactory (Cottle, 1990: 22). When you do not meet clients' expectations - if their expectations were higher than the service you actually delivered - your score is negative and clients grade your service quality as unsatisfactory (Cottle, 1990: 22-23). If your service delivery exceeds clients' expectations, satisfaction is positive, and clients grade your service as superior (Cottle, 1990: 23).

According to Mudie and Cottam (1999: 255), there are five key factors that influence a customer's expectations: previous experience; personal recommendation; personal needs; marketing communications; and the level of involvement in the purchase, as shown in Figure 2.4 below:

**Figure 2.4: Antecedents of Expectations**



**Source: Adapted from Mudie and Cottam (1999: 255)**

Mudie and Cottam (1999) further report that research suggests that the most important of these factors (shown in Figure 2.4) in shaping expectations, is consumer's past experience of the service and what other people say about it.

Drucker (1985: 228, cited in Cottle, 1990: 21) observes that quality is not what you put into the service: it is what the client gets out of it and is willing to pay for. Cottle (1990: 22) argues that clients don't buy your professional services; they buy solutions to their problems. He further suggests that clients buy expectations of benefits that they think you offer them, and, you provide quality when you fulfil those expectations, solve those problems and deliver those benefits.

Cottle (1990: 29) suggests that to get clients to grade your services as high quality, you must learn what clients really expect from you .. you must listen - really listen - to your clients ... you must make sure your clients have realistic expectations of what you will be able to accomplish, which requires good communication in both directions.

To effectively manage quality, services firm should:

- Help customers formulate expectations;
- Measure the expectation level of its target market; and
- Strive to maintain consistent service quality at or above the expectation level (Etzel *et al*, 2001: 308).

The next section considers the importance of measurement of customer satisfaction and levels at which to measure satisfaction levels.

## **2.6 Measuring Customer Satisfaction**

Woodruffe (1995: 21) suggests (using the banking sector as an example) that service quality is measured on two levels:

Technical quality - the overall efficiency with which a bank handles its customer accounts in terms of prompt statements, rates of interest offered and so on.

Functional quality - the way the service is actually delivered; this includes personal courtesy, the service environment in terms of comfort and decor, and the customer's

own role (are there long queues, are pens and forms provided to make the actual transaction simpler?).

The importance which is attached to functional and technical quality depends on the type of service, and the benefit sought by the customer (Woodruffe, 1995: 21).

Maister (1992: 79) suggests that the importance of client service is well understood by most professionals and most professional firms and most, if not all, firms acknowledge the critical distinction between technical quality (how good is the work?) and service quality (what kind of experience does the client have with the firm?).

According to Maister (1992), based on a larger-scale study, satisfaction levels were consistently high when clients were asked to evaluate their satisfaction with the technical quality of the work done for them, but when asked about their level of satisfaction with the way they were dealt with by the professionals during the course of the engagement, satisfaction levels were low with numerous complaints.

Mudie and Cottam (1999: 282) suggest that when the service becomes available, the company should begin to monitor and evaluate its performance with the help of its customers. They suggest that an holistic approach to this evaluation means treating as customers, not only those who purchase the service, but also those who deliver it.

Desimone *et al* (2002: 338) argue that customer quality can be defined as the extent to which the organisation has met or surpassed overall customer expectations. They further suggest that this (customer quality) can be measured by such things as customer surveys and tracking customer complaints .... and caution that customer quality should not be ignored (Desimone *et al*, 2002: 338). Desimone *et al* (2002: 338) also argue that even if the product or service is technically perfect it may fail in the marketplace if it does not meet customer expectations.

Woodruffe (1995) suggests that the techniques for monitoring service quality essentially fall into three main categories:

- Internal performance analysis
- Customer satisfaction analysis
- Specialist market research

The purpose of monitoring and evaluation in all of these (above) methods is to ensure that plans and programmes are working effectively, and that desired standards are being achieved (Woodruffe, 1995: 17). There must be systems to feed back the findings of monitoring processes into the service quality programmes so that continual improvement can result (Woodruffe, 1995: 117-118).

## **2.7 Summary**

This chapter provided an overview of services marketing and highlighted the challenges faced by most service organisations both in terms of accepting/adopting a marketing concept and in developing and implementing an appropriate sustainable marketing strategy. The chapter also provided direction for acquiring and maintaining customers/clients.

The following chapters 3 and 4 review literature on skills shortages in general and skills shortages in the civil engineering industry in particular, respectively.

## CHAPTER 3 : SKILLS SHORTAGES (GENERAL)

### 3.1 Introduction

According to Booth and Snower (1996: 1) the acquisition of human capital is recognised to be absolutely central to countries' growth performance. They further suggest that when people acquire skills they not only make themselves more productive and are able to produce more output for a given amount of time and effort, they commonly also make themselves more adaptable (Booth and Snower, 1996: 1). Booth and Snower (1996: 1) further point out that when tasks and technologies are changing rapidly, necessitating a high rate of labour turnover across industries and occupations, adaptability is crucial for keeping labour and capital employed and maintaining competitiveness.

The HSRC (2003: 187) suggests that a human resources base that is highly skilled, well educated, innovative, productive and equitable is one of society's most important assets. They therefore suggest that the human resources development (HRD) process must meet the changing demands of the economy in terms of size and quality of human resources supply (HSRC, 2003: 187).

According to Booth and Snower (1996: 1) *when people acquire skills, they make each other more productive. Since most work is team work, my productivity generally depends on your productivity .... the more training you have on-the-job or off-the-job, the more I can learn from you about doing the job effectively, and the more productively the two of us can interact in production, innovation, distribution and sales* (Booth and Snower, 1996: 1).

This chapter further discusses the importance of skills to organisations, the general shift towards skilled labour, the skills gap and skills shortages and some common reasons cited for the skills gap and skills shortages. The effects of HIV/AIDS on the supply of labour in South Africa is also discussed. The section will finally explore the relationship between skills shortages and productivity growth and workforce skills and product quality by presenting empirical evidence from previous studies.

### 3.2 Skills Defined

Ferguson and Ferguson (2000: 72) suggest that skills describe the ability of an individual to perform particular tasks ... which ... are attained by a mixture of innate talent, education,

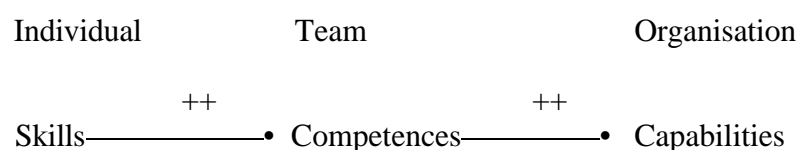
training and experience. They extend beyond purely technical attributes, such as skills in machining or baking, to include creativity, assertiveness, the ability to listen, numeracy, the ability to plan or exercise judgement and so forth (Ferguson and Ferguson, 2000: 72).

The 1997 Green Paper, Skills Development Strategy for Economic and Employment Growth in South Africa, (cited in DoL, 2003: 1) defines skill as the necessary competencies that can be expertly applied in a particular context for a defined purpose. Competencies that denote what is meant by a "skill" include:

- Practical competence - the ability to perform a set of tasks.
- Foundational competence - the ability to understand what we or others are doing and why.
- Reflexive competence - the ability to integrate or connect our performance with an understanding of the performance of others, so that we can learn from our actions and are able to adapt to changes and unforeseen circumstances (1997 Green Paper, cited in DoL, 2003: 1).

Ferguson and Ferguson (2000) argue that human capital of an organisation is derived from a combination of skills, competences and capabilities. This is illustrated in Figure 3.1 below.

**Figure 3.1: Level of Human Capital (A Taxonomy of Terms)**



Note: ++ in combination, influenced by synergies, culture and governance structure.

**Source: Adapted from Ferguson and Ferguson (2000: 72)**

With reference to Figure 3.1:

- Skills: describe the ability of an individual to perform particular tasks.
- Competences: occur at the level of the team (groups of individuals), when the skills of individuals are combined ... they lead to an outcome that is more than simply the sum of individuals' skills.



- Capabilities: occur at a broader level still; that of the organisation. They result from the combination of competences, and once again may be more than the sum of their parts as a result of synergies and influences of organisation's culture and governance. (Ferguson and Ferguson, 2000: 72).

### **3.3 The Shift in Demand for Skilled Workers**

According to Machin (date unknown, cited in Booth and Snower, 1996: 129) based on a study in the UK, there is evidence of a considerable shift towards the use of what may be termed more skilled labour (i.e. towards non-manual work, away from manual work and towards more highly educated labour). Further, the demand for more skilled labour is evident in more R&D intensive and innovative workplaces or industries, hence suggesting some support for the idea that manual-labour-saving technological changes are behind some of the observed employment shifts that occurred during the decade (Machin, date unknown, cited in Booth and Snower, 1996: 129).

Desimone *et al* (2002: 321) report that organisations have become increasingly dependent on skilled technical and professional employees, and this trend is expected to continue. According to Judy and D'Amico (1997, cited in Desimone *et al*, 2002: 321) according to the Bureau of Labour Statistics (in the US) the fastest growing occupations between 1994 and 2005 will include those involving professionals and technical and service workers. This trend can be traced to changes in the workplace resulting from such things as technology advances, changing organisational goals, and organisational restructuring (Desimone *et al*, 2002: 321). Desimone *et al* (2002: 321) further argue that whether the changes result from plant modernization, computerization, or other innovations, they have helped create a shift away from jobs requiring low skill levels to jobs demanding higher skill levels.

According to the DoL (2003: 10), in South Africa, between 1990 and 1998, formal employment of semi-skilled and low skilled workers fell by 19% or approximately 700 000 jobs. Conversely, according to the DoL (2003: 10), employment of skilled and highly skilled workers rose by 12% or 80 000 jobs. The DoL (2003: 10) suggests that this change is as a result of important changes that have occurred in the economic environment over this period, including a liberalisation of the economy, not to mention a rapid uptake of technology in all sectors, all of which favour skilled labour.

As can be observed from the above, the changes in our global environment require a skilled workforce for organisation and countries to be competitive. As the HSRC (2003: 459) points out, the highly protected and insulated domestic economy (of South Africa) of the 1980s is something of the past, and businesses are learning to compete globally in order to survive. The economic changes have had a significant impact on the profile of the workforce, with an increase in the demand for highly skilled workers and a decline in the number of skilled jobs (HSRC, 2003: 459).

### **3.4 The Skills Gap and Skills Shortages**

According to Dole (1990, cited in Desimone *et al*, 2002: 321) a skills gap is the difference between the skills requirements of available jobs and the skills possessed by job applicants.

The NACI (2003: 31) suggests that a skills gap is different from a scarce skill and occurs where deficiencies in the employed workforce retard the ability of employers to achieve strategic and business objectives. The NACI (2003: 31) further explains scarce skills (for example, insufficiency in chemical engineers) and skills gap (for example, sufficient chemical engineers but lacking experience in say, catalytic processes) as an understanding of the concepts of scarce skills and skills gap.

Haskel and Martin (1993, cited in Booth and Snower, 1996: 149) suggest that skill shortages are one aspect of the skills gap and that skill shortages are skilled vacancies that take a long time to fill. The effect of the skills gap is therefore to increase the duration of skilled vacancies (Haskel and Martin, 1993, cited in Booth and Snower, 1996: 149).

Wallis (2002, cited in Skinner *et al*, 2004: 183) defines a skills shortage in the terms used by the Department of Education and Skills (DfES) as a situation where there is a genuine scarcity in the accessible external labour market of the type of skill being sought, and which results in recruitment difficulties. An internal skill gap reflects a situation where employees' current skills are insufficient to meet the business objectives of the employer (LSC, 2004, cited in Skinner *et al*, 2004: 183).

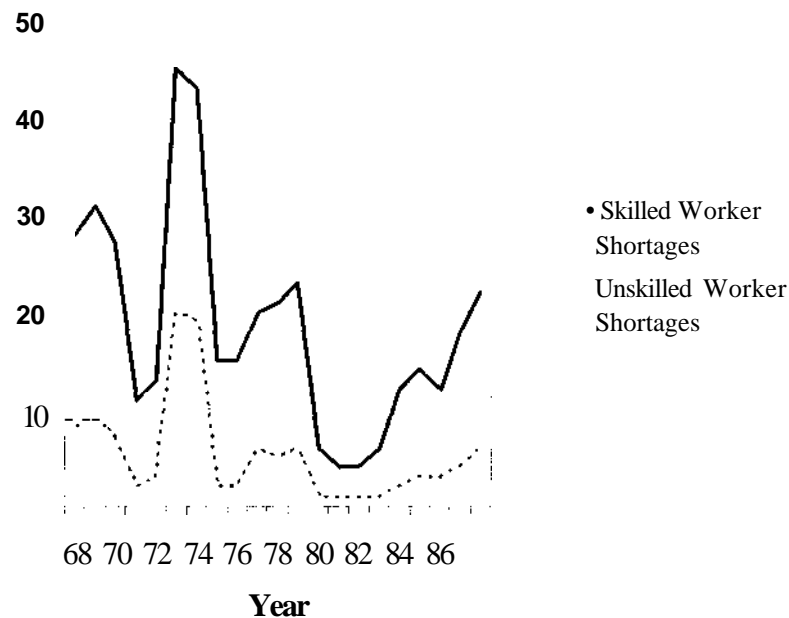
According to the DoL (2003: 10) a skills shortage can be defined as a situation in which employers are unable to fill, or experience difficulty in filling, vacancies in a specific occupation or specialization due to an insufficient number of workers with the required qualifications and experience. Indicators of skills shortages include:

- Very strong employment growth - a rapid growth in employment in a sector or sub-sector will necessitate a larger human resource base with the required levels of skill.
- Strong vacancy growth - when employers cannot find workers with the skills they require and have to advertise vacancies over long periods of time.
- Upward pressure on earnings - a strong upward trend in earnings of people with specific skills may indicate a situation of high demand or shortage.
- Special recruitment strategies - employers may resort to special advertising, head hunting and/or recruitment on international markets for workers with specialised skills (DoI, 2003:10).

Haskel and Martin (1993, cited in Booth and Snower, 1996: 151) note the following from a study they conducted in the UK:

- Skill shortages are highly procyclical, affecting as few as 2% of firms in the recession of the early 1980s yet over 20% of firms in the later upturn (Refer to Figure 3.2).
- Unskilled shortages are also cyclical but lower on average (Refer to Figure 3.2).
- Some industries, such as chemicals and food, never face significant (shortage) problems, while others, particularly the engineering sectors, consistently face severe shortages.
- Skills shortages also differ between regions of countries.

**Figure 3.2: Shortages of Skilled and Unskilled Labour in the UK**



**Source: Adapted from Haskel and Martin (1993, cited in Booth and Snower, 1996: 152)**

The NACI (2003: 31) further argues that an understanding of the distinction (between skills gap and skills shortages) is also important for determining the ways in which the problem is addressed. For example, in the case of an insufficiency (shortage) in chemical engineers, actions at secondary school level and incentives for matriculants to enter tertiary education may suffice; but for skills gaps, short course, coaching and advanced tertiary education would be more appropriate (NACI, 2003: 31).

Finally, and based on the foregoing, the following interpretations shall apply for the remainder of the report:

Skill-shortage vacancies (SSVs):	Hard-to-fill vacancies which are skill related and caused by low number of applicants with the required skills, lack of work experience the company demands or lack of qualifications the company demands
Skill gaps, or internal skill gaps:	The extent to which employers perceive their employees as not being fully proficient at their jobs

- Skill deficiencies, or skill shortages: The sum of the SSVs and skill gaps (NESS, 2004: 24).

### 3.5 Some Common Reasons Cited for The Skills Gap and Skills Shortages

According to Desimone *et al* (2002: 22) almost 30 percent of today's (US) high school students fail to graduate, and employers must confront the fact that many young adults entering the workforce are unable to meet current job requirements. Even though the United States has one of the highest standards of living in the world, the Upjohn Institute for Employment Research report that between 25 and 40 percent of hourly (paid) employees have some basic skills deficiency (Sorohan, 1995, cited in Desimone *et al*, 2002: 22).

According to Steck (1992, cited in Desimone *et al* 2002: 321) the skills gap (in the US) is as a result of at least three factors:

- the declining skill level achieved by many high school and college graduates;
- the growing number of racial minorities and non-English-speaking immigrants in the labour market (many of whom are concentrated in the worst-performing schools and school systems in the country); and
- the increased sophistication of jobs due to increased reliance on information technology.

Kronholz (1999, cited in Desimone *et al*, 2002: 321) found that in the US, 80 percent of employers said that high school graduates lacked grammar and spelling skills, and 57 percent of employers said that these students couldn't speak English properly.

Fiske (1997, cited in Desimone *et al*, 2002: 323) states that a 1995 report by the Organisation for Economic Cooperation and Development provided the following estimates for adults whose reading proficiency was below primary school level:

Belgium	18.6%
Canada	16.6%
Germany	13.8%
Ireland	22.6%
Netherlands	10.4%

New Zealand	18.2%
Poland	42.7%
Sweden	7.2%
United Kingdom	21.6%
United States	20.8%

In a recent survey of the American Manufacturing Workforce by Deloitte (2005: 16-17), inter alia, the following were found:

**Figure 3.3: Are schools doing a good job in preparing students for the workplace? (Those responding "No")**

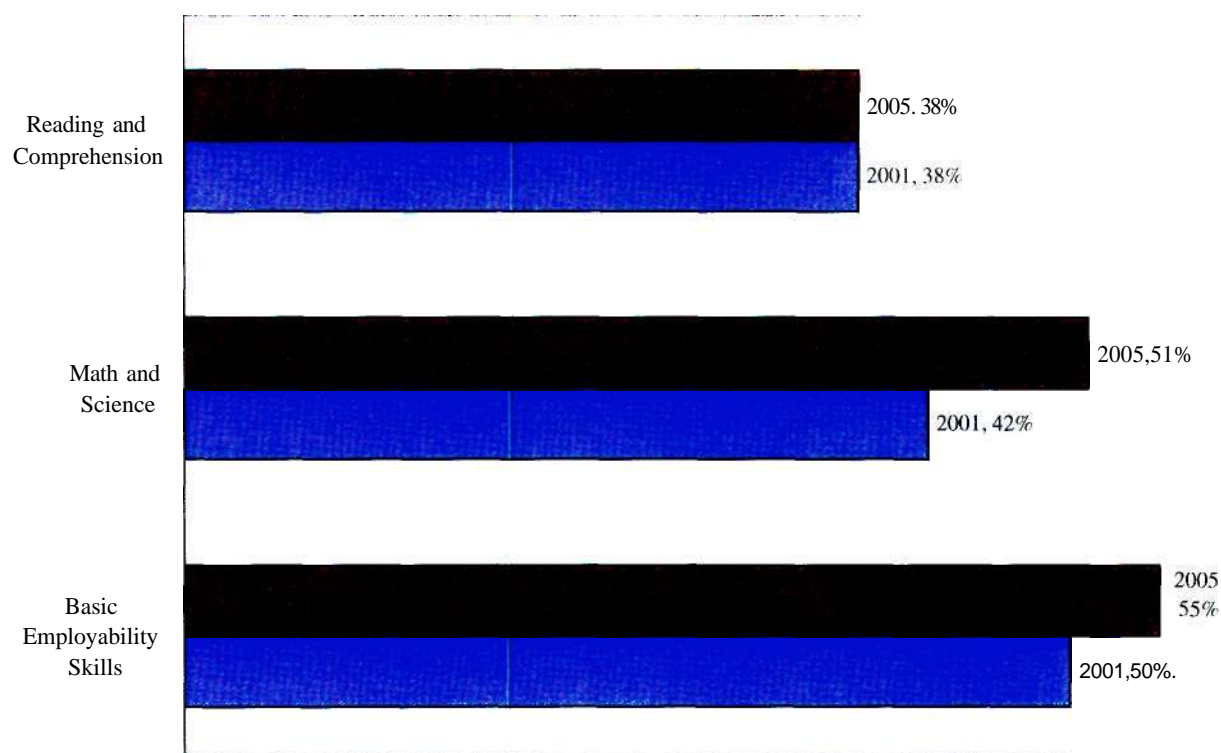
- i) When manufacturers were asked if schools were doing a good job preparing students for the workplace, 84 percent of respondents indicated "no", compared to 78 percent who said "no" in 2001 and 81 percent in 1997, as shown in Figure 3.3.



**Source: Adapted from Deloitte (2005: 16)**

- ii) When asked to elaborate on the specific deficiencies of the public education system in preparing students for the workplace, the top three most frequently cited responses were as shown in Figure 3.4. The results of the 2005 survey are compared to findings in 2001 to illustrate changes in perception of respondents.

**Figure 3.4: Specific Deficiencies of Public Education System**



**Source: Adapted from Deloitte (2005: 17)**

According to Daly *et al* (1985) and Steedman and Wagner (1987, 1989) (cited in Haskel and Martin, 1993, cited in Booth and Snower, 1996: 171), studies that compare technologically similar establishments in Germany and other EC countries with the UK, consistently find that productivity is lower in the UK. Haskel and Martin (1993, cited in Booth and Snower, 1996: 149) further suggest that this appears to support the view that the UK suffers from a "skills gap", whereby workers are disadvantaged by low levels of human capital, caused by inadequacies in the education and training systems.

The DoL (2005: 31) suggests that two factors need to be taken into account when evaluating the current state of skills in South Africa, which they claim have to do with the education and training deficit inherited from apartheid in 1994. The first, according to the DoL (2005: 31) is concerned with the dramatic decline in both apprenticeship and enterprise-based training during the late 1980s and 1990s. The key figures are provided in Table 3.1.

**Table 3.1: The decline of apprenticeship training, 1980s and 1990s**

	1986	1988	1990	1992	1994	1996	1998
<b>Apprentices indentured</b>	29 826	23 416	24 448	25 785	22 015	18 546	16 577
<b>Total formal sector training</b>	288 633	318 025	320 070	283 664	58 004	10 278	61 145

**Source: Adapted from Kraak *et al* (2000, cited in DoL, 2005: 31)**

The DoL (2005: 31) further argues that the declines in apprenticeship and enterprise training precede the implementation of the (SA) government's national skills development strategy. They provided a very low base off which to build and reflected a historically evolved enterprise culture that remained unconvinced of the merits of widespread training (DoL, 2005: 31).

The second factor, suggested by the DoL (2005: 31) for the current state of skills in South Africa is the generally low level of education acquired by the South African workforce ... although there have been significant improvements since 1997, specifically amongst the African workforce. See Table 3.2 for changes in the qualifications of the workforce by population group.

**Table 3.2: Changes in the qualifications of the workforce by population group (000s)**

<b>Year</b>	<b>None</b>		<b>Less than matric</b>		<b>Matric</b>		<b>Post Matric</b>		<b>Total</b>	
	African	Whites, Coloureds & Indians	African	Whites, Coloureds & Indians	African	Whites, Coloureds & Indians	African	Whites, Coloureds & Indians	African	Whites, Coloureds & Indians
<b>1997</b>	642	66	3310	1195	880	1121	563	828	536800	3210
<b>%</b>	12%	2%	62%	37%	16%	35%	10%	26%	100%	100%
<b>2003</b>	662	56	4850	1285	1568	1490	819	981	789900	3812
<b>%</b>	8%	1%	61%	34%	20%	39%	10%	26%	100%	100%

**Source: Statistics SA, Labour Force Survey, September 2003 and October Household Survey 1997 (cited in DoL, 2005: 31)**

The DoL (2005: 31) however points out that notwithstanding the improvements (shown in Table 3.2), the educational background of the current workforce remains very low with the vast majority of African workers (69%) possessing less than a matriculation certificate.

The DoL (2005) further claims that based on the findings of the National Skills Survey 2003, about 25 percent or 1 in 4 workers received training in the 2002/2003 year in South African



enterprises and notes that the training rate is similar to countries such as Spain and Italy, but lower in countries such as France and the United Kingdom.

Hunter (2002: 35) suggests the following two main reasons for the skills shortages in South Africa:

- the education system does not produce sufficient technically qualified people; and
- many of the skilled people have left the country.

Hunter (2002: 35) further suggests that there are many reasons why people leave the country but the main reasons are the crime rate, and the higher salaries earned in many other countries... .

To illustrate the extent of emigration (and the extent of the emigration undercount) Meyer *et al* (2000, cited in HSRC, 2003: 238) collected data on South African professional immigrants in the five major receiving countries - United Kingdom, United States, Australia, Canada and New Zealand - for the period 1987 to 1997 and compared these with the official statistics. The results of their findings are shown in Table 3.3.

**Table 3.3: Emigration of Professionals: Comparative figures for top destination countries, 1989 -1997**

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Australia									
(CSS and Stats SA)	312	291	198	189	356	274	308	420	310
<i>Australia</i>	<i>588</i>	<i>479</i>	<i>295</i>	<i>213</i>	<i>353</i>	<i>610</i>	<i>765</i>	<i>696</i>	<i>1122</i>
New Zealand									
(CSS and Stats SA)	25	<b>24</b>	12	<b>49</b>	93	349	209	297	286
<i>New Zealand</i>	<i>60</i>	<i>59</i>	<i>63</i>	<i>104</i>	<i>551</i>	<i>656</i>	<i>462</i>	<i>628</i>	<i>631</i>
Canada									
(CSS and Stats SA)	94	<b>85</b>	<b>63</b>	<b>69</b>	136	224	173	170	118
<i>Canada</i>	<i>327</i>	<i>227</i>	<i>213</i>	<i>243</i>	<i>407</i>	<i>677</i>	<i>421</i>	575	<i>421</i>

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
United States									
(CSS and Stats SA)	56	68	89	81	153	216	235	254	258
<i>United States</i>	<i>399</i>	<i>418</i>	<i>389</i>	<i>528</i>	<i>461</i>	<i>450</i>	<i>538</i>	<i>618</i>	<i>538</i>
United Kingdom									
(CSS and Stats SA)	275	331	296	349	661	450	368	422	444
<i>United Kingdom</i>	<i>2574</i>	<i>1408</i>	<i>1760</i>	<i>1518</i>	<i>2068</i>	<i>1782</i>	<i>924</i>	<i>2508</i>	<i>2417</i>

Note: Estimates by Meyer *et al* shown in italics.

**Source: Adapted from Meyer *et al* (2000:10, Table 10, cited by HSRC, 2003: 238).**

The main finding of the (emigration) study was that the receiving country data reported around three times as many skilled South Africans entering their borders prior to 1997 than did Stats SA data (Meyer *et al*, 2000: 12, cited in HSRC, 2003: 238). They further report the following:

*For the eleven years from 1987 to 1997 included, the country lost 233 609 emigrants as opposed to the 82 811 declared and registered by the South Africa statistics. This is 2.8 times higher than the official figures show. ... With regard to professionals, during the nine years from 1987 to 1997, the country lost 41 496 emigrants, which is 3.2 times more than the 12 949 declared (Meyer *et al*, 2000: 12, cited in HSRC, 2003: 238).*

### **3.6 The Impact of HIV/AIDS on Labour Supply in South Africa**

Accordingly to HSRC (2003: 187), the human resources capacity in South Africa may be constrained in future, given the scale and nature of HIV/AIDS and its morbidity and mortality effects. It further argue that HIV /AIDS also has the potential to severely affect the capacity of education and training to maintain and improve the skills of current and future human resources (HSRC, 2003: 187).

At the end of 2001, out of approximately 40 million HIV-infected people globally, an estimated five million lived in South Africa (UNAIDS 2002a, cited in HSRC, 2003: 187). This implies that whilst the South African population constitutes only 0.7 percent (43.792

million) of the global population (6.1 billion) (UNAIDS, 2002a, cited in HSRC, 2003: 187), South Africa has 12.5 per cent of global HIV infections (HSRC, 2003: 187).

Accordingly to the HSRC (2003: 190) HIV/AIDS strikes at the heart of the economy because it has a disproportionate impact on the economically active population - people between the ages of 15 and 65 - who are in their most sexually active, reproductive and economically productive years.

ASSA (2000, cited in HSRC, 2003: 190) projected a high adult (20 years to 65 years) HIV prevalence rate of 22.3 per cent in 2001, peaking at 27 per cent in 2006. While citing lower prevalence levels, the Doyle - Metropolitan Model (date unknown, cited in HSRC, 2003: 190) predicts a doubling of aggregate HIV prevalence levels in the labour force (15 years to 64 years) from 11 per cent to 21 per cent for 1999 and 2010 respectively. Assuming that no significant interventions occur, HIV prevalence rates for 2000 show a particular concentration amongst those aged 15 to 49 among both men and women (ASSA, 2000, cited in HSRC, 2003: 190). According to the HSRC (2003: 191) this age range constitutes a critical period in terms of entry into the labour force as well as consolidation of skills and experience.

The Bureau for Economic Research (2001, cited in HSRC, 2003: 191) reports that macro-economic projections show that HIV/AIDS will slow down the labour force growth, owing to reductions in the population growth rate, increased mortality rates amongst adults, and a decline in life expectancy.

The Bureau for Economic Research (2001, cited in HSRC, 2003: 191) further reports that the total labour force will be at least 21 per cent smaller than it would be under a No-AIDS scenario, as shown in Table 3.4.

**Table 3.4: Projected Changes in the Size of the Labour Force, 2000 - 2015**

<b>Year</b>	<b>No-AIDS Scenario (millions)</b>	<b>AIDS Scenario (millions)</b>	<b>Percentage Difference</b>
2000	14.5	14.4	<b>-0.7</b>
2005	15.8	15.1	<b>-4.0</b>
2010	17.2	15.1	-12.0
2015	18.7	14.8	-21.0

**Source: Adapted from Abt Associates Inc and AIDS Research Unit Metropolitan Life as cited in Bureau for Economic Research (2001:12, cited in HSRC, 2003:191)**

Educators are regarded as a high-risk group, being predominantly African and female, with an average age of 32 years (HSRC, 2003: 193). The World Bank (2002, cited in HSRC, 2003: 193) reports an HIV prevalence rate of 12 per cent (44 000) amongst educators, implying that by 2010 more than 50 000 educators will have died and many more will be absent due to AIDS- related illnesses. Cohen (2001, cited in HSRC, 2003: 193) reports an estimated HIV prevalence rate (in educators) of 15 per cent in 2001, rising to 24 percent in 2005 and 30 per cent in 2010.

A study of paper and pulp manufacturers in KwaZulu-Natal and Mpumalanga reports a 20 percent HIV prevalence rate (Lifeworks as cited by the SABC 2002, cited in HSRC, 2003: 192). Manufacturers and chemical firms report HIV prevalence rates of 16 percent and 12 percent respectively, whilst telecommunication and financial firms report the lowest rates at 7 percent and 5 percent respectively. These findings show that HIV infection rates vary across skills levels with lower infection rates in the higher skilled jobs, possibly due to relative differences in educational levels.

The challenge lies in adapting and streamlining HRD and organisational change strategies to retain and extend the current stock of skills and experience, by extending the productive lives of people who are infected, and preventing new infections (HSRC, 2003: 205).

### **3.7 Relationship Between Skills Shortages and Productivity Growth**

According to Haskel and Martin (1993, cited in Booth and Snower, 1996: 149) the UK suffers from a "skill gap", whereby workers are disadvantaged by low levels of human capital, caused by inadequacies in the education and training systems.

In order to establish whether there is a relationship between skills shortages and productivity, a study was carried out by Haskel and Martin (1993, cited in Booth and Snower, 1996) to, inter alia, provide empirical evidence on the effects of skills shortages on productivity growth in the UK.

The following are brief details, assumptions and findings of the study by Haskel and Martin (1993, cited in Booth and Snower, 1996: 149-150):

#### *Details*

The skills shortages data was from firms who reported difficulty in recruiting as many skilled workers as they desired. Two panel data sets were used, the first was of a panel of 81 industries covering almost all of manufacturing and the second consisted of 33 industries from engineering.

#### *Assumptions*

The following three ways by which skill shortages might reduce productivity were examined:

- Since skill shortages increase the cost of employing skilled workers, they lead the firm to substitute unskilled workers for skilled workers.
- A shortage of skills puts the skilled workers into a strong bargaining position when negotiating about working conditions at the firm. They may therefore be more able to demand an easier pace of work.
- A shortage of skilled workers might inhibit learning and the development and implementation of new technology.

### *Findings*

In order to gauge the impact of shortages, equations were estimated that related the growth in productivity to the growth in skills shortages. Other factors that might affect productivity such as inputs of capital and raw materials, union and firm market power, and utilization were controlled. Results for both data sets suggested that the growth of skills shortages over the 1980s reduced productivity growth by about 0.4% per annum (average productivity growth was 5% per annum), i.e. about an 8% reduction per annum.

### **3.8 The Relationship between Workforce Skills and Product Quality**

A study was carried out by Mason *et al* (date unknown, cited in Booth and Snower, 1996) to, inter alia, provide empirical evidence on the effects of workforce skills on product quality.

Mason *et al* (date unknown, cited in Booth and Snower, 1996: 177) suggest that a large proportion of British manufacturing output is concentrated towards the "lower" (more standardised, less complicated) end of the quality spectrum for which skill requirements are relatively low when compared with manufacturing industries in The Netherlands, Germany and France.

The following are the brief details and findings of the study by Mason *et al* (date unknown, cited in Booth and Snower, 1996: 179):

#### *Details*

Twenty one biscuit manufacturing plants were visited - ten in Britain, eight in Germany, six in France and five in The Netherlands. Detailed information on biscuit output and associated employment - both direct and indirect - over a 12-month period (considered a sufficient length of time for calculations not to be distorted by seasonal fluctuations) was gathered from the plants. There were no significant differences in the age and sophistication of the capital equipment in the four industries.

#### *Findings*

The findings are summarized in Table 3.5 below:

**Table 3.5: "Quality-adjusted" measures of labour productivity levels in biscuit manufacturing in Britain, The Netherlands, Germany and France**  
**i index numbers: Britain = 100; rounded to nearest five)**

Description	Britain	The Netherlands	Germany	France
Output (tons) per person hour	100	115	80	105
Value added per ton	100	110	175	115
"Quality-adjusted" output per person-hour	100	125	140	120

**Source: Adapted from Mason *et al* (date unknown, cited in Booth and Snower, 1996)**

The results show that the average value added per ton of biscuit in Britain is (in real terms) about 40% lower than in Germany and some 10 - 15% lower than in France and The Netherlands. In terms of "quality-adjusted" productivity levels in Britain were found to be some 25% below those in Germany, 20% below The Netherlands and 15% below France.

Mason *et al* (date unknown, cited by Booth and Snower, 1996: 178) found that the main conclusion of the study is that there is indeed a close correspondence between the structure of the workforce skills delivered by Britain's education system over recent decades and the orientation of large numbers of British manufacturers towards relatively low-skill, low-quality product areas.

### **3.9 Summary**

Based on the discussions in this chapter, the main causes of the skills shortages and skills gaps are generally due to a country's educational systems and workplace training being found wanting. In South Africa, the situation is further exacerbated by the effects of apartheid, the extent of emigration and the effects of HIV/AIDS.

Further empirical evidence was provided to illustrate that skills shortages have a negative impact on productivity growth in a country and low levels of workforce skills lead to an orientation towards relatively low-skill, low-quality products.

The chapter also cited some reasons for the shift in demand for more skilled workers which included technological changes and the increase in demand for services.

A systematic, inclusive and long-term approach needs to be adopted to redirect the trajectory of the HIV/AIDS impact on human resources development, fast-track skills acquisition, and overcome structural obstacles to developing human resources, in terms of both quantity and quality (HSRC, 2003).



## **CHAPTER 4 : ENGINEERING SKILLS SHORTAGES**

### **4.1 Introduction**

In this chapter, skills shortages in engineering is discussed, firstly from a global perspective (in general) and thereafter from a South African perspective.

Based primarily on the discussion in Chapter 3, engineering skills shortages in South Africa will be discussed under the following general headings:

- The Engineering Profession in South Africa
- The Status Quo (Demand): essentially an overview of the findings of the Lawless (2005) study
- Secondary Education: as highlighted in Chapter 3 has a major impact on the quality of the workforce.
- Tertiary Education: as highlighted in Chapter 3 has a major impact on the quality of the workforce.
- Graduates
- Professionals
- Demand

### **4.2 Engineering Skills Shortages (Global Perspective)**

Studies conducted by Henshaw (1991) and Lang *et al* (1999, cited in Mills and Treagust, 2003: 3) found the following with regard to today's engineering graduates:

- Today's engineering graduates need to have strong communication and team work skills, but they don't.
- They need to have a broader perspective of the issues that concern their profession such as social, environmental and economic issues, but they haven't.

- They are graduating with good knowledge of fundamental engineering science and computer literacy, but they don't know to apply that in practice.

According to the Institution of Civil Engineers (ICE), the UK is about to embark on ambitious construction projects such as the Olympics without enough homegrown engineering talent in place to deliver the end results (ICE, 2006: para 2).

According to ICE President, Gordon Masterton, "The UK is currently abundant with infrastructure projects, but we simply haven't got enough young engineers coming through the education system to meet our needs." (ICE, 2006: para 3).

Research by recruitment consultant Resourcing Solutions found that demand for professionally qualified civil engineers has already increased by 20% in recent years and civil engineering graduate starting salaries have also risen by 20% over the past five years, reflecting the demand for qualified professionals (ICE, 2006: para 4).

ICE feels that the skills shortage has occurred due to the "boom and bust" activity in the 1990s, which led engineers to choose alternative careers (ICE, 2006: para 5). The President of ICE suggests the need for a cultural shift in the UK's education system, with heavier emphasis placed on the importance of the teaching of science and maths - essential subjects to develop tomorrow's engineers and scientists (ICE, 2006: para 7).

In a study conducted by Harman and Lyons (2003: 17) in local authorities in England, Scotland, Wales and Northern Ireland they found the following two main categories of staff shortages:

- For about one third of respondents there is concern over the shortage of senior staff, such as principal engineers or others, who had experienced relevant responsibility in local authority work. There is considered to be a serious shortfall of people in this category, and good available staff are able to command a premium (salary).
- Many respondents were worried about shortfalls of new graduates. Gaining a share of graduates is important in filling more junior posts, especially with a specialist technical content, while adding to the number of career grade staff available for development.

Harman and Lyons (2003: 33) report that there is a widespread belief that promotion of the industry should start at school level, with much more being done to market the opportunities among school pupils, especially when they are considering going into work or moving on to higher education.

Harman and Lyons (2003: 24) also found in their study that geographical factors played an important role on levels of skills shortages with authorities in more remote locations - South West England, parts of Scotland - suggesting that their distance from larger centers where there is more opportunity for career development through job moves and professional meetings, placed them at a disadvantage in gaining new skilled staff.

The findings of ICE (2006) and Harman and Lyons (2003) are similar to those found by Egan (2004) in a study entitled "The Egan Review, Skills for Sustainable Communities". Egan (2004: 61) reported that two key trends point to the possibility of future shortage; firstly, there has been an overall decline over the last 10 years in the number of applicants to built environment degree courses, and, secondly, the age structure of some professions is such that there will be a retirement bulge over the next decade.

### **4.3 Engineering Skills Shortages (South African Perspective)**

#### ***4.3.1 The Engineering Profession in South Africa***

The Engineering Council of South Africa (ECSA) regulates the engineering profession in South Africa, by controlling the registration of individuals as professional engineers, and those in other categories falling under the engineering profession (HSRC, 2003: 556). ECSA is a statutory body that was established by the Engineering Professions Act (N° 46 of 2000), and is the current successor of the South African Council for Professional Engineers, established in 1969 (HSRC, 2003: 556).

According to the HSRC (2003: 556), a further function of ECSA is to accredit engineering courses in South Africa and it therefore plays an important intermediary role between the demand side of the profession (i.e. industries and firms that employ engineers) and the supply side of the profession (i.e. tertiary institutions).

The ECSA method for classifying engineering professionals is: "Graduate Engineers" are defined as those individuals who have graduated from university with a graduate or post-graduate degree in engineering; "Technologists" are defined as those who have graduated

with a bachelor's or master's degree in technology from a technikon and "Technicians" are defined as all those who have graduated with a national diploma or certificate in engineering (HSRC, 2003: 557).

This study largely focuses on the civil engineering industry which includes civil engineers, civil technologists and civil technicians, collectively referred to as civil professionals.

#### **4.3.2 The Status Quo (Demand)**

The status quo for the demand of civil professionals in South Africa, as identified by the Lawless (2005) study commissioned by the South African Institution of Civil Engineering (SAICE), is presented verbatim below (shown in italics) as presented by Lawless (2005: 4), as an introduction to the state of skills in the civil engineering industry in South Africa.

*Civil professionals are employed in many sectors. All sectors reported staff shortages, particularly of experienced mid-career professionals who are required to execute major projects, and transfer knowledge to junior staff.*

*Further, the current ratio of university to technikon graduates does not match the number absorbed in industry and points to a need to produce more university graduates.*

*It was found that across the board experienced and mid-career professionals regularly worked extremely long hours, with 15% regularly working more than sixty hours per week. These staff are generally highly qualified with 40% holding postgraduate technical qualifications and 30% holding postgraduates business or project management qualifications.*

#### **The Private Sector**

*The consulting sector reports that the current workload and continual reduction in staff has meant that capacity utilization is now over 90% on average and in excess of 100% in many practices. Over 80% of the consulting practices were seeking experienced engineers. In terms of equity goals, all were searching for black engineers. Fifty per cent were also looking for technicians and technologists.*

*In considering the viability of the huge investments required to develop and upgrade the transport network, the Department of Transport estimates that an additional 945 to 1 890 staff will be required by consulting practices in the private sector within the next few years.*

*This translates roughly to a 7,5% to 15% increase, that is, 450 to 900 more engineers, technologists and technicians will be required. They also suggest that an additional 310 to 3 060 highly skilled staff would be required by contracting companies in the private sector. In terms of civil engineering this could mean 100 to 1 000 more engineers, technologists and technicians, a 5%, to 50% increase in the number currently employed in civil engineering contracting.*

#### *The Public Sector*

*Shortages in all tiers of government are even more acute.*

*Local government has been particularly hard hit as a result of a number of factors including budget constraints, restructuring, increased bureaucracy and pursuing equity targets.*

*A census of all local and district municipalities and metros yielded the following statistics:*

- ***No civil professionals***
  - > *Of the 231 local municipalities 79 have no civil engineers, technologists or technicians*
  - > *Of the 47 district municipalities 4 have no civil engineers, technologists or technicians*
- ***Only one civil technician***
  - > *Of the 231 local municipalities 42 have only one civil technician*
  - » *Of the 47 district municipalities 4 have only one civil technician*
- ***Only Young Staff***
  - > *Of the 231 local municipalities 38 employ only technologists and technicians under the age of 35*
  - » *Of the 47 district municipalities 6 employ only technologists and technicians under the age of 35*
- ***Only 70 with Civil Engineers***
  - » *Only 45 of 231 local municipalities have any civil engineers*
  - > *Only 25 of 47 local municipalities have any civil engineers*

*Those municipalities that have civil engineering staff report 35% vacancies, the freezing of many posts owing to budget constraints and little or no capacity for the project management units (PMUs) that have been set up to handle the Municipal Infrastructure Grant (MIG). Metros on average reported 45% vacancies. These vacancies mean that at least 1 000 civil engineers, technologists and technicians are required in local government.*

*Shortages in provincial and central government are no less acute. Provincial structures reported posts that have been vacant for seven years and more. The Department of Transport suggests that an additional 70 to 710 highly skilled staff will be required to support their increased expenditure.*

*The increased investment and activities to address the water and sanitation Millennium Development Goals (MDGs) will also require a great deal of increased capacity.*

*Parastatals reported significant vacancies, Transnet is particularly concerned about its capacity to deliver the new and upgraded infrastructure that is required. The total number of technical staff employed by Spoornet less than half the number that was employed on the construction of the Witbank-Richards Bay Coal Line alone.*

*Adding up these estimates, it can be concluded that between 3 000 and 6 000 additional civil engineers, technologists and technicians may be needed in the next few years.*

Against this rather gloomy backdrop of the demand for civil engineering skills in South Africa, the balance of this section deals with the supply and demand for civil professionals in the industry.

#### **4.3.3 Secondary Education (Supply)**

According to the HSRC (2003: 303), the public provision of schooling contributes fundamentally to human resources development by laying the basis of the life skills needed to function in society, as well as preparing people for the labour market and higher education. The HSRC (2003: 303) further reports that by 2001, 8 percent of Coloured men and women, 7 percent of Indian women, 1 percent of Indian men, 18 percent of African women and 13 percent of African men had received no schooling at all - an indication of the inequalities in the stock of human capital, particularly the access of Africans to school education. Neverthe-

less, the HSRC (2003: 303), reports that there is a marked improvement even over 1995, where 23 percent of African women and 16 percent of African men had no education at all.

To study civil engineering at university a higher grade mathematics symbol of A, B or C is required and for most universities of technology a minimum of a C symbol in standard grade maths is required (Lawless, 2005: 79). To gain entry to university, matriculants are required to pass matric with endorsement. Further, to study engineering, matriculants require a minimum C symbol on the higher and standard grade to study at a university or university of technology respectively.

### *Endorsements*

According to Lawless (2005: 79), the number (of matriculants) gaining endorsements has improved over the past few years, but not significantly. Breier (2004, cited by DoL, 2005: 24) reports that only 53.4% of those who passed the senior certificate with endorsement in 2002 in fact enrolled in a higher education institution in 2003. This suggests that other factors, such as financial constraints, may be at play (for matriculants with endorsements not going on to higher education) (DoL, 2005: 24-25). Figures for first-time enrolments at universities and universities of technology (technikons) for 2002/03 are provided in Table 4.1.

**Table 4.1: First time enrolments as percentage of senior certificate passes 2002/03**

Year	Passed Senior Certificate	First time enrolments in technikons and universities	Enrolment as percentage of passes %	Passed senior certificate with endorsement	First time enrolments in universities	Enrolment as percentage of passes %
2002	277 206	61 172	22.07	67 707	33 995	50.2
2003	305 774	71 445	23.37	75 048	40 077	53.4

**Source: Breier, 2004; Department of Education, 2004d and 2003c (cited in DoL, 2003: 25)**

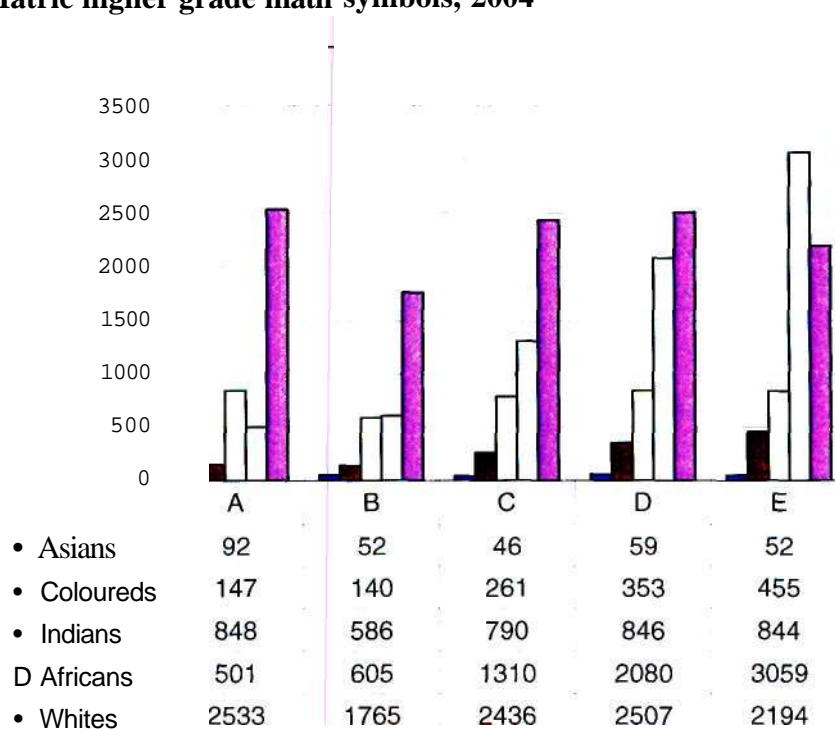
Breier (2004, cited in DoL, 2005: 25) further reports that there is a great deal of provincial variation with about 80% of those who passed Senior Certificate in 2002 in the economic heartland of Gauteng enrolled at university in 2003, compared with 36.6% in KwaZulu-Natal. The DoL (2005: 25) suggests that the slightly increasing proportion of first-time enrolments (as indicated in Table 4.1) relative to the pool of matriculants from 2002 to 2003 is perhaps an indication of a future positive trend.

## Mathematics

Despite the upward trend in the number of matriculants passing matric with endorsement, Lawless (2005: 79) reports that the number of passes in higher grade math has seen little improvement over the years. Lawless (2005: 79) further suggests that the number of higher grade math passes is not enough to satisfy the needs of science, engineering and technology (SET) and the financial professions. In particular, according to Lawless (2005: 80) the number of black higher grade (math) passes is severely hampering the transformation of these (SET and financial) professions. In terms of achieving gender targets, there is little difference in higher grade results between male and female; of those who passed in the higher grade, 62% were male and 59% were female, with the percentage achieving A, B, C and D (symbols for math) almost the same (Lawless, 2005: 80).

According to Lawless (2005: 81), the analysis of 2004 (math, higher grade) does not bode well for the professions in South Africa. Lawless (2005: 81) further argues that since there are over half a million matriculants annually, the number of students passing with higher grade math is totally inadequate. Matric higher grade maths symbols for 2004 are illustrated in Figure 4.1.

**Figure 4.1: Matric higher grade math symbols, 2004**



**Source: Department of Education (cited in Lawless, 2005: 82)**



## *Educators*

According to Lawless (2005: 85), owing to declining employment conditions and benefits, the pool of excellent, dedicated professional teachers is limited and the recruitment of bright young minds into teaching has been reduced to a trickle. Many teachers have qualifications below the level at which they are being asked to teach, partly because too few teachers are being trained (Lawless, 2005: 86).

In many instances, learners are being taught by:

Underqualified teachers

Teachers who do not complete the syllabus

Teachers who cannot give adequate explanations

Teachers who do not mark or check their work (Lawless, 2005: 86).

The HSRC (2003) reports that there has been, in recent times, an increase in the number of educators. This increase also saw an increase in the number of unqualified and under-qualified educators (HSRC, 2003: 33). An unqualified or under-qualified educator is regarded as having less than a SCE pass plus a three-year teaching diploma or degree (HSRC, 2003: 313). The number of unqualified and under-qualified educators in 1975, 1985, 1994 and 2000 is shown in Table 4.2.

**Table 4.2: Unqualified/Under-qualified educators, 1975,1985,1994 and 2000**

Year	Unqualified/ Under- qualified	Percentage Unqualified	Qualified	Total
1975	15 705	11%	127 927	143 632
1985 (excludes whites and TBVC states)	24 679	17%	119 356	144 035
1994	122 459	36%	219 444	341 903
2000	76 839	22%	266 641	343 480

**Source: 1975 data from CSS (1980); 1985 data from RIEP (1985) and SAIRR (1988); 1994 and 2000 data from Bot (2001) (cited in HSRC, 2003: 313)**

As can be seen in Table 4.2, the percentage of unqualified and underqualified educators decreased significantly from 36% in 1994 to 22% in 2000, indicating a positive trend.

### *Quality of Physical School Facilities*

Sources of great inequality in learning opportunities are the shortage of classrooms, condition of school buildings and physical facilities in schools (HSRC, 2003: 314). The HSRC (2003: 314) reports that there has been a significant improvement in some areas, most noticeably in the building of additional classrooms, electrification of schools and the installation of telecommunications, lagging somewhat behind is the upgrading and refurbishment of schools and the installation of water and sanitation.

Table 4.3 shows the extent of services provision per school in the various provinces as a percentage of the number of schools in the province.

**Table 4.3: Percentage of Schools with Telephones, Water, Electricity, Toilets and Classroom Shortages, 1996 and 2000**

Province	Telephones		Water		Electricity		Toilets		Schools with Classroom Shortages	
	1996	2000	1996	2000	1996	2000	1996	2000	1996	2000
<b>Eastern Cape</b>	19	59	57	59	22	40	75	81	65	47
<b>Free State</b>	26	59	6	68	42	54	83	87	24	16
<b>Gauteng</b>	91	96	94	97	86	93	98	99	26	26
<b>KwaZulu-Natal</b>	35	68	65	68	38	43	90	94	61	48
<b>Mpumalanga</b>	39	52	73	62	51	51	88	93	50	55
<b>Northern Cape</b>	76	92	90	97	81	88	98	98	16	10
<b>Limpopo</b>	38	49	34	63	21	51	91	93	66	49
<b>North West</b>	37	57	82	89	45	64	95	92	42	28
<b>Western Cape</b>	94	98	94	98	88	95	100	100	16	17
<b>National</b>	40	<b>64</b>	<b>65</b>	71	42	<b>55</b>	88	<b>91</b>	<b>50</b>	40

Source: Adapted from 1996 and 2000 data from DoE (2001c, cited in HSRC, 2003: 314)

### *Summary*

In summary, the provision of schooling in South Africa is extensive and the outlook for improved levels of basic and further education for the population as a whole is extremely positive (HSRC, 2003: 323). The challenge for the country in future years is the continuous

improvement of the quality of education output in order to ensure that the school system contributes effectively to HRD while increasing the pool of candidates available for further education and training (HSRC, 2003: 323)

According to Lawless (2005: 93) there are about 6 000 high schools in South Africa, however, the students who were registered in first-year and final-year civil engineering came from just over 500 schools nationwide. Of the 6 000 high schools, only 3 000 offer higher grade maths with only 1 500 schools producing more than 10% of learners passing higher grade maths (Lawless, 2005).

Based on the foregoing discussion and despite significant improvements already being achieved at schools in South Africa, considerably more still is to be achieved to reduce skill gaps in secondary education.

#### **4.3.4 Tertiary Education**

Higher education in South Africa plays a major role in the development of the high-skills of the workforce, in the form of professionals, managers, as well as producing the scientists and knowledge base so critical to the national system of innovation (DoL, 2005: 23). According to the DoL (2005: 23) there has been a steady increase in enrolments across the system over the decade 1993-2003. Head count enrolments (at universities and technikons) for the period 1993 to 2003 are provided in Table 4.4.

**Table 4.4: Headcount Enrolments at Universities and Technikons, 1993-2003**

	1993	1995	1997	1999	2000	2001	2002	2003
<b>University enrolments</b>	340 000	385 000	380 000	384 000	388 369	428 648	460 438	<b>488 000</b>
<b>Technikon enrolments</b>	133 000	184 000	200 000	208 000	202 792	224 327	214 690	230 000
<b>Total enrolments</b>	473 000	569 000	580 000	586 000	591 161	652 975	675 128	718 000

**Source: Adapted from CHE, 2004; Breier, 2004 (cited in DoL, 2005: 23)**

The number of matriculants entering the engineering profession are affected by two important factors:

- (a) the absolute number of matriculants with the requisite academic requirements; and
- (b) the attractiveness of the engineering profession to suitably qualified individuals (HSRC, 2003: 570).

According to Kruss (2002, cited in HSRC, 2003: 570), the number of matriculants with suitable merits in math and science has been declining in recent years. To compensate for this deficiency, most engineering facilities have instituted academic development programmes to compensate for the poor quality education many school learners have received (HSRC: 2003). According to the HSRC (2003 : 570) UCT pioneered this area when they started their Academic Support Programme for Engineering in Cape Town in the early 1980s. The Universities of Stellenbosch, Pretoria, The Witwatersrand and most other institutions have similar programmes (HSRC, 2003: 570)

Lawless (2005: 113) reports that a similar approach was identified at technikons, where some offer dedicated foundation programmes, and others choose to teach the first semester over two semesters. This is one of the most critical components of future engineering education (and) seems to be the worst funded and least understood aspect of tertiary education (Lawless, 2005: 113).

The attractiveness of engineering to school-leavers is more difficult to assess, since it deals with students' perceptions of the profession (HSRC, 2003: 570). ECSA believes that perceptions are affected by expected remuneration rates and employability (Roux, 2000 cited in HSRC, 2003: 570). These, in turn, are thought to be affected by contact with family members or friends who are professionals (Schoonwinkel, 2000 cited in HSRC, 2003: 570-571). Remuneration rates for engineering are often below those offered by the finance professions, and therefore, engineering recruitment suffers (Roux 2002, Schoonwinkel 2002, cited in HSRC, 2003:571).

Table 4.5 describes the balance between fields of study in relation to the targets set by the National Plan for Higher Education (NPHE) (2001) to enhance the system's ability to produce high-level skills (DoL, 2005: 25). Table 4.5 shows that the universities of technology remain a key location for SET enrolments, closely followed by the universities, with more favourable ratios than set by the NPHE (DoL, 2005: 25). The DoL (2005: 25) further points out that although institutional variation is important in a differentiated system, the greatest challenge lies in shifting the balance in the new comprehensives, and particularly in the super distance institution, which has approximately 60% of its enrolments in Humanities and Social Sciences and Education.

**Table 4.5: Fields of Study Across the New Institutional Landscape, 2001**

	<b>Science, Engineering and Technology</b>	<b>Business, Commerce and Management Sciences</b>	<b>Humanities and Social Sciences</b>	<b>Education</b>
<b>National Plan Target</b>	30%	<b>30%</b>	<b>40%</b>	
<b>Universities:</b>				
Independent	35%	<b>33%</b>	<b>15%</b>	17%
Merged	33%	<b>30%</b>	<b>16%</b>	21%
<b>Total</b>	34%	<b>32%</b>	<b>15%</b>	18%
<b>Universities of Technology:</b>				
Independent	39%	<b>41%</b>	<b>19%</b>	1%
Merged	39%	<b>31%</b>	<b>19%</b>	11%
<b>Total</b>	39%	<b>33%</b>	<b>19%</b>	9%
<b>Comprehensives:</b>				
Independent	24%	<b>50%</b>	<b>12%</b>	14%
Merged	23%	<b>21%</b>	<b>27%</b>	28%
Unisa	9%	<b>28%</b>	<b>50%</b>	13%
<b>Total</b>	<b>14%</b>	<b>27%</b>	<b>42%</b>	<b>18%</b>

**Source: CHE (2004, cited in DoL, 2005: 25)**

The following institutions supplied engineers, technologists and technicians as at 2004:

**Engineers:**

Cape Town University  
University of KZN  
Pretoria University  
Rand Afrikaans University  
Stellenbosch University  
Witwatersrand University

**Technologists and Technicians:**

Border Technikon  
Cape Technikon  
DUT (DIT)  
Eastern Cape Technikon  
Central University of Technology  
Mangosutho Technikon  
Peninsula Technikon  
Port Elizabeth Technikon  
Tshwane University of Technology  
Technikon SA  
Vaal University of Technology  
Witwatersrand Technikon (Lawless, 2005).

### *Professional Graduations*

Lawless (2005) reports that civil engineering first-degree graduations from universities declined while postgraduate research increased for the period 1986 to 2003, and technikon graduates reflected a steady increase.

In terms of transformation and engineering graduations from universities the following are reported:

- Graduations of all previously disadvantaged individuals (PDIs) have increased.
- While the number of white male graduates has decreased, 25% more white males than all PDIs graduate.
- The second largest group of graduates is African males, but at the current rate of graduation there is little hope of transformation at management level in civil engineering organisations in the short to medium term.
- First-year registrations at universities in 2004 showed the same trend, with African males representing 24% and the total number of black students enrolled exceeding 50% for the first time (Lawless, 2005).

In terms of transformation and engineering graduation from technikons, the following is reported:

- The student population has transformed dramatically

White males represent less than 25% of technikon graduates.

The numbers (graduating) are not reflected in industry and a great deal of work needs to be done to ensure that all graduates are employed (Lawless, 2005).

The HSRC (2003: 576) is of a similar view as Lawless (2005) in terms of equity targets and suggests that the significance of the magnitudes (of transformation) become more apparent when the figures are adjusted for the relative size of each race group, as shown in Table 4.6

**Table 4.6: Technikon and University Engineering Graduates per million, per race, 2000**

Graduates	White	Coloured	Indian	African
Technikon graduates: National diplomas	128.94	46.41	89.72	29.96
Technikon graduates: Higher diplomas and B Tech degrees	69.29	9.23	59.51	3.88
University graduates: Bachelor degrees	175.05	9.76	56.76	6.53

**Source: Compiled by the authors on the basis of data from DoE (1991-1999); DoE (2000); Kane-Berman (2001) (cited in HSRC, 2003: 576)**

The HSRC (2003: 576) further points out that the numbers (shown in Table 4.6) of historically disadvantaged graduates are still one to two orders of magnitude lower than in the white population. While there are more African graduates than Coloured or Indian graduates, the rate of African graduations is still substantially lower than that of the other groups when expressed relative to each group's size (HSRC, 2003: 576).

#### *Responsiveness to Changing Demand*

The response of engineering faculties at tertiary institutions to changes in the structure of demand is, inter alia, shaped by:

The national academic standards that are co-ordinated by ECSA's degree and qualification accreditation process. As part of the process, ECSA assesses the needs of employers on a regular basis and communicates these needs to tertiary institutions (HSRC, 2003). However, Lawless (2005: 130) suggests that it seems that industry and ECSA are currently "out of sync" and to determine the needs and address the many problems ... a major think-tank needs to be convened with the institutions, ECSA, CHE, DoE, SETAs and industry.

- Direct interaction with industry to learn about their needs, e.g. both UCT and the University of Stellenbosch have faculty advisory committees consisting of industrialists representing the demand for the different disciplines offered by the faculty (HSRC, 2003).

Lawless (2005) further argues that the level of math and depth of chemistry taught at university may be excessive and that a review of the appropriateness of these subjects is needed. Lawless (2005) suggests that subjects should be added to or improved as per Table

4.7, as suggested by comments from the public and private sector from her study. A number of these suggestions are similar to the Mills and Treagust (2003) study findings.

**Table 4.7: Industry Input on Additions and Improvements Required in Tertiary Curricula**

Industry input - tertiary wish list - December 2004		University Improve	University Add	Technikon Improve	Technikon Add
Life Skills	Literacy (good English)	1%	10%	20%	18%
	Numeracy	6%	1%	31%	6%
	Report writing	11%	17%	23%	33%
	Communication skills/negotiating	15%	14%	33%	30%
	Public speaking		1%		3%
	Computer literacy	8%	2%	18%	3%
	Time management	3%		3%	
	Thinking and problem solving skills	5%	2%	8%	3%
	Conducting meetings				3%
	Philosophy				3%
	General		6%	5%	6%
	Economics, financial management, accounting & budgeting	27%	45%	21%	48%
	HR	4%		3%	27%
	General business	18%	9%	18%	21%
	Quality management	3%	2%		
Business management skills and marketing	Marketing	1%	7%	3%	6%
	Strategic thinking and planning	1%			
	Industrial psychology		1%		12%
	Change management	1%			
	Management skills		8%		15%
Construction/contractual/legal and legislation	Value engineering		1%		
	Project management	27%	6%	31%	39%
	Construction and contract management	6%	2%	18%	3%
	Contract law	18%	2%		9%
	OHSA	1%	3%	5%	12%
Technical know-how	Municipal Finance Act, etc	1%			
	Legislation	1%	7%		6%
	Structures	6%	6%	18%	3%
	Urban		1%		
	Water and sanitation	9%		10%	
	Roads, earthworks and stormwater			8%	
	Transport and traffic	10%	1%	10%	9%
	Geotechnical	5%		18%	
IT	Materials	8%			
	General improvement required	14%	1%	21%	3%
	Planning		2%		6%
	Maintenance		3%		
IT	CAD	3%	3%	13%	12%
Environmental		14%	7%	3%	12%
Communities/ social and labour-based issues	Social and community engineering	3%	23%	5%	9%
	Labour intensive courses	3%	1%		6%
Improved content and standards		4%	5%	10%	9%
Insufficient theory			2%	21%	
More practical experience		11%	13%	5%	6%
Other	Survey		2%		3%
	Other (including ethics, history of engineering, HIV, lecturers from the industry)		5%		6%

Source: Lawless (2005:127)



## *Lecturers*

According to the HSRC (2003: 581) the financial pressure on tertiary institutions, and thus the lower salaries being offered in comparison to the private sector, means that they are struggling to retain quality engineers as teaching and research staff, which will potentially affect the quality of training and research provided.

The Lawless (2005: 16) study found that although students experience many external difficulties, problems with staff/student ratios, lecturer quality and attitude were also highlighted as areas of concern. Some areas of concern are discussed below:

- (i) *Student to staff ratio:* The increase in enrolments has meant in some industries that classes are too large to be taught effectively. In some institutions the staff to student ratio was as low as one lecturer to 96 students while in other institutions additional staff with inadequate qualifications had been taken on because of budget constraints (Lawless, 2005: 116). Hugo *et al* (1988, cited by Lawless, 2005: 117) found that in order to have sufficient depth of knowledge in each field, university civil engineering departments should have an academic staff complement of at least 25, this was at a time that they were recommending that there should be a total of 300 graduates per annum to support a significantly smaller population and demand on development. Lawless (2005: 117) found that: only one institution has 20 academic staff members and the rest are in the low middle teens, as a result, various subjects are suffering.

Lawless (2005: 117) also found that the technikons were worse off and although they have more students, only one institution has more than 13 academic staff, and some only five or six.

- (ii) *Lecturer qualifications and experience:* A comparison of the qualifications and years of experience of heads of departments in civil engineering revealed disparities. In several technikons the highest qualification of many lecturers was a national diploma lecturing. By contrast, most university staff hold doctorates, and some hold master's degrees in the specialist field in which they are lecturing undergraduate students. The study also found that there was a correlation between lecturer qualifications and student throughput (Lawless, 2005: 117).

- (iii) *Lecturer salaries:* The study found that salaries are generally much lower than those offered in industry, and this has been a problem for a long time. As there is a severe shortage of academic staff, interventions must be established to attract and retain the top caliber (lecturers) (Lawless, 2005: 117). Lawless (2005: 117) further suggests that if government is unable to address this, then industry and perhaps SETAs should consider subventing lecturer salaries. In the USA and Canada significant funds are provided from the private sector to ensure that salaries are competitive (Lawless, 2005: 117). Lawless (2005, 118) reports that the accounting profession aggressively recruits and retains top candidates in academia through subvention.
- (iv) *Technocrats not teachers:* Lecturers are technical people who have not specifically been trained to teach, while some may be "naturals", many cannot explain concepts, and students battle to understand what they have been taught (Lawless, 2005: 118).
- (v) *Lecturer ethics:* The study found that certain lecturers are never available to answer questions and that some arrive halfway through the lecture period or not at all. Heads of department (also) complained of not being able to demand the discipline and dedication required of lecturing staff (Lawless, 2005: 120).

### *Employment Opportunities*

Lawless (2005: 128) found that generally civil engineering students from universities have no difficulty in finding employment, regardless of gender or race. ... the situation was significantly different at the technikons, where over 70% were unable to secure any form of employment. According to Lawless (2005: 128) this seems to indicate a mismatch between the number of technikon and university graduates and the requirements of industry. The Lawless (2005) study further found that in excess of 60% of final year students at technikons could not obtain experimental training and therefore could not graduate.

### *Industry Assessment of Tertiary Institutions*

The Lawless (2005) study found that although many respondents from industry stated that they had employed talented individuals from all institutions, generally the respondents were unhappy with students from institutions with low throughput, i.e. the number of students who actually qualify after the minimum prescribed period of study.

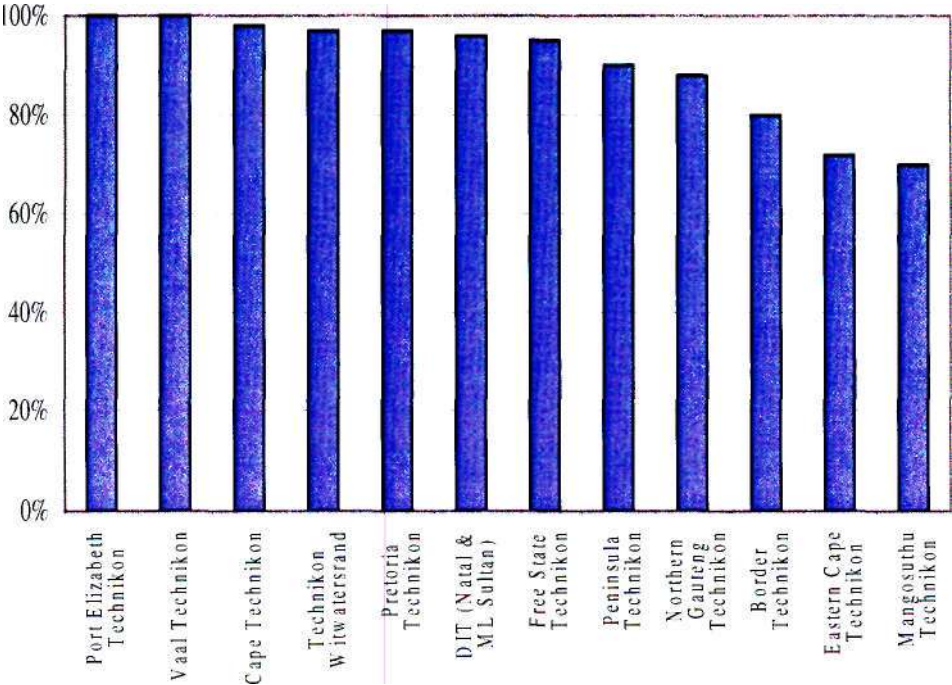
While industry was not happy with the quality of education from several institutions, the orders of preference for employing graduates differed, reflecting more on the calibre of students from each of the institution^ than the quality of tuition (Lawless, 2005: 125). Industry's preferences for employing gifaduates from universities and technikons, as found by Lawless (2005), are shown in Figure 4. and Figure 4.3.

**Figure 4.2: Percentage of employers vkhwo will employ from universities again**



Source: Adapted from Lawless (2005: 126)

**Figure 4.3: Percentage of employers ^who will emply from technikons again**



Source: Adapted from Lawless (2005: 125)

## Summary

Over the past decade there have been positive trends across the entire education system (schools, FET colleges and higher education institutions) indicating improvements in school enrolments and education outcomes (DoL, 2005: 30). In both schooling and higher education, there is a strong determination to improve enrolments and performance in mathematics, science, engineering and technology - the challenge now is for the entire education system to sustain and consolidate progress, in particular, there is a need to improve efficiency, enhance progression between the differing subsectors (schools, colleges and universities) and increase responsiveness to the economy's labour market needs (DoL, 2005: 30).

With regard to the attractiveness of engineering to school-leavers, the HSRC (2003: 571) notes that many of the large engineering faculties are now investing heavily in marketing. Strategies to attract school-leavers include undertaking school visits, hosting an engineering winter school for scholars at the faculty and other outreach projects (HSRC, 2003: 571).

### 4.3.5 Graduates

The Towards a Ten Year Review (PCAS, 2003 cited in DoL, 2005: 28) identified graduate unemployment as a key concern:

*There is a relatively large reservoir of young unemployed matriculants and even graduates of technikons and universities. The percentage of unemployed graduates of tertiary institutions grew from 6% in 1995 to 15% in 2002. For Africans, the percentage of unemployed graduates rose from 10% in 1995 to 26% in 2002. Many of these unemployed people have earned degrees and diplomas that have not sufficiently prepared them for the labour market. Two messages come out of the data. The first is that school, technikon and university programmes are not always effectively geared towards employability. The second is that school-goers and school-leavers do not have sufficient guidance regarding practical study and career paths (PCAS, 2003, cited in DoL, 2005: 29).*

The DoL (2005: 29) further reports that a more recent HSRC study found that factors such as field of study, geographical area, choice of institution, as well as gender and race are seen as determining factors in the growing phenomenon of graduate unemployment in South Africa. The DoL (2005: 29) also found that graduates from historically White universities had better prospects than those from historically Black universities.

The Lawless (2005) study found that 60% to 70% of the 2004 final-year university students had already found employment in the South African civil engineering industry prior to graduation, but only 20% to 30% of technikon graduates had found work at that stage (Lawless, 2005: 135). The study also found that the drop-out rate within the initial few years after graduation is also alarming with training and career prospects as their main frustrations (Lawless, 2005: 135).

The DoL (2005: 29) reports that only in engineering, African graduates experienced the highest proportion of those in immediate employment (88.9%) compared to 78.3%, 50% and 50% for Whites, Asians and Coloureds respectively.

Lawless (2005: 135) further argues that due to pressure on profit margins, and little capacity or time to train young staff, all wish for instantly trained or fast-tracked staff, that is, they want the product but are not prepared to take responsibility for the process. As a result, job hopping and poaching of comprehensively trained staff are rife, especially among previously disadvantaged individuals (PDIs) (Lawless, 2005: 135).

### *Education and Training in Civil Engineering*

Education and training in civil engineering is a two-stage process; initial education takes place at university or technikon, thereafter industry is expected to offer the graduate work-place training (Lawless, 2005: 136). Having developed sufficient competence to be able to handle projects on his or her own, the graduate may then register with ECSA as a professional engineer, technologist or technician (PrEng, Pr Tech Eng or Pr Techni) (Lawless, 2005: 136).

According to ECSA Bulletin (6 April 2005: 3, cited in Lawless, 2005: 136) the development of the so-called Stage II, candidate qualifications for registration with the South African Qualifications Authority (SAQA) are underway, and will replace ECSA's voluntary "Commitment and Undertaking" system.

SAQA is responsible for:

- establishing a single unified system of education and training qualifications in the country by overseeing and implementing the National Qualifications Framework (NQF).

- generating unit standards and qualifications for registration on the NQF.
- creating and accrediting the institutions necessary to ensure that these qualifications are of a high quality, which means that the quality of training provided by training providers has to be monitored (barker, 2003: 258).

The Stage II unit standards, as suggested by SAQA for civil engineering, are as shown in Table 4.8.

**Table 4.8: Proposed unit standards for Stage II learnerships**

<b>Stage II Engineer</b>	<b>S<sup>^</sup>age II Engineering technologist</b>	<b>Stage II Engineering technician</b>
Management	Management and two of:	Management
Design and planning	Desig and planning	Design and planning or
	Invest!gation and reporting	investigation and reporting
Investigation and reporting	Operations management	Construction Management or
		operations management
Plus one elective	Plus one elective	Plus one elective

**Source: ECSA (date unknown, cited in Lawless, 2005: 136)**

Lawless (2005: 136) suggests that at tie time of graduation, the candidate civil engineering professional has had little or no experience and needs to experience as much of the project cycle as possible in order to become proficient. In terms of sustainable development, the graduate must not only develop technical skills, but must also understand many more facets of the project cycle, such as political, socio-economic, institutional, environmental, health, legal, financial and management issues (Lawless, 2005: 136). Lawless (2005: 136) argues that as graduates seldom repeat experiences in terms of planning, design or site work, as the training phase is relatively short, there is little scope for fast tracking the practical experience phase.

Lawless (2005: 137) laments that before the introduction of information technology, the design office production team include^ tracers, draughting staff and detailers. The engineer explained his or her requirements to these members of the team, who would produce the final drawings, in this way the production team became a knowledge center for the organisation and could support the training of youn graduates (Lawless, 2005: 137).

Prior to the formation of ECSA, the South African Council for Professional Engineers required their affiliates to define and rsregister their training procedures for assisting graduates to attain registration (Lawless, 2005) According to Lawless (2005: 138) each company

submitted detailed programmes outlining the disciplines to be mastered, the activities to be carried out and the staff at various levels who would contribute to the training of the young graduate.

For example, the Anglo American "Formal training programme" covered activities, durations and responsibilities as outlined in Table 4.9, which was typical of the training process at the time (Lawless, 2005: 138). Lawless (2005: 138) claims that many successful black civil engineering company owners today owe their success, at least in part, to the solid grounding given them by Anglo American.

**Table 4.9: Excerpts from the Anglo American civil engineering training scheme of the eighties**

#### **Design office**

The period to be spent here will normally be 12 months ... this period will be split as follows:

Approximately one month will be spent on the drawing board preparing concrete layout drawings and steel reinforcement details and schedules ... the graduate will be guided by experienced draughtsman and detailers ... this period enables the graduate to learn the standard methods of detailing, departmental procedures, codes and specifications, and to gain an appreciation of the close liaison necessary between the designer and detailer

Approximately three months will be spent on detailed design ... Supervised by a qualified engineer ...

Approximately three months will be spent on the detailed design of a series of different structures, supervising detailer and draughtsman. The graduate will be guided by a chief designer and supervised, but to a lesser extent by a qualified civil engineer, deputising for him or her when necessary

Approximately five months to be spent in charge of a design project ... all under the supervision of the divisional civil engineer ... etc

**Source: Anglo American (date unknown, cited in Lawless, 2005: 137)**

#### *The demise of training programmes*

In the past 15 to 20 years the effort put into formal training has been greatly reduced, and in many instances has completely disappeared as a result of a number of factors including:

Withdrawal of tax benefit for training: in the 70s and 80s employers could claim tax relief for staff training. Once this was withdrawn, it was perceived that there was no economic benefit in training, so many companies reduced their training schemes or closed them altogether.

Information technology: productivity gains from the introduction of IT have meant that the size of the technical team has been reduced. Draughting staff, whose responsibility was to produce working drawings and who had an invaluable wealth of practical knowledge, were the first casualties. CAD systems and design programmes that automatically generate working drawings meant that engineers and technologists could produce drawings as a by product of their design work.

Time and capacity: email and fax communication allow information to travel around the world in a matter of seconds. As a result, the business environment expects instant answers. Senior staff are expected to work at an exceptionally high pace and simply have no time to train their young graduates.

Declining industry and margins: little effort was put into long-term planning and training during the decline years. Margins were squeezed as companies competed for work to survive, leaving little on the table for training.

Non-technical senior staff: In many quarters senior technical staff have been replaced by staff trained in other fields such as marketing, management, law, finance, town planning, teaching and in some instances individuals with no qualifications.

As a result there are fewer or sometimes no senior staff with engineering knowledge capable of training young graduates. This is particularly prevalent in government departments, provinces and municipalities.

Equity targets: The strict enforcement of affirmative appointments in engineering posts has meant that young black graduates are placed in very senior posts, for which they are not yet equipped. They battle to cope and often leave the profession. The older professionals who have lost their posts or have been bypassed as a result of affirmative action are often not prepared to train their successors.

The public sector no longer trains: In the past the public sector was a major training ground for civil professionals. The former South African Railways and Harbours, Department of Transport, Department of Water Affairs and Department of Public Works, the provinces and local authorities provided huge numbers of bursaries in the sixties and seventies, canvassed widely for appropriate learners, and offered training.



Many of the leaders in the industry today owe their position to the sound training they received on 'The Railways' and in government (Lawless, 2005: 138).

The SAACE found (for the period July December 2004) the following with regard to training and bursaries in the industry:

13% of respondents spent more than 2.5% of their payroll on training, comprising of both in-house and external training expenses.

On average the industry spent a higher 1.8% of their payroll on training during the last six months of 2004, which amounted to an annualized figure of about R84 million (in current prices), the highest value: since June 2000.

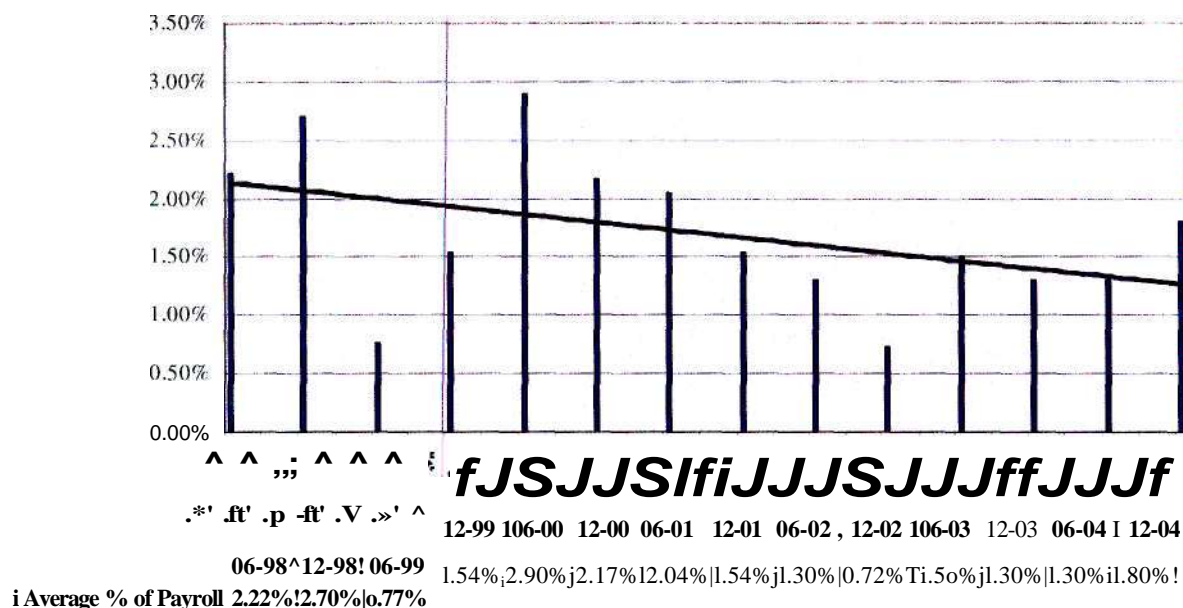
- Bursaries fell to a record low of 0.48% of the salary and wage bill, down from 0.55% in the first six months, or otherwise put, from an annualized R24 million (current prices) in the first six months, to R22 million.

68% of the bursary recipients were PDIs, compared to 63% in the first six months, achieving a new record.

The average bursary amount rose to R40,000 in 2004, up from R39,000 in the previous year (SAACE, 2005: lfe)

Despite the recent positive steps taken by most companies, the trendline of expenditure on training shows a decline since January 1998, as shown in Figure 4.4:

**Figure 4.4: Expenditure on Training, Average % of Payroll**



**Source: Adapted from SAACE (2005:24)**

Skills shortages in the industry require additional investment in training, albeit sometimes to the employer's disadvantage, as many "trained" staff are lured by more lucrative packages (SAACE, 2005: 24).

The SAACE (2005: 24) points out that the forthcoming construction charter will stipulate that companies must spend a given percentage of payroll, over and above the Skills Development Levy, on direct training of black staff in order to qualify for scorecard points.

### *Summary*

Without comprehensive workplace training programmes, incorporating ongoing supervision, mentorship and career path planning, graduates will not become effective professionals and, worse still, they may be permanently lost to the industry (Lawless, 2005: 148). Because the margins are inadequate and few professionals in the industry have time to take on and manage the training of young graduates, mechanisms must be put in place to increase funding and capacity to employ and train (Lawless, 2005: 148).

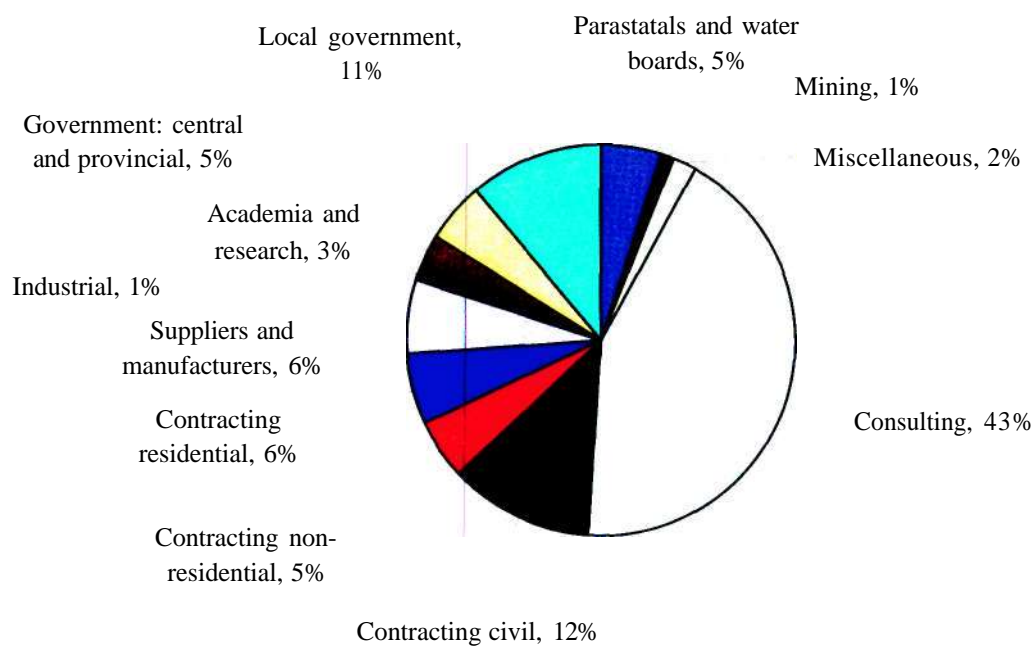
Finally, Lawless (2005: 148) points out that understanding the character of and the needs of the young generation is of vital importance to addressing retention problems facing the industry.

#### 4.3.6 Professionals

Civil engineering professionals are key to the development and growth of South Africa, yet they have become an exploited group who command little respect or recognition for their skills, dedication, the risks they take and the role they play (Lawless, 2005: 182).

Civil professionals are employed in a number of sectors in South Africa. The spread per sector is provided in Figure 4.5.

**Figure 4.5: Distribution of Civil Professionals per Sector**



**Source: Lawless (2005: 223)**

#### *Current Number in Industry*

The total number of civil professionals, i.e. engineers, technologists and technicians in South Africa, not necessarily registered with ECSA, is shown in Table 4.10.

**Table 4.10: Industry Utilisation of Civil Engineering Professionals**

<b>Sector</b>	<b>Engineer</b>	<b>Technologist</b>	<b>Technician</b>	<b>Total</b>
Consulting	2 977	865	2 024	<b>5 866</b>
Contracting - civil, non-res and res	1012	101	2 030	<b>3 143</b>
Suppliers and manufacturers	309	84	408	<b>801</b>
Mining and industrial	198	22	13	<b>232</b>
Academia and research	343	73	<b>53</b>	<b>469</b>
Government - central and provincial	222	47	438	<b>708</b>
Local government	376	368	780	<b>1524</b>
Parastatals and water boards	297	119	316	<b>732</b>
Miscellaneous	189	33	12	<b>233</b>
Add 10% for sectors not covered, and companies not registered with stakeholders	592	171	607	<b>1371</b>
<b>Total</b>	<b>6 515</b>	<b>1883</b>	<b>6 681</b>	<b>15 079</b>

**Source: Lawless (2005: 223)**

In 2004, the employment domain in the consulting engineering profession was characterised by the following:

- Total employment fell from 25 000 in the eighties, to 12 000 in the late nineties, to just more than 10 000, in line with a drop in nominal fee income during the same period.
- Employment levels were at an all time low (since the inception of the survey), but despite the intention by firms to increase staff, the industry was challenged by severe shortages of qualified personnel, irrespective of race or gender.
- The cost of employment escalated by 10% y/y on average during 2003 and accelerated to an annual increase of 29% as demand started to exceed supply during 2004.
- Due to a shortage of skilled personnel, expenditure on training inevitably increased to R44 million (annualized).
- Employment in the consulting engineering profession consisted of 11.3% partners and directors, 6.9% associates and 8% professional engineers (not appointed as a partner, director or associate). Administrative staff represented 26.4% of total employment, slightly lower compared to the same period in 2003 (SAACE, 2005: 25).

The race and gender orientation of the consulting engineering profession is as follows:

- Employment in the consulting engineering industry continues to be dominated by males, representing 64% of total employment. At the senior level, i.e. employed as partner, director or associate, females represent less than 10%.
- The employment of black staff increased by three percentage points from 23% in the July to December 2003 survey to 26.2% in the current (July to December 2004) survey. There was also an increase in the last six months, albeit marginal. However, black partners, directors and associates remain in the minority representing 10.3% of total partners and directors, and 5.8% of the industry's associates (SAACE, 2005: 26).

In terms of equity, SAACE member firm's employment equity for 2004 was as shown in Table 4.11.

**Table 4.11: SAACE Member Firms' Employment Equity**

<b>Positions Held</b>	<b>Black representation December 2004 survey (Average 2004)</b>	<b>Black representation change 2003 - 2004</b>	<b>Total Black Employment</b>
Partners/Directors/Associates	6.3% (6.9%)	1.5%	
Professionals (Pr. Eng., Architects, QS, other Professionals, Engineers, other graduates)	13.0% (11.4%)	3.1%	
Technical (Technologists, Technicians, Technical Assistants, Draughtsperson)	31.2% (31.2%)	1.5%	<b>26.2%</b>
Admin/Support (Laboratory/Survey Assistants, Administrative, Support Staff, Site Staff)	57.5% (56.5%)	16.9%	

**Source: December 2004 SAACE MIS Survey, cited in SAACE (2005: 27)**

The number of civil professionals, registered and non-registered with ECSA, practicing in South Africa, as established from field research by Lawless (2005) is as shown in Table 4.12.

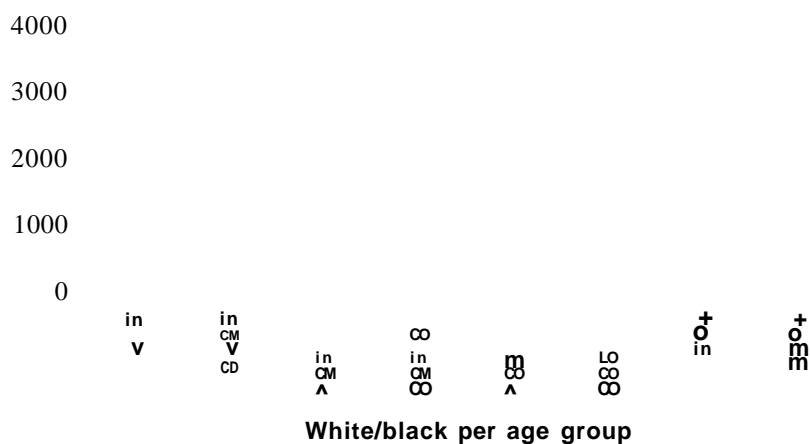
**Table 4.12: Registered Versus Non-Registered Civil Engineering Professionals Practising in South Africa**

	Registered Pr Eng, Pr Tech Eng or Pr Techni	Not registered or registered as candidate	Total
Engineer	3 915	2 600	6 515
Technologist	966	917	1883
Technician	516	6 165	6 681
<b>Total</b>	<b>5 396</b>	<b>9 679</b>	<b>15 079</b>

Source: Lawless (2005: 224)

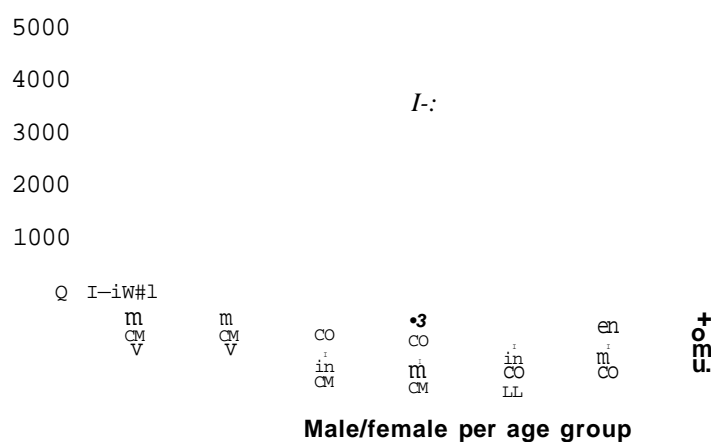
The age and race profile and age and gender profile of civil professionals in South Africa, as found by the Lawless (2005) study, are shown in Figure 4.6 and Figure 4.7 respectively.

**Figure 4.6: Profile of civil engineering professionals employed in South Africa, by age and race, 2004**



Source: Adapted from Lawless (2005: 224)

**Figure 4.7: Profile of civil engineering professionals employed in South Africa, by age and gender, 2004**



Source: Adapted from Lawless (2005: 225)

### *International Benchmarks*

The international ratios of engineers (all disciplines) to population and ratios of doctors to population, as found by Lawless (2005), are as shown in Table 4.13. The following limitations apply, which render the figures to serve as an indication only:

- Many registering bodies similar to ECSA quote only the number of professional engineers registered in their country.
- Other countries quote all engineers, whether professionally registered or not.
- The data comes from widely scattered sources with varying degrees of reliability and detail, and dates of datasets varied to some extent. This may have led to minor inconsistencies (Lawless, 2005: 229).

**Table 4.13: International Engineer and Doctor to Population Statistics**

Country	Population	Nº of registered engineers	Population per engineer	Population per doctor
Norway	4 600 246	37 685	122	308
China*	1 300 000 000	10 000 000	130	593
Finland	5 357 934	39 537	136	304
India*	1 020 000 000	6 500 000	157	2 320
Greece	15 000 000	87 337	172	199
Denmark	5 520 295	30 926	179	273
Canada	30 337 000	169 512	179	475
Sweden	9 254 613	44 352	209	291
Germany	82 443 000	380 000	217	291
Brazil	184 203 744	811 483	227	379
Iceland	270 603	1 019	266	283
France	60 656 178	220 000	276	297
Ireland	3 917 203	14 000	280	362
Japan	121 000 000	400 000	303	476
UK	58 821 000	189 406	311	492
USA	296 771 226	762 000	389	361
Argentina	36 260 130	80 000	453	354
Australia	20 372 452	44 767	455	414
Hong Kong	5 000 000	10 798	463	617
Malaysia	25 500 000	47 000	543	1 436
Chile	14 973 843	22 000	681	2 025
Poland*	40 265 683	53 796	748	408
Singapore	4 240 000	3 161	1 341	318

Country	Population	N° of registered engineers	Population per engineer	Population per doctor
Korea	45 985 289	21534	2 135	585
Hungary	10 661747	4815	2214	437
Romania	23 434 194	8 056	2 909	523
<b>South Africa</b>	<b>46 888 200</b>	<b>14 806</b>	<b>3 166</b>	<b>1493</b>
Sri Lanka	18 732 255	3 348	5 595	-
Tanzania	36 766 356	6 200	5 930	-
Namibia	2 030 692	320	6 346	4 545
Zimbabwe	12 746 990	2 000	6 373	7 092
Swaziland	979 000	80	12 238	9 100
Zambia	11 261 795	881	12 783	11 100
Ghana	21 029 853	1644	12 792	2 500

\*May represent all engineers and not just registered engineers.

**Source: Various (cited in Lawless 2005: 231)**

Since South Africa is perceived to be technologically stronger than many countries, it is disquieting that the ratio of population to engineers in South Africa is not significantly better than Zimbabwe, Namibia and Tanzania and other less developed countries (Lawless, 2005: 229).

#### *Transformation/Equity Targets*

Firms are subjected to rigid procurement policies and while the industry has succeeded in increasing black participation across all employment categories, increasing black participation at both senior management and professional levels is much harder to achieve, due to the unavailability of experienced black professionals in numbers sufficient to cater for the industry's requirements (SAACE, 2005: 30).

Lawless (2005: 159) points out that although transformation looks impressive in comparison with the original all-white industry, there is a worrying trend in that although most graduates have registered as candidates (with ECSA), female graduates and black graduates have been slower to register professionally than their white male counterparts.

Lawless (2005: 178) argues that most government departments have been over-zealous in pursuing their equity profiles and have set appointment criteria so that only black applicants may fill vacant posts, without considering the availability of suitable staff. As a result many posts remain vacant, while suitable white candidates have emigrated because there is no opportunity for employment in their field of expertise (Lawless, 2005: 178).



According to SAACE (2005: 3) the unfortunate reality is that, based on current estimates, experienced black professionals will be in short supply for a number of years to come, a view supported by Lawless (2005).

### *Under 35*

According to Lawless (2005: 160) the future of civil engineering lies in the hands of the under-35 age group. The challenges cited by young respondents in the Lawless (2005) study include:

- Low salaries: the biggest complaint was poor salaries. Despite having studied for three, four or more years, the under-25 group are offered starting salaries lower than or equivalent to those of the junior secretarial staff in the front office. Employment agencies confirm that starting salaries are low, so young people job-hop for the slightest increase. By changing jobs many times, training suffers.
- Lack of training: many complained of the lack of training. As a result, few register with ECSA within three to five years of graduating, which was commonplace until the eighties.
- Image and status: many respondents said that "we should make the government and public more aware of our work so that they will value us" ... etc ...

"Proudly Engineering", ECSA's planned campaign to brand engineering professionals, needs to be put in place urgently and be given encouragement and support.

- The establishment: analysing the age profile in consulting, there is a large group of senior people, mostly baby boomer "control freaks". Many are not ready to relinquish control. Hence young people cannot see any hope of rising in the ranks in the short to medium term.
- Leaving the industry: despite the many gripes, only 13% of respondents said they would consider leaving the industry, mostly for better salaries. Although this is a low percentage, it represents 500 to 600 young people in the under-35 group with significant experience that the industry cannot afford to lose.

- Future plans: just over 28% hope to start their own businesses. In part they are looking for better financial prospects, but also for greater responsibility, flexibility and status. Fortunately, many want to improve their current positions, to become specialists and be successful. Similar responses came from the Women in Civil Engineering Survey (Lawless, 2005: 161-162).

### *Women*

Women represent 25% of all students registered in civil engineering in South Africa in 2004 (Lawless, 2005: 163). This is impressive, when compared with international figures of about 15% in the Netherlands (Boezeroy and Kaiser, 2001, cited in Lawless, 2005: 163), 15% in Australia (Lewis *et al*, 2000, cited in Lawless, 2005: 163) and 14% in the US (GAO, 2004 and Wulf and de Planque, 1999, cited in Lawless, 2005: 163).

However, according to Lawless (2005: 163) when one tracks the number of women in the industry, the figure is significantly lower ...a large percentage of the senior women in the industry are immigrants - many of whom came to the country in the busy eighties.

In the UK (Phipps, 2000) and Australia (Roberts and Ayre, 2000) women constitute 5% and South Africa women constitute 4% of professional engineers (cited in Lawless, 2005: 163).

Lawless (2005: 166) argues that guidelines and policies should be developed to allow women to take their place in the industry and awareness campaigns are needed to encourage women to enter the profession.

According to Lawless (2005: 166) problems of integration and reaching the top are not limited to civil engineering, as the Grant Thornton Business Owners Survey of 2003 showed that although 7.1% of board directorships were held by women in South Africa, the figures for Australia, Canada and the US were only 8.4%, 11.2% and 13.8% respectively (Lawless, 2005: 166).

### *Fees*

Another vexing problem concerns consulting fees. Although the fees for a project represent only a fraction of the overall cost, the custom of negotiating fees, instead of the deliverables, has resulted in fees remaining low. Discounting fees puts pressure on salaries and at times

compromises the quality of the service (Lawless, 2005: 172). The SAACE (2005: 30) is also of a similar view.

The delay in rolling out many major infrastructure projects in the last ten years has resulted in large and small consultants and contractors competing for numerous small jobs. Because smaller companies have lower management and overhead structures, price cutting and counter-offers have become common (Lawless, 2005: 172).

According to the Institution of Civil Engineers (ICE) in London, competitive tendering for design plays a key role in perpetuating skills shortage. Low-cost design contributes directly to shortages by preventing companies from providing attractive careers (ICE, November 2002, cited in Lawless, 2005: 172).

The SAACE (2005: 30) suggests that the growing tendency amongst professionals to offer expertise, for which they are not qualified, to reduce the prices of their services, can be linked almost directly to clients who simply do not understand the cost of services. They further claim that clients too often sacrifice quality for price, causing long term damage to the industry, the implications of which will unfortunately only be seen in the years ahead (SAACE, 2005: 30). It is therefore not surprising that a mere 53% of clients are satisfied with work completed (SAACE, 2005: 30).

Lawless (2005: 172) points out that the public sector is particularly guilty of ignoring recommended fee levels in a bid to save a percentage or two.

Finally, Lawless (2005: 172) claims that attention to all aspects of design and sustainable development has suffered enormously and prejudiced the principles of good engineering.

### *Salaries*

According to a survey conducted by Lawless (2005: 168) a major source of unhappiness was salaries. The survey found:

- a major disparity between earnings of fully trained and registered civil professionals and other engineering professionals;
- the disparity appears to be most dramatic in the younger groups, another reason that the industry battles to retain its bright young stars;

- many (professionals) have moved away from pure engineering into more commercial environments and are earning significantly more than their technocrat colleagues (Lawless, 2005:168).

This is not unique to South Africa. A recent survey carried out by HESA (the Higher Education Statistics Agency) in the UK found that more than half of engineering graduates defect to other careers, with the main reasons quoted as being money, status and image (HESA, 1 September 2005, cited in Lawless, 2005: 168).

According to Lawless (2005: 168) graduates in the UK could command double the starting salary offered to them in engineering by joining the finance and business sectors, which is similar to the findings of ECSA (cited in HSRC, 2003).

#### *Emigration/globalization*

South Africa has been experiencing a brain drain since before 1994, and this trend looks set to continue (HSRC, 2003: 235). According to the HSRC (2003: 235) at the same time the flow of skilled immigrants into the country has slowed tremendously in the post-apartheid era, which means that fewer skills are being replaced than are lost through emigration.

It appears that the primary reasons why skilled South Africans emigrate have to do with concerns about crime and violence, poor economic growth rates, the decline in public services in this country, and lucrative job opportunities overseas. More recently, the globalising labour market for highly skilled professionals is also impacting on skills migration trends (HSRC, 2003: 235).

As the growth in GDP in Australia and other countries increases, capacity is inadequate to maintain this growth. Opportunities in countries with growing economies are being aggressively marketed and the packages and benefits are luring South Africans abroad. Some are emigrating permanently, while others are accepting two-, three- and five-year contracts, and expect to return to South Africa at the end of their contracts (Lawless, 2005: 173).

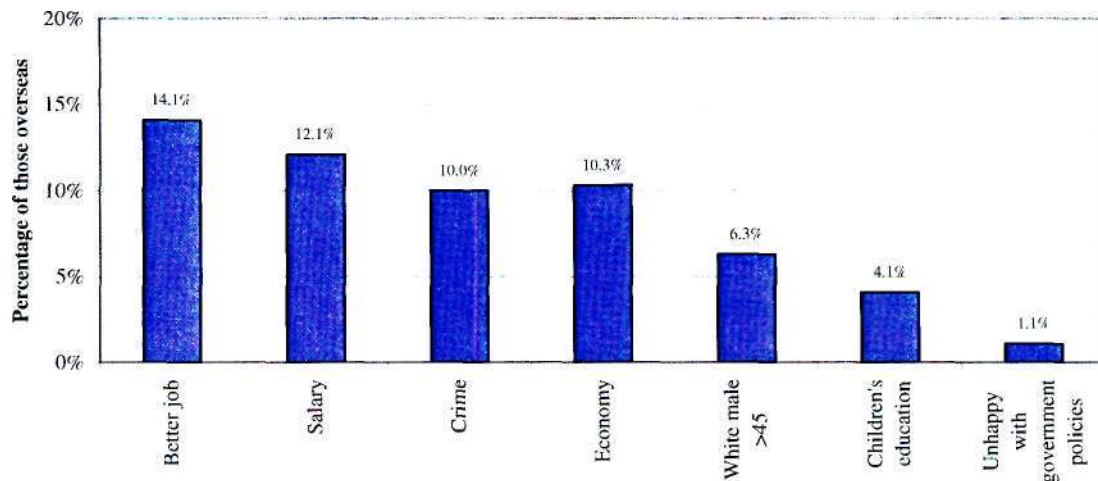
According to Lawless (2005: 173) the trend is similar for other professions. The R&D survey listed the top emigration destinations for R&D workers as the UK (27.7%), Australia (16.2%), New Zealand (10.1%) and the USA (9.8%) (NACI, 2004 cited in Lawless, 2005: 173). According to Lawless (2005: 173) more than 600 civil engineering professionals who are

living outside South Africa are still registered with ECSA. Further ECSA reports that over the past eight years 1 400 engineers resigned because they were emigrating (Lawless, 2005: 173).

The total number of civil engineering professionals that left the country in the past 20 years appears to be of the order of 3 000 to 4 000 (Lawless, 2005: 175). Lawless (2005: 175) further suggests that South African engineers are now being actively sought to augment the British teams that are preparing for the 2012 Olympic Games in London.

Reasons for emigration and the magnitude thereof are as shown in Figure 4.8:

**Figure 4.8: Reasons for emigration**



**Source: Lawless (2005:175)**

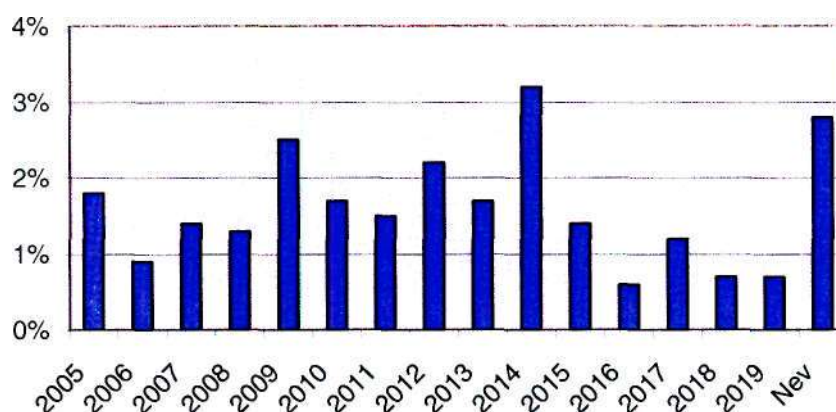
### *Retirement*

According to Lawless (2005: 177) from the current profile (of engineering professionals), it appears that 47% of practicing engineers are 45 years and older. Lawless (2002, 177) claims that allowing for premature deaths, early retirement and some leaving the industry or emigrating, the 45+ group should account for only about 25% to 35% of the workforce.

In the USA the proportion of all workers aged 45 and older will increase from 33% of the labour force in 1998 to 40% in 2008 (Transport Research Board, 2003, cited in Lawless, 2005: 177). According to Lawless (2005: 177), South African engineers are already way beyond the percentage that is causing grave concern in the USA.

The retirement trend as a percentage of total civil professionals, due to retire per year, is shown in Figure 4.9.

**Figure 4.9: Percentage of total due to retire per year**



**Source: Lawless (2005: 177)**

Anticipated retirements are as follows:

- high in 2009 onwards when the first of the baby boomers born in 1946 reach 63. This is a worldwide phenomenon and is cause for concern in all professions internationally.
- the next large wave of retirements can be expected in 2012 onwards. The peaks in 2012 and 2014 relate to the effect that the change in duration of military service had on tertiary intakes in the early seventies (Lawless, 2003: 177).

A further point that Lawless (2005: 178) makes is that in the mid-nineties, long-serving staff at all levels of government were offered attractive packages to take early retirement, the theory being that this would create positions for black professionals. However, the overall profile of the civil engineering professional team was not understood at the time and there were insufficient numbers of senior black professionals to fill these posts (Lawless, 2005: 178).

### *Conclusion*

The nett result of all of the above processes is that the number of professionals is reducing (Lawless, 2005: 180). Young people are not progressing to become well-trained registered professionals as fast as they did in the seventies and eighties as a result of the absence of

formal training. Capacity is further threatened as the waves of retirement begin in 2009 and the public sector continues to offer early retirement packages to experienced senior staff (Lawless, 2005: 183).

Finally Lawless (2005: 183) argues that to rebuild a healthy industry requires more capacity, improved training, better salaries and investment in personnel; and better client, consulting, contracting and interpersonal relationships.

#### 4.3.7 Demand

##### *Distribution of Engineers by Economic Sector*

According to the HSRC (2003: 560), the distribution of engineers by economic sector for the period 1996-2001 is as shown in Table 4.14.

**Table 4.14: Distribution of engineers by economic sector, 1996-2001**

<b>Year</b>	<b>Agriculture</b>	<b>Mining</b>	<b>Manufacturing</b>	<b>Electricity</b>	<b>Construction</b>
1996	-	-	11975	4 243	<b>7 336</b>
1998	-	3711	8 593	11073	<b>9 973</b>
2000	-	5 199	10561	2 077	<b>5 889</b>
Feb 2001	-	5 710	17 276	6 033	<b>3 642</b>
Sept 2001	685	3 082	20 983	3 243	<b>5 308</b>
<b>Year</b>	<b>Trade</b>	<b>Transport</b>	<b>Finance</b>	<b>Services</b>	<b>Unknown</b>
1996	<b>4 423</b>	12 146	<b>8 187</b>	7 477	5313
1998	569	<b>4 021</b>	20 634	9 118	-
2000	<b>4 335</b>	10 647	29 446	5 352	-
Feb 2001	<b>4 488</b>	<b>8 584</b>	18 626	9 391	-
Sept 2001	<b>6 134</b>	<b>6 068</b>	16 186	5 181	365

**Source: Stats SA (1996b,1997,1998b, 1999a, 2000J, 2000b, 2001a, 2001b, cited in HSRC, 2003: 560)**

As can be seen in Table 4.14, there is considerable fluctuation in the number of engineers employed over the period 1996 to 2001, with the manufacturing and finance sectors the largest and fastest growing in absolute terms (HSRC, 2003: 560). The fastest declining sectors in absolute terms include the transport, services (trade) and construction sectors (HSRC, 2003: 560). These trends thus show considerable intersectoral differences and substitution shifts in the employment of engineers, however, the figures also fluctuate

dramatically within sectors, suggesting considerable intra-sectoral factors affecting employment (HSRC, 2003: 560).

While the dominance of manufacturing as an employer of engineers is instructive and can be associated with the growth in manufacturing, the importance of finance is less obvious ... this suggests that a vast number of engineers use their skills indirectly, for example, in investment banks or in project management activities sponsored by large finance houses, rather than directly in industry (HSRC, 2003: 560). One possible reason for this, according to the HSRC (2003: 560), is that the incentive for engineers to be employed, or stay employed in traditional engineering industries is low, due to apparently poor relative remuneration rates. ECSA supports this hypothesis and argues that the finance sector is more than capable of offsetting any real or perceived remunerative deficiency in this regard, thereby attracting engineers (HSRC, 2003: 560). This view is supported by the findings of the Lawless (2005) study which also reports that other employers of graduates, for example legal and finance, are also more attractive to graduates.

#### *Shortcomings of Labour Forecasts*

Barker (2003: 266) claims that labour forecasts should be treated with great circumspection. There are so many factors that influence the demand for skilled and unskilled workers that blindly accepting the results of detailed labour market forecasts for educational and career-planning purposes will result in very serious errors (Barker, 2003: 266).

Forecasts of expected broad trends, to provide guidelines for education, training and labour market planners, have in the past been made by the National Manpower Commission (1988a) and the Department of National Education, however, these forecasts were not found to be very helpful (Barker, 2003: 266).

Barker (2003: 267) suggests that apart from the movements in wages and employment of workers with specific levels of schooling and training, some of the labour market signals that can and should be utilized (to better identify demand) are unemployment rates for particular skill levels, job vacancy rates, enrolment and graduation trends, tracer studies that follow graduates into the labour market for a year or two and household surveys. It is noted that the DoL (2003) is of a similar view.



### *Budget and Implications for the South African Construction Industry*

Total expenditure in infrastructure is projected to increase from R19.7 bn in 2004/05 to close to R30 bn in 2007/08 (SAACE, 2005: 6). A summary of infrastructure expenditure for 2003/04 to 2007/08 is shown in Table 4.15.

**Table 4.15: Summary of infrastructure expenditure: 2003/04 - 2007/08**

<b>Fiscal period</b>	<b>2003/04</b>	<b>2004/05</b>	<b>2005/06</b>	<b>2006/07</b>	<b>2007/08</b>
R'000 current prices	16,789,742	19,789,175	21,988,034	25,469,874	29,502,993
Real annual change	11.6%	12.2%	1.5%	7.7%	9.7%

**Source: Budget 2005/06, Estimates of National Expenditure 2005/06  
(Cited in SAACE, 2005: 6)**

The SAACE (2005) points out that the 2005 budget highlighted two important infrastructure grants, the Municipal Infrastructure Grant (MIG) and the Provincial Infrastructure Grant (PIG).

PIG is a transfer from National Treasury and is primarily aimed at maintenance and upgrade of provincial roads (SAACE, 2005: 6).

MIG is projected to increase by an annual rate of 11.7% in 2005/06 (adjusted for building cost inflation) and 27.5% y/y in 2006/07 (SAACE, 2004: 6). This fund is expected to increase from R4.4 bn in 2004/05 to R8.3 bn in 2007/08.

Other major projects/programmes include:

- Soccer World Cup 2010
- Provincial transfers: on the basis of equitable share formula and conditional grants, more funding could be allocated to KwaZulu-Natal, while Gauteng and Western Cape lose approximately 0.5% of market share
- Department of Transport: is expected to spend about R2.5 bn in 2007/08.
- Transnet: in line with its five year investment plan is expecting to invest R49.5 bn (SAACE, 2005).

Summary of infrastructure projects planned over the next five years include:

- > Wagons and locomotives, R7.9 bn
  - > Rail signaling and power supply, R6.7 bn
  - > Upgrade of Coallink line, R1.87 bn
  - > Upgrade of Orex line from Sishen to Saldanha, R1.25 bn
  - 'r- New container terminal for Durban, R748 m
  - > Container expansion and replacement in Cape Town, R600 m
  - > Upgrade of bulk terminals at Richards Bay, R663 m
  - > Upgrade of bulk terminals at Saldanha, R920 m
  - > New Durban Pier 1 Container, R689 m
  - > Enlarging Durban Harbour entrance, R1.5 bn
  - > Completion of the Port of Ngqura at Coega, R1.6 bn
  - > Completion of Cape Town container terminal and berth expansion, R1.4 bn
  - > Durban-Johannesburg-Pretoria petroleum products pipeline (700 km), R4.2 bn
- (SAACE, 2005: 17).

Implications for the construction industry include:

- Investment growth will mainly stem from small to medium scale projects, in particular water and sanitation projects. With funding emanating from the MIG, the largest benefit will be for locally based, labour-intensive small to medium size consultants / contractors.
- Slowdown in large provincial road projects can be expected this year, which will adversely affect large contracting companies that rely on large government infrastructure projects. The drop in SANRAL's funding compounds the negative state of affairs for roads in 2005/06.
- Development of delivery-bottlenecks at local government level may occur, as more and more funding is channeled through local government that may not have the appropriate delivery mechanisms in place.
- BEE targeted procurement increasingly require consulting engineers to transform their businesses in order to obtain work through government funded projects. The adoption of Charters for each of the major sectors of the national economy (in terms of the

BBBEE Act) during 2005 will furthermore result in an increasing emphasis of targeted procurement by private sector clients.

Delivery of low income housing units expected to slowly accelerate over the MTEF period, reaching a peak of 200 000 houses built during 2007/08. The low income housing market will become more attractive in the medium term as private sector engagement is more actively encouraged.

Large projects planned for correctional services, will benefit large construction companies during the next three years.

- Improved building conditions can be expected this year in line with the hospital revitalization programme, urban renewal development and large amounts of money donated by the European Union for building of schools (total of R400 million in three years).
- Supply constraints translating to stronger increases in construction costs, will adversely affect funding earmarked for infrastructure expenditure during 2005/06 (SAACE, 2005: 7-8).

#### *Future Demand*

The Lawless (2005) study found, inter alia, the following needs:

- (i) In consulting:
  - > most respondents indicated a need for more staff in the next two and five years
  - > all need more PDI engineers and technologists, and more technicians as a whole
  - > need for 10% more draughting staff in the next two years
  - > need 40% more structural detailers in the next two years and 80% in the next five years to cope with the large projects that are anticipated in the near future (Lawless, 2005:41).
- (ii) In the public sector and in particular to roll out the MIG programme:

At both district and local municipality level, there is an acute shortage of capacity in most Project Management Units (PMUs) whose task it is to deliver basic services (Lawless, 2005). The additional staff required to roll out MIG in some district municipalities and some local municipalities is shown in Table 4.16 and Table 4.17 respectively.

**Table 4.16: Additional Staff Required to Roll Out MIG in Some District Municipalities**

District Municipality							
Number of people required	For budgets within the following ranges						Total
	Up to R20 million		R20 to R50 million		R50+ million		
	Internal	External	Internal	External	Internal	External	
Engineers	1	6	2	1	4	2	16
Technologist	-	1	-	-	6	-	7
Technician	1	10	2	2	13	3	31
Project managers	5	-	-	-	11	8	24
Others	1	2	2	-	10	3	18
Total	8	19	6	3	44	16	96

Source: Lawless (2005: 65)

**Table 4.17: Additional Staff Required to Roll Out MIG in Some Local Municipalities**

Local Municipality							
Number of people required	For budgets within the following ranges						Total
	Up to R20 million		R20 to R50 million		R50+ million		
	Internal	External	Internal	External	Internal	External	
Engineers	8	16	1	2	5	14	46
Technologist	11	1	1	-	10	17	40
Technician	17	-	6	-	22	32	77
Project managers	3	11	5	3	11	7	40
Others	-	7	-	-	7	4	18
Total	39	35	13	5	55	74	221

Source: Lawless (2005: 66)

Finally and taking into account the limitations mentioned earlier with demand forecasting, Lawless (2005) suggests the numbers to be educated and trained (to maintain the status quo) (as per Table 4.18) intended to stimulate debate and to elicit input.

**Table 4.18; The Numbers to be Trained per Annum**

<b>Adjustments</b>	<b>Engineer</b>	<b>Technologist</b>	<b>Technician</b>	<b>Total</b>
Number in Industry in 2004	6515	1 883	6 681	15 079
Need to be trained pa based on a 40-year career	163	<b>47</b>	167	377
Adjustment for huge number retiring in next 8 years	43	<b>43</b>	<b>44</b>	100
People leaving industry/emigrating	69	20	<b>70</b>	159
Foreign students add 6%	10	<b>3</b>	10	<b>23</b>
<b>Total to train pa to maintain status quo</b>	<b>285</b>	<b>83</b>	<b>291</b>	<b>659</b>

**Source: Lawless (2005: 233)**

The size and structure of labour demand cannot be forecast reasonably accurately, because it is not possible to forecast economic growth rates and structural changes in various sectors. Labour planning models are therefore regarded with great skepticism, and are apposed by many observers because of the damage that planning based on incorrect forecasts can do (Barker, 2003:269). Accordingly, the numbers suggested in this section and in section 2.3.2.2 should be regarded as indications only.

To match "demand", significant numbers of civil engineering professionals must be educated and trained. Staff who left the industry should be enticed to return and retention mechanisms must be put in place to ensure that losses from the industry are kept to a minimum (Lawless, 2005:57).

#### **4.4 Conclusion**

This chapter illustrated that skills shortages in the civil engineering industry is a world-wide problem with a critical shortage of experienced civil professionals, particularly mid-career civil engineers responsible for production work.

Lawless (2005: 14) argues that training is imperative and significant effort must be put into education and training from kindergarten to retirement to ensure and maintain high-calibre professionals.

This chapter also highlighted the need for the civil engineering industry in general to be made more attractive to attract and retain new entrants in terms of paying competitive salaries and providing job satisfaction when compared to other sectors.

## **CHAPTER 5 : RESEARCH METHODOLOGY**

### **5.1 Introduction**

This chapter deals with the research methodology and design used to collect and analyse the data collected via the research instrument, a questionnaire. The chapter further discusses and explains the contents of the questionnaire and reasoning for the particular questionnaire design. The reliability and validity of the data collection methods used, as well as the reliability, validity and representativeness of the data collected during the research are also discussed.

### **5.2 Statement of Problem and Research Objectives**

One rarely picks up a newspaper in recent times without coming across an article (or two) on the shortages of skills (in all sectors) and the impact these shortages are having and will have in the future on service delivery. A visit to a local provincial hospital or municipality or some other government department will provide ample proof that the lack of skills is severely impacting on service delivery in those organisations.

A study conducted by Lawless (2005) entitled Numbers & Needs (Addressing imbalances in the civil engineering profession), found that there was a critical shortage of experienced civil professionals responsible for production work, these professionals were working extremely long hours and often work carried out by less experienced (particularly young graduates) was not checked, just to get the work out of the door.

In view of the foregoing, the research objectives were a) to establish current levels of client satisfaction; b) to establish (from clients) whether there has been a decline in their satisfaction levels from five years ago; and c) to establish whether clients believe that any decline in satisfaction levels is as a result of skills shortages in the industry.

The period of five years for objective b) is not based on any scientific research, but on the researcher's view that up to about five years ago there were considerably more experienced professionals within SSI in KwaZulu-Natal servicing clients.

### 5.3 Sampling Unit, Population and Sample

According to Wegner (2002: 4) a sampling unit is the item/individual being measured or counted with respect to the random variable(s) under study. The sampling unit in this case is relevant individuals within client organisations who typically occupy the positions of general managers, technical managers, managers of project management units and project managers.

A population is the collection of all the observations of a random variable under study and about which one is trying to draw conclusions in practice (Wegner, 2002: 4). Wegner (2002: 4) further cautions that a population must be defined in very specific terms to include only those sampling units with characteristics relevant to the problem. Therefore, for this research, the sampling unit, and ultimately the population, are those individuals from client organisations with the following characteristics:

- senior managers with whom SSI has been doing business with, for at least five years (and who have been in the employ of the respective client organisation for at least five years). Five years to satisfy research objective b).
- senior managers SSI interacts with directly on projects on a routine basis.
- senior managers who deal largely with civil engineering projects in KwaZulu-Natal.

The population for the research is therefore all those managers identified as having the above characteristics and as shown in the table below:

**Table 5.1: Sampling Unit**

Organisation	Total N of Respondents Identified
Parastatal	2
Provincial 1	2
National (Local) 1	2
National (Local) 2	2
Metro	3
Provincial 2	3
District Municipality 1	2
District Municipality 2	1
District Municipality 3	5
District Municipality 4	2
Local Municipality 1	1
Local Municipality 2	3
Other (private, etc)	3
<b>Total Population/Sample</b>	<b>31</b>



Sampling techniques available can be divided into two types:

- probability or representative sampling (for example, simple random sampling)
- non-probability or judgmental sampling (Saunders, *et al*, 2000: 152)

Saunders, *et al* (2000: 152) further state that with probability sampling it is possible to answer research questions and to achieve objectives that require you to statistically infer the characteristics of the population from the sample. For non-probability sampling, the probability of each case being selected from the total population is not known and it is impossible to answer research questions or to address objectives that require you to make statistical inferences about the characteristics of the population (Saunders, *et al*, 2000: 152). Saunders, *et al* (2000: 153) further suggest that probability sampling is most commonly associated with survey-based research where you need to make inferences from your sample.

However, Henry (1990, cited in Saunders, *et al*, 2000: 153) argues that for populations of less than 50, you should collect data on the entire population as the influence of a single extreme case on subsequent statistical analyses is more pronounced than for larger samples.

Based on the foregoing, the sample size is deemed to be thirty one individuals.

#### **5.4 Research Strategy, Research Method and Data Collection**

According to Saunders, *et al* (2000: 92) the research strategy will be a general plan of how you will go about answering the research question(s) you have set ... the justification should always be based on your research question(s) and objectives. The data collected was analysed through descriptive statistics. According to Wegner (2002: 5) descriptive statistics aim to identify the essential characteristics of a random variable and produce a profile of its behaviour. The research method for gathering the data was the survey method, which according to Saunders, *et al* (2000: 93) is a popular and common strategy in business and management research. Saunders, *et al* (2000) further report that the survey method most often makes use of a questionnaire to collect data. In addition, the survey method is perceived as authoritative by people in general (Saunders, *et al*, 2000: 94).

The data collection instrument used in this study was a structured questionnaire. According to de Vaus (1996, cited in Saunders, *et al*, 2000: 278) a questionnaire is an instrument in which each person is asked to respond to the same set of questions in a predetermined order.

Saunders, *et al* (2000: 278) further argue that it (the questionnaire) therefore includes both structured interviews and telephone questionnaires as well as those in which the questions are answered without an interviewer being present. Wegner (2002: 16) suggests that when the target population from which primary data is required is large and/or geographically dispersed, then the use of mailed questionnaires is considered most suitable.

The main advantages and disadvantages of postal surveys are:

Advantages:

- A larger sample of respondents can be reached.
- Postal interviews are more cost effective.
- Respondents have more time to consider their responses.
- Anonymity of respondents is assured, generally resulting in more honest responses (Wegner, 2002: 16).

Disadvantages:

The problems of postal surveys stem largely from the lack of personal communication between the researcher and the respondent. The researcher has less control over the data collection procedure than in a personal interview (Wegner, 2002: 16).

- Response rates are very low (between 5% and 15%).
- The respondent cannot obtain clarity on questions.
- Of necessity, mailed questionnaires must be shorter and simpler to complete.
- The possibilities of probing or investigating further are limited.
- Data collection takes a long time.
- There is no control over who actually answers the questionnaire.
- There is no possibility of checkbacks to check on the validity of responses (Wegner, 2002: 16).

Hard copies of the questionnaires were distributed by SSI managers to the targeted respondents via the relevant local SSI office. Questionnaires were hand delivered to respondents and/or to their offices for completion, to be collected on an agreed date. Follow-up phone calls were made to respondents a few days before the agreed collection dates, to remind them and ensure a reasonable response rate. Of the twenty six questionnaires

distributed in this manner, twenty three completed questionnaires were received. Five questionnaires were sent to respondents via email, one completed questionnaire was received via email and two completed questionnaires were received by fax; the other two respondents did not return completed questionnaires despite being reminded/requested by telephone.

The response rate by email was very low (20%), this is consistent with the findings of Saunders, *et al* (2000) who report a response rate of 10% or lower (although the actual number of questionnaires sent out via email was relatively small).

The response rate by the delivery and collection method was about 89%, higher than the 30%-50% reported by Saunders, *et al* (2000).

Overall, the response rate of the targeted population/sample was about 84%.

## **5.5 Questionnaire Design (Refer to Appendix 2 for a Sample Questionnaire)**

The design of the questionnaire was based on a sample questionnaire by Maister (1997: 85-86) adapted to suit the researcher's research question and objectives. The questionnaire was structured such that both technical and service quality attributes of SSI could be measured, consistent with Maister (1997) and Woodruffe (1995) who both argue that client satisfaction/service quality should be measured at both the technical and service quality levels.

According to Saunders, *et al* (2000: 288) the validity and reliability of the data you collect and the response rate you achieve depend, to a large extent, on the design of your questions, the structure of your questionnaire and the rigour of your pilot testing.

### *Designing Individual Questions*

Bourque and Clark (1994, cited in Saunders, *et al*, 2000: 290) suggest that when designing individual questions researchers do one of three things: adopt questions used in other questionnaires, adapt questions used in other questionnaires or develop their own questions. Saunders, *et al* (2000: 290-291) argue that adopting or adapting questions from other questionnaires is more efficient than developing your own questions provided that you can still collect data you need to answer your research question(s) and meet your objectives. Hence the approach of adapting the sample questionnaire by Maister (1997).

The primary aim of the questionnaire was to collect data on attitudes and beliefs. Attitude variables record how respondents feel about something, they differ from belief variables which record what respondents think or believe is true or false (Saunders, *et al*, 2000: 186). Saunders, *et al* (2000: 286) further point out that questions about belief imply neither good nor bad, only an assessment of what the respondent thinks.

Scale or rating questions are often used to collect attitude and belief data (Saunders, *et al*, 2000: 295). According to Saunders, *et al* (2000: 295) the most common approach (to collect data for scale or rating questions) is the Likert-style rating scale in which you ask the respondent how strongly they agree or disagree with a statement or series of statements, usually a four- or five- point scale. A five-point scale was used for this research.

#### *Pilot Testing and Assessing Validity*

According to Saunders, *et al* (2000: 305) the purpose of the pilot test is to refine the questionnaire so that respondents will have no problems in answering the questions and there will be no problems in recording the data. In addition, it will enable you to obtain some assessment of the validity of the questions and the likely reliability of the data that will be collected (Saunders, *et al*, 2000: 305).

The questionnaire was tested by emailing the first draft to a selected number of civil professionals from within SSI for comment, it being noted that respondents from client organisations have a similar educational background. Valuable comment on the content and phrasing of questions was received. The questionnaire was amended and re-tested. After further minor modification, the questionnaire was adopted for the research.

## **5.6 Analysis of Data**

The data was analysed using the SPSS: Analysis Without Anguish, Version II, Windows, 2003 computer software to generate the relevant charts and tables for presentation and discussion.

Further the following tests and analysis were conducted:

- (i) Spearman's correlation to check whether significant relationships exist between the two sets of variables in Section B.

- (ii) Cronbach's alpha was calculated to assess how reliable the results were and whether similar results would be obtained to generalise if the sample size was increased.
- (iii) The Chi-Square test was carried out to test whether there are differences in perception of respondents.
- (iv) Factor analysis (FA) was carried out on the datasets. The two major uses of factor analysis are:
  - FA seeks to summarise data by grouping together variables that are intercorrelated, termed exploratory FA.
  - FA is used to test hypotheses about the structure of underlying processes, termed confirmatory FA (Tabachnick and Fidell, 1983, 372-373).

Exploratory FA was conducted on the datasets.

## **5.7 Conclusion**

This chapter outlined how the population and sample for the research were established, and the response rate from the selected sample. Justification for the research strategy was provided. Details of the research method, design of the data collection instrument and the method for analysis of the data were discussed.

Ethical clearance was obtained from the University, a copy is attached in Appendix 6.

## CHAPTER 6 : RESEARCH FINDINGS

### 6.1 Introduction

This chapter covers the findings that emerged from the survey. Prior to the presentation of the findings, the researcher's main objectives of the study will be reiterated. A discussion of the findings is included in Chapter 7. The main objectives were:

- to establish current levels of client satisfaction
- to establish (from clients) whether there has been a decline in their satisfaction levels from five years ago
- to establish whether clients believe that any decline in satisfaction levels is as a result of skills shortages in the industry

The results for each question per section, and in the case of Section 2 per subsection, are presented (both in graphical and tabular form) and discussed, followed by a discussion of the modes and means, the reliability test (to assess how consistent the results were), correlation testing (to determine whether any significant relationships existed) and finally exploratory factor analysis to determine groupings of attributes. Emphasis has been placed on modal results, the value (or feeling or belief) that occurs most frequently as, according to Saunders, *et al* (2000: 353) for descriptive data, "the mode is the only measure of central tendency that can be sensibly interpreted". In addition, Wegner (2002: 61) points out that an advantage of the mode is that it is not influenced by outliers.

Sheet 4 of 4 of the questionnaire was designed to obtain feedback from the different sectors and different provinces, the latter was not relevant at the time of the research due to the research being confined to KwaZulu-Natal for practical reasons. Feedback on sectors could not be interpreted meaningfully as some respondents did not fill in the sector information at all while some filled in more than one sector (it being noted that the population and sample size was small). These two aspects, i.e. sectors and geographic location, have been suggested for future research, as Haskel and Martin (1993, cited in Booth and Snower, 1996: 151) found to be differently affected by skills shortages.

## 6.2 Presentation of Section A results per Attribute (Current Levels of Client Satisfaction)

**Figure 6.1: Attribute: SSI is thorough in its approach to work**

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	neutral	5	19.2	19.2	19.2
	agree	15	57.7	57.7	76.9
	strongly agree	6	23.1	23.1	100.0
	Total	26	100.0	100.0	

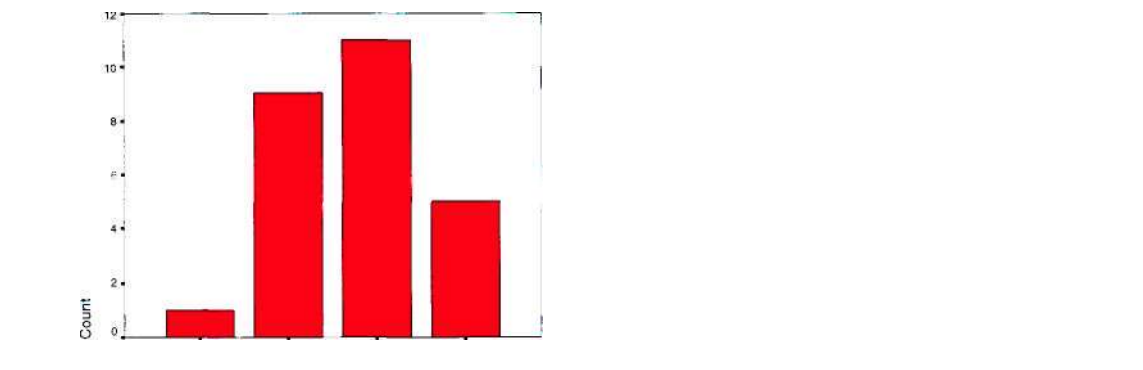
The modal responses were "agree" (57.79%) and "strongly agree" (23.1%). No respondent chose "disagree" or "strongly disagree"

**Figure 6.2: Attribute: SSI shows creativity in proposed solutions**

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	disagree	3	11.5	11.5	11.5
	neutral	4	15.4	<b>15.4</b>	26.9
	agree	14	53.8	<b>53.8</b>	80.8
	strongly agree	5	19.2	<b>19.2</b>	100.0
	Total	26	100.0	<b>100.0</b>	

The modal responses were "agree" (53.8%) and "strongly agree" (19.2%). 11.5% "disagree" with no "strongly disagree" responses.

**Figure 6.3: Attribute: SSI is helpful in diagnosing the causes of our problem areas**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	1	3.8	3.8	3.8
	neutral	9	34.6	34.6	38.5
	agree	11	42.3	42.3	80.8
	strongly agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (42.3%) and "neutral" (34.6%) with no "strongly disagree" responses.

**Figure 6.4: Attribute: SSI documents work activities well**

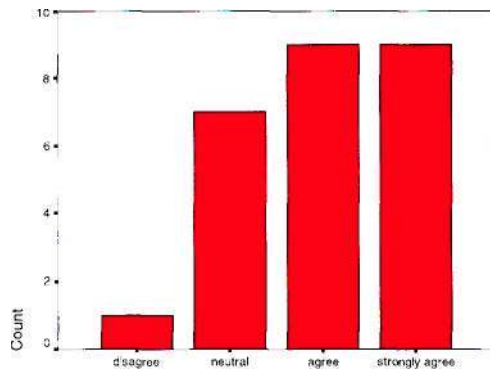


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neutral	9	34.6	34.6	34.6
	agree	12	46.2	46.2	80.8
	strongly agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (46.2%) and "neutral" (34.6%) with no "strongly disagree" responses.



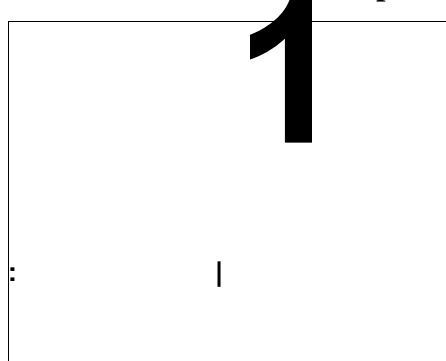
**Figure 6.5: Attribute: SSI's people are accessible**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	1	3.8	3.8	3.8
	neutral	7	26.9	26.9	30.8
	agree	9	34.6	34.6	65.4
	strongly agree	9	34.6	34.6	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (34.6%) and "strongly agree" (34.6%) with no "strongly disagree" responses.

**Figure 6.6: Attribute: SSI keeps its promises on deadlines**

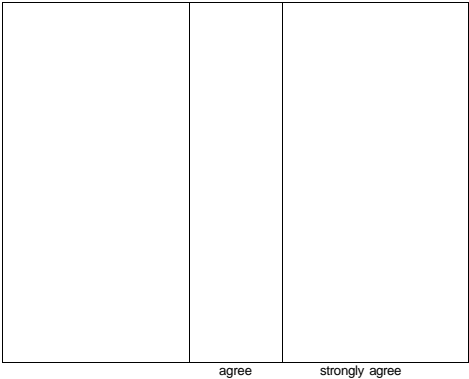


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	7.7	7.7	7.7
	neutral	7	26.9	26.9	34.6
	agree	13	50.0	50.0	84.6
	strongly agree	4	15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (50%) and "neutral" (26.9%) with no "strongly disagree" responses.



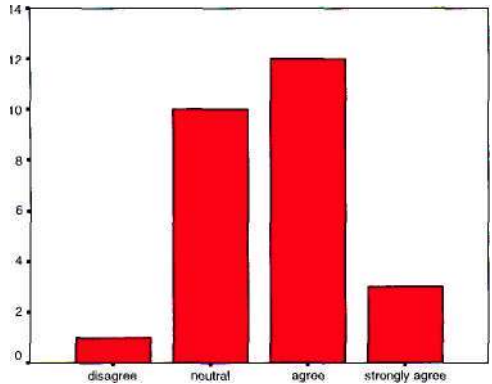
**Figure 6.9: Attribute: SSI relates well to our people**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neutral	6	23.1	23.1	23.1
	agree	12	46.2	46.2	69.2
	strongly agree	8	30.8	30.8	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (46.2%) and "strongly agree" (30.8%) with no "disagree" and "strongly disagree" responses.

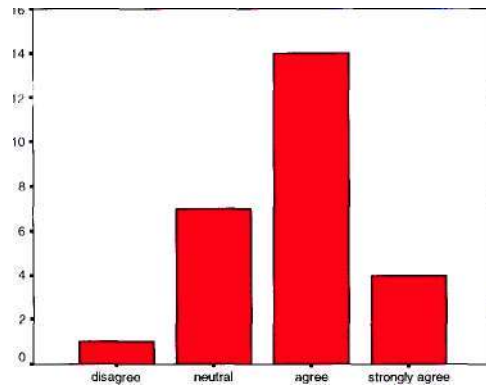
**Figure 6.10: Attribute: SSI informs us in advance what its going to do**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<u>disagree</u>	1	3.8	3.8	3.8
	neutral	10	38.5	38.5	42.3
	<u>agree</u>	12	46.2	46.2	88.5
	<u>strongly agree</u>		11.5	11.5	100.0
	Total	26	100.0	100.0	

The moda responses were "agree" (46.2%) and "neutral" (38.5%) with no "strongly disagree" responses.

**Figure 6.11: Attribute: SSI notifies us promptly of changes in scope, and seeks our approval**

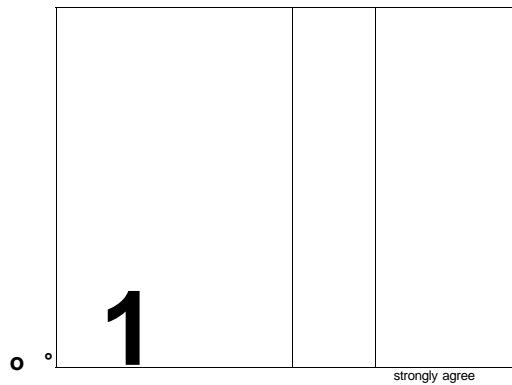


AQ11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	1	3.8	3.8	3.8
	neutral	7	26.9	26.9	30.8
	agree	14	53.8	53.8	84.6
	strongly agree	4	15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (53.8%) and "neutral" (26.9%) with no "strongly disagree" responses.

**Figure 6.12: Attribute: SSI does not wait for us to initiate everything, you anticipate**

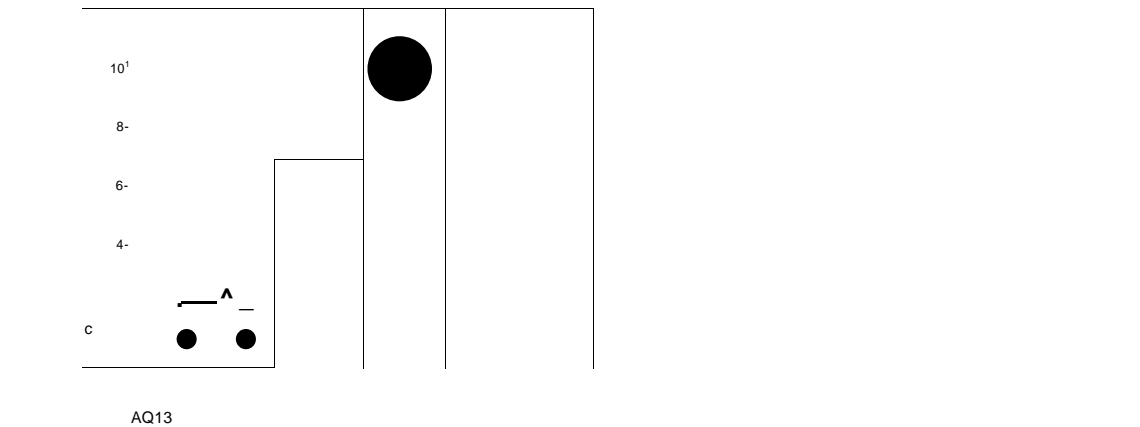


AQ12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	3	11.5	11.5	11.5
	neutral	6	23.1	23.1	34.6
	agree	13	50.0	50.0	84.6
	strongly agree	4	15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (50%) and "neutral" (23.1%) with no "strongly disagree" responses.

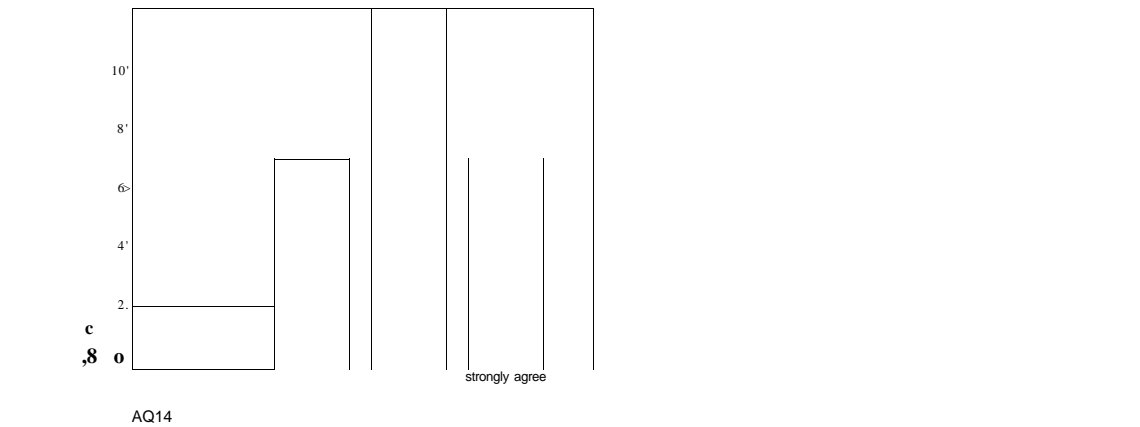
**Figure 6.13: Attribute: SSI keeps us informed on progress**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	7.7	7.7	7.7
	neutral	7	26.9	26.9	34.6
	agree	11	42.3	42.3	76.9
	strongly agree	6	23.1	23.1	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (42.3%) and "strongly agree" (23.1%) with no "strongly disagree" responses.

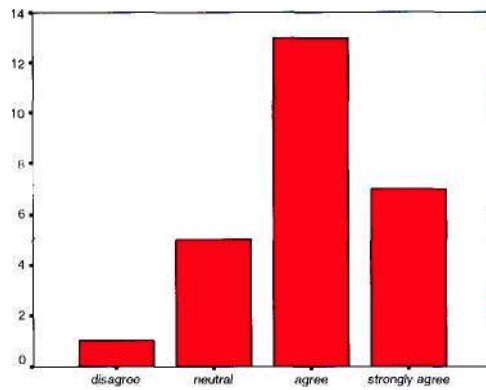
**Figure 6.14: Attribute: SSI makes it its business to understand our organisation**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree		7.7	7.7	7.7
	neutral		26.9	26.9	34.6
	agree	10	38.5	38.5	73.1
	strongly agree		26.9	26.9	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (38.5%), "strongly agree" (26.9%) and "neutral"(26.9%), with no "strongly disagree" responses.

**Figure 6.15: Attribute: SSI is an easy firm to do business with**

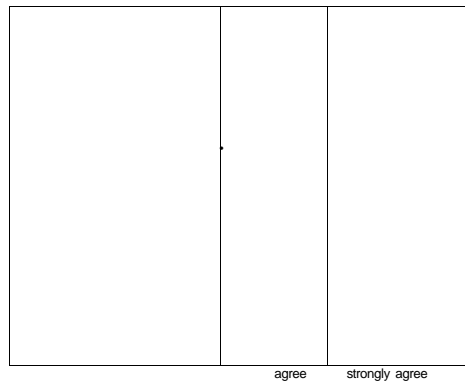


AQ15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	1	3.8	3.8	3.8
	neutral	5	19.2	19.2	23.1
	agree	13	50.0	50.0	73.1
	strongly agree	7	26.9	26.9	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (50%) and "strongly agree" (26.9%) with no "strongly disagree" responses.

**Figure 6.16: Attribute: SSI deals with problems in our relationship openly and quickly**

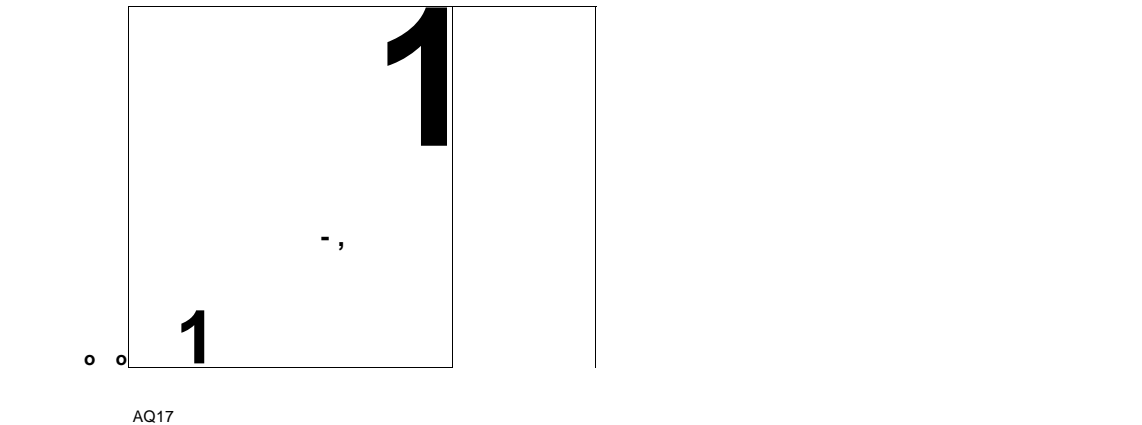


AQ16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	7.7	7.7	7.7
	neutral	9	34.6	34.6	42.3
	agree	10	38.5	38.5	80.8
	strongly agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (38.5%) and "neutral" (34.6%) with no "strongly disagree" responses.

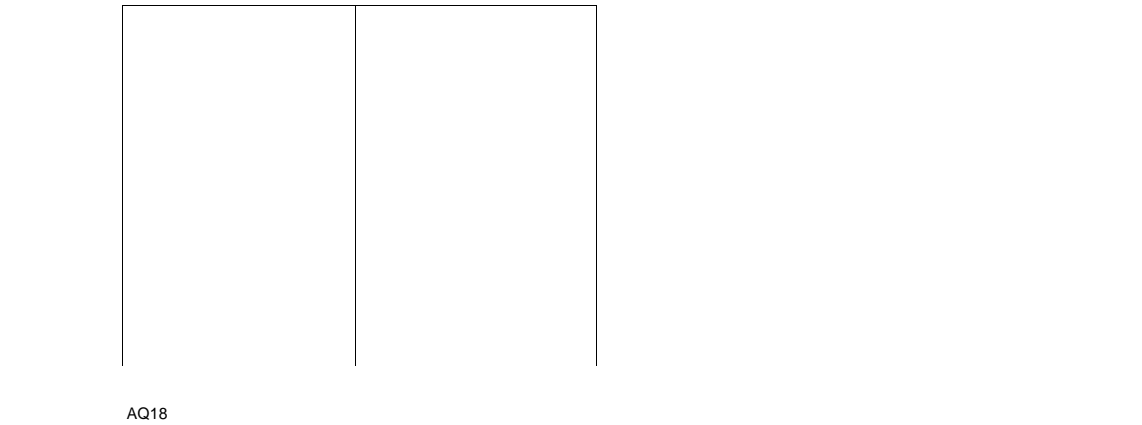
**Figure 6.17: Attribute: SSI keeps us informed on technical issues affecting our organisation**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	7.7	7.7	7.7
	neutral	5	19.2	19.2	26.9
	agree	12	46.2	46.2	73.1
	strongly agree	7	26.9	26.9	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (46.2%) and "strongly agree" (26.9%) with no "strongly disagree" responses.

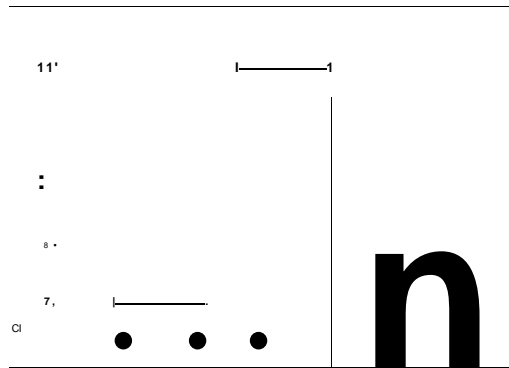
**Figure 6.18: Attribute: SSI shows an interest in us beyond the specifics of projects**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	7.7	7.7	7.7
	neutral	8	30.8	30.8	38.5
	agree	8	30.8	30.8	69.2
	strongly agree	8	30.8	30.8	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (30.8%), "neutral" (30.8%) and "strongly agree" (30.8%) with no "strongly disagree" responses.

**Figure 6.19: Attribute: Overall, I would rate SSI's service very highly**



AQ19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neutral	7	26.9	26.9	26.9
	agree	11	42.3	42.3	69.2
	strongly agree	8	30.8	30.8	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (42.3%) and "strongly agree" (30.8%) with no "strongly disagree" responses.

### 6.2.1 Conclusion

A large percentage (40%-55%) indicated a response of positiveness and acknowledgement that the service that SSI provides is good to very good. However, about 20%-30% of respondents were "neutral" with respect to the service levels provided by SSI. The respondents who are "neutral" need to be convinced of the service provided by SSI, action is therefore required here.

Particular areas (attributes) of neutrality were:

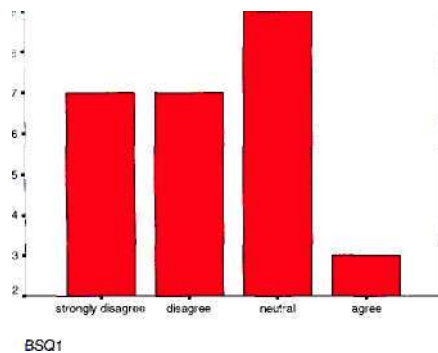
- (i) Q16, SSI deals with problems in our relationship openly and quickly; and
- (ii) Q18, SSI shows an interest in us beyond the specifics of projects.

Overall, approximately 70% of the respondents were pleased with SSI, it may therefore be concluded that the service provided by SSI is good to very good.



### 6.3 Presentation of Section B (SQ) results per attribute (whether there has been a decline in client satisfaction levels)

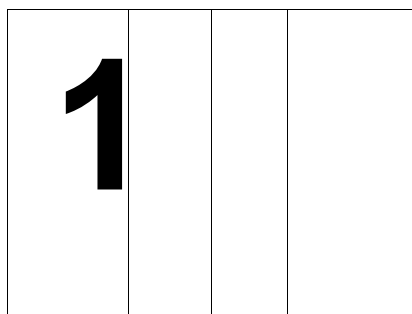
**Figure 6.20: Attribute: There has been a decline in SSI's approach to work**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	26.9	26.9	26.9
	disagree	7	26.9	26.9	53.8
	neutral	9	34.6	34.6	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (26.9%), "strongly disagree" (26.9%) and "neutral" (34.6%) with no "strongly agree" responses.

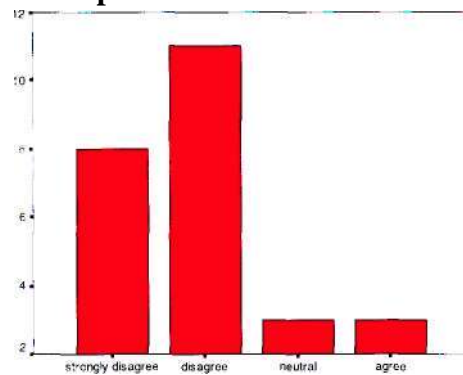
**Figure 6.21: Attribute: There has been a decline in SSI's creativity in proposed solutions**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	26.9	26.9	26.9
	disagree	8	30.8	30.8	57.7
	neutral	7	26.9	26.9	84.6
	agree	4	15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (30.8%), "strongly disagree" (26.9%) and "neutral" (26.9%) with no "strongly agree" responses.

**Figure 6.22: Attribute: There has been a decline in SSI's helpfulness in diagnosing the causes of our problem areas**

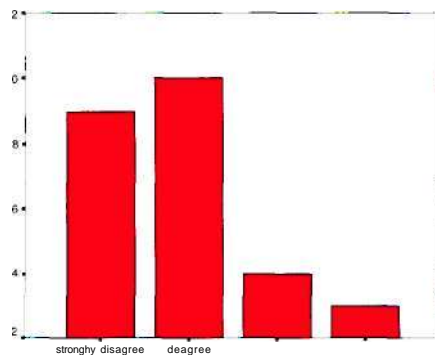


BSQ3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	32.0	32.0
	disagree	11	42.3	44.0	76.0
	neutral	3	11.5	12.0	88.0
	agree	3	11.5	12.0	100.0
	Total	25	96.2	100.0	
Missing	System	1	3.8		
	Total	26	100.0		

The modal responses were "disagree" (42.3%) and "strongly disagree" (30.8%) with "strongly agree" responses.

**Figure 6.23: Attribute: There has been a decline in how SSI documents work activities**

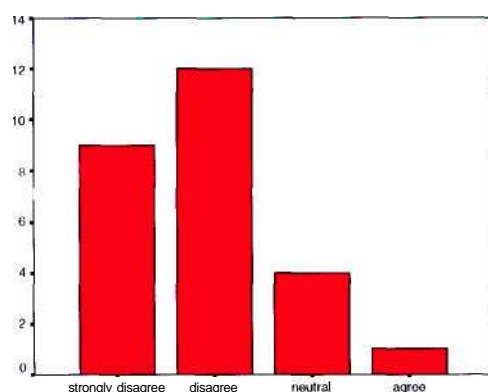


BSQ4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<u>strongly disagree</u>		34.6	34.6	34.6
	<u>disagree</u>	10	38.5	38.5	73.1
	neutral		15.4	15.4	88.5
	<u>agree</u>		11.5	11.5	100.0
	Total	26	100.0	100.0	

The moda responses were "disagree" (38.5%) and "strongly disagree" (34.6%) with no "strongly agree" responses.

**Figure 6.24: Attribute: There has been a decline in accessibility of SSI's people**

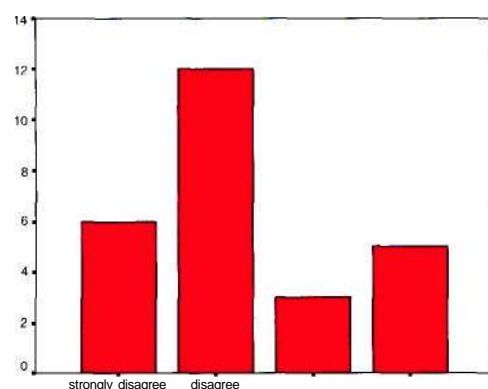


BSQ5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<u>strongly disagree</u>		34.6	34.6	34.6
	<u>disagree</u>	12	46.2	46.2	80.8
	neutral		15.4	15.4	96.2
	<u>agree</u>		3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (46.2%) and "strongly disagree" (34.6%) with no "strongly agree" responses.

**Figure 6.25: Attribute: There has been a decline in accessibility of SSI's people**

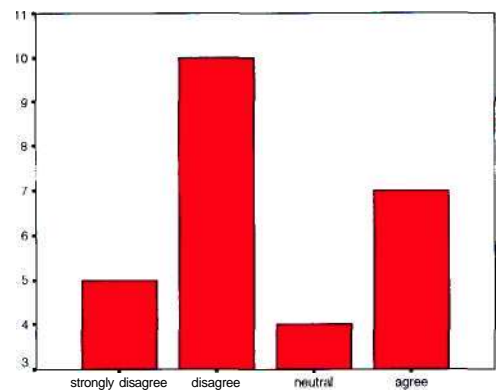


BSQ6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	23.1	23.1	23.1
	disagree	12	46.2	46.2	69.2
	neutral	3	<b>11.5</b>	11.5	80.8
	agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (46.2%) and "strongly disagree" (23.1%) with no "strongly agree" responses.

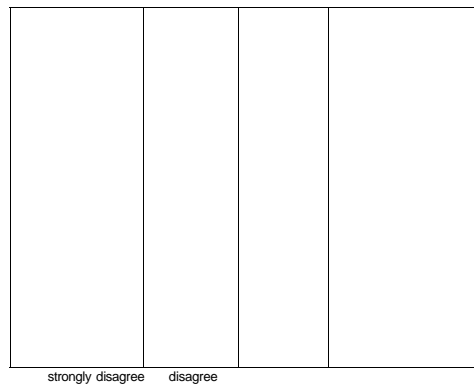
**Figure 6.26: Attribute: There has been a decline in SSI's turnaround time**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	5	19.2	19.2	19.2
	disagree	10	38.5	38.5	57.7
	neutral	4	15.4	15.4	73.1
	agree	7	26.9	26.9	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (38.5%) and "agree" (26.9%) with no "strongly agree" responses.

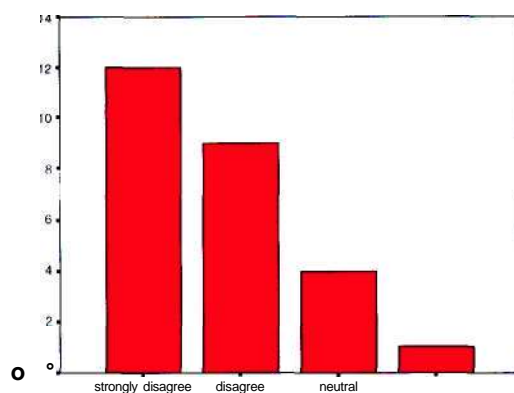
**Figure 6.27: Attribute: There has been a decline in SSI's attention to what we have to say**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	30.8	30.8
	disagree	10	38.5	38.5	69.2
	neutral	5	19.2	19.2	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (38.5%) and "strongly disagree" (30.8%) with no "strongly agree" responses.

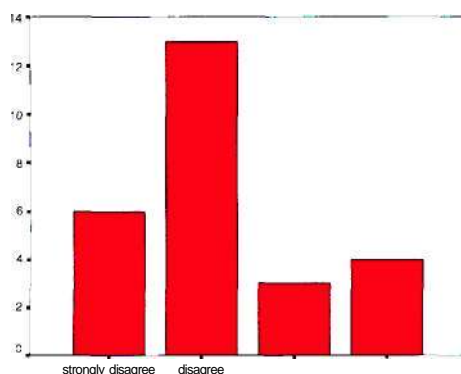
**Figure 6.28: Attribute: There has been a decline in SSI's relationship with our people**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	12	46.2	46.2	46.2
	disagree	9	34.6	34.6	80.8
	neutral	4	15.4	15.4	96.2
	agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (34.6%) and "strongly disagree" (46.2%) with "strongly agree" responses.

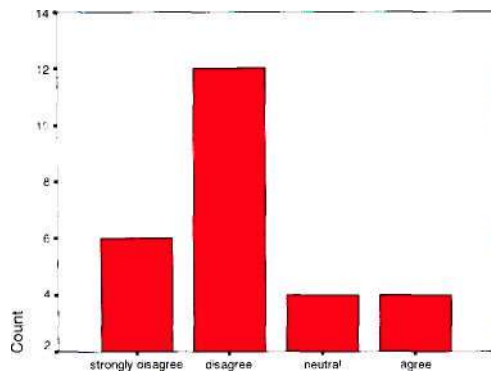
**Figure 6.29: Attribute: There has been a decline in SSI keeping us informed in advance of what it is going to do**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	23.1	23.1	23.1
	disagree	13	50.0	50.0	73.1
	neutral	3	11.5	11.5	84.6
	agree	4	15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (50%) and "strongly disagree" (23.1%) with no "strongly agree" responses.

**Figure 6.30: There has been a decline in SSI keeping us notified of changes in scope, and seeking our approval**

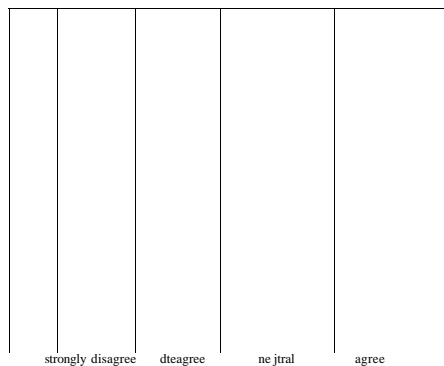


BSQ11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<u>strongly disagree</u>		23.1	23.1	23.1
	<u>disagree</u>	12	46.2	46.2	69.2
	neutral		15.4	15.4	84.6
	agree		15.4	15.4	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (46.2%) and "strongly disagree" (23.1%) with no "strongly agree" responses.

**Figure 6.31: Attribute: There has been a decline by SSI in showing initiative**

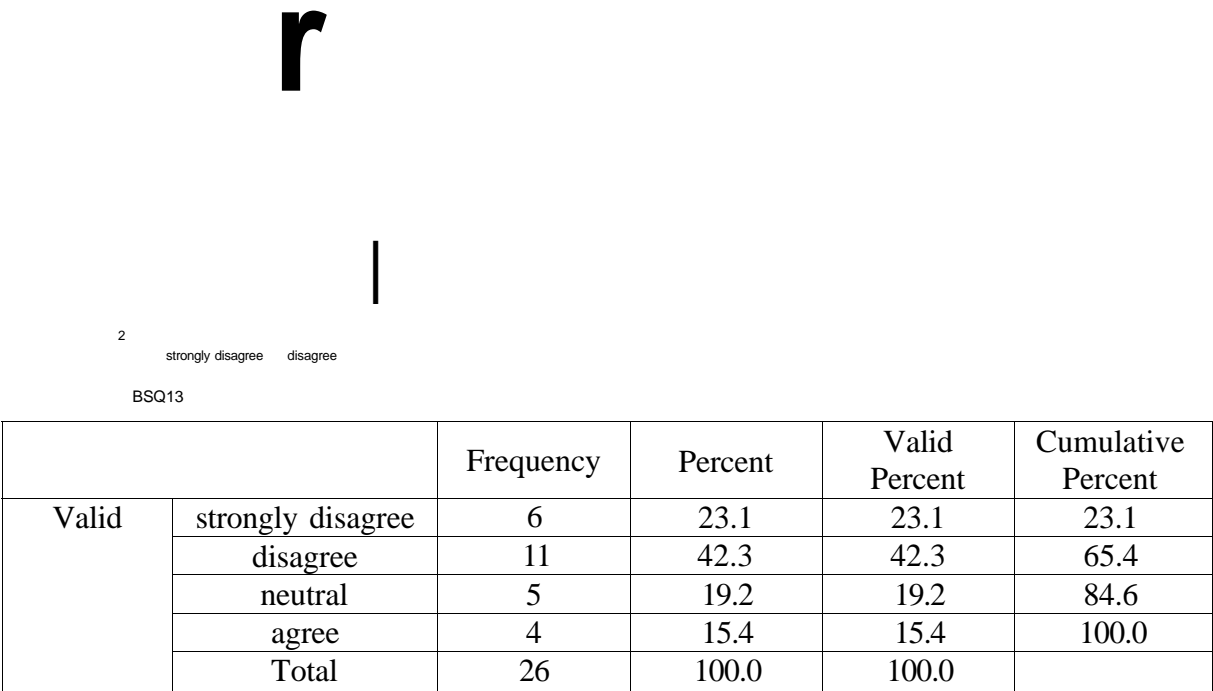


BSQ12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	34.6	34.6	34.6
	disagree	11	42.3	42.3	76.9
	neutral	1	3.8	3.8	80.8
	agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

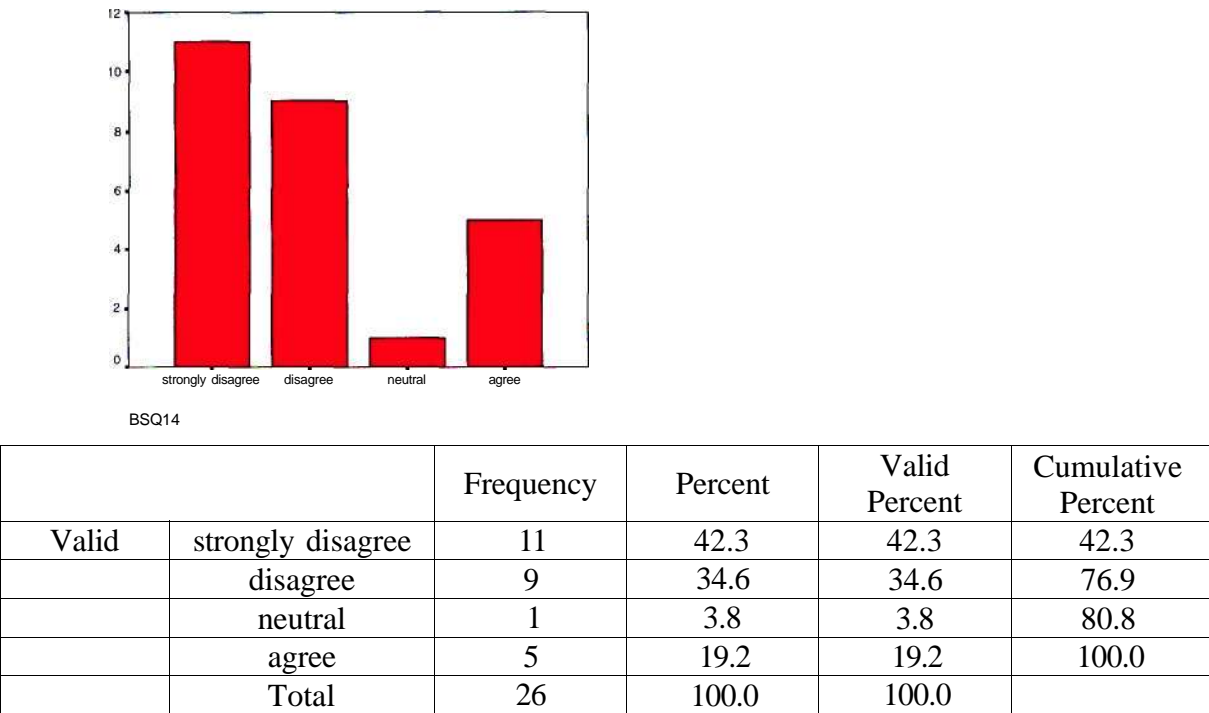
The modal responses were "disagree" (42.3%) and "strongly disagree" (34.6%) with no "strongly agree" responses.

**Figure 6.32: Attribute: There has been a decline by SSI in keeping us informed on progress**



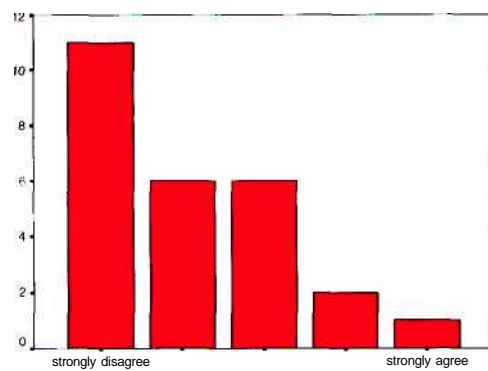
The modal responses were "disagree" (42.3%) and "strongly disagree" (23.1%) with no "strongly agree" responses.

**Figure 6.33: Attributes: There has been a decline in SSI's understanding of our organisation**



The modal responses were "disagree" (34.6%) and "strongly disagree" (42.3%) with no "strongly agree" responses.

**Figure 6.34: Attribute: There has been a decline in the ease we do business with SSI**



BSQ15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	11	42.3	42.3	42.3
	disagree	6	23.1	23.1	65.4
	neutral	6	23.1	23.1	88.5
	agree	2	7.7	7.7	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (23.1%), "strongly disagree" (42.3%) and "neutral" (23.1%).

**Figure 6.35: Attribute: There has been a decline in the manner and timeframes SSI deals with problems in our relationship**

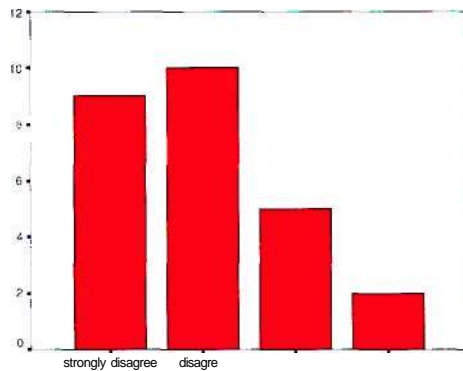
n

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	23.1	23.1	23.1
	disagree	11	42.3	42.3	65.4
	neutral	6	23.1	23.1	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (42.3%), "strongly disagree" (23.1%) and "neutral" (23.1%) with no "strongly agree" responses.



**Figure 6.36: Attribute: There has been a decline in SSI keeping us informed on technical issues affecting our business**

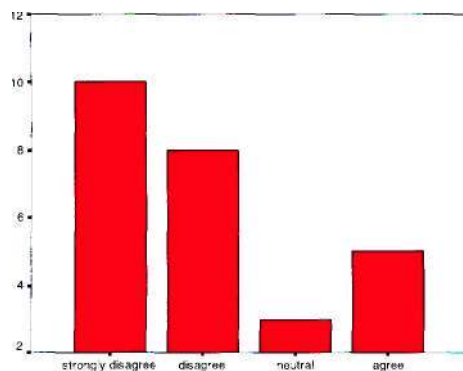


BSQ17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	34.6	34.6	34.6
	disagree	10	38.5	38.5	73.1
	neutral	5	19.2	19.2	92.3
	agree	2	7.7	7.7	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (38.5%) and "strongly disagree" (34.6%) with no "strongly agree" responses.

**Figure 6.37: Attribute: There has been a decline in interest shown by SSI in us beyond the specifics of projects**

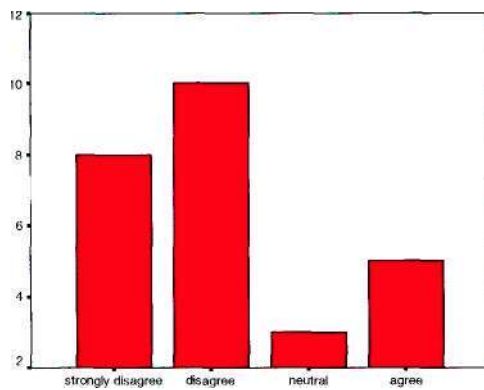


BSQ18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	38.5	38.5	38.5
	disagree	8	30.8	30.8	69.2
	neutral	3	11.5	11.5	80.8
	agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (30.8%) and "strongly disagree" (38.5%) with no "strongly agree" responses.

**Figure 6.38: Overall, there has been a decline in the service provided by SSI**



BSQ19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	30.8	30.8
	disagree	10	38.5	38.5	69.2
	neutral	3	11.5	<b>11.5</b>	80.8
	agree	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

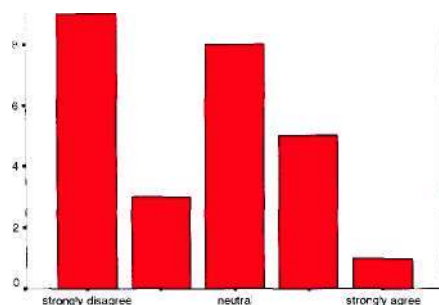
The modal responses were "disagree" (38.5%) and "strongly disagree" (30.8%) with no "strongly agree" responses.

### **6.3.1 Conclusion:**

Approximately 65%-77% of the respondents disagreed that there was a decline in the quality of service. A small group of about 20% agreed that the quality of service had declined. A small percentage (of about 10%) were "neutral" and they need to be won over. On the whole, the quality of service had not declined significantly.

#### 6.4 Presentation of Section B (SK) Results per Attribute (belief that any decline is due to skills shortages)

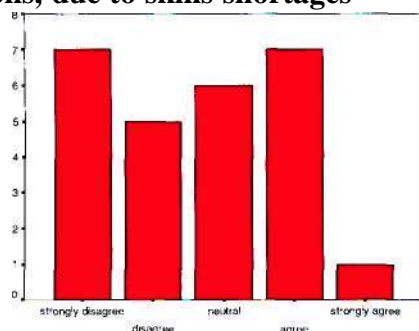
**Figure 6.39: Attribute: There has been a decline in SSI's approach to work, due to skills shortages**



BSK1		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	34.6	34.6	34.6
	disagree	3	<b>11.5</b>	<b>11.5</b>	46.2
	neutral	8	30.8	30.8	76.9
	agree	5	19.2	19.2	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "neutral" (30.8%) and "strongly disagree" (34.6%).

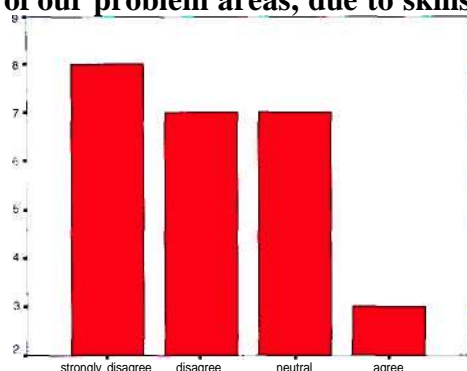
**Figure 6.40: Attribute: There has been a decline in SSI's creativity in proposed solutions, due to skills shortages**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	26.9	26.9	26.9
	disagree	5	19.2	19.2	46.2
	neutral	6	23.1	23.1	69.2
	agree	7	26.9	26.9	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were 'agree" (26.9%), "strongly disagree" (26.9%) and "neutral" (23.1%).

**Figure 6.41: Attribute: There has been a decline in SSI's helpfulness in diagnosing the causes of our problem areas, due to skills shortages**

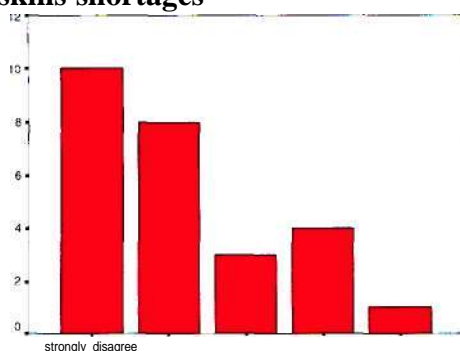


BSK3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	32.0	32.0
	disagree	7	26.9	28.0	60.0
	neutral	7	26.9	28.0	88.0
	agree	3	11.5	12.0	100.0
	Total	25	96.2	100.0	
Missing	System	1	3.8		
	Total	26	100.0		

The modal responses were "disagree" (26.9%), "strongly disagree" (30.8%) and "neutral" (26.9%) with no "strongly agree" responses.

**Figure 6.42: Attribute: There has been a decline in how SSI documents work activities, due to skills shortages**



BSK4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	38.5	38.5	38.5
	disagree	8	30.8	30.8	69.2
	neutral	3	11.5	11.5	80.8
	agree	4	15.4	15.4	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (30.8%) and "strongly disagree" (38.5%).

**Figure 6.43: Attribute: There has been a decline in accessibility of SSI's people, due to skills shortages**

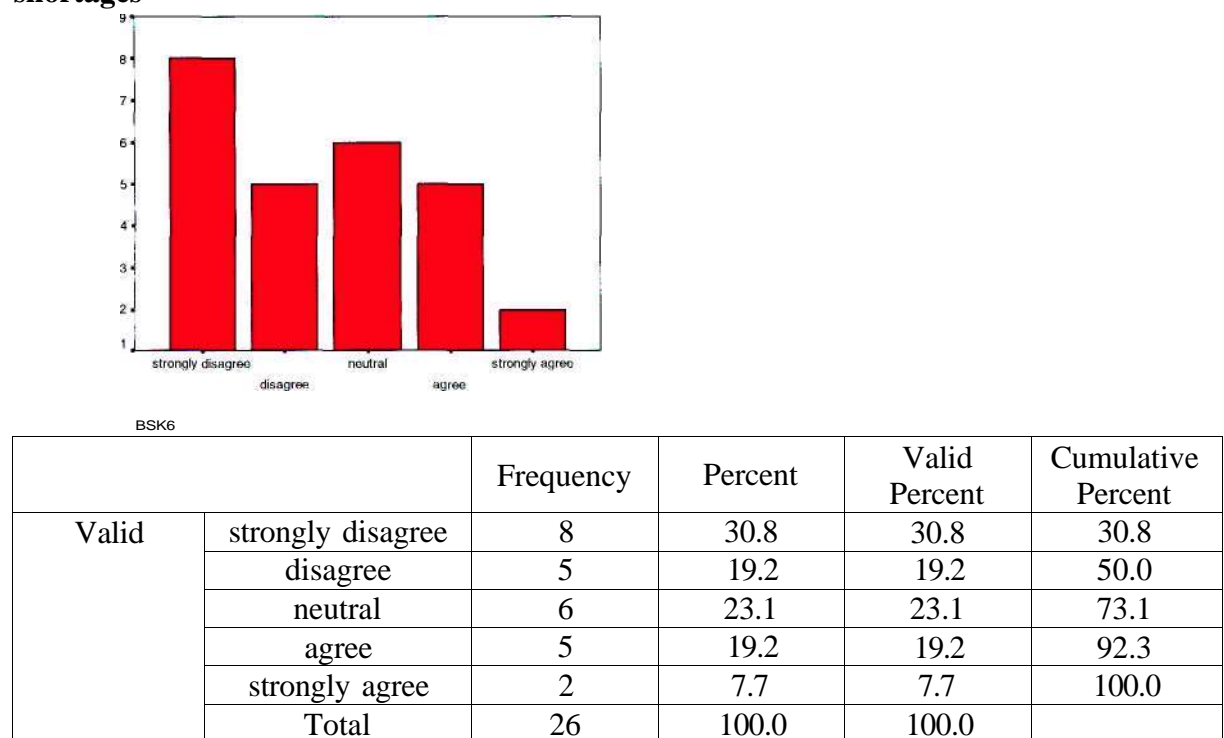
strongly disagree   disagree

BSK5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	38.5	38.5	38.5
	disagree	8	30.8	30.8	69.2
	neutral	6	23.1	23.1	92.3
	agree	2	7.7	7.7	100.0
	Total	26	100.0	100.0	

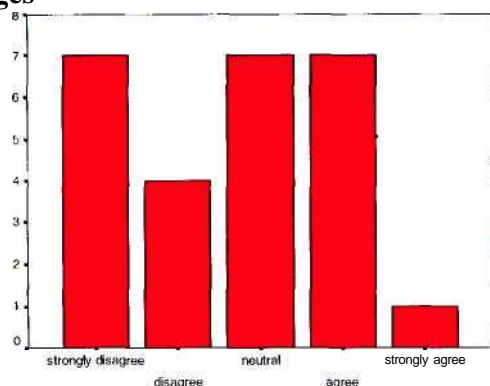
The modal responses were "disagree" (30.8%), "strongly disagree" (38.5%) and "neutral" (23.1%) with no strongly agree responses.

**Figure 6.44: There has been a decline in SSI keeping promises on deadlines, due to skills shortages**



The modal responses were "neutral" (23.1%) and "strongly disagree" (30.8%).

**Figure 6.45: Attribute: There has been a decline in SSI's turnaround time, due to skills shortages**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	26.9	26.9	26.9
	disagree	4	15.4	15.4	42.3
	neutral	7	26.9	26.9	69.2
	agree	7	26.9	26.9	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

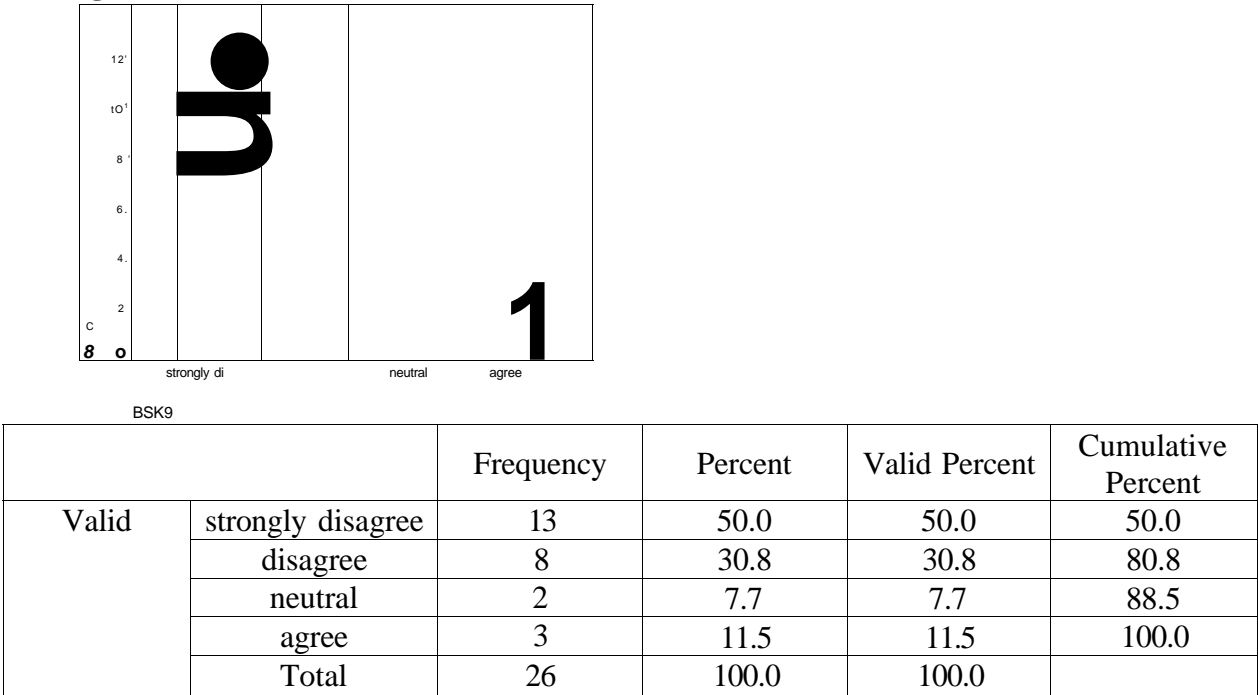
The modal responses were "neutral" (26.9%) "agree" (26.9%) and "strongly disagree" (26.9%).

**Figure 6.46: Attribute: There has been a decline in SSI's attention to what we have to say, due to skills shortages**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	38.5	38.5	38.5
	disagree	8	30.8	30.8	69.2
	neutral	5	19.2	19.2	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

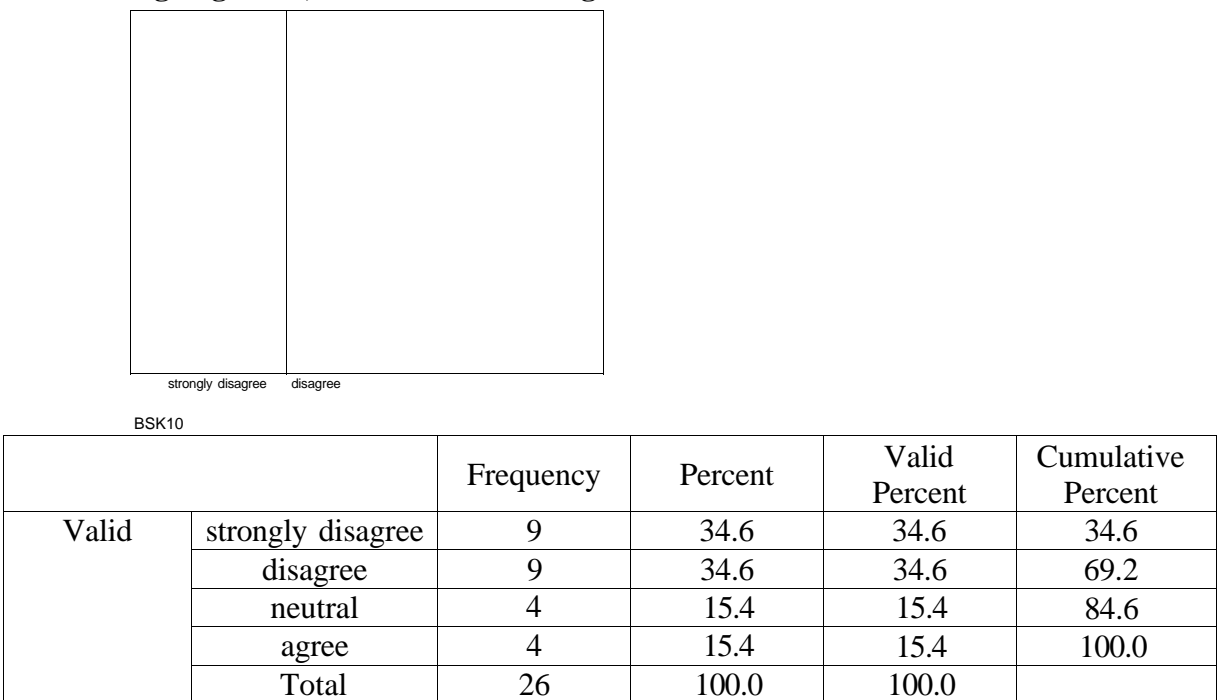
The modal responses were "disagree" (30.8%) and "strongly disagree" (38.5%) with no "strongly agree" responses.

**Figure 6.47: There has been a decline in SSI's relationship with our people, due to skills shortages**



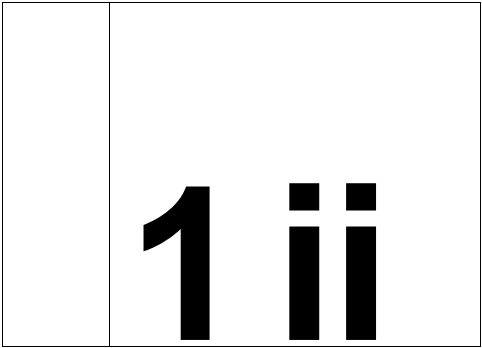
The modal responses were "disagree" (30.8%) and "strongly disagree" (50%) with no "strongly agree" responses.

**Figure 6.48: Attribute: There has been a decline in SSI keeping us informed in advance of what its going to do, due to skills shortages**



The modal responses were "disagree" (34.6%: and "strongly disagree" (34.6%) with no "strongly agree" responses.

**Figure 6.49: Attribute: There has been a decline in SSI keeping us notified of changes in scope, and seeking our approval, due to skills shortages**



BSK11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	30.8	30.8
	disagree	10	38.5	38.5	69.2
	neutral	4	15.4	15.4	84.6
	agree	3	11.5	11.5	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (38.5%) and "strongly disagree" (30.8%)

**Figure 6.50: Attribute: There has been a decline by SSI in showing initiative, due to skills shortages**

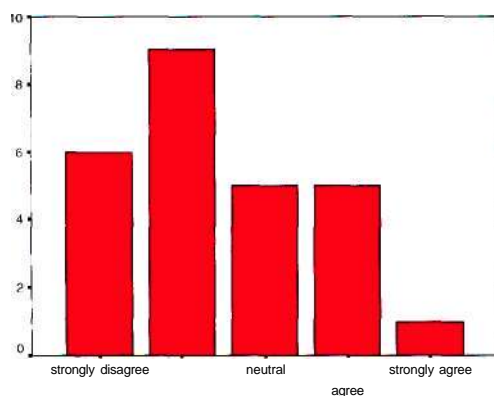


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	34.6	34.6	34.6
	disagree	8	30.8	30.8	65.4
	neutral	4	15.4	15.4	80.8
	agree	4	15.4	15.4	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (30.8%) and "strongly disagree" (34.6%).



**Figure 6.51: Attribute: There has been a decline by SSI in keeping us informed on progress, due to skills shortages**

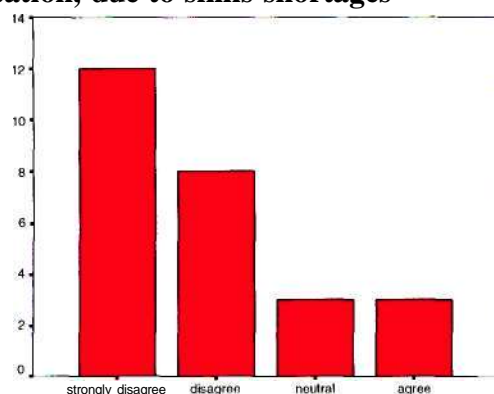


BSK13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	23.1	23.1	23.1
	disagree	9	34.6	34.6	57.7
	neutral	5	19.2	19.2	76.9
	agree	5	19.2	19.2	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (34.6%) and "strongly disagree" (23.1%).

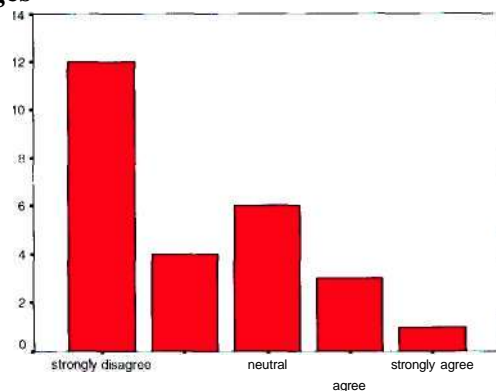
**Figure 6.52: Attribute: There has been a decline in SSI's understanding of our organisation, due to skills shortages**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	12	46.2	46.2	46.2
	disagree	8	30.8	30.8	76.9
	neutral	3	11.5	11.5	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (30.8%) and "strongly disagree" (46.2%) with no "strongly agree" responses.

**Figure 6.53: There has been a decline in the ease we do business with SSI, due to skills shortages**

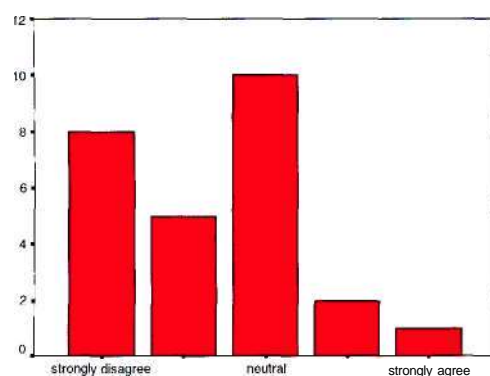


BSK15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	12	46.2	46.2	46.2
	disagree	4	15.4	15.4	61.5
	neutral	6	23.1	23.1	84.6
	agree	3	11.5	11.5	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "neutral"(23.1%) and "strongly disagree" (46.2%).

**Figure 6.54: Attribute: There has been a decline in the manner and timeframes SSI deals with problems in our relationship, due to skills shortages**



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	30.8	30.8
	disagree	5	19.2	19.2	50.0
	neutral	10	38.5	38.5	88.5
	agree	2	7.7	7.7	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "neutral" (38.5%) and "strongly disagree" (30.8%).

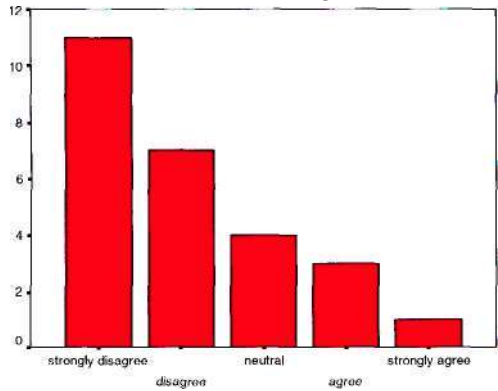
Figure 6.55: Attribute: There has been a decline in SSI keeping us informed on technical issues affecting our business, due to skills shortages



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	38.5	38.5	38.5
	disagree	8	30.8	30.8	69.2
	neutral	5	19.2	19.2	88.5
	agree	3	11.5	11.5	100.0
	Total	26	100.0	100.0	

The modal njspnses were "disagree" (30.89i) and "strongly disagree" (38.5%) with "strongly agree" responses.

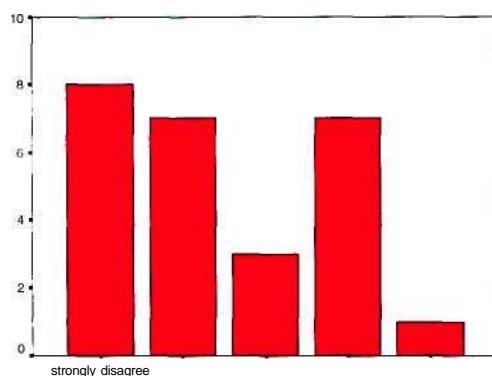
Figure 6.56: There has been a decline in interest shown by SSI in us beyond the specifics of projects, due to skills shortages



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	11	42.3	42.3	42.3
	disagree	7	26.9	26.9	69.2
	neutral	4	15.4	15.4	84.6
	agree	3	11.5	11.5	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "disagree" (26.9%) ftnnd "strongly disagree" (42.21%).

**Figure 6.57: Overall, there has been a decline in the service provided by SSI, due to skills shortages**



BSK19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	30.8	30.8	30.8
	disagree	7	26.9	26.9	57.7
	neutral	3	<b>11.5</b>	<b>11.5</b>	69.2
	agree	7	26.9	26.9	96.2
	strongly agree	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

The modal responses were "agree" (26.9%), "disagree" (26.9%) and "strongly disagree" (30.8%).

#### **6.4.1 Conclusion:**

About 55%-68% disagreed that any decline is as a result of shortages of skills. However, there were a portion of respondents that were simply "neutral". The areas where the respondents "agreed" that the decline in service was due to the shortage of skills were as follows:

- There has been a decline in SSI's creativity in proposed solutions (2)
- There has been a decline in SSI's turnaround time (7)

Overall, respondents did not believe that any decline in the quality of service was due to the shortage of skills.

#### **6.5 Analysis of General Statistics**

The means, the modes, the medians, the sample variances and sample standard deviations were calculated. The mean or the arithmetic mean is the sum of all the values divided by the sample size, the mode is the most frequent response by the respondents and the median is the middle most value when the data (per variable/question) is arranged from highest to lowest.

The sample variance is the degree or quantity by which each observation varies from one another. The sample standard deviation is the square root of the sample variance (Wegner, 2002: 54). The standard deviations are consistently about 1 which indicates good consistency between the observations due to low variability. The mean and median values are consistent with modal values. To illustrate the consistency in responses, the modes and means are compared, as shown in Table 6.1. The statistical results are provided in Appendix 3.

**Table 6.1: Comparison of Modes and Means per Attribute per Section and Subsection**

Attribute	Modes			Means		
	Section A	Section B		Section A	Section B	
		SQ	SK		SQ	SK
1	4	3	1	4.0	2.3	2.5
2	4	2	1&4	3.8	2.3	2.6
3	4	2	1	3.8	2.0	2.2
4	4	2	1	3.9	1.9	2.2
5	4&5	2	1	4.0	1.9	2.0
6	4	2	1	3.7	2.3	2.5
7	4	2	1,3&4	4.1	2.5	2.7
8	4	2	1	3.9	2.1	2.0
9	4	1	1	4.1	1.8	1.8
10	4	2	1&2	3.7	2.2	2.1
11	4	2	2	3.8	2.2	2.2
12	4	2	1	3.7	2.1	2.2
13	4	2	2	3.8	2.3	2.5
14	4	1	1	3.9	2.0	1.9
15	4	1	1	4.0	2.1	2.1
16	4	2	3	3.7	2.2	2.4
17	4	2	1	3.9	2.0	2.0
18	3,4&5	1	1	3.9	2.1	2.1
19	4	2	1	4.0	2.2	2.5

## 6.6 Reliability Analysis

Cronbach's alpha was also calculated as part of the reliability test to assess how consistent the results were and whether similar results would be obtained to generalise if the sample size were increased. A value of 0.7 or higher is considered a good value to conclude that similar results would be obtained if this survey was conducted with a larger sample of respondents (Coakes and Steed, 2003). Cronbach's alpha was calculated for OVERALL, SECTION A:Q1-19 (current levels of satisfaction), SECTION B:Q1-Q19 (decline in quality of service), SECTION B:Q1-Q19 (if any decline is due to skills shortage). The results are as follows:

Section	Items	Cronbach's Alpha
Overall (all sections)	Q1-Q19,Q1-Q19,Q1-Q19	0.9231
Section A (current levels of satisfaction)	Q1-Q19	0.9591
Section B (decline in quality of service)	Q1-Q19	0.9702
Section B (if any decline is due to shortage of skills)	Q1-Q19	0.9594

The alpha values indicate good internal consistency. It may therefore be concluded that similar results would be obtained if this survey was conducted with a larger sample of respondents.

## 6.7 Correlation Analysis

In order to assess whether any relationships in the datasets for Section B existed, a correlation analysis was performed on the data. The following two types of relationships could exist:

- Those where a change in one variable is accompanied by a change in another variable but it is not clear which variable caused the other to change, a correlation; or
- Those where a change in one or more (independent) variables causes a change in another (dependent) variable, a cause-and effect relationship (Saunders, *et al*, 2000: 364).

The Kolmogorov Smirnov test was used to check if the data followed a normal distribution, before the appropriate correlation test could be carried out. The results of the Kolmogorov Smirnov test are shown in Appendix 4.

The hypothesis tested was:

Ho: the data follow a Normal distribution

Hi: the data do not follow a Normal distribution

The p-values are all less than 5% level of significance, therefore reject Ho and conclude that the data do not follow a Normal distribution.

Spearman's rank order correlation was performed on Section B.

The results of Spearman's rank order correlation for Section B are included in Appendix 5.

As shown in Appendix 5, significant relationships exist between the two sets of variables. It may therefore be concluded that level of skills and quality of service are related, which is to be expected, i.e. as skills level increase so too does the quality of service.

The following hypothesis was also tested:

$H_0$ : there are no differences in the perceptions of respondents of Section A and Section B questions

$H_i$ : there are differences in the perceptions of respondents of Section A and Section B questions

The Chi-Square test was used to test this hypothesis. The results are presented in Table 6.2.

**Table 6.2:: Results of Chi-Square Test**

Question N°	Chi-Square	df	Asymp. Sig. (p values)
AQ1	7.000	2	.030
AQ2	11.846	3	.008
AQ3	9.077	3	.028
AQ4	2.846	2	.041
AQ5	6.615	3	.085
AQ6	10.615	3	.014
AQ7	11.231	3	.011
AQ8	9.385	3	.025
AQ9	2.154	2	.041
AQ10	13.077	3	.004
AQ11	14.308	3	.003
AQ12	9.385	3	.025
AQ13	6.308	3	.098
AQ14	5.077	3	.166
AQ15	11.538	3	.009
AQ16	6.308	3	.098
AQ17	8.154	3	.043
AQ18	4.154	3	.045
AQ19	1.000	2	.007
BSQ1	2.923	3	.004
BSQ2	1.385	3	.009
BSQ3	7.480	3	.058
BSQ4	5.692	3	.028
BSQ5	11.231	3	.011
BSQ6	6.923	3	.074
BSQ7	3.231	3	.057

Question N°	Chi-Square	df	Asymp. Sig. (p values)
BSQ8	4.462	3	.016
BSQ9	11.231	3	.011
BSQ10	9.385	3	.025
BSQ11	6.615	3	.005
BSQ12	9.077	3	.028
BSQ13	4.462	3	.006
BSQ14	9.077	3	.028
BSQ15	12.077	4	.017
BSQ16	5.077	3	.006
BSQ17	6.308	3	.008
BSQ18	4.462	3	.006
BSQ19	4.462	3	.006
BSK1	8.615	4	.071
BSK2	4.769	4	.002
BSK3	2.360	3	.001
BSK4	10.538	4	.032
BSK5	5.385	3	.006
BSK6	3.615	4	.001
BSK7	5.538	4	.006
BSK8	4.462	3	.006
BSK9	11.846	3	.008
BSK10	3.846	3	.009
BSK11	10.538	4	.002
BSK12	8.231	4	.003
BSK13	6.308	4	.007
BSK14	8.769	3	.003
BSK15	13.615	4	.009
BSK16	11.308	4	.023
BSK17	4.462	3	.006
BSK18	11.692	4	.020
BSK19	7.077	4	.002

At the 5% significance level, reject  $H_0$  since all the p-values are less than 0.05 (except for questions AQ5, AQ13, AQ14, AQ16, BSQ3, BSQ6, BSQ7 and BSK1) and conclude that there are differences in the perceptions of respondents in the survey. For those questions with p-values greater than 0.05, accept  $H_0$  and conclude that there are no differences in the perceptions of respondents in the survey, at the 5% significance level.

## 6.8 Factor Analysis

A factor analysis was carried out on data obtained for each Section and Subsection of the questionnaire to find out whether groupings of feelings per sets of questions/attributes existed.



Factor analysis was carried out as an exploratory tool to be able to (if possible) reduce the set of items to a smaller set that adequately explained the data and could account for being a set of similar items. The Principal Components method was used with varimax rotation.

As a rule of thumb, loadings in excess of 0.30 are eligible for interpretation, whereas lower ones are not, because a factor loading of 0.30 indicates at least a 9% overlap in variance between the variable and the factor (Tabachnick and Fidell, 1983: 411). Tabachnick and Fidell (1983: 411) further argue that the greater the overlap between a variable and a factor, the more that variable is a pure measure of the factor. Comrey (1973, cited in Tabachnick and Fidell, 1983: 411) suggests that loadings in excess of 0.71 (50% variance) are considered excellent, 0.63 (40%) very good, 0.45 (20%) fair and 0.32 (10% of variance) poor. Loadings of 0.4 or higher have been adopted for this study.

The following are the findings of the factor analysis per section and subsection:

#### 6.8.1 Section A: Current Levels of Satisfaction

**Table 6.3: Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.161	58.743	58.743	11.161	58.743	58.743	6.214	32.704	32.704
2	1.709	8.996	67.739	1.709	8.996	67.739	5.272	27.750	60.453
3	1.311	6.902	74.641	1.311	6.902	74.641	2.696	14.188	74.641
4	.902	4.750	79.391						
5	.746	3.928	83.318						
6	.686	3.611	86.929						
7	.528	2.779	89.708						
8	.446	2.346	92.054						
9	.330	1.736	93.790						
10	.291	1.530	95.320						
11	.268	1.409	96.729						
12	.205	1.078	97.808						
13	.143	.750	98.558						
14	.112	.592	99.150						
15	.073	.386	99.535						
16	.035	.186	99.721						

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
17	.028	.148	99.869						
18	.020	.106	99.975						
19	.005	.025	100.000						

*Extraction Method: Principal Component Analysis.*

From Table 6.3, the cumulative variance that 3 factors are explaining is 74.461%. Furthermore all of these 3 factors have Eigenvalues over 1. The first factor accounts for 58.743% of the variation as is normally the case in factor analysis. The rotated loadings table was inspected to find out which questions are not loading at all on the factors and could hence be eliminated from the data set and for the factor analysis to be re-run.

**Table 6.4: Rotated Loadings Table**

	Component		
	1	2	3
AQ17	.866	.400	.095
AQ7	.814	.234	.179
AQ15	.813	.396	.150
AQ12	.793	.110	.435
AQ19	.785	.434	.187
AQ14	.773	.390	.222
AQ16	.677	.394	.239
AQ18	.628	.596	.070
AQ3	.628	.357	.440
AQ13	.486	.393	.468
AQ9	.279	.843	.194
AQ5	.358	.809	-.102
AQ10	.292	.773	.307
AQ8	.443	.727	.232
AQ6	.314	.675	.213
AQ11	.346	.621	5.687E-06
AQ4	.118	.611	.294
AQ2	.182	.095	.902
AQ1	.249	.199	.862

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.*

From the rotated component matrix (Table 6.4), no questions were deleted. The factors for Section A may be as follows:

**Factor 1: Overall Service**

<b>Question N°.</b>	<b>Question</b>
<b>17</b>	SSI keeps us informed on technical issues affecting our organisation
<b>7</b>	SSI offers fast turnaround when requested
<b>15</b>	SSI is an easy firm to do business with
<b>12</b>	SSI does not wait for us to initiate everything you anticipate
<b>19</b>	Overall, I would rate SSI's service very highly
<b>14</b>	SSI makes it its business to understand our organisation
<b>16</b>	SSI deals with problems in our relationship openly and quickly
<b>18</b>	SSI shows an interest in us beyond the specifics of projects
<b>3</b>	SSI is helpful in diagnosing the causes of our problem areas
<b>13</b>	SSI keeps us informed on progress

**Factor 2: Working Relationships**

<b>Question N°.</b>	<b>Question</b>
<b>9</b>	SSI relates well to our people
<b>5</b>	SSI's people are accessible
<b>10</b>	SSI informs us in advance of what its going to do
<b>8</b>	SSI listens well to what we have to say
<b>6</b>	SSI keeps its promises on deadline
<b>11</b>	SSI notifies us promptly of changes in scope, and seeks our approval
<b>4</b>	SSI documents work activities well

**Factor 3: Technical Skills**

<b>Question N°.</b>	<b>Question</b>
<b>1</b>	SSI is thorough in its approach to work
<b>2</b>	SSI shows creativity in proposed solution

### 6.8.2 Section B (QS): Whether there has been a decline in client satisfaction levels

Table 6.5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	<b>12.587</b>	<b>66.248</b>	<b>66.248</b>	12.587	66.248	66.248	7.812	41.115	41.115
2	1.275	<b>6.711</b>	<b>72.960</b>	1.275	6.711	72.960	4.337	22.824	63.939
3	1.133	5.961	<b>78.921</b>	1.133	5.961	78.921	2.846	14.981	78.921
4	.980	5.156	84.076						
5	.656	3.454	87.530						
6	.487	2.564	90.094						
7	.423	2.229	92.323						
8	.365	1.921	94.244						
9	.275	1.446	95.690						
10	.229	1.203	96.893						
11	.175	.919	97.812						
12	.139	.731	98.543						
13	.086	.450	98.993						
14	.076	.401	99.394						
15	.047	.247	99.641						
16	.033	.173	99.814						
17	.025	.131	99.946						
18	.009	.047	99.992						
19	.001	.008	100.000						

*Extraction Method: Principal Component Analysis.*

From Table 6.5, there seems to be three factors accounting for 78.921% of the variation. The rotated loading results is shown in Table 6.6:

**Table 6.6: Rotated Loadings Table**

	Component		
	1	2	3
BSQ11	.891	.307	.054
BSQ5	.817	.294	.190
BSQ17	.795	.166	.272
BSQ10	.755	.164	.365
BSQ14	.743	.319	.343
BSQ9	.726	.128	.402
BSQ6	.720	.371	.439
BSQ13	.714	.434	.239
BSQ18	.694	.454	.239
BSQ3	.692	.524	.206
BSQ19	.653	.557	.046
BSQ4	.638	.512	.277
BSQ8	.613	.549	.211
BSQ2	.070	.907	.248
BSQ1	.469	.727	.146
BSQ12	.393	.694	.389
BSQ7	.572	.578	.320
BSQ15	.197	.290	.873
BSQ16	.356	.227	.865

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.*

*Rotation converged in 7 iterations.*

From the rotated component matrix Table 6.6, no questions were deleted. The factors for Section B (SQ) may be as follows:

### Factor 1: Service

Question N°	Question
17	There has been a decline in SSI keeping us informed on technical issues affecting our business
5	There has been a decline in accessibility of SSI's people
11	There has been a decline in SSI keeping us notified of changes in scope, and seeking our approval
10	There has been a decline in SSI keeping us informed in advance of what its going to do
19	Overall, there has been a decline in the service provided by SSI
14	There has been a decline in SSI's understanding of our organisation
9	There has been a decline in SSI's relationship with our people
6	There has been a decline in SSI keeping promises on deadlines
3	There has been a decline in SSI's helpfulness in diagnosing the causes of our problem areas
13	There has been a decline by SSI in keeping us informed on progress
4	There has been a decline in how SSI documents work activities
8	There has been a decline in SSI's attention to what we say
18	There has been a decline in interest shown by SSI in us beyond the specifics of projects

### Factor 2: Technical Service

Question N°.	Question
1	There has been a decline in SSI's approach to work
2	There has been a decline in SSI's creativity in proposed solutions
12	There has been a decline by SSI in showing initiative
7	There has been a decline in SSI's turnaround time

### Factor 3: Relationship Skills

Question N°.	Question
15	There has been a decline in the ease we do business with SSI
16	There has been a decline in the manner and time frames SSI deals with problems in our relationship

### 6.8.3 Section B (SK): Is any decline in satisfaction levels due to skills shortages

**Table 6.7: Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	<b>11.208</b>	<b>58.988</b>	<b>58.988</b>	11.208	58.988	58.988	4.548	23.935	23.935
2	<b>1.921</b>	<b>10.112</b>	<b>69.101</b>	1.921	10.112	69.101	4.340	22.842	46.777
3	<b>1.246</b>	<b>6.557</b>	<b>75.658</b>	1.246	6.557	75.658	4.136	21.770	68.547
4	<b>1.032</b>	<b>5.430</b>	<b>81.088</b>	1.032	5.430	81.088	2.383	12.541	81.088
5	.915	4.816	85.904						
6	.690	3.630	89.534						
7	.425	2.236	91.770						
8	.401	2.113	93.883						
9	.334	1.760	95.643						
10	.217	1.141	96.784						
11	.205	1.079	97.864						
12	.132	.695	98.559						
13	.101	.534	99.093						
14	.057	.299	99.393						
15	.035	.184	99.576						
16	.033	.174	99.751						
17	.020	.104	99.855						
18	.017	.090	99.944						
19	.011	.056	100.000						

*Extraction Method: Principal Component Analysis.*

From Table 6.7 it can be seen that 4 factors collectively account for 81.088% of the variation. The rotated loading results are provided in Table 6.8:

**Table 6.8: Rotated Loadings Table**

	Component			
	1	2	3	4
BSK15	.825	.306	.170	-.042
BSK16	.819	.320	.076	-.039
BSK6	.814	.227	.336	.214
BSK13	.789	.294	.373	.206
BSK12	.720	.364	.099	.267
BSK19	.584	.019	.566	.380
BSK9	.312	.833	.182	.058
BSK14	.284	.820	.247	.024
BSK3	.272	.752	.371	.238
BSK18	.432	.636	.357	.376
BSK10	.308	.615	.371	.161
BSK4	.447	.584	.347	.373
BSK8	.212	.262	.840	.217
BSK17	.187	.309	.822	.017
BSK11	.187	.210	.756	.415
BSK5	.189	.346	.743	.175
BSK7	.287	.486	.516	.384
BSK1	.011	.045	.333	.881
BSK2	.289	.502	.141	.731

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.*

From the rotated component matrix (Table 6.8), no questions were deleted. The factors for Section B (SK) may be as follows:



### **Factor 1: Service Quality**

<b>Question N°</b>	<b>Question</b>
<b>15</b>	There has been a decline in the ease we do business with SSI
<b>16</b>	There has been a decline in the manner and time frames SSI deals with problems in our relationship
<b>6</b>	There has been a decline in SSI keeping promises on deadlines
<b>13</b>	There has been a decline by SSI in keeping us informed on progress
<b>12</b>	There has been a decline by SSI in showing initiative
<b>19</b>	Overall, there has been a decline in the service provided by SSI

### **Factor 2: Admin and Problem Solving Skills**

<b>Question N°</b>	<b>Question</b>
<b>9</b>	There has been a decline in SSI's relationship with our people
<b>14</b>	There has been a decline in SSI's understanding of our organisation
<b>3</b>	There has been a decline in SSI's helpfulness in diagnosing the causes of our problem areas
<b>18</b>	There has been a decline in interest shown by SSI in us beyond the specifics of projects
<b>10</b>	There has been a decline in SSI keeping us informed in advance of what it is going to do
<b>4</b>	There has been a decline in how SSI documents work activities

### **Factor 3: People Skills**

<b>Question N°</b>	<b>Question</b>
<b>5</b>	There has been a decline in accessibility of SSI's people
<b>7</b>	There has been a decline in SSI's turnaround time
<b>8</b>	There has been a decline in SSI's attention to what we have to say
<b>17</b>	There has been a decline in SSI keeping us informed on technical issues affecting our business
<b>11</b>	There has been a decline in SSI keeping us notified of changes in scope, and seeking our approval

### **Factor 4: Technical Quality**

<b>Question N°</b>	
<b>1</b>	There has been a decline in SSI's approach to work
<b>2</b>	There has been a decline in SSI's creativity in proposed solutions

## **6.9 Conclusion**

It is apparent from the findings in this chapter that the level of service provided by SSI was good to very good. Overall there did not appear to be a significant decline in the quality of service, except for Question 1 of Section B, *there has been a decline in SSI's approach to work*. The most frequent response for this attribute was "neutral" which suggests that respondents could go either way indicating attention is required in this regard.

The findings of this chapter are discussed in more detail in Chapter 7.

## **CHAPTER 7 : DISCUSSION AND CONCLUSION**

The focus of this chapter is to link the findings in Chapter 6 to the research objectives. To recap, the research objectives were:

- to establish current levels of client satisfaction;
- to establish (from clients) whether there has been a decline in their satisfaction levels from five years ago; and
- to establish whether clients believe that any decline in satisfaction levels is as a result of skills shortages in the industry.

Each objective will be discussed in terms of the research findings.

### **7.1 Establish Current Levels of Client Satisfaction**

Although the measurement of current levels of client satisfaction will not strictly contribute to the research question, i.e. the impact of skills shortages on client satisfaction at Stewart Scott International in KwaZulu-Natal, the exercise was undertaken for completeness of the research. Further, the findings would be valuable for management of SSI in general and in KwaZulu-Natal in particular, to devise strategies for problem areas identified.

Accordingly to Woodruffe (1995) the purpose of monitoring and evaluation of customer satisfaction is to ensure that plans and programmes are working effectively, and that desired standards are being achieved. Service quality is measured on two levels, the first is technical quality (how good the work is) and the second is service or functional quality (the experience of the client) (Woodruffe: 1995, Meister, 1992).

Attributes 1 and 2 of Section A of the Questionnaire may be regarded as essentially technical issues and as such measure the technical quality of the service SSI provides to its clients. For Attribute 1, 80.8% of respondents "agreed" that SSI was thorough in its approach to work, of which 23.1% of respondents "strongly agreed". For Attribute 2, 73% of respondents "agreed" that SSI showed creativity in proposed solutions, of which 19.2% "strongly agreed". The modes and means for both Attributes 1 and 2 showed good correlation (see Table 6.1) suggesting that respondents were generally consistent with their responses. The technical service quality SSI provided to its clients was therefore found to be good-to-very-good.

Meister (1995) found in a study he supervised that generally clients were happy with the technical aspects of services provided by firms.

For all other service attributes, the modes were "agree" indicating that respondents rated SSI's service, for those services attributes, as good.

Attribute 18, *SSI shows an interest in us beyond the specifics of projects*, was multimodal with 30.8% of "neutral" responses. Further, Attribute 16, *SSI deals with problems in our relationship openly and quickly*, also had a high "neutral" response. Attention is required in these two areas to sway the neutrals in favour of SSI.

Desimone *et al* (2002 : 338) argue that even if the product or service is technically perfect it may fail in the marketplace if it does not meet customer expectations. Mudie and Cottam (1999: 254) further argue that to secure satisfaction, management need not (and indeed should not) focus exclusively in improving its performance and that resources should also be devoted to managing customer expectations. Given the findings of Lawless (2005: 157) and SAACE (2005: 14) that current utilisation rates are high (in some cases 60+ hours a week) and that there is a shortage of experienced middle management staff, both of which have resulted in stressed and overworked senior management, it is not surprising that SSI's clients are not entirely satisfied with respect to Attributes 16 and 18. Senior Managers at SSI are not extending themselves (and possibly physically cannot extend themselves) beyond the specifics of the technical issues of projects, an aspect which could be detrimental to SSI in the future if not addressed.

Findings of the factor analysis suggest that Attributes 16 and 18 may be grouped with other factors (as shown in paragraph 6.8) to contribute to the factor of Overall Service Quality. Although regression analysis was not carried out as part of the analysis in this research to quantify the effect any change in Attributes 16 and 18 would have on the factor, it can be assumed with reasonable certainty that any decline in these two areas would result in a decline in the quality of service SSI provides.

## **7.2 Establish (From Clients) Whether there has been a Decline in their Satisfaction Levels from Five Years Ago**

Overall, respondents did not believe that there was a significant decline in SSI's quality of service, but a marginal decline is noted. Of particular concern is Attribute 1, *there has been a*

*decline in SSI's approach to work*, where there was a high (34.6%) "neutral" response. Further, Attributes 2 and 16 also had relatively high (26.9% and 23.1% respectively) "neutral" responses. These areas need urgent attention.

An explanation for Attribute 16, *there has been a decline in the manner and timeframes SSI deals with problems in our relationship*, has been suggested in paragraph 7.1 above.

Lawless (2005: 157) suggests that the number of recent (civil engineering) failures may be as a result of work not being checked and found that a lack of concentration owing to exhaustion (for the reasons mentioned in paragraph 7.1) and lack of staff to check work have become commonplace through skills shortages. The SAACE (2005: 15) found that capacity utilisation was on average 93% which was the highest level since June 1998. The decline in the quality of (technical) service, although marginal, may therefore be attributed to skills shortages in the main.

In terms of the factor analysis groupings (refer to paragraph 6.8) Attributes 1 and 2 are included with other attributes which contribute to the factor of Technical Service. Attribute 16 together with Attribute 15 contributes to the factor of Relationship Skills. Once again, in the absence of empirical evidence, it can be assumed with reasonable certainty that any further decline in Attributes 1, 2 and 16 will result in a decline in the quality of service SSI provides.

The findings on factor, Technical Service, suggest that there has been a decline in performance by SSI in its core competence, i.e. of providing a high quality basic product. These findings are similar to the findings of the NACI (2003: 67) study on "The Potential Impact of Skills Shortages on the Innovative Capacity of Major Capital Engineering Projects", which concluded that if the challenge (skills shortages) is not efficiently and effectively addressed, the role of innovation in contributing to economic growth, international competitiveness and improved quality of life could be seriously impaired. Interestingly, clients did not believe that the decline in Attribute 1, *there has been a decline in SSI's approach to work* (if it is assumed that a "neutral" response is a "negative" response) was due to skills shortages, but this is a matter for further internal analysis.

### **7.3 Establish Whether Clients Believe that any Decline in their Satisfaction Levels is as a Result of Skills Shortages in the Industry**

As stated in 7.2, respondents indicated a decline in the quality of service for Attributes 1, 2 and 16. In the case of Attribute 1, *there has been a decline in SSI's approach to work*, 50% of respondents were either "neutral" or believed that the decline was as a result of skills shortages. For Attribute 2, *there has been a decline in SSI's creativity in proposed solutions*, 50% of respondents were either "neutral" or believed that the decline was as a result of skills shortages. For Attribute 16, *there has been a decline in the manner and timeframes SSI deals with problems in our relationship*, 38.5% of respondents were "neutral" on whether the decline was as a result of skill shortages.

Overall, and once again assuming that "neutral" is a "negative" response, respondents believe that changes in the quality of SSI's services is related, in varying proportions, to the skills shortages in the civil engineering industry. Statistically, as stated in paragraph 6.7 (Correlation Analysis), levels of skills and quality of service are related. This is consistent with the findings of Mason, *et al* (date unknown, cited in Booth and Snower, 1996) and the Deloitte (2005) study on A Survey of the American Manufacturing Workforce.

In terms of the factor analysis groupings (refer to paragraph 6.8) Attributes 1 and 2 alone contribute to the factor of Technical Service. Attribute 16, together with other attributes, contribute to the factor, Service Quality. Once again, in the absence of empirical evidence, it can be assumed with reasonable certainty that any further decline in these attributes will lead clients to believe that the decline is as a result of skills shortages.

### **7.4 Conclusion**

In this chapter the findings of the survey with respect to the research objectives were discussed. The research found that, overall, the levels of skills and quality of service are related and that clients do believe that skills shortages have affected the quality of service SSI has offered to them over time. Of particular note, the following attributes have been affected by skills shortages, although marginally (in the eyes of clients):

- (i) SSI's approach to work.
- (ii) SSI's creativity in proposed solutions.
- (iii) SSI's approach in dealing with problems in relationships.

The findings of the study are consistent with the findings of Lawless (2005), NACI (2003) and Mason *et al* (date unknown, cited in Booth and Snower, 1996).

Recommendations, based on the above findings, which could be useful to SSI are discussed in Chapter 8.

Finally, based on the discussions in this report, any strategy to address skills shortages should include at least the following elements:

- better supply of trainable workers through better education
- improved training
- domestic policies that do not encourage an outflow of skilled workers (the so-called "brain drain")
- immigration policies that encourage the immigration of skilled workers
- better utilisation of Africans, Coloureds and Asians, and of women
- a strategy to address the HIV/Aids epidemic
- better support of high-level workers by middle-level workers, to alleviate the administrative and routine tasks of the highly skilled workers
- better utilisation of retired persons and those with a disability
- reducing deaths and injuries in the workplace through greater safety consciousness and better training (South Africa also loses a greater proportion of its highly skilled workers through other causes of death, such as heart disease and vehicle accidents, than many other countries)
- improved labour market information, for example career information to stimulate study in critical occupations and improved placement services (Barker, 2003: 269-270).

Packer and Christensen, 1998 (cited in Barker, 2003: 268) found from studies in the USA that basic skills required to live and work in the 21<sup>st</sup> century include: teamwork, managing

information, interpreting and communicating information through mathematics and science, using technological and scientific systems, problem solving, thinking and learning in different ways and acquiring fundamental personal qualities such as integrity and ability to make wise choices.



## **CHAPTER 8 : RECOMMENDATIONS**

### **8.1 Introduction**

The various studies conducted, especially those of the HSRC (2003), Lawless (2005) and NACI (2003) highlighted the extent and possible impacts of skills shortages on the civil engineering industry in South Africa. Those studies further identified possible causes of the skills shortages and made recommendations to address the skills shortages and skill gaps. Recommendations included, *inter alia*, major attention/changes to both the secondary and tertiary education systems, improved workplace training and extending the retirement age of professionals. The reader is advised to consult those studies for further information in this regard.

Lawless (2005), Egan (2004) and NACI (2003) all argue that addressing the problem of skills shortages is long-term due to the nature of the problem. The purpose of this research was to understand the perceptions of clients with regard to their levels of satisfaction with the technical quality and other service attributes of the firm and suggest/recommend specific strategies to be formulated to improve client satisfaction levels (as appropriate) in the short and medium term. The recommendations in this section should therefore be implemented (if accepted) in parallel with any other short, medium and long-term initiatives.

The NACI (2003: 53) suggests a number of guiding principles in the development of any strategy to address current and future skills shortages. The following two guiding principles are worth noting (due to their uniqueness):

- Acknowledge the limitations of resources and ensure that these are utilised so as to build sustainable capacity; and
- Encourage clients to take greater ownership of the challenge (NACI, 2003: 54).

### **8.2 Recommendations**

The following are recommended and discussed further hereafter:

- More efficient use of resources (short-term)
- Coaching and training initiatives be reviewed and formalised (short-term)

- Develop a new skills management specification (medium-term)

### **8.2.1 *More Efficient Use of Resources***

Egan (2004: 46) found that many local planning authorities used qualified planning staff to deal with minor/other applications that had relatively little impact on the community. It found no point in using more experienced people with strategic skills to undertake tasks that could be completed primarily by planning technicians who could be given the requisite skills through practical, on-the-job training and suggested that local planning authorities needed to examine carefully the competencies required to deal effectively with minor/other applications and ensure they matched staff skills and qualifications to the job (Egan, 2004: 46).

The researcher is aware that SSI has similar practices to those found by Egan (2004), i.e. inappropriate use of resources, and recommends that more efficient use of resources be investigated and the necessary steps taken to ensure that the more senior and experienced staff members are freed up to undertake client maintenance, complex designs, preparation of documentation and specifications and in general deal with high level, non-routine jobs and not routine, relatively low-level applications such as the preparation of contractors' payment certificates and the preparation of MIG claim forms as is currently common practice.

With regard to client maintenance it is worth noting once more that even if the product or service is technically perfect it may fail in the marketplace if it does not meet customer expectations, Desimone *et al* (2002: 338). The researcher is of the view that the firm's most senior and experienced employees are generally more comfortable in dealing with clients, addressing points of conflict and in shaping customer expectations. As Mudie and Cottam (1999: 54) point out, to secure (client) satisfaction, management need not (and indeed should not) focus exclusively on improving its performance and that resources should also be devoted to managing customer expectations.

Finally and in support of the foregoing, it is worth noting that "service quality is often closely linked to the people element of the (marketing) mix (components)" (Woodruffe, 1995: 126).

### **8.2.2 *Coaching and Training Initiatives be Reviewed and Formalised***

Both Lawless (2005) and Egan (2004) argue that coaching can play an important part in dealing with the current skills problem. Egan (2004: 79) suggests that every project should have at least one experienced individual assigned to the project team to bring the benefit of

their experience, past mistakes, creativity and process knowledge, and so to help to ensure the success of new and regenerated developments. Coaches will not work full time on projects, but will be available to help set strategic direction at the outset and to facilitate next steps when sticky points threaten to delay progress (Egan, 2004: 79).

Egan (2004: 79) further suggests that coaches should act as role models for young people and career changers, so that these groups are inspired to develop the required skills themselves that will enable them to work on high profile projects in the UK and abroad.

In terms of training, Lawless (2005: 138) claims that many successful black civil engineering company owners owe their success, at least in part, to the solid grounding given them by Anglo American. Lawless (2005: 138) found that (in South Africa) in the past 15 to 20 years, the effort put into formal training has been greatly reduced, and in many instances has completely disappeared.

The researcher is aware that SSI currently provides coaching to staff largely by retired professionals of the firm and in many instances these "coaches" do the actual project work. Training of graduates is conducted on an ad hoc basis with no formal plan in place (which often leads to graduates gaining too much exposure to certain aspects of civil engineering and too little in other aspects), which very often leads to graduates taking far longer than necessary in accumulating sufficient training to be registered professionally with ECSA. In view of the foregoing discussion, it is recommended that the coaching function be reviewed and formalised as discussed to ensure that coaching and training are effective and that skills transfer takes place. Training programmes could be developed and formalised along the lines of the Anglo American "Formal training programme" covering activities, durations and responsibilities as illustrated in Table 4.9.

### **8.2.3 *Develop a New Skills Management Specification***

In an increasingly complex and changing global market, the UK construction industry, worth 83 592 million pounds in 2002 (Department of Trade and Industry, 2003 cited in Matsumoto *et al*, 2005) faces an uncertain future. The prospect of design work being subcontracted overseas is a real threat. To remain competitive, organisations need to maintain a flexible and strategic approach to their business, constantly assessing their strengths and weaknesses (Barber, 2004 cited in Matsumoto *et al*, 2005).

It is noted that SSI currently manages its employees' skills (at an operational level) by line managers conducting annual performance reviews, where employees discuss their achievements, short- and long-term objectives, and training requirements in a similar format to the performance management system set out by Armstrong (1991, cited in Matsumoto *et al*, 2005). Matsumoto *et al* (2005: 57) argue that this approach makes it difficult for a firm to:

- a) assess its current skills performance/abilities and ensure that continuous improvement is made every year;
- b) leverage employee skills and knowledge on projects if the particular project manager does not know the individual well;
- c) assess the impact of employees leaving and replace the key skills that are not covered by others;
- d) measure the overall effectiveness of their training programme;
- e) enforce training strategies that have been developed to position the organisation in new markets; and
- f) coordinate training across different groups (Matsumoto *et al* 2005: 57).

By not controlling these tasks (managing skills), the organisation could be losing valuable skills without knowing, wasting money on ineffective training programmes and strategies, and reducing its productivity by not effectively matching employee skill ability and work tasks together (Homer, 2001 cited in Matsumoto *et al*, 2005: 57).

In view of the shortcomings of the current system for managing skills as suggested by Matsumoto *et al* (2005: 57), it is recommended that a new skills management specification for SSI be developed. The objectives for developing a skills management specification must include the following:

- i) How can skill performance be measured?
- ii) How can a structure be developed to represent the employees' direct skills?
- iii) How can different discipline requirements be integrated into one application?

- iv) How can different discipline grades (engineers, managers and directors) requiring different levels of skill performance be incorporated into one application (Matsumoto *etal*, 2005:57)?

Matsumoto *et al* (2005, 60) suggest that the benefits to employees of such a framework (as discussed above) include that employees can identify their strengths and weaknesses and by comparing themselves to the discipline position benchmark, identify the skills they most need to improve. Further, they can arrange training and discuss practical work experience with their team leader to bring them up to the relevant benchmark.

Benefits for the firm include:

- workload can be better matched with skill strengths and training strategies developed to address skill weaknesses, or core skill gaps in its future business needs;
- continuously monitoring skill development would allow the impact of different training programmes to be better assessed and evenly distributed across the different teams and disciplines; and
- the impact of key employees leaving can be better assessed in terms of the skill gap created and also allows a more focused recruitment/selection process to occur (Matsumoto *et al*, 2005: 61).

### **8.3 Limitations of the Research**

Despite the design of the questionnaire and in view of the findings of Lawless (2005) and HSRC (2003) regarding relative differences in levels of education per province in South Africa, and Haskel and Martin (1993, cited in Booth and Snower, 1996) regarding regional differences in skills shortages in the UK, the following are considered limitations:

- (i) the research did not probe the impact of skills shortages on client satisfaction per sector of civil engineering, ie on the different disciplines such as water sanitation, transportation, etc.
- (ii) the research did not probe regional impacts on the effects of skills shortages on client satisfaction.

Future research into the above may provide useful insights on the impact of skills shortages in civil engineering in South Africa.

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**LETTER OF CONSENT FROM THE CEO OF SSI TO  
CONDUCT STUDY WITHIN FIRM**

Date 9 November 2006

Our Reference:

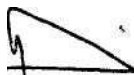
Your Reference:

## TO WHOM IT MAY CONCERN

### DEENA JOHN (STUDENT N° 2025 11463) MBA DISSERTATION LETTER OF CONSENT TO CONDUCT RESEARCH

This letter serves to confirm that Deena John has been granted permission to conduct research in SSI, KwaZulu-Natal for the purpose of a dissertation prepared in partial fulfilment of the requirements for the degree of Masters in Business Administration. It is noted that the dissertation topic is "The Impact of Skills Shortages on Client Satisfaction at Stewart Scott International in KwaZulu-Natal".

Yours faithfully



CVvW\*-  
ST

**N Bhojaram**

**Chief Executive Officer**

## CLIENT FEEDBACK QUESTIONNAIRE

### PURPOSE

The primary purpose of obtaining feedback from Clients is to assist an employee of Stewart Scott International with research as part of a MBA dissertation.

The results of the feedback will also be presented to the management of Stewart Scott with the view that areas requiring attention may be addressed from a company-wide perspective.

Completing this questionnaire is voluntary.

### CONFIDENTIALITY

Feedback will be treated strictly confidentially and only results of all feedback will be presented in reports.

The filling in of your, organisation name, your name and position within your organisation is optional.

On completion of the research, all questionnaires received will be destroyed.

### OBJECTIVE OF RESEARCH

The research aims to measure client satisfaction, to establish whether clients feel that there has been a decline in client satisfaction from 5 years ago, and whether clients believe that any decline in quality of service is as a result of skills shortages in our industry.

### CONTACT DETAILS

Name of Researcher	DeenaJohn
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Name of Supervisor	Ms Clare O' Neill
Institution	University of KwaZulu-Natal Pietermaritzburg Campus School of Psychology
Telephone N°	(033) 260 5675
Email Address	<a href="mailto:Oneilld@ukzn.ac.za">Oneilld @ukzn.ac.za</a>

### 5. DECLARATION BY PARTICIPANT

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

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

**Signature of Participant**

**Date**

**Thank you for your assistance.**

**CLIENT FEEDBACK QUESTIONNAIRE: (SECTION A)**

This Section aims to measure the level of service Stewart Scott International (SSI) provides to its clients. Please circle the appropriate number per attribute that best indicates your feeling.

Attribute of the Firm	Please circle one response per attribute						
1. SSI is thorough in its approach to work	Strongly disagree		2	3	4	5	Strongly agree
2. SSI shows creativity in proposed solutions	Strongly disagree		2	3	4	5	Strongly agree
3. SSI is helpful in diagnosing the causes of our problem areas	Strongly disagree		2	3	4	5	Strongly agree
4. SSI documents work activities well	Strongly disagree		2	3	4	5	Strongly agree
5. SSI's people are accessible	Strongly disagree		2	3	4	5	Strongly agree
6. SSI keeps its promises on deadlines	Strongly disagree		2	3	4	5	Strongly agree
7. SSI offers fast turnaround when requested	Strongly disagree		2	3	4	5	Strongly agree
8. SSI listens well to what we have to say	Strongly disagree		2	3	4	5	Strongly agree
9. SSI relates well to our people	Strongly disagree		2	3	4	5	Strongly agree
10. SSI informs us in advance what its going to do	Strongly disagree		2	3	4	5	Strongly agree
11. SSI notifies us promptly of changes in scope, and seeks our approval	Strongly disagree		2	3	4	5	Strongly agree
12. SSI does not wait for us to initiate everything: you anticipate	Strongly disagree		2	3	4	5	Strongly agree
13. SSI keeps us informed on progress	Strongly disagree		2	3	4	5	Strongly agree
14. SSI makes it its business to understand our organisation	Strongly disagree		2	3	4	5	Strongly agree
15. SSI is an easy firm to do business with	Strongly disagree		2	3	4	5	Strongly agree
16. SSI deals with problems in our relationship openly and quickly	Strongly disagree		2	3	4	5	Strongly agree
17. SSI keeps us informed on technical issues affecting our organisation	Strongly disagree		2	3	4	5	Strongly agree
18. SSI shows an interest in us beyond the specifics of projects	Strongly disagree		2	3	4	5	Strongly agree
19. Overall, I would rate SSI's service very highly	Strongly disagree		2	3	4	5	Strongly agree

**CLIENT FEEDBACK QUESTIONNAIRE: (SECTION B)**

This Section aims to measure whether you believe that there has been a decline in the quality of service provided by SSI over the last 5 years and whether you believe that any decline is as a result of skills shortages in our industry. Please circle the appropriate number per attribute being measured.

Attribute of the Firm	Do you believe there has been a decline in quality of service? (SQ)							Do you believe that any decline is due to skills shortages? (SK)						
	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
1. There has been a decline in SSI's approach to work	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
2. There has been a decline in SSI's creativity in proposed solutions	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
3. There has been a decline in SSI's helpfulness in diagnosing the causes of our problem areas	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
4. There has been a decline in how SSI documents work activities	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
5. There has been a decline in accessibility of SSI's people	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
6. There has been a decline in SSI keeping promises on deadlines	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
7. There has been a decline in SSI's turnaround time	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
8. There has been a decline in SSI's attention to what we have to say	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
9. There has been a decline in SSI's relationship with our people	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
10. There has been a decline in SSI keeping us informed in advance of what it is going to do	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
11. There has been a decline in SSI keeping us notified of changes in scope, and seeking our approval	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
12. There has been a decline by SSI in showing initiative	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
13. There has been a decline by SSI in keeping us informed on progress	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
14. There has been a decline in SSI's understanding of our organisation	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
15. There has been a decline in the ease we do business with SSI	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
16. There has been a decline in the manner and time frames SSI deals with problems in our relationship	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
17. There has been a decline in SSI keeping us informed on technical issues affecting our business	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
18. There has been a decline in interest shown by SSI in us beyond the specifics of projects	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree
19. Overall, there has been a decline in the service provided by SSI	Strongly disagree	1	2	3	4	5	Strongly agree	Strongly disagree	1	2	3	4	5	Strongly agree

Appendix 2 (Sheet 4 of 4)

<b>Kindly provide the following information:</b>			
Name of Organisation		(optional)	
Name of Person Completing Questionnaire		(optional)	
Position in Organisation		(optional)	
Sector (please tick Sector(s) working in)	Water	<input type="checkbox"/>	Sanitation <input type="checkbox"/>
	Transportation	<input type="checkbox"/>	Industrial <input type="checkbox"/>
	Other (please specify)	_____	
Province (please tick Province you are in)	KwaZulu-Natal	<input type="checkbox"/>	Northern Cape <input type="checkbox"/>
	Gauteng	<input type="checkbox"/>	Free State <input type="checkbox"/>
	Eastern Cape	<input type="checkbox"/>	Limpopo <input type="checkbox"/>
	Western Cape	<input type="checkbox"/>	Northern Province <input type="checkbox"/>
	North-West Province	<input type="checkbox"/>	
Date	_____		

Please provide any additional comments you may wish to make in the space provided below:

**Thank you for your assistance.**

## Statistical Results

	N		Mean	Median	Mode	Std. Deviation	Variance	Range	Minimum	Maximum
	Valid	Missing								
AQ1	26	0	4.0385	4.0000	4.00	.66216	.43846	2.00	3.00	5.00
AQ2	26	0	3.8077	4.0000	4.00	.89529	.80154	3.00	2.00	5.00
AQ3	26	0	3.7692	4.0000	4.00	.81524	.66462	3.00	2.00	5.00
AQ4	26	0	3.8462	4.0000	4.00	.73170	.53538	2.00	3.00	5.00
AQ5	26	0	4.0000	4.0000	4.00(a)	.89443	.80000	3.00	2.00	5.00
AQ6	26	0	3.7308	4.0000	4.00	.82741	.68462	3.00	2.00	5.00
AQ7	26	0	4.1154	4.0000	4.00	.81618	.66615	3.00	2.00	5.00
AQ8	26	0	3.8846	4.0000	4.00	.81618	.66615	3.00	2.00	5.00
AQ9	26	0	4.0769	4.0000	4.00	.74421	.55385	2.00	3.00	5.00
AQ10	26	0	3.6538	4.0000	4.00	.74524	.55538	3.00	2.00	5.00
AQ11	26	0	3.8077	4.0000	4.00	.74936	.56154	3.00	2.00	5.00
AQ1 2	26	0	3.6923	4.0000	4.00	.88405	.78154	3.00	2.00	5.00
AQ1 3	26	0	3.8077	4.0000	4.00	.89529	.80154	3.00	2.00	5.00
AQ14	26	0	3.8462	4.0000	4.00	.92487	.85538	3.00	2.00	5.00
AQ15	26	0	4.0000	4.0000	4.00	.80000	.64000	3.00	2.00	5.00
AQ16	26	0	3.6923	4.0000	4.00	.88405	.78154	3.00	2.00	5.00
AQ17	26	0	3.9231	4.0000	4.00	.89098	.79385	3.00	2.00	5.00
AQ1 8	26	0	3.8462	4.0000	3.00(a)	.96715	.93538	3.00	2.00	5.00
AQ19	26	0	4.0385	4.0000	4.00	.77360	.59846	2.00	3.00	5.00
BSQ1	26	0	2.3077	2.0000	3.00	1.01071	1.02154	3.00	1.00	4.00
BSQ2	26	0	2.3077	2.0000	2.00	1.04954	1.10154	3.00	1.00	4.00
BSQ3	25	1	2.0400	2.0000	2.00	.97809	.95667	3.00	1.00	4.00
BSQ4	26	0	2.0385	2.0000	2.00	.99923	.99846	3.00	1.00	4.00
BSQ5	26	0	1.8846	2.0000	2.00	.81618	.66615	3.00	1.00	4.00
BSQ6	26	0	2.2692	2.0000	2.00	1.04145	1.08462	3.00	1.00	4.00
BSQ7	26	0	2.5000	2.0000	2.00	1.10454	1.22000	3.00	1.00	4.00
BSQ8	26	0	2.1154	2.0000	2.00	.99305	.98615	3.00	1.00	4.00



### Appendix 3 (Sheet 2 of 2)

BSQ9	26	0	1.7692	2.0000	1.00	.86291	.74462	3.00	1.00	4.00
BSQ10	26	0	2.1923	2.0000	2.00	.98058	.96154	3.00	1.00	4.00
BSQ11	26	0	2.2308	2.0000	2.00	.99228	.98462	3.00	1(K)	4.00
BSQ12	26	0	2.0769	2.0000	2.00	1.09263	1.19385	3.00	1.00	4.00
BSQ13	26	0	2.2692	2.0000	2.00	1.00231	1.00462	3.00	1.00	4.00
BSQ14	26	0	2.0000	2.0000	1.00	1.13137	1.28000	3.00	1.00	4.00
BSQ15	26	0	2.0769	2.0000	1.00	1.16355	1.35385	4.00	1.00	5.00
BSQ16	26	0	2.2308	2.0000	2.00	.95111	.90462	3.00	1.00	4.00
BSQ17	26	0	2.0000	2.0000	2.00	.93808	.88000	3.00	1.00	4.00
BSQ18	26	0	2.1154	2.0000	1.00	1.14287	1.30615	3.00	1.00	4.00
BSQ19	26	0	2.1923	2.0000	2.00	1.09615	1.20154	3.00	1.00	4.00
BSK1	26	0	2.4615	3.0000	1.00	1.27219	1.61846	4.00	1.00	5.00
BSK2	26	0	2.6154	3.0000	1.00(a)	1.26734	1.60615	4.00	1.00	5.00
BSK3	25	1	2.2000	2.0000	1.00	1.04083	1.08333	3.00	1.00	4.00
BSK4	26	0	2.1538	2.0000	1.00	1.22286	1.49538	4.00	1.00	5.00
BSK5	26	0	2.0000	2.0000	1.00	.97980	.96000	3.00	1.00	4.00
BSK6	26	0	2.5385	2.5000	1.00	1.33359	1.77846	4.00	1.00	5.00
BSK7	26	0	2.6538	3.0000	1.00(a)	1.26309	1.59538	4.00	1.00	5.00
BSK8	26	0	2.0385	2.0000	1.00	1.03849	1.07846	3.00	1.00	4.00
BSK9	26	0	1.8077	1.5000	1.00	1.02056	1.04154	3.00	1.00	4.00
BSK10	26	0	2.1154	2.0000	1.00(a)	1.07059	1.14615	3.00	1.00	4.00
BSK11	26	0	2.1923	2.0000	2.00	1.13205	1.28154	4.00	1.00	5.00
BSK12	26	0	2.2308	2.0000	1.00	1.21021	1.46462	4.00	1.00	5.00
BSK13	26	0	2.4615	2.0000	2.00	1.17408	1.37846	4.00	1.00	5.00
BSK14	26	0	1.8846	2.0000	1.00	1.03255	1.06615	3.00	1.00	4.00
BSK15	26	0	2.1154	2.0000	1.00	1.24344	1.54615	4.00	1.00	5.00
BSK16	26	0	2.3462	2.5000	3.00	1.12933	1.27538	4.00	1.00	5.00
BSK17	26	0	2.0385	2.0000	1.00	1.03849	1.07846	3.00	1.00	4.00
BSK18	26	0	2.0769	2.0000	1.00	1.19743	1.43385	4.00	1.00	5.00
BSK19	26	0	2.4615	2.0000	1.00	1.30325	1.69846	4.00	1.00	5.00
SECTOR	25	1	1.9600	1.0000	1.00	1.17189	1.37333	3.00	1.00	4.00

Notes: (a) Multiple modes exist. The smallest value is shown

## One-Sample Kolmogorov-Smirnov Test

	N	Normal Parameters! a.b)		Kolmogorov-Smirnov Z	P values Asymp. Sig. (2-tailed)
		Mean	Std. Deviation		
AQ1	26	4.0385	.66216	1.491	.023
AQ2	26	3.8077	.89529	1.610	.011
AQ3	26	3.7692	.81524	1.157	.038
AQ4	26	3.8462	.73170	1.209	.007
AQ5	26	4.0000	.89443	1.093	.003
AQ6	26	3.7308	.82741	1.435	.033
AQ7	26	4.1154	.81618	1.282	.005
AQ8	26	3.8846	.81618	1.267	.001
AQ9	26	4.0769	.74421	1.190	.007
AQ10	26	3.6538	.74524	1.304	.007
AQ11	26	3.8077	.74936	1.497	.023
AQ12	26	3.6923	.88405	1.478	.025
AQ13	26	3.8077	.89529	1.218	.003
AQ14	26	3.8462	.92487	1.121	.002
AQ15	26	4.0000	.80000	1.373	.046
AQ16	26	3.6923	.88405	1.086	.009
AQ17	26	3.9231	.89098	1.352	.002
AQ18	26	3.8462	.96715	.988	.000
AQ19	26	4.0385	.77360	1.082	.000
BSQ1	26	2.3077	1.01071	1.096	.000
BSQ2	26	2.3077	1.04954	.980	.000
BSQ3	25	2.0400	.97809	1.382	.000
BSQ4	26	2.0385	.99923	1.255	.000
BSQ5	26	1.8846	.81618	1.282	.000
BSQ6	26	2.2692	1.04145	1.501	.000
BSQ7	26	2.5000	1.10454	1.283	.000
BSQ8	26	2.1154	.99305	1.216	.000
BSQ9	26	1.7692	.86291	1.403	.000
BSQ10	26	2.1923	.98058	1.573	.000
BSQ11	26	2.2308	.99228	1.449	.000
BSQ12	26	2.0769	1.09263	1.516	.000
BSQ13	26	2.2692	1.00231	1.324	.000
BSQ14	26	2.0000	1.13137	1.373	.000
BSQ15	26	2.0769	1.16355	1.253	.000

Appendix 4 (Sheet 2 of 2)

BSQ16	26	2.2308	.95111	1.273	.000
BSQ17	26	2.0000	.93808	1.177	.000
BSQ18	26	2.1154	1.14287	1.186	.000
BSQ19	26	2.1923	1.09615	1.336	.000
BSK1	26	2.4615	1.27219	1.126	.000
BSK2	26	2.6154	1.26734	.869	.000
BSK3	25	2.2000	1.04083	.978	.000
BSK4	26	2.1538	1.22286	1.236	.000
BSK5	26	2.0000	.97980	1.177	.000
BSK6	26	2.5385	1.33359	.935	.000
BSK7	26	2.6538	1.26309	.943	.000
BSK8	26	2.0385	1.03849	1.152	.000
BSK9	26	1.8077	1.02056	1.457	.000
BSK10	26	2.1154	1.07059	1.199	.000
BSK11	26	2.1923	1.13205	1.324	.000
BSK12	26	2.2308	1.21021	1.170	.000
BSK13	26	2.4615	1.17408	1.172	.000
BSK14	26	1.8846	1.03255	1.355	.000
BSK15	26	2.1154	1.24344	1.411	.000
BSK16	26	2.3462	1.12933	1.115	.000
BSK17	26	2.0385	1.03849	1.152	.000
BSK18	26	2.0769	1.19743	1.218	.000
BSK19	26	2.4615	1.30325	1.098	.000

Notes:

(a) Test distribution is Normal.

(b) Calculated from data.

## Appendix 5 (Sheet 1 of 2)

## Spearman's Rank Order Correlation on Section B

		BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	BSQ6	BSQ7	BSQ8	BSQ9	BSQ10	BSQ11	BSQ12	BSQ13	BSQ14	BSQ15	BSQ16	BSQ17	BSQ18	BSQ19
BSK1	Correlation Coefficient	.677(*)	.657(*)	.4860	.382	.363	.5310)	.5210)	.566(*)	.4270	.4390	.506(*)	.4880	.4830	.3950	.191	.211	.387	.4530	.552(*)
	Sig. (2-tailed)	.000	.000	.014	.054	.068	.005	.006	.003	.030	.025	.008	.011	.013	.046	.350	.300	.051	.020	.003
BSK2	Correlation Coefficient	.595(*)	.6670)	.609(*)	.4610	.4670	.5530)	.6450)	.4600	.640(*)	.4830	.387	.555(*)	.524(*)	.660(*)	.4170	.5310)	.358	.6270)	.4560
	Sig. (2-tailed)	.001	.000	.001	.018	.016	.003	.000	.018	.000	.012	.051	.003	.006	.000	.034	.005	.072	.001	.019
BSK3	Correlation Coefficient	.584(*)	.539(*)	.8980)	.7370)	.6260)	.7110)	.697(*)	.595(*)	.622(*)	.5190)	.5710)	.708(*)	.659(*)	.7270)	.4540	.5730)	.566(*)	.827(*)	.4940
	Sig. (2-tailed)	.002	.005	.000	.000	.001	.000	.000	.002	.001	.008	.003	.000	.000	.000	.023	.003	.003	.000	.012
BSK4	Correlation Coefficient	.582(*)	.512(*)	.652(*)	.884(*)	.5210)	.6890)	.6470)	.337	.590(*)	.4400	.586(*)	.4730	.545(*)	.5710)	.3980	.609(*)	.364	.4510	.4760
	Sig. (2-tailed)	.002	.007	.000	.000	.006	.000	.000	.093	.002	.025	.002	.015	.004	.002	.044	.001	.068	.021	.014
BSK5	Correlation Coefficient	.706(*)	.4510	.720(*)	.6240)	.909(*)	.6260)	.690(*)	.7150)	.6630)	.5700)	.7870)	.5180)	.691(*)	.7950)	.4580	.4670	.779(*)	.7380)	.6890)
	Sig. (2-tailed)	.000	.021	.000	.001	.000	.001	.000	.000	.000	.002	.000	.007	.000	.000	.019	.016	.000	.000	.000
BSK6	Correlation Coefficient	.501 (*)	.4370	.639(*)	.7360)	.4310	.8110)	.6470)	.4480	.4570	.4950	.502(*)	.600(*)	.7250)	.5170)	.7040)	.7840)	.4340	.622(*)	.5170)
	Sig. (2-tailed)	.009	.026	.001	.000	.028	.000	.000	.022	.019	.010	.009	.001	.000	.007	.000	.000	.027	.001	.007
BSK7	Correlation Coefficient	.639(*)	.3960	.812(*)	.659(*)	.6220)	.680(*)	.8150)	.6400)	.5390)	.579(*)	.6310)	.5580)	.7220)	.6840)	.4110	.5200)	.420(*)	.753(*)	.5630)
	Sig. (2-tailed)	.000	.045	.000	.000	.001	.000	.000	.000	.005	.002	.001	.003	.000	.000	.037	.006	.033	.000	.003
BSK8	Correlation Coefficient	.800(*)	.511(*)	.766(*)	.5480)	.6790)	.701(*)	.798(*)	.8370)	.556(*)	.578(*)	.7250)	.6040)	.707(*)	.6580)	.5290)	.4950	.6930)	.8160)	.668(*)
	Sig. (2-tailed)	.000	.008	.000	.004	.000	.000	.000	.000	.003	.002	.000	.001	.000	.000	.005	.010	.000	.000	.000
BSK9	Correlation Coefficient	.436(*)	.4060	.572(*)	.689(*)	.4660	.5790)	.4620	.340	.822(*)	.5270)	.5020)	.4880	.4290	.5650)	.369	.5750)	.4880	.4720	.4420
	Sig. (2-tailed)	.026	.040	.003	.000	.017	.002	.018	.089	.000	.006	.009	.011	.029	.003	.064	.002	.011	.015	.024
BSK10	Correlation Coefficient	.4800	.330	.5810)	.6200)	.4590	.6890)	.635(*)	.550(*)	.6760)	.7340)	.4850	.4150	.6020)	.4830	.4370	.6200)	.342	.5340)	.355
	Sig. (2-tailed)	.013	.099	.002	.001	.018	.000	.000	.004	.000	.000	.012	.035	.001	.013	.026	.001	.087	.005	.075
BSK11	Correlation Coefficient	.680(*)	.4480	.7060)	.654(*)	.7180)	.7140)	.666(*)	.7190)	.5340)	.5850)	.8080)	.4490	.7400)	.584(*)	.281	.4030	.586(*)	.605(*)	.6960)
	Sig. (2-tailed)	.000	.022	.000	.000	.000	.000	.000	.000	.005	.002	.000	.021	.000	.002	.164	.041	.002	.001	.000
BSK12	Correlation Coefficient	.509(*)	.626(*)	.7230)	.6730)	.4370	.5550)	.5310)	.4540)	.4220	.272	.378	.8720)	.5790)	.4680	.572(*)	.639(*)	.363	.6410)	.515(*)
	Sig. (2-tailed)	.008	.001	.000	.000	.025	.003	.005	.020	.032	.179	.057	.000	.002	.016	.002	.000	.068	.000	.007
BSK13	Correlation Coefficient	.4510	.4750	.6210)	.5630)	.4980)	.7480)	.5790)	.5410)	.578(*)	.5540)	.4660	.6270)	.837(*)	.6280)	.7700)	.8030)	.5720)	.750(*)	.616(*)
	Sig. (2-tailed)	.021	.014	.001	.003	.010	.000	.002	.004	.002	.003	.016	.001	.000	.001	.000	.000	.002	.000	.001

BSK14	Correlation Coefficient	.515(*)	.4300	.538(*)	.525(*)	.5470	.637(*)	.6170	.4870	.652(*)	.569(*)	.4380	.4230	.4290	.8710	.568(*)	.5410	.4610	.540(*)	.4750
	Sig. (2-tailed)	.007	.028	.006	.006	.004	.000	.001	.012	.000	.002	.025	.031	.029	.000	.002	.004	.018	.004	.014
BSK15	Correlation Coefficient	.3900	.509(*)	.355	.4260	.247	.5840	.5450	.4010	.4630	.380	.169	.499(*)	.470(*)	.569(*)	.9010	.771(*)	.366	.5060	.383
	Sig. (2-tailed)	.049	.008	.082	.030	.224	.002	.004	.042	.017	.056	.411	.009	.015	.002	.000	.000	.066	.008	.053
BSK16	Correlation Coefficient	.4460	.4310	.4200	.562(*)	.4290	.4510	.5550	.3930	.601(*)	.4140	.270	.5570	.4310	.382	.705(*)	.859(*)	.290	.4280	.293
	Sig. (2-tailed)	.022	.028	.037	.003	.029	.021	.003	.047	.001	.035	.182	.003	.028	.054	.000	.000	.150	.029	.146
BSK17	Correlation Coefficient	.557(*)	.283	.635(*)	.3960	.6710	.6510	.565(*)	.659(*)	.6540	.588(*)	.5710	.4690	.6750	.653(*)	.548(*)	.517(*)	.9140	.830(*)	.5840
	Sig. (2-tailed)	.003	.162	.001	.045	.000	.000	.003	.000	.000	.002	.002	.016	.000	.000	.004	.007	.000	.000	.002
	N	26	26	25	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
BSK18	Correlation Coefficient	.612(*)	.602(*)	.794(*)	.557(*)	.573(*)	.7390	.7300	.670(*)	.7750	.660(*)	.550(*)	.705(*)	.7340	.815(*)	.6180	.6600	.6370	.8770	.6250
	Sig. (2-tailed)	.001	.001	.000	.003	.002	.000	.000	.000	.000	.000	.004	.000	.000	.000	.001	.000	.000	.000	.001
	N	26	26	25	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
BSK19	Correlation Coefficient	.7250	.5780	.554(*)	.5660	.590(*)	.7120	.7160	.616(*)	.609(*)	.555(*)	.6190	.563(*)	.750(*)	.730(*)	.6590	.6050	.550(*)	.656(*)	.905(*)
	Sig. (2-tailed)	.000	.002	.004	.003	.002	.000	.000	.001	.001	.003	.001	.003	.000	.000	.000	.001	.004	.000	.000
	N	26	26	25	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

Notes:

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

SQ: Whether respondents believed that there has been a decline in quality of services

SK: Whether any decline is as a result of skills shortages

## **ETHICAL CLEARANCE FROM UNIVERSITY**



RESEARCH OFFICE (GOVAN MBEKI CENTRE)  
WESTVILLE CAMPUS  
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2 AUGUST 2006

MR. D JOHN (202511463)  
MANAGEMENT STUDIES

Dear Mr. John

ETHICAL CLEARANCE APPROVAL NUMBER: HSS/06360A

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

"The impact of skills shortages on client satisfaction at Stewart Scott international, an engineering consultancy firm, within South Africa"

Yours faithfully

.....I.W^Vvlo^,  
MS. PHUMELELE XIMBA  
RESEARCH OFFICE

PS: The following general condition is applicable to all projects that have been granted ethical clearance:

THE RELEVANT AUTHORITIES SHOULD BE CONTACTED IN ORDER TO OBTAIN THE NECESSARY APPROVAL SHOULD THE RESEARCH INVOLVE UTILIZATION OF SPACE AND/OR FACILITIES AT OTHER INSTITUTIONS/ORGANISATIONS. WHERE QUESTIONNAIRES ARE USED IN THE PROJECT, THE RESEARCHER SHOULD ENSURE THAT THE QUESTIONNAIRE INCLUDES A SECTION AT THE END WHICH SHOULD BE COMPLETED BY THE PARTICIPANT (PRIOR TO THE COMPLETION OF THE QUESTIONNAIRE) INDICATING THAT HE/SHE WAS INFORMED OF THE NATURE AND PURPOSE OF THE PROJECT AND THAT THE INFORMATION GIVEN WILL BE KEPT CONFIDENTIAL.

cc. Faculty Officer (Post-Graduate Studies)  
CC Supervisor (Ms. C O'Neill)