

**CHANGING PERCEPTIONS OF WOMEN IN  
THE SCIENCE, ENGINEERING AND  
TECHNOLOGY INDUSTRY:**

**Evaluating the Career Histories of Role  
Models in South Africa**

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SCIENCE, ENGINEERING AND TECHNOLOGY  
INDUSTRY:  
EVALUATING THE CAREER HISTORIES OF  
ROLE MODELS IN SOUTH AFRICA**

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# 1 INTRODUCTION

## 1.1 Background

Studies indicate that women are not represented sufficiently in Science, Engineering and Technology (SET) careers (European Commission, 2003; Greenfield, 2002). Previous research indicates that gender might influence the propensity to move into SET education and careers, i.e. that females are less inclined to do so. The perception amongst many women is that "science is an area for men". (Ideura et al, 2004). A host of factors influence the perception of and hence interest in science, engineering and technology (cf. Etzkowitz, Kemelgor, & Uzzi, 2000):

*"Several factors can explain why there are so few women in industrial research and why so many drop out. Firstly, there are barriers at entry level. Barriers to recruitment (biased hiring practices, for example), women's lack of self-confidence, lack of information on Science and Technology (S&T) careers, lack of career opportunities for women, lack of role models, a gender pay gap and gender stereotypes all play a role. Prejudices are particularly strong in the world of scientific research..." (European Commission, 2003, p.6).*

International studies indicate that women specifically in the field of Engineering do not adapt adequately in their chosen career and that many exit their career prematurely (cf. European Commission, 2003). It seems that this problem is most prevalent in the male-dominated environment of Engineering, but due to a lack of research, making comparisons with other fields is difficult. In South Africa one is limited to a study of the figures for current male/female distributions in the various job fields, which indicate the number of females entering certain careers (for instance, only 9 % of academic staff in engineering departments in South Africa are Women)(NACI, 2004:27). The initial hypothesis was that women find it difficult to adapt within a male-dominated environment, and so the extent to which work culture and perceptions, traditionally constructed by males, leads to females of various ages being disinclined to move into the science and technology arena needs to be investigated. It is, of course, easy to make the straightforward inference that females do not feel comfortable in a male dominated environment, but other reasons may also exist. In fact, it might emerge that a number of related factors contribute to the problem and that it is then compounded by the perception of the field of technology and science as a male domain.

Throughout the world, many organisations, including governments, business and educational institutions, promote and encourage the entry of girls into science. This is executed by means of attraction strategies which encourage increased participation by girls; as well as retention strategies that keep young women in the educational pipeline. The success of these strategies in reaching all girls is challenged by various factors including literacy levels, the rural location of many girls and the importance of maintaining the social and cultural structure of the diverse communities where girls are located across the globe. In some contexts, girls (and boys) accept general myths and beliefs that science or math is difficult and girls cannot do science as true (Bryne, 1993). One such belief is that women perform worse than men in technology-enhanced environments, where the argument goes that technology (such as computers) allows men to perform better due to the underlying myth is that women cannot and do not want to work with technology (see Anderson, Lankshear, Timms, & Courtney, 2008; Papastergiou, 2008). Although Mayer-Smith, Pedretti and Woodrow (2000) investigated the gender based differences in technology-enhanced environments and found that women fared equally well within mixed classes and particular technology enhanced classroom setups, other studies found the opposite with regard to the mode and nature of interaction in educational contexts.

Recent international surveys confirm the traditional problems women in SET experience, namely, family related problems, career breaks, work culture and atmosphere, and women's expectations (Donovan, Hodgson, Scanlon, & Whitelegg, 2005). Family related problems involve leaving a SET career for a partner's relocation, child rearing or caring for sick family members. Thus, women that do enter SET careers do not necessarily stay there (European Commission, 2003): "[E]vidence shows that it is more difficult for women to remain attached to the Science and Technology workforce or return after a significant break ..." (Peters *et al*, 2000:13). It is also more difficult to catch up on lost research time (Donovan *et al*, 2005). Work culture refers to the male dominated work environment into which women find it difficult to fit. In addition, expectations of women involve the idea that women will start families, rather than pursue professional careers.

Trends were found that at the tertiary level, fewer women than men study agriculture, science, and engineering, regardless of region, throughout the world. Even in nations where more women than men are enrolled at university, fewer women study sciences and technology (United Nations WISTAT database). This means that access to education is not sufficient in itself to increase the numbers of women entering the sciences. More must be done to address their lack of participation. A proper understanding of the attitudes, expectations and experiences underlying women's subject and career choices and performance in the wider field of science is still lacking. This lack of understanding of this complex issue is illustrated by the following:

- More than half of enrolments in higher education in 2001 in South Africa consisted of women (NACI, 2004). Although the participation of South African women in higher education has risen over the past few years, gender categorized data show that women are still under-represented in the sciences at both undergraduate and graduate levels (cf. also NACI, 2004, p.21).
- Assumptions are often made that women are not as committed to pursuing a career in the sciences as men, but when queried, the post-graduation plans of women and men in all scientific disciplines were remarkably similar. Women appear to have similar ambitions to those of men, contrary to the long-held belief that women are not as dedicated in pursuing a scientific career.
- The growing number of women receiving science degrees does not result in an increase in the numbers of women working in the scientific labour force. In addition, women trained in science and technology are not fully utilized.

In the working environment women are further confronted with informal discrimination such as gossip, sarcasm, humour, denial, language, rituals and remarks that emphasise gender inequality in science careers (Peters *et al*, 2002:45). At first glance, these incidents seem minor but they are part and parcel of bullying and harassment behaviour that may cause the premature exit of women in SET careers.

Alice Goddard (2004:1) asked a female scientist to give her view on how the situation had changed in the years she has been working as a scientist. Her answer was as follows:

*"...I think there is still a lot of prejudice in engineering, allied to the macho culture. It's demanding on a woman's psyche to impress some male engineers. If there's a culture of drinking and sport, women can feel excluded. Ideally, men and women working together should have complimentary skills, though men are often more combative. I do think women can have scientific insights that come less easily to men. I like to synthesise knowledge from a wide range of sources and put over the bigger picture in reviews. I notice many men have a tunnel vision approach and don't see the point of this."*

In a similar vein Peter *et al* (2002:29) quoted Osborn: "... according to recent reports overt discrimination is not the prime factor causing either not to enter, or to drift away from SET careers. Rather it is the perception and reality of the workplace, coupled with a systemic set of policies and processes that work together to create a culture that excludes or marginalises women."

## **1.2 Background to the commission of the current study**

This study was commissioned by the Science, Engineering and Technology for Women (SET4W) committee which is a permanent national advisory committee of the National Advisory Council on Innovation (NACI). It aims to provide advice on how to achieve equality between women and men in science, engineering and technology (SET) by integrating a gender equity perspective into policy-making and implementation of the National System of Innovation (NSI).

During the course of 2007 the SET4W committee initiated a project on the current perceptions of women in SET. It was agreed that increased visibility on women's achievements and contribution to the SET sector would encourage other women, particularly, young women and girls to pursue careers in SET. It was in the context of this discussion that SET4W commissioned a research study, *Changing Perceptions of Women in Science, Engineering and Technology (SET)*. The study intended to capture career histories of the selected role models in SET sector.

The purpose of the SET4W research study was to generate advice on what the government needs to do in order to support and possibly fast track the growth and development of women in SET sector. To this end, the objectives of the SET4W study were as follows:

- Factors that contributed to the role models' success in their SET careers;
- Obstacles and challenges they were confronted with in their SET workplaces and academia; and
- Ways on how to effectively enhance the participation of women in SET sector.

## **1.3 Purpose of the study**

The purpose of the study is briefly

- (a) to use a methodology appropriate to interviewing to obtain information about the careers of 19 pre-identified role models (women in high profile SET careers) which comprised Phase 1. The career fields included in this phase covered science in general. In Phase 2 information about the careers of 10 pre-identified role models between the ages of 25 and 35 years were obtained. The focus of their careers was on mechanical engineering, electrical engineering, nuclear physics and general physics.
- (b) To identify from the interviews, the factors that contribute to the interviewees' success in their respective careers. Information regarding obstacles they have experienced and ways they see how women can be involved in SET careers, will also be focused on. The results will be supported by additional information.

## **2 RESEARCH METHOD**

The method entailed interviewing and thematic analysis. An interview schedule was developed to include the aspects important to the client namely: a career history; what obstacles the person encountered; how the person dealt with those obstacles; what the career successes were; and what ideas the person has with regards to attracting women to SET careers (cf. Birbaumer, Lebano, Ponzellini, Tolar, & Wagner, 2007; Hayhoe, 2004; Shackleton, Riordan, & Simonis, 2006). The interview schedule can be found in Appendix 1. The current role of socio-political, socio-economic and other contextual factors were considered when probing for additional information.

Interviewers were trained to enable them to listen analytically and identify inadequate responses to questions, probe tactfully, motivate and maintain control. Interviews were conducted by one main interviewer with a supporting person doing the recording, taking additional notes and providing follow up where necessary. Some interviews were conducted simultaneously with only one person present. The majority of the interviews were of one hour duration. All interviewees completed a consent form, which was discussed with them. Seventeen face-to-face interviews and two electronic mail interviews were completed.

## **3 SAMPLING**

The final shortlist of role models provided by the client included women from both SET industry and NRF's A and B rated scientists. The SET industry from which some role models come comprised SAPPI, EXXARO, ESKOM, Anglo-Research, De Beers, MinTek and SASOL. The sample of role models was made to be ideally balanced in terms of race, SET careers and demography of the country to ensure diversity. In total there were nineteen (19) interviewees for Phase 1.

In total there were ten (10) interviewees for Phase 2. The SET industry from which some role models come comprised iThemba Labs, Richards Bay Coalmine, Telkom, the Department of Science and Technology, PBMR, National Nuclear Regulator, University of Pretoria and the CSIR.

## **4 DATA COLLECTION**

An interview schedule was compiled to include the issues required by the client. It was decided that a face-to-face interview would be most effective in allowing the interviewers to probe for particular issues. Structured questionnaires in this instance would have hampered the flow of conversation and the freedom to ask specific probing questions.

Interviews were digitally recorded, and interviewees were asked to agree to a consent form that will enable the researchers to use the information for research purposes and allow the client to use the information for marketing and publication purposes. It was agreed that any information that will be used will be authorised by the participants before use. The recorded interviews were transcribed verbatim by a number of research assistants.



## 5 ANALYSIS

A thematic analysis of the results (based on the transcribed interviews and field notes) was done based on the initial categories on which the interview schedule was developed. However, this deductive method was supplemented by an inductive approach whereby additional themes not identified initially, were identified. A reiterative process was followed where the themes were checked recursively, i.e. after a certain percentage of transcripts were analyzed; the process was re-started to check whether newer themes fit earlier analyzed transcripts. Initially, to ensure, reliability of the results, three researchers each worked on the transcriptions. The themes were compared for consistency and reworked.

## 6 RESULTS

### 6.1 Description of sample Phase 1

Table 1 provides the main descriptive information of the sample. The results are presented alphabetically and the interviews are discussed in the same order below. In the table, the interviewee's name, current position and company are indicated. Their main field of expertise is also indicated, along with the number of years in their respective positions. This is important because some participants have recently moved to a new position. The participant's ages, marital status and whether they have children is also indicated. This information is important in order to evaluate the impact of their personal circumstances on their careers.

**Table 1 Biographical details of the sample of Phase 1**

Surname	Current Position	Company	Field	Highest qualification	*Years in current position	Age	Marital status	Children
Patricia Berjak	Prof emeritus/ senior research associate	University of Kwazulu Natal	Plant cell and seed Biology	PhD Cell Biology	35	68	Married	Not mentioned
Vinotha Bheem	Programme Leader	SAPPI	Chemical Engineering	BSc Chemical Engineering	4	34	Married	No
Judith Bishop	Professor	University of Pretoria	Computer Science	PhD Computer Science	16	56		Yes
Anusuya Chinsamy-Turan	Professor	University of Cape Town	Paleobiology	PhD Palaeontology	11	45	Married	Yes
Judy Coates	Head BIOMED	MINTEK	Chemistry	PhD Chemistry	3.5	32	Married	No
Cheryl De La Rey	Chief Executive	Council on Higher Education	Psychology Environmental	PhD Psychology	1 month	46	Married	No
Stephanie De Villiers	Officer Associate professor	University of Fort Hare	Geochemistry	PhD Oceanography	4 months	42	No	No

Surname	Current Position	Company	Field	Highest qualification	*Years in current position	Age	Marital status	Children
Bronwynne Ferreira	Principal metallurgist	Anglo Research	Chemical Engineering / metallurgy	MSc Chemical Engineering	2	29	Married	No
Isabel Fick	Grid manager	ESKOM	Engineering/ Management	MBA	3	37	Married	Yes
Diane Hildebrandt	Director SARCHI Professor	COMPS WITS University	Process design, Chemical engineering	PhD Design Research	8	46	Married	Yes
Erica Johnson	Chief Officer: Networks and Customer Service	ESKOM	Electrical Engineering/ management	MSc Electrical Engineering	3 months	39	No	No
Ryneth Nengovhela	Scientist	EXXARO	Chemistry	PhD Chemistry	7 months	30	Married	Yes
Stella Nkomo	Professor	Graduate School of Business UNISA	Management and organization	PhD Management	8	61	Married	Not mentioned
Tebello Nyokong	DST/NRF Chair, professor of medicinal chemistry and nanotechnology	Rhodes University	Chemistry	PhD Chemistry	11	56	Widow	Not mentioned
Belinda Reyers	Principal researcher	CSIR	Conservation Biology	PhD Zoology	3	33	Living together	No
Mamokgethi Setati	Executive Dean of College of Science, Engineering and technology; Full professor	UNISA	Mathematics Education	PhD Mathematics	1	42	No	Yes
Kathryn Sole	Technical specialist	Anglo research	Metallurgical engineering	PhD Metallurgical Engineering	2	46	Single	No
Beverley Sukhdeo	General manager	SAPPI	Business	MBA	6 months	40	Married	Yes
Nadine Van Tonder	Live work PTO	Eskom	Electrical studies	N4 Electrical Studies	6	26	Single	No

\* Number of years and months in current career up to May 2008.

Some of the information provided in the table above is summarised in Table 2 and Table 3. Table 32 provides information regarding marital status. Fifty-seven percent of the sample is married. Table 3 shows whether the women in the sample have children. It can be seen that 37 % have children, whilst the majority (47 %) do not have children.

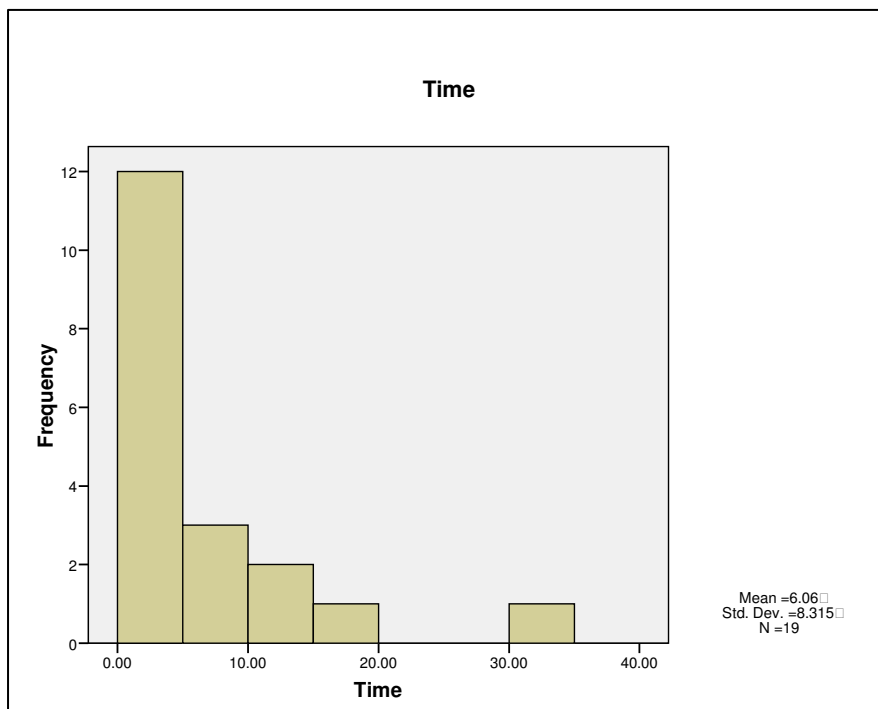
**Table 2 Marital status distribution**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5.3	5.3	5.3
Married	11	57.9	57.9	63.2
No	7	36.8	36.8	100.0
Total	19	100.0	100.0	

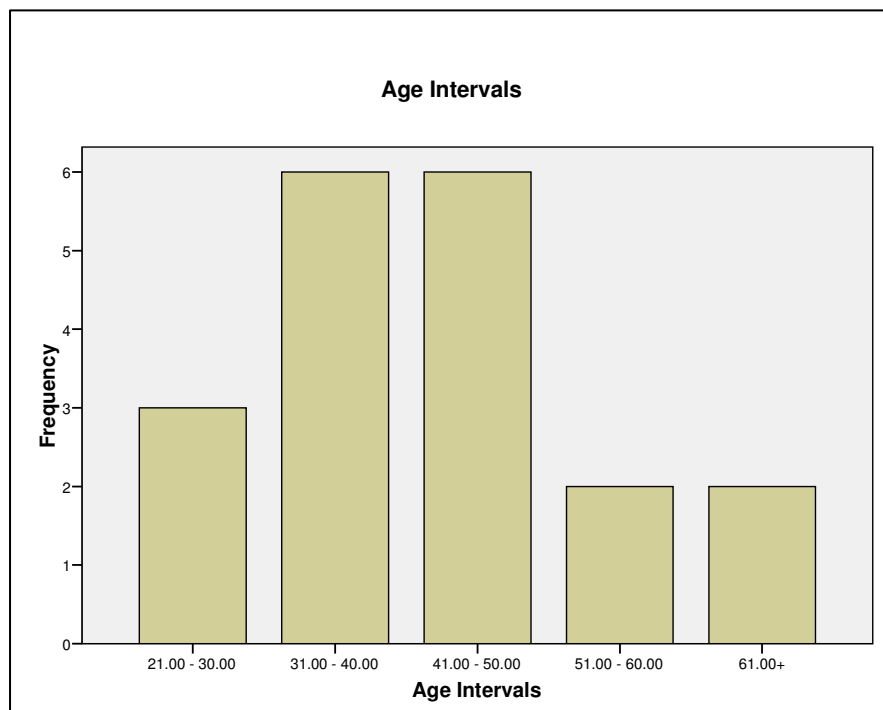
**Table 3 Children distribution**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9	47.4	47.4	47.4
No	3	15.8	15.8	63.2
Not mentioned	7	36.8	36.8	100.0
Yes	19	100.0	100.0	

Figure 1 shows the distribution of the time members of the sample have been employed with their *current* employers. The average time is 6 years, but one can see that the distribution is skewed. Figure 2 indicates the age distribution of the sample with a mean of 42.5 (SD = 11.38; N = 19).



**Figure 1 Time in current post employed of the sample (years)**



**Figure 2 Age distribution of the sample**

## 6.2 Description of sample Phase 2

**In**

Table 4 relevant information for the sample is provided. Half or 50 % of the women are married. Their ages range from 26 to 39 with an average age of 32 years.

**Table 4 Biographical details of the sample of Phase 2**

Surname	Current Position	Company	Field	Highest qualification	*Years in current position	Age	Marital status	Children
Isendu Aghachi	Senior Lecturer	Tshwane University of Technology	Mechanical Engineering	MSc Mechanical Engineering	10 years	39	Married	3
Zinhle Buthelezi	Researcher	iThemba Labs	Nuclear Physics	PhD Nuclear Physics	8 years	36	Single	None
Amanda Kgokane	Structural Specialist	Richards Bay Coal Terminal	Management/ Mechanical engineering	Technical Diploma Mechanical Engineering	6 months	29	Married	
Ntando Dhlamini	Manager: Technical	Telkom	Electrical Engineering	BSc Electrical Engineering	6 months	27	Single	None

Surname	Current Position	Company	Field	Highest qualification	*Years in current position	Age	Marital status	Children
	product development							
Mathoto Thaoge- Lefyedi	Deputy Director	DST	Microbiology/ Astronomy	PhD Food Science	2 months	34	Married	2
Mosidi Makgae	Manager: Waste and Nuclear Liability Management	PBMR	Chemistry	PhD Chemistry	3 years	33	Divorced	None mentioned
Margaret Mkhosi	Senior Specialist: nuclear engineering	National Nuclear regulator	Nuclear engineering	PhD Nuclear Engineering	3 months	37	Married	1
Peladi Mohlala	Research Scientist	University of Pretoria	Surface analysis	MSc	8 years	28	Married	None mentioned
Mamoeletsi Mosia	Manager: SET professional development programme	CSIR	Human Capital development/ Chemistry	PhD Polymer Chemistry	2 months	33	Single	None
Verosha Singh	OPS specialist	Telkom	Tele- communications	MSc Tele- communication	1 year	26	Single	None

\* Number of years and months in current career up to September 2008.

### 6.3 Summary of interviews Phase 1

In the follow section, the interviews will be summarised according to the main themes of the interview schedule. The questions will be listed as they appear in the interview schedule (see Appendix 1) to facilitate ease of reading. The complete interview transcripts are available from NACI.

#### 6.3.1 *Berjak*

**(a) Tell me about your what your current career entails**

She is involved in seed research at the University of Kwa-Zulu Natal. Her interest lies specifically in researching seeds that cannot be stored or dried – so-called recalcitrant seeds. She is also involved with postgraduate student supervision.

**(b) Why would you regard yourself as successful in your SET career?**

She is very determined and believes that nothing is impossible. She has a very supportive husband.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She did not experience difficulties at all, except on one occasion when she was bypassed for a job application because she was female. However this experience motivated her to achieve more.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She did not plan to become a seed scientist – however, she did begin her studies in the natural sciences and due to what she calls ‘serendipity’, ended up where she is now. Her father was involved in medical science, but she did not wish to pursue that field of study. However, she was sure her choice would be in the natural sciences and not the human sciences. Her father was very ambitious for his children and pushed them to perform.

**(e) Which factors contribute towards you remaining a professional in this field?**

She is an A-rated scientist at the NRF and enjoys working in her chosen field. Her research and science is progressing well and she has international standing as a scientist. She finds the process of doing science very enjoyable.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She did not really experience difficulties. However, she is very outspoken against treating women as being incapable of doing science or assigning women to traditional roles. She also points out that the female scientists she knows are ambitious and make things happen (they are “go-getters”).

**(g) How did your personal life influence your professional life and vice-versa?**

She shares her science interest, plus other hobbies such as ballroom dancing, with her partner.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She feels that an important piece of advice to young women embarking on a career in science is to marry a supportive person who encourages her to achieve (“who is actually very pleased about your endeavours and achievements”). She regards her being married to a fellow scientist as an example to the senior students. She also emphasizes having a balance in one’s life and not to work all the time.

She feels that her achievements and enthusiasm are important characteristics of a role model.

One can see which students have potential not only by their performance, but by them having real interest and drive (being “switched on”).

She feels that one should focus on school children. They must get into science for the right reasons. For example, getting into medical sciences is often a social status issue and not so much what they really want to do. One must also change the attitude in learners that certain careers are for men and some for women: science is for everyone. Cultural and familial issues hamper participation in science, such as some Indian girls not being allowed to go on science camps. She acknowledges that one needs an intermediary, such as a sociologist or anthropologist, to understand the contextual issues and needs of girls – it will not merely help to get children to participate in things like science camps (“somewhere you’ve got to break the taboos”).

The role of parents and teachers is important in conveying science to pupils. She describes an instance of where teachers were exposed to conservation practices by a local farmer. As a result, they became excited about science-related issues and conveyed the message to the learners.

### **6.3.2 Bheem**

**(a) Tell me about your what your current career entails**

She works at SAPPI at the Innovation Hub in Pretoria. She does research and development. She develops innovative paper products. She also manages a few technicians and shares her knowledge.

**(b) Why would you regard yourself as successful in your SET career?**

She says that the enjoyment she gets from what she does is an indicator of her success. It entails enjoyment if ideas are translated into products. Her work provides her with a living. Her current career gives her the opportunity to balance her personal and work life.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She regards the fact that engineering does not pay as well as BCom careers as a demotivating factor for both males and females. The type of environment could also put females off: it is not clean and one has to wear boots and overalls. Issues such as the availability of toilets for females (non-existent or far away from the plant) can also be difficult.

In the beginning of her career, she experienced resistance from the older males. She points out that they did not know how to respond to a female and that she was better qualified than them, which caused them to feel threatened. One has to cope with nasty comments and they do not share information due to a lack of trust. The younger males and engineers are not a problem and she could see their attitudes change.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her parents played a role in motivating her to study math and science. Her father motivated her to be self-sufficient and independent. He was also involved in a technically orientated field. He emphasized that women were equal to men.

**(e) Which factors contribute towards you remaining a professional in this field?**

She finds her career challenging and exciting, and enjoys working in a hands-on environment: "putting on boots and...getting dirty".

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She mentions resistance of male colleagues to sharing information with her, nasty comments and difficulties regarding facilities for women (toilets). To overcome these difficulties, she mentions being humble and down to earth, and trying to win the confidence of male colleagues.

**(g) How did your personal life influence your professional life and vice-versa?**

Her husband also works in engineering but she maintains a balanced life. She found her previous job tiring and stressful (as a process engineer) and found that a research environment suits her best.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

One has to inform children that not all of the knowledge one has gained will be applied in a particular field - the actual application in a field could be much more complicated than one expects. Thus, the exposure to real-world applications is important.

There are a number of obstacles on this particular career path, but she would regard her perseverance as that which she wants to hold up as an example to others. One has to go on despite negativity. One also has to stay humble.

Children need to be exposed to the industry and science has to be marketed. The media such as movies portray scientists as geeks/nerds and that should change. The perception that math and science are difficult also needs to change.

### **6.3.3 Bishop**

**(a) Tell me about your what your current career entails**

She works in computer science and specifically with programming languages and distributed systems. Her job entails typical university duties such as lecturing, research, administrative and management duties. She is also heading a research project group, is involved in organizing conferences, international programme committees, do summer schools, and writes books.

**(b) Why would you regard yourself as successful in your SET career?**

She regards herself as successful because she is regarded as an expert and is often consulted. Her NRF rating also shows that she is the top woman computer scientist in the country.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She mentions that one should not become discouraged and that one should actively look for opportunities. One should not let being a woman become an excuse for not succeeding. As a woman one should push harder.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She was born in Grahamstown, which has a strong academic tradition, and she knew from the start she wished to embark on an academic career. Her interest in computer science started when she observed the enthusiasm surrounding the newly introduced computer science degree. She wanted to go the UK for her doctorate, but funding was closed to females. Her parents supported her financially initially. She has a drive to succeed and thus strong motivation to progress in her career. She also mentioned that her parents' faith in her to succeed spurred her on to achieve greater heights.

In a humorous aside, she mentions that her interest in boys got her into science - she had a keen mind and could converse with them about their interests.

**(e) Which factors contribute towards you remaining a professional in this field?**

She pursued the option of being an academic, whilst having the support to also be a mother. She was given sufficient support to work from home. She also enjoyed moving into management and thus mentioned three aspects that keep her in her role: support, money and fulfilment.



**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

In the past, women were not very vocal at the university and she claims that she had to be careful to step out of this mode and expectations. As a person with good ideas and ways to solve problems, she had to negotiate her way around the fact that women could not be seen to take a leading role. She voiced her concerns and solutions through persons and processes that then eventually achieved success. Not receiving acknowledgment at the time did not bother her.

**(g) How did your personal life influence your professional life and vice-versa?**

She is of the opinion that younger people closer to the current generation could contribute more meaningfully to indicating how to balance personal and work life, since the time and context in which she developed as a scientist is quite different to that of today.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She mentions a number of characteristics such as not being rude, selfish or disorganized. To be a role model one should be helpful which takes a lot of time and energy. Enthusiasm and enjoyment of one's career is also important. She also emphasized that accommodating her children on her travels was not difficult and this can also be included in being a role model.

School children should be exposed to opportunities in sciences and not be forced to make choices too early. They must, even at university level, be allowed to explore and find that which interests them in the scientific arena.

Science should be advertised to children at school - road-shows and science festivals should be encouraged. One should limit the number of students accepted into other degree programmes such as BCom. Public awareness campaigns such as the 'Women in Science' awards should be encouraged. Children's books on science should also be encouraged for children of twelve years onwards.

### **6.3.4 Chinsamy-Turan**

**(a) Tell me about your what your current career entails**

She is a paleobiologist working at the University of Cape Town. She works on the reconstruction of the biology of extinct animals. The microscopic structure of bone growth gives clues about the growth and biology of animals. It is a typical university position involving research and lecturing.

**(b) Why would you regard yourself as successful in your SET career?**

Because the field is very specialized, not many people do this kind of work. She is one of the few that leads the field and has done some foundational work. She also contributes in the field based on the discovery of new fossils. The field can also contribute to understanding modern or non-extinct animals.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She experienced her preparation for her academic career as a student as difficult in terms of her race and not her gender. As a black person, her studies at WITS were difficult during the apartheid era because of the restriction on black people studying at university. She also opted to stay at home and not in the available residences which made driving to and from

the university quite trying. In addition, students of colour did not have easy access to information and resources, which luckily changed. Obtaining bursaries was also very difficult. Thus, finishing her first degree was difficult. However, she says that her post graduate studies were easier.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She regards her father as the motivating factor in her career and studies. He is an Indian teacher with high standing in the community. He motivated his three daughters to stand up as individuals who value education highly and who should not be afraid to have opinions and speak their minds. Thus, contrary to traditional Indian culture which expects women to play a submissive role, they were taught to be independent. She wanted to become a science teacher because this is what her father did, but also because she was interested in science. Her father motivated her to do a degree rather than a diploma. In the end she obtained the degree, a teacher's diploma and an honours degree. Whilst doing her PhD she obtained a position at the University. Although she said she always loved science, she acknowledged having a healthy curiosity in scientific aspects of the environment. She also credits Indian schools for not perpetuating submissive attitudes but encouraging girls to excel in science and math.

**(e) Which factors contribute towards you remaining a professional in this field?**

She initially had emotional and financial support from her family which she values greatly. Currently, she has a support system at home. Her partner is very supportive. Thus she receives help with the young children and she is able to attend conferences and travel. The responsibilities at home are equally shared between her husband and herself.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She perceived the difficulties she experienced as being a result of being a black person rather than as a result of being a woman. Her family assisted her to overcome the difficulties, including the financial ones.

**(g) How did your personal life influence your professional life and vice-versa?**

She reiterates that she receives support from her husband. She is able to organise the responsibilities towards the children well. She maintains that her children come before her career and if she needs to choose she would opt for her children. However, her system at home works very well. University life is flexible, enabling parents to fulfil their responsibilities. Her husband is also in the position to be flexible with his hours.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She regards the balance she obtains between family life and a career in science as an example to young women. Secondly, she would encourage them to choose their partners very carefully. She says that women should be assertive in terms of their choices: it should involve their careers but it should also involve lifestyle aspects.

She also feels that promotion of science should happen at school level. Children have a natural curiosity and one should capitalise on this – for example, she has written a children's book on African dinosaurs.

### **6.3.5 Coates**

**(a) Tell me about your what your current career entails**

She works at MINTEK and is head of the Biomed programme. It involves collaboration between MINTEK and Harmony Gold which entails finding new medical applications for gold, including treatments for cancer, HIV and malaria. Her work also involves managing approximately 30 researchers.

**(b) Why would you regard yourself as successful in your SET career?**

She says that she does not regard herself as successful in the traditional sense of the word since she does not define success in terms of acknowledgement, or the number of articles on her CV. Rather, she defines success in terms of seeing people grow intellectually and personally, whether they are children, students or a team of researchers.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She experienced some difficulty at university because of the male dominated environment. She perceived the university structures as being male dominated and observed that the few female lecturers present did not form part of the "Old Boys" club. In addition, males filled the top positions at university. However, at MINTEK she did not experience the same imbalance and mentions that she had female managers.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She was initially unsure of which career path to choose, primarily because she wished to follow her father, who was an accountant, but she was also very interested in science. However after talking to one of her mother's friends; the fact that she did well in science at school; her interest in medical issues and the bursary she obtained from MINTEK, she was compelled to go in a scientific direction. She did her honours in organic chemistry and then her MSc and PhD. A position on MINTEK's biomedical programme was offered to her. She was seconded to a Biomedical lab at a university, worked in Germany for a few months and then joined MINTEK. She mentioned that in some sense she knew from school that she would embark on a scientific career.

She mentions that she had a passionate science teacher. When she completed her PhD she was still torn between teaching and the practical application of science. Currently she is able to do both. She also had a female lecturer in Chemistry at university that she identifies as a mentor. The lecturer motivated and supported her, and allowed her to present some lectures.

**(e) Which factors contribute towards you remaining a professional in this field?**

She has passion for her work, referring to her project as her "baby". She is also loyal to her co-workers and wants to stay with them for a given period. She is also committed to the students in her employment.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She identifies her age rather than her gender as the main obstacle in her career thus far. People are always surprised to see how young she is. She says that the way to combat the perception of being young and inexperienced is to always be professional in one's communications; to be always on time for meetings; and to be well prepared. Thus, even before people met her she created the expectation of an experienced and professional person and then her age never came up as an issue.

At MINTEK she had to deal with her university seniors (she was at university for 9 years) and it took some time to establish trust so that they respected her as an equal and not a student to boss around. She said that as a person awarding bursaries she easily could have used the power of her position, but instead she opted for building trust.

She also mentions that in the early stages of her job she encountered jealousy and negative attitudes because of her accomplishments. She says that one cannot rely on the fact that if people use your title to address you, they necessarily respect you. Respect only comes with hard work and the establishment of trust.

**(g) How did your personal life influence your professional life and vice-versa?**

She finds the combination of home and work responsibilities challenging. Her partner, now her husband, takes this in his stride. She thinks that it is important at this stage to allow more time for work, because women need to work harder than men to establish themselves as credible. She realises that her priorities will change in future when she starts a family, but for now her career has priority. Now that she has established herself at work, she can delegate more and start finding a balance between work and personal life. She tries to set boundaries for her work although she does sometimes work over weekends. She has a number of interests outside work, such as teaching Sunday School and being involved in the church. These activities increase her quality of life.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She regards a role model as someone who "*loves what they are doing and promotes that they are happy and enjoy it.*" She also feels that commitment involves working hard and getting the respect of those with whom one works. She also thinks that as a role model one should convey the message that trusting your instincts is better than listening to advice and doing the wrong thing. She feels that gender should not play a role in science: success is not determined by gender.

### **6.3.6 De La Rey**

**(a) Tell me about your what your current career entails**

She is the Chief Executive Officer at the Council on Higher Education and also the Chair for the group on *Science, Engineering and Technology for Women*.

**(b) Why would you regard yourself as successful in your SET career?**

She mentions that although it may not seem as if her career fits into the SET definition, it does, because she is an academic and researcher. In terms of her role as research psychologist, she measures her success in terms of papers published, senior students supervised, number of invitations for keynote addresses, and the impact of her research. In terms of her management and executive role, the indication of success she sees as important is whether one meets the objectives that have been set for one's role.

**(c) Did you find it difficult as a woman to achieve success in your career?**

The gender specific issue that she believes is usually foremost in everyone's minds is family and domestic responsibilities. She mentions that even though she chose not to have children, she still has a household to run. She also mentions dealing with gender specific expectations and countering stereotypes about women's capabilities.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her interest in research on women's careers developed before she began her PhD, which focused specifically on this topic. Becoming chair of the committee was part of that interest and driven by a desire to make a contribution to the restructuring of institutional arrangements in Higher Education by means of research. She summarises by stating that her motivation has been a combination of having been in the setting she was at the time, having a personal interest, and taking up the opportunities that arose.

**(e) Which factors contribute towards you remaining a professional in this field?**

She finds a source of satisfaction in seeing her work having an impact.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She mentions that the process of overcoming gender bias is a continuous one, but also that one should be deliberate and think about it. She mentions allowing herself to take on roles that are traditionally not women's roles and overcoming any anxiety about this; as well as acknowledging that success and failure are both part of one's life, as two instances of this process. She proposes that dealing with societal expectations around traditional gender roles is a specific problem for women in SET.

**(g) How did your personal life influence your professional life and vice-versa?**

She mentions that it is always difficult to balance one's personal and professional life, and that it depends on how one manages one's time as well as one's home situation.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She believes that showcasing women who have been able to succeed within SET careers and assisting the Minister to facilitate the pathway for the next generation of women by identifying possible obstacles, will allow for more women and girls to embark upon successful SET careers.

### **6.3.7 De Villiers**

**(a) Tell me about your what your current career entails**

She is an academic at the University of Fort Hare. She works in Earth Science, especially analytical chemistry related to climate change.

**(b) Why would you regard yourself as successful in your SET career?**

She defines success as fulfilling one's potential as a human being and as a scientist. She is a research orientated academic, although she enjoys teaching.

**(c) Did you find it difficult as a woman to achieve success in your career?**

After her post-doctoral work in the USA, she returned to South Africa but found it very difficult in the male dominated environment. In her experience, it is difficult to express your interest in teaching as a female because one gets labelled as a teaching-orientated academic. She found a discrepancy between those that believe in her ability locally and overseas – she had much more support overseas than from her local male peers. It seems that she experienced discrimination as a female scientist at a particular university.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her grandmother and her parents inspired her in her career. She thinks that her science and math teachers had an important influence on her. She also had a CSIR bursary which required her to work in holidays, which she found inspiring and motivating.

**(e) Which factors contribute towards you remaining a professional in this field?**

Currently, the students at Fort Hare inspire her to remain in the field; and she is committed to staying for a few years to teach.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

Since she has returned to South Africa, she has perceived the academic environment in which she has moved as being hostile to females. She has found it very difficult to overcome this difficulty.

**(g) How did your personal life influence your professional life and vice-versa?**

She is single and this provides her with the flexibility to commit to her career.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She does not see herself as a role model but rather as a mentor: she believes there is a difference. She says that she did not become a scientist because she had a role model in science. She has a problem with the concept of role models.

She does not think that a focus on high school students is the answer and says that she can only speak about students. She thinks that one should encourage all students to perform better, not only females. She attributes the difficulties that female and black students experience to the political environment within academic departments. She feels this is very different from that in overseas departments. She finds the academic culture and environment at most universities still white male dominated. Female scientists in those departments should be identified as role models.

She acknowledges the problems at school level and thinks that enthusiastic teachers are required. However, she feels that more can be achieved at the tertiary level by focusing on issues such as degree structures. By abolishing the Honours degree, for example, one can retain students for four years before they move into jobs. This ensures better training.

### **6.3.8 Ferreira**

**(a) Tell me about your what your current career entails**

She is a chemical engineer working at Anglo Research. She specializes in electro-chemical engineering. Her works entails testing new ideas, presenting the ideas, building pilot demonstrations and finally commissioning plants. She is also involved in visiting sites and supporting existing plants and operations. Her main focus is research and development work.

**(b) Why would you regard yourself as successful in your SET career?**

She thinks that if you measure success by money, the kind of car you drive and whether you manage financially, then she is moderately successful. However, for her success is to be good at what you do and to develop continuously. She feels she is getting there.

**(c) Did you find it difficult as a woman to achieve success in your career?**

On the whole, she has not had difficulties as a woman in her line of work. She thinks that a previous generation broke down the barriers for women in science. However, she feels that women still have to work a bit harder to prove themselves equal to men. Discrimination is very subtle. However, overt discrimination is not as severe as it used to be. Her focus on her work dominates her thinking to such an extent that she is often not aware of overt discrimination. However, she acknowledges that women might find challenges in the industry.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She did not know that she become a chemical engineer from an early age, but her mother, who loved math and science, played a large role in instilling a love for these areas of study in her. Her mother, who was very dedicated to raising their large family, assisted in her homework. Her mother's stories about her meetings with engineers when she had to work as a representative for heat exchangers and oil coolers made a great impression on Ferreira. Her mother's motivation also led her to take up a bursary with Anglo; she worked for a year and then eventually studied chemical engineering. Thus, her mother's motivation and her home environment provided the necessary exposure and stimulus for embarking on her particular career. Her father was a role model in terms of inspiring dedication and getting the work done.

**(e) Which factors contribute towards you remaining a professional in this field?**

She has a good support system and supportive husband.

She loves what she does and compares her project to a child that she wants to nurture and see grow up.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She mentions that men and women have different personalities when it comes to the world of work – the business world is adapted to men's personalities. She believes that men can separate work and personal feelings, for example, they may argue at meetings and afterwards still be friends. As a woman, she considers herself to be more nurturing, and someone who carries her emotional issues into the boardroom.

**(g) How did your personal life influence your professional life and vice-versa?**

Because she experiences herself as passionate and emotional, she has difficulty separating criticism of her work from her personal feelings. However, she also is driven and willing to achieve.

Her husband provides an excellent support system – he allowed her to complete her studies. They share household duties. She also acknowledged that she probably does not achieve a balance between her work and family life, and concentrates more on her work.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Her mother taught her that one should be confident, i.e. that one can do anything one puts one's mind to. This mindset should be taught to children.

She thinks that girls and boys should be taught about each other's strengths and weaknesses. She believes that women are more emotional.

She emphasizes that a female in a career should choose her partner wisely in order to find the necessary support.

On the whole, she does not believe that one should have role models. She emphasizes that being passionate and motivated are far more important. Women can go into any career if they are passionate.

It is also important to get the message to children that engineering with its many fields is a good options for a career. Thus, the emphasis should be on advertising campaigns. Teachers need to be passionate about science because that is how one instils passion in children.

### **6.3.9 Fick**

**(a) Tell me about your what your current career entails**

She works at Eskom as a grid manager for the high voltage national grid. She is responsible for one of the 8 national areas. She is involved with management, operations and maintenance of the plant.

**(b) Why would you regard yourself as successful in your SET career?**

She regards success as a process of evolving from one's studies to getting a job and so on. Success to her is building on previous experience. One must have drive, take chances (in order to utilize opportunities) and work hard to achieve success. She also participates in maintenance once in a while and that gains the respect of the males.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She does not currently experience problems as a woman and manager. She has never experienced difficulties as a woman, excepting for when she started her career when there was some resistance from older males. Her attitude is that it is their problem, not hers.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She had an excellent mentor that allowed her to participate in all activities in the engineering environment. He also taught her the importance of relationship building and networking.

Her parents played a strong role in her motivation: they emphasized that she can do anything she wanted to do. Thus when she wanted to study engineering, some people were resistant, but to her it was not an issue. She also had support from her family in general. She mentioned two teachers who believed she could succeed. She elaborated in detail how the support of these teachers' motivated her to study engineering. She made her career choice in Grade 9 when she attended a science expo.



**(e) Which factors contribute towards you remaining a professional in this field?**

She loves what she does. She thinks the choice she has to get involved in practical matters is important, because she could not only do a desk job. She is very positive regarding how the field she is involved in can contribute to South Africa (despite the current problems).

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

See (c) above.

**(g) How did your personal life influence your professional life and vice-versa?**

Resilience and the ability to take pressure are important. She also had to learn to relax. She took a leading role in the household when her mom had cancer while she was still in her parents' home. Because of the responsibility she took she developed a strong personality.

She views her roles in order of importance: woman, wife, mother and engineer. However, she does experience conflict surrounding her roles because she travels frequently and would like to make some adaptation to be more available for her sons. She receives support from her husband and if it were not for him she would not have achieved what she did.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

It is possible to be a leading woman in SET and one must believe: *"Don't listen to people that are saying you can't do it or have their only little things about what women can or cannot achieve."* The perceptions about gender specific careers must be changed (*"make your choice based on what you like to do"*). However, one should make an informed choice because it is hard work: she provides a few examples about situations that could be difficult for a woman in a technical field. Although females can do the job, the impact of the job on personal and family life could be detrimental at some stages.

### **6.3.10 Hildebrandt**

**(a) Tell me about your what your current career entails**

She directs twenty full-time staff at a research centre at the Faculty of Engineering at WITS. They do process design for reducing CO<sub>2</sub> emissions. The centre has projects running in many countries such as Australia, China and the USA. She is involved in supervising the research of students (mostly post-graduate), and in technical issues such as finding projects and funding.

**(b) Why would you regard yourself as successful in your SET career?**

She has two goals, namely, the development of persons with postgraduate qualifications that can lead industry and government. As such, the centre fully funds 40 PhDs. Secondly, the reduction of CO<sub>2</sub> emissions is her passion because of the chemical industry's impact on the environment. She feels her research is on the leading edge to contribute to this goal.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She did not really experience difficulties. She regards being a woman an advantage because there were not many women in her field when she started, so this contributed to her gaining prominence in the field. She feels the university environment accommodates women scientists well.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She began her studies by registering for a BA, but quickly changed to nuclear physics. She realized that this career was not conducive to making a living and so went to Engineering faculty to ask which department would take her on as a second year. Chemical engineering agreed to take her on as a student and that is how she landed in her career.

At school she had a teacher that was negative towards females taking science, but this attitude just motivated her to do well out of stubbornness. Eventually it developed into an interest.

**(e) Which factors contribute towards you remaining a professional in this field?**

Although sometimes she thinks that she could easily stop, her long term goals and her teaching keep her in the field. The developments in the field also keep her motivated and interested.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She experienced difficulties in both her studies and work. The engineering departments were mainly male dominated, although the situation did change slightly over the years. She was very self-conscious being one of the few females in the classes but eventually overcame her shyness with stubbornness and determination. She did not really experience difficulties at work, excepting for minor logistical problems such as no toilets for women in the mines. She also was not allowed to work underground and had to put up with sexist remarks from males (which she terms "silly"). Her bosses, though, were open-minded.

**(g) How did your personal life influence your professional life and vice-versa?**

Her current working environment is supportive and accommodating of religious and family responsibilities. Work was delegated when her children were very young. She also finds that flexibility and time management is important. She is assertive and evaluates the relative value of activities that may keep her away from her family before agreeing to take part in them.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She would like to regard herself as an example showing that a career in SET is possible for women. She feels that science should be made accessible to females. In this regard she says that males and females are attracted to chemical engineering for different reasons and that one should use those differences when trying to attract students. For instance, females would respond to those facets of the career that could help society and the environment. She would also point to the creative and exciting side of her field. She likens math and the basic subjects as the tools for greater goals.

She found that her efforts to reach school children to motivate them to study science were not having much of an effect. She is therefore not a keen advocate of campaign drives at schools. She believes they are not worth the time and effort compared to the results. She would rather focus on providing adequate means for promising university students because motivating learners at school and then not allowing them to study because they do not have funding is unfair and cruel.

Children should be encouraged to take science at school and keep their options open as long as they can.

### **6.3.11 Johnson**

**(a) Tell me about your what your current career entails**

She is currently the 'Chief Officer Networks and Customer Services' at ESKOM.

**(b) Why would you regard yourself as successful in your SET career?**

She believes that success comes firstly from having technical competence, which includes an ability to see patterns and linkages; having the organizational capability to try to anticipate problems; and thinking holistically and systemically about those problems.

She also mentions perseverance, the ability to communicate well and having a high EQ. In terms of personality traits, she believes that her not being accepting of authority has contributed towards her strong internal drive towards success.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She found the environment both during her studies and her early days at ESKOM challenging in terms of having to deal with prejudices or perceptions (for example, dealing with what she calls 'little dolly jokes'). She mentions that there were very few black women with engineering degrees at the time and found that she had to 'challenge the environment'.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She was inspired by the non-conformist attitude of her English teacher. She was also influenced by her parents, but rebelled against their wishes to have her study medicine.

She found she was good at mathematics, science and biology at school and sees herself as a generalist.

**(e) Which factors contribute towards you remaining a professional in this field?**

She remains in the field because she wants to use her skills for development in South Africa; electrical engineering was her training and also because she enjoys her work.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She mentions having to deal with people's assumptions and prejudices, as well as telling them her boundaries in the environment in which she worked. She found taking on these prejudices an enjoyable challenge. To overcome the challenges, she had to insert herself within the environment; and develop the EQ skills to deal with diversity challenges. She mentions that the bonds that were formed in the transformation period are still very close

She believes that you cannot merely hire women for the sake of gender targeting. The debate has to become more nuanced in asking about a person's strengths and where best to place that person.

In dealing with difficulties, the most important thing is: 'Knowing yourself'.

**(g) How did your personal life influence your professional life and vice-versa?**

At present, she feels that her personal life is completely 'crowded out'. She is not married and has no children - this is a personal choice which she says she is not unhappy about. She aims for more balance during the next six months. She would like to have children or adopt, and she mentions that the ESKOM environment is very accommodating in terms of 'baby breaks'; quite clear on maintaining the work-life balance and being a 'caring' space.

- (h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She does a lot of encouraging and mentoring and her message is that 'It's possible, guys!' Young women and girls need to dream and then to go for it. Knowing and understanding oneself and inserting oneself in the environment are important. She encourages people to have a sense of development by knowing their impact on the environment. Education and perseverance are also important.

### **6.3.12 Nengovhela**

- (a) Tell me about your what your current career entails**

She has been working for Exxaro (a coal mine) for the past 6 months and has previously worked at the CSIR. She supports the business units in terms of environmental issues such as recycling waste water and is involved in developing systems to this end.

She is currently completing her PhD because she was studying and working for a number of years.

- (b) Why would you regard yourself as successful in your SET career?**

She does not see herself as successful but on her way to success, aiming to become a technical manager.

- (c) Did you find it difficult as a woman to achieve success in your career?**

She finds that mining is a male dominated environment but regards this as a challenge.

While studying, she also encountered male discriminatory attitudes towards female engineers and scientists.

- (d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She cannot pinpoint a specific person who motivated her to study science. She likes challenges and from the background she gave of her experience at Turfloop, it seems that the challenge of being one of the few women in science class motivated her to go further. She mentioned that the campus was full of female students but there were very few in her science class. This resulted in her observing that there are not many possibilities in science because the majority of women seem to opt for other degrees. Despite this observation, she regarded it as a challenge and continued.

- (e) Which factors contribute towards you remaining a professional in this field?**

She is passionate about science and knows there is nothing to fear – she wants to show that she can do it.

- (f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

Her studies were difficult but she said that motivation and determination are important to persevere. The attitude that her field is not for women was problematic for her but she persevered and the challenge motivated her.

**(g) How did your personal life influence your professional life and vice-versa?**

She has a strong support system and so does not struggle too much to balance the two. She carefully manages her time and allocates time for work, studies and family. She would rather finish her work at work and then spend time at home with her family. She has a person helping at home and her husband is very supportive.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She would advise females that "*there is nothing to fear in science*". One needs commitment and passion and one has to like the subjects.

She thinks that women scientists are more focused and better organized. Women should not be afraid of science and research and think that it is a male domain.

Female learners should be motivated to take science subjects. She also thinks it is important that successful women in SET do presentations at schools as role models and show that it is possible.

### **6.3.13 Nkomo**

**(a) Tell me about your what your current career entails**

She works at the Graduate School of Business at UNISA. She is involved in teaching, research and academic service. Her research focus is leadership in business and the effect of race and gender on the access to leadership. She has been in South Africa since 2000.

**(b) Why would you regard yourself as successful in your SET career?**

She is an NRF-rated researcher, she serves on the editorial boards of many journals, and she was invited as keynote speaker for conferences. She also mentored a number of doctoral students she supervises.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She found it difficult as the first black female in a predominantly male business environment. Her research focus received criticism from early on (race and gender) but she persisted.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She wanted to be an educator since her 20s. Her parents motivated her to study as a way to overcome racism. She also had many mentors along the way that motivated and supported her.

**(e) Which factors contribute towards you remaining a professional in this field?**

She feels that passion about one's goals is important. She is also passionate about social justice and endeavours to assist women and non-dominant groups to find equality in the workplace.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She says that the road was difficult but that she had a network of support. She also asserted herself when necessary.

**(g) How did your personal life influence your professional life and vice-versa?**

Her husband is an academic and is a major source of support. She also has friends and family that support her.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Race and gender should not stand in the way of success. She emphasizes the network of support on the way to one's goals. Women should assist women. Girls should have self-confidence in their abilities. One also need not let poverty be a hurdle on one's way to success. Young women need to be supported.

### **6.3.14 Nyokong**

**(a) Tell me about your what your current career entails**

She is DST/NRF Chair, professor of medicinal chemistry and nanotechnology, and the director for nanotechnology innovation centre (NIC). She is involved in research and teaching.

**(b) Why would you regard yourself as successful in your SET career?**

She has left a legacy of students that are successful in industry and academia.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She feels that overall women do not get sufficient support.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She had good high school teachers who made science interesting. She did not have an interest in social science.

**(e) Which factors contribute towards you remaining a professional in this field?**

She loves teaching and would like to see that South Africa solves its problems through science and not a mere dependence on the West.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She experienced a lack of support, but just worked hard to overcome this.

**(g) How did your personal life influence your professional life and vice-versa?**

Her father was her role model and instilled the ethic of hard work from an early age.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She feels that girls and women should have role models, especially those that can end the isolation of females in science.

### **6.3.15 Reyers**

**(a) Tell me about your what your current career entails**

She works in conservation science with a focus on biodiversity and conservation. Research is applied on national and local government levels. Her work also entails a management component as research leader of projects. Her current work involves development of a policy framework about biodiversity in ecosystems. She is also involved in climate change, fire ecology and environmental resource management.

**(b) Why would you regard yourself as successful in your SET career?**

She finds her job stimulating and she is happy with what she does, she feels challenged. She does not feel that she has arrived –s he feels she is still on her way to the top.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She distinguishes between the challenges experienced as a young researcher and as a female. She feels that the menial jobs in an academic department are usually given to the younger and not necessarily the female academics, even though the biological sciences seem to attract mostly younger women. She does mention that she experienced some discrimination as a female PhD student in that she would be given the administrative tasks as opposed to the male students. She also mentions that although she does not have children she imagines that family duties can hamper the amount of time one can allocate to work.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She started off in veterinary science, inspired by the example of her father - a veterinary clinical pathologist. However, she lasted only a year and opted for zoology because it was presented by experienced and eminent academics that made the subject challenging, interesting and exciting.

She regards her father as role model who made science fun and challenging. Her experience of school was not inspiring since she had some teachers that believed that girls cannot do math. Her father took it upon himself to teach her math and keep her interested.

She regards the path that she followed as one of opportunities that opened up. She regards the decisions she made as being inspired by a number of excellent mentors. Interestingly, her excellent international female mentors showed her that one does not have to comply the male-stereotype of a scientist, namely to be opinionated and aggressive. She also learned that one does not need to comply with the female-stereotype of a scientist, namely being nurturing and a better organizer. In fact, she resents this label.

**(e) Which factors contribute towards you remaining a professional in this field?**

She finds the challenges in her current job satisfying, the remuneration is better than at the university, she has opportunity to publish, and she does consulting which she likes. Her work creates an environment within which she is comfortable.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She mentions the problem that female candidates with potential often seem to get promoted too early - before establishing their careers or completing their studies. To be involved in management whilst struggling with family and studies strengthens the perception that women are not good scientists.

She does experience benefits as a woman, namely getting funding more easily, attracting female students and the fact that she is a manager gives her control over issues.

**(g) How did your personal life influence your professional life and vice-versa?**

She finds her personal circumstances supportive for her career. Her partner is supportive and works from home, which means she can work late and even over weekends. She does not have children.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Although she is hesitant to regard herself as a role model, she does mention that she presents an image contrary to what people have of women scientists, i.e. one need not be grey haired and without social skills - one can be a part of society and participate in normal social activities and still be a scientist.

However, on a professional level she regards hard work and some intelligence as necessary characteristics. She would like to motivate children to take subjects that really matter such as math and science. One should set an example of how much fun it can be and that science is interesting.

### **6.3.16 Setati**

**(a) Tell me about your what your current career entails**

She is the Executive Dean of the College of Science, Engineering and Technology and full professor at UNISA. She also holds an honorary professorship in Mathematics Education at WITS University and a professor extraordinaire at Tshwane University of Technology. She believes that she is a scholar or researcher first, and an executive second.

**(b) Why would you regard yourself as successful in your SET career?**

She does not think that one ever reaches success, since the moment one thinks one has attained success or excellence, one begins the slide into mediocrity. Success is not a destination – it is always something one strives towards.

She does, however, believe that she is doing well in the greater scheme of things because as a scholar she is thriving, publishing, and her work receives international co-operation, respect and impact.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She feels as if she's had to lose who she is as an African person to succeed in her career, by having to adopt a culture that is not hers. Even today, she continues to feel that she has to qualify for the job that she's doing: 'You always have to earn your space' and '...work 100 times more than an average person'.

For her, gender hasn't been as big a challenge as her race has been, but she admits that the difficulties she has experienced could possibly be a conflation of her race, gender, body size and age. She has accepted what she sees as a constant battle. She perceives the really hard or oppressive things she has experienced as not coming from white males, but rather as coming from across the board or from white women.



**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her parents always encouraged their children to be excellent in whatever they were doing. She decided upon mathematics because she felt comfortable with it and was good at it. She also valued the certainty and feeling of control which mathematics gave her.

A professor at university inspired her to become an academic by showing her that it was possible to be very knowledgeable, but also warm and human. She notes the paradox emergent from her prior claim that she has received most opposition from white women, and yet her role model in terms of the academic world is a white woman.

**(e) Which factors contribute towards you remaining a professional in this field?**

For her, being an academic is a luxury. Although it doesn't pay much, one can shape your job and research for oneself. She finds teaching very exciting, and says that her research inspires her teaching. She stays in academia because she is curious, and sees the academic world as one where curiosity is fed.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

To overcome the difficulties she mentioned previously, she says that she just had to say to herself that she was capable. It was a turning point in her career when she stopped doubting herself: 'I'm good! I'm going to do this'.

**(g) How did your personal life influence your professional life and vice-versa?**

She admits that she does not 'have a life' and that she is very driven. Her professional life has had huge costs in terms of her personal life. She got divorced in 2007, and believes that her marriage suffered because she focused exclusively on her job. She also believes that it is uncomfortable for many men to live with a successful woman.

She has a seventeen year old son with whom she has a wonderful relationship. She thinks he works as hard as he does due to her example, even though he is still a very social person. She does try to maintain balance in her life by being social; keeping up to date with things; reading non-academic books; using her iPod; and going to movies and the theatre. She claims she is happy.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She thinks that young people are inspired by her showing that it is possible to be a professor and *still* be funky. Her message to the young people she works with is that they can be what they want to be, irrespective of where they come from. She sees herself as an example of that since her father was an alcoholic, and her mother was a domestic worker, who eventually finished high school and got a degree.

She runs an 'Adopt-a-Learner' project involving adopted twelve students between Grades 8 – 12, with one at university level. One of her students assists these learners with mathematics during the holidays, and she teaches them for a week once a year. At the end of the year, she buys a computer for the best performer.

She believes that the media has a huge impact on people and suggests developing a 'hip, cool-looking' character in a soapie who is a successful person in mathematics or science to inspire and inform young people.

### **6.3.17 Sole**

**(a) Tell me about your what your current career entails**

She is a technical specialist working with solvent extraction and iron exchange which are processes in metallurgy. She acts as consultant for the Anglo group and is section-head for the structural metallurgy department.

**(b) Why would you regard yourself as successful in your SET career?**

Not answered.

**(c) Did you find it difficult as a woman to achieve success in your career?**

In the beginning of her career, she did not experience difficulties. When she moved into engineering and started visiting plants she experienced some discrimination. When she worked on a project in Mexico, a male colleague stood in for her although she found some credibility after a few weeks. She still finds it surprising that boardrooms and so on are male dominated.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She had good science teachers at school especially those in chemistry and physics. Her parents both have science degrees. In her previous job, she had some good role models for whom gender was irrelevant. She also had supportive female student friends. She has a very good support structure (in terms of friendship).

**(e) Which factors contribute towards you remaining a professional in this field?**

To some extent she feels comfortable with what she has in her current job. She supports herself well and she experiences some freedom in her job. She also has a wonderful group of people that she works with and emphasized her loyalty to them

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She has to struggle hard to obtain projects for her mostly female team. One way to confront the challenges is to persevere. She mentions that she often wonders whether her inclusion in activities such as chairing meetings is mere tokenism.

**(g) How did your personal life influence your professional life and vice-versa?**

She finds outlets for her interests and energy outside of her current job such as running and organizing the running club.

She is not married and does not have children, and says that she would not have achieved what she has if she had a family. Her work demands weekends and long hours. She also doubts whether one can achieve the right balance between personal life and work. She struggles to make space for her personal life due to the demands of clients and work.

The network of friends that she has provides good support.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Due to her perceived lack of balance in her own life in terms of emphasizing some aspects of her work, she wishes to accentuate characteristics that open persons up to new experiences. She is very reluctant to regard herself as a role model.

Learners at school should take math and not give up on science too early. Children should keep their options open as long as possible.

She also emphasizes networking and healthy self-promotion. Women tend to think that their skills will be recognized (if I do a good job, somebody will notice me) whilst they should rather aim to make things happen. Men are much more aggressive. One should take responsibility for one's career and not depend on "champions".

Teaching science and math should include pointing out the relevance of the subjects so that children realize how science can be applied. However, merely exciting children will not achieve anything: many students who find science exciting drop out in the first year because the glamour fades and all that is left it is hard work. So determination and perseverance are also characteristics one has to foster.

The negative perceptions surrounding math and science can be changed and must be changed – separate gender schools achieve this but boys need to change their mindsets as well. Girls must realize that it is fine to be clever.

### **6.3.18 Sukhdeo**

**(a) Tell me about your what your current career entails**

She is general manager for Adamas Mill in Port Elizabeth. She is concerned with the viability of the mill and assesses resources and continued operation in comparison to international practices. It is a paper mill and it has about 300 workers. It runs continuously.

**(b) Why would you regard yourself as successful in your SET career?**

She sees herself as someone that can facilitate change in a changing environment. She is also able to 'get results' from her personnel.

**(c) Did you find it difficult as a woman to achieve success in your career?**

While working at Sappi she has not experienced any difficulties as a woman in a male dominated environment. She does not align herself with feminism and women's causes and feels that if people have a problem with her gender, it is their problem. She focuses on results and that is all that counts to her.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She firstly eliminated what she did not want to do. She was interested in science but also did a business degree, because she wanted to be able to make a difference with the results of science. She enjoyed science and describes it as fun. She did not really have teachers, friends or other role models that were in science before her whose example she followed. She did, however, enjoy the lecturers.

**(e) Which factors contribute towards you remaining a professional in this field?**

She enjoys the numerous aspects of the job she is currently involved in, namely: management, human resources, finances, production and engineering. She feels her science training prepared her for effective and informed decision making. The diverse bodies of knowledge she works with, such as science and economics, allows her to make things happen by understanding what she is making decisions about. She enjoys the combination of business and science and does not see herself only as a researcher.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She found it necessary to work hard, establish credibility, be assertive and she made sure that people took notice of her. She feels that her strong focus on the tasks at hand possibly made her oblivious to potential problems.

**(g) How did your personal life influence your professional life and vice-versa?**

Although she travels extensively she has a good support system; her husband is flexible within his business thus providing substantial support. Her children understand that her job makes certain demands. She said that she manages to not work at home and tries to keep her personal life separate from her work. She believes in delegation of work.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She has a motto that "anything is possible" and that one should just go and do it; she also feels one cannot "define your life by what people think of you". Thus, despite circumstances and background, one can achieve one's goals. With hard work, one can combine family life with a career and one need not compromise.

Math and science should be made practical and address children's interests at their particular age. She acknowledges that the subjects can be boring but this depends on the teacher. She also feels that a set of role models, for example women, can be displayed to pupils in terms of who they are and what they have achieved. She also thinks that there should be more science road shows. It is important that children should relate to these shows.

Currently the world of science and technology is still portrayed as a man's world, but perceptions are changing. At SAPPI, there are more women scientists than men. She thinks that tenaciousness and thoroughness are characteristics of women that can make them good scientists.

### **6.3.19 Van Tonder**

**(a) Tell me about your what your current career entails**

She is a high-voltage operator at Eskom (PTO). She is currently involved with the maintenance of networks.

**(b) Why would you regard yourself as successful in your SET career?**

She feels that the right attitude and hard work contribute to success. Attitude means that you should not have a negative attitude - realizing that you need to rely on other people and that there are some things that you cannot do.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She says that she did not experience problems being a woman, although she mentions what she sees as small things, like not having a toilet on site. She says that one just has to work harder and that negative comments such as "women will not last in a particular job" should spur on one to work harder. The willingness of men to "relieve" her of the harder part of the job spurred her on even more because she wanted to learn the job first hand.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her father was an electrician for Eskom and she always helped him. He instilled in her an interest in the field. She was not really interested in math at school – it was only later when she realized that she had to have it as a subject that she developed an interest in it. She had misconceptions about clever kids at school taking math.

**(e) Which factors contribute towards you remaining a professional in this field?**

One of the factors is that she has not yet achieved what she wanted to – she will remain in the field although she has had opportunities for promotion. She enjoys the field. She also enjoys working in the field, outdoors and seeing that things work.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She says that there were some discriminatory remarks made about her being a woman in this line of work. However, she is determined to carry on and achieve success.

**(g) How did your personal life influence your professional life and vice-versa?**

She works hard, but has only recently realised the importance of a personal/work life balance.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She has never thought of herself as a role model. She wants people to see her enthusiasm for her work. She also thinks that women and girls can do anything, although at school the preconceived idea that math and science is difficult still exists.

## **6.4 Summary of interviews Phase 2**

In the follow section, the interviews are summarised according to the main themes of the interview schedule. The questions will be listed as they appear in the interview schedule in order to facilitate ease of reading. The complete interview transcripts are available from NACI.

### **6.4.1 Aghachi**

**(a) Tell me about what your current career entails**

She is a lecturer in mechanical engineering at the Tshwane University of Technology (TUT). She lectures mechanics of materials and mechanics of machines. She also does research. She has been lecturing for about ten years. An example of her research would be determining what materials to use in the fuselage of an aeroplane.

She chose mechanical engineering because she feels that it is the basis for the other engineering specialities. She also took up the challenge to move into a field that does not have many women as opposed to some of the other engineering fields that have more women.

**(b) Why would you regard yourself as successful in your SET career?**

She does not regard herself as successful currently but as in the process of achieving success. She is consistently working towards her goals, one which is to obtain her PhD.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She did find it difficult at first. There were only two women in her class and they were always regarded as not belonging in the field. She used the example of when males make mistakes it is excused much more readily than when a woman makes a mistake. In fact mistakes are taken as proof that women do not belong in the field. Because of this the women work much harder and more careful than the males.

Race is not much of a problem in the field – however, gender discrimination remains a big problem. In the beginning of her career she experienced outright discrimination and negativity because of her race and gender. However, she is not perturbed by this as she says other people speak out of ignorance so she does not feel bad. She also experienced negativity in the classroom because of her gender but after the first semester she gained respect from the students.

She believes that much depends on one's own perceptions. Feelings of competence rise from within and people will see that. You cannot force people to change their perceptions but one can change one's own perceptions.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

When she was in high school she met a female pilot. She felt that if a woman can fly a plane she should be able to build the plane. This was one incident that motivated her to go into the field of science. She was good in both science and language/art subjects. At a stage in her school career she chose to do drama and arts but her mathematics teacher interrupted her plans by ordering her back to math class.

**(e) Which factors contribute towards you remaining a professional in this field?**

She is on her way to success so the fact that she has not reached her goals yet keeps her in the field. She feels that she can contribute in her own way to solving some of the problems of the world. Some problems (such as the energy crisis) can only be solved by engineers.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She did experience difficulties in terms of negative remarks because of her gender but she turns the remarks of others into perceptions, believing they speak out of ignorance.

**(g) How did your personal life influence your professional life and vice-versa?**

She has good support structures. She and her husband support each other. The family understands when she works long hours. She also tries to adapt when caring for the children such as when one of her children were in hospital she found ways to work. She also copes through good time management. She lists tasks to do and when she is busy with one thing she switches off from the other duties.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She does not regard herself as a role model. However, if she did she would give advice about always keeping an interest in one's activities and career. One must always rekindle the interest. One's work must be exciting and she emphasised the inner motivation and perceptions. The rest will follow if the inner motivation is there.

She thinks that one should target children from kindergarten, especially the girls, and tell them constantly that they can do the same things as boys. One should not make a

distinction between activities for girls and boys. All have received the same abilities and can develop them further.

She also feels that children's brains need to be developed through stimulation. For instance, by introducing calculators too early in school children do not learn proper mathematic skills.

Furthermore, the negative publicity by teachers about how difficult maths and science are should stop. She strongly believes that it lies within the children's ability to do the so called difficult subjects – one must just stop telling children that it is difficult.

#### **6.4.2 Buthelezi**

**(a) Tell me about what your current career entails**

She is a nuclear physicist. Nuclear physics has implications for medicine or energy. She is also involved in the research of the collider at CERN in Geneva.

**(b) Why would you regard yourself as successful in your SET career?**

She regards herself as successful because she works hard and focuses on her work.

**(c) Did you find it difficult as a woman to achieve success in your career?**

One has to move beyond the idea or perception that one cannot do the work or study in the field as a women: *"You have to believe 'No, I can do it. I don't need someone else to tell me that I'm not capable of doing it.' Because when I was at school, there was this idea that girls are not as smart... are not smart enough..."*. Thus, at school one has to break through the beliefs that girls cannot do maths or sciences.

At university there was much competition between the males and females and the women had to work very hard. She feels that women have to sacrifice a lot of things whereas males have received the support from their partners. She also feels that one has to be selfish about one's career. Thus, because work takes so much time of one life, one's family always suffers.

In the beginning of her career she found it difficult to voice her opinions. She feels that women physicists have strong characters because they develop assertiveness over time. Thus more than men they have to work harder to be heard. She likens it to always fighting especially in the earlier part of one's career and especially when one is ambitious and wants to move to higher positions.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Her mother was in medicine and influenced her interest in science in general. She was good in general science and at school decided to become a doctor. She did her first three years at university in medicine but then decided by chance to change direction. Because of the motivation of one of her lecturers, she decided to move into nuclear physics. She says it came naturally to her.

**(e) Which factors contribute towards you remaining a professional in this field?**

She regards nuclear physics as a difficult career to pursue because it takes many years to qualify. It is difficult for both genders in terms of time and no financial gain. Slowly, however more money is made available for the development of the field and more people are moving into it.

One of the factors that make her stay in the field is because of her proficiency in the field. She also would like to contribute to someone else's development – because they do training she has the opportunity to transfer skills and knowledge.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She feels that one has to be very focused and determined to achieve success. Because of the life-cycle of projects one has to follow an idea through for at least three years which calls for focus and determination. She also mentions the importance of the ability to relate to people and to communicate, to work hard and be determined.

**(g) How did your personal life influence your professional life and vice-versa?**

She says that one sacrifices much of one's personal life especially if one is ambitious and focus on one's career. She says that because one is selfish with regard to progress in one's career, social interaction and friendships suffer. So it becomes unbalanced.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She would convey the reality of the hard work to prospective students and people wanting to enter the field. She feels it's hard work and that you make sacrifices. She says it is personally and professionally satisfying but one really has to have a drive to do it. The interaction with other people on an international level is also satisfying. She feels time-management is important as well to make a success but the drive, focus and determination to make a success is very important in this field.

She thinks that one can be a role model to young people in the sense of showing that one can go beyond the limits and attain certain goals.

She regards herself as a role model, in fact living proof that women can achieve much in the science world. She feels that the current situation in South Africa is favourable towards women: women have the platform to show that they can achieve much through hard work and perseverance. Her message to young women would be to believe in themselves and that they are capable of achieving success.

### **6.4.3 Dhlamini**

**(a) Tell me about what your current career entails**

Currently she is involved in product development. The particular department oversees the development process from marketing to production and support. She is manager of technical product development.

**(b) Why would you regard yourself as successful in your SET career?**

She considers herself on the way to success.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She started off with technical difficulties in her work. As a young person it is difficult to sell new technology to the older staff in the organization because they are used to older platforms. Furthermore, it is difficult to change the direction of a project once it starts. She is unsure whether it is an organisational problem or because of her inexperience (which she refers to as 'being young'). However, she finds that older staff and subordinates would find



it difficult to correct her or disagree with her due to politeness because she is a woman. Thus, she thinks that because the staff is merely polite, she does not get a honest opinion about her designs, which means she has to work harder and longer to solve problems.

Overall she says the organization is accommodating towards young women in various sections, so they do not struggle all the time. There are certain projects running to sensitise staff.

The relationship between older, more experienced staff and younger, energetic staff was very carefully stated: older staff find it difficult to cope with young staff that supposedly know quite a lot more about the work than them and who tell the older staff what to do. However, she says that younger persons have broad knowledge about many areas and not the in-depth knowledge about specialised areas. However, she realises that the situation is threatening to older, entrenched staff. Interestingly, this is a challenge that younger persons must face when trying to advance their careers.

As a student, some of the challenges she faced included the practical work – although she had the opportunity to work with her hands, other females found the practical work in the labs difficult. She feels that some females just go to university to find educated husbands.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She wanted to be a geologist when she was at school because her exposure to the environment on her family's holidays piqued her interest in rock formations and plant growth. Her mother encouraged her to read about it, which she did. She started her first year at the University of Natal, but could not continue due to financial constraints and had to look for a bursary. Telkom then offered her a bursary to study engineering which she then did. However, she still fosters an interest in geology.

Her mother and uncle gave her scientific books to read in order to stimulate her. She said her curiosity initially played a large part, but her uncle and mother showed her the value of determination, focus and perseverance.

**(e) Which factors contribute towards you remaining a professional in this field?**

She finds her work exciting and challenging and she learns new things every day. This she finds satisfying.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She feels that women are not given the responsibility for tasks they deserve because of the strong stereotypes that exist about females in the work place. The more responsibility, the more dependent others become on the person and if they suddenly, marry and/or become pregnant they are away from the job for a substantial amount of time. She feels that the typical stereotype of the childbearing responsibility of women fuels the attitude towards women in the workplace, despite the women's clearly recognised expertise. She had to cope with these typical stereotypical discriminatory remarks from managers. She mentioned an interesting example where she was sick for a few days and remarks such as "Are you pregnant? Should we be worried?" were made, whilst males are just welcomed back to work.

She feels that engineering is regarded as a typically male domain and that that they are getting better opportunities than their female counterparts. She also thinks that black females are regarded with suspicion as engineers, although she found that older and not necessarily female engineers experience similar problems of self-doubt and negative perceptions.

At university, an environment should be created where both males and females are accommodated. There are students that would rather email the lecturer than expose themselves in class. She pointed out a subtle racial perception that emerges in class: the questions that white male students ask are perceived to be intellectual whilst a black has to think carefully about the questions he/she can ask.

When asked why women move out of SET careers, she replied that it is the result of old white males in the industry. In fields where knowledge is encapsulated in the plant, the older experienced males should convey the information and they do not do this. In these fields, there are not yet black males and females to teach the younger engineers, and the white males regard the new recruits as threats to their positions.

Her solution is that the company should have a structured programme in place (it is assumed she is referring to a company other than her current one). However, she feels that one should show that one is determined to learn and do better, although she mentioned, that it becomes tiring to keep up this fight.

**(g) How did your personal life influence your professional life and vice-versa?**

She struggles to find work-family balance with her work. She is quite clear that her work came first, at least for the first part of her career. She mentions that she has missed some activities with her family due to work and that she cannot just leave the work at the workplace, which puts strain on her family life. She also studies part-time which makes striking a balance harder.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She does not regard herself as a role model because she has just entered the field and is still carving out a career for herself. She does give motivational talks to young high school students in her home environment. She encourages them to study and move into SET careers. She also feels that young people should be made aware that life is difficult but that you have to be determined and keep on trying. Even if one fails a subject at university, one should keep trying to succeed.

At school one of the reasons that science is not important to children – except in the light of being naturally gifted or due to extraordinary events – is lack of contextualisation and meaningfulness of the material learnt. If a child cannot apply the information and it is not meaningful to him/her then he/she loses interest. Teacher should play a role in motivating children to work harder but they do not.

Children thus need to be exposed to actual professions and what they do. In school they can do practical assignments such as finding such what parents do. They need to understand how jobs fit into the economy, what skills are needed and what the requirements of the job are (she makes an interesting remark – if you want to work with fire you need to understand the different types of fire and so on). This type of guidance needs to be integrated into daily classroom situations and not be restricted to career expos.

She is of the opinion that it is no use to aim at tertiary level to get females into SET careers. The intervention should take place earlier. Interestingly she mentions that if you do well at school, you are expected to go into engineering or a medical career. Thus the SET field becomes restricted, because children think they have few options.

#### **6.4.4 Kgokane**

**(a) Tell me about what your current career entails**

She is a structural specialist at the Richards Bay Coal Terminal. Her field is management and mechanical engineering.

**(b) Why would you regard yourself as successful in your SET career?**

She completed her studies at the Technikon. The first year was very difficult but she persevered. The second and third years were easier. She worked at several industries since she graduated. She is with RBC since June 2007. It is difficult to study away from home because in the first year there are no rules and there are so many decisions to be made – one does not know what to do.

**(c) Did you find it difficult as a woman to achieve success in your career?**

It is difficult being the only women in a position all taken up by men. In a meeting she is the only female and sometimes some of the men are 25 years in their positions. If one also show interest in them, know what is going on in the plant and go prepared to meetings they can see that one knows what one is doing.

When one enters the workplace one is fresh from one's studies with ideas and enthusiasm. Then one encounters old and established employees who are sceptical about one's ideas. One should listen to them and tell them their ideas are good. When one combines their ideas with one's thoughts you can work together.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

Curiosity was the main motivation. She also feels that there are few women in the field.

**(e) Which factors contribute towards you remaining a professional in this field?**

It is very fulfilling to complete a project and know that you have been part of a successful project. It is also a challenge to work in this field.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

It is difficult because sometimes one is the only woman in the field. Issues such as pregnancy and maternity leave are not acceptable. Even comments in meetings will be made about women in this field. Remarks are made such as why women should be appointed if you know that they are going to take maternity leave. Males will come to work even if they are injured or sick – if a woman goes on maternity leave the company should appoint someone in her place.

One should stay focused in the light of difficulties. One should also work very hard.

**(g) How did your personal life influence your professional life and vice-versa?**

It is difficult because her husband is an electrical engineer and has a good post in Pretoria. She has a baby but the baby is also in Pretoria with her husband. He wants to further his career and she wants to develop her career here because of the opportunities in Richards Bay. It is really difficult to balance family life and professional work.

- (h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She considers herself as a role model because when she goes home in the Eastern Cape she talks to young people to motivate them to continue their studies. She tells them if they really want to do something they can even if they do not have access to all the resources. They can even borrow the books from fellow students. The previous time she visited home she motivated a young girl to go and study. The girl phoned her recently to tell she took her advice.

To study engineering one must set goals and one must stick to it, even if the first year of study is very difficult. It will get better from the second year.

One should plan one's life carefully: before one has a family one should first have a house, before one has a house one should have a work in order to buy a house; in order to have a work one should study. One should not do it the other way around namely to have a family first and then try to provide for them.

#### **6.4.5 Lefyedi**

- (a) Tell me about what your current career entails**

She is a deputy director. She addresses policies and strategies that influence research or that direct research in the country, and she is responsible for research areas such as astronomy, biological research, physics, research in the Antarctic and oceans.

- (b) Why would you regard yourself as successful in your SET career?**

Not answered

- (c) Did you find it difficult as a woman to achieve success in your career?**

Women in general experience challenges about issues such as maternity leave.

- (d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She became interested in science at school. She followed a BSc stream and did her MSc in medical science, partly in South Africa and partly in the UK. In the UK, she realised that women from all kinds of circumstances pursue science PhDs with passion. She did not really have a particular person who inspired her, but because she did well at school, people expected her to go on with science. Her motivation grew out of the expectations of people around her, expecting her to be a doctor some day. In the end, she came to believe it as well. Her first real mentor was a woman who showed her that becoming a vice-chancellor of a university as a black woman (at UCT) was achievable.

She moved out of academia because of poor remuneration and lack of experience. The government position she is in now allows her to work on a higher level and influence more people.

- (e) Which factors contribute towards you remaining a professional in this field?**

She thinks it is a personality issue: some people like working in labs, whilst others like working in admin or management. She feels that people do not remain in the field because of poor remuneration. Laboratory work is hard work and financially speaking one is not rated accordingly.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

Provision could be made for women on maternity leave – job security seems to be important. Allowance should be made for women who work whilst raising a baby, because women do not get enough sleep and have to cope with all the normal responsibilities of child-rearing. Possible solutions might be to bring the child to work, hiring a nanny or having a crèche close by.

She experienced gender discrimination from the lecturers when she was studying. When females came late to class and they had to tolerate remarks about women always being late. She wanted to be treated as an equal to males. She felt that the only way to beat men at their own game was by means of hard work.

She finds it disheartening in her new job that people expect one to do and know everything – she feels as if she is being used and the excuse used is that she has a PhD. By implication, if she does not do what is asked of her, she is seen as stupid.

**(g) How did your personal life influence your professional life and vice-versa?**

When she did her PhD, she got married and fell pregnant. Thus, it became very hard to do her PhD and work. However, the support she received from her spouse in terms of looking after the baby while she worked late was invaluable.

She realised that she had to overcome the idea of coming from a disadvantaged background. She had to stay focused and work hard. She used the words “stay strong” and “fight for the goal”. It seems perseverance and determination play a strong role in her work ethic.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She said that a number of black women do not know what it is to be successful and they need role models. There are not many role models, and she keeps photos of successful black women which she can show to girls to motivate them. She also feels that girls at school have limited choices: it is only between engineering and being a medical doctor. She also thinks that the business type model is inappropriate and so when she gets the opportunity to have talks with girls she dresses casually.

She thinks that girls should be exposed to science in an organised way by government.

She also feels that some teachers are not well equipped to teach science.

### **6.4.6 Makgae**

**(a) Tell me about what your current career entails**

She is a manager for waste and nuclear liability management. It looks as issues about a plant's such as Pelindaba, life cycle end. It also looks at fluid and solid waste management.

**(b) Why would you regard yourself as successful in your SET career?**

She does not regard herself as successful yet. She says she is on her way to success. She regards success as being in a position of power such as management.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She experienced a gender and age gap in a male-dominated environment. She constantly needs to prove herself and work hard. However, she never had real problems because she did her PhD at a young age, and so people regarded her differently. Although her work environment includes many women (she graduated with three other women) female representation in the broader environment in her field is still small.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She had good marks in science in high school and so she followed a science stream. It was not really planned but then she studied science at university as well. She met the dean of the science faculty and he mentored her whilst she studied. Her parents did not really play a role about her decision to study in a particular field but they played a mainly supportive role.

When she started her studies she found out more about women in science through the media, which motivated her. However, the media is not adequately covering the experiences and lives of people in science. One needs information about why and how people are successful, which the media does not cover.

**(e) Which factors contribute towards you remaining a professional in this field?**

She says that one has to enjoy one's work, one has to be on the fore front and one has to have a drive to succeed. She enjoys giving presentations and seeing the reaction to her work. She is often asked how she achieved what she does and she inspires others.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

Not answered.

**(g) How did your personal life influence your professional life and vice-versa?**

She surrounds herself with supporting people. She also finds that she and her peers support each other well.

She also completes her normal duties at home and takes care of her daughter. She spends time with her so that she is well prepared for school. She spends her time at home with her family and they share with each other.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Her daughter regards her as a role model and also wants to become a scientist. She believes one should invest in education, believe in oneself and work hard to achieve one's goals:

*"And what they should also know is that this is not an easy road. It's not. It's quite steep and winding. But you need to work hard, be focused, and believe in yourself. South Africa is a country which is alive with possibilities. If you believe in yourself, you are going to see the results"*

She thinks that greater publicity surrounding women in science and their stories in papers and magazines will do much to inspire young people. It needs to be visible.

### **6.4.7 Mkhosi**

**(a) Tell me about what your current career entails**

She is a senior specialist in nuclear engineering with the National Nuclear Regulator. She works in the Assessment group department. They look after the safety of the public and the environment with regards to nuclear issues. They also deal with places that work with radioactive material.

**(b) Why would you regard yourself as successful in your SET career?**

She regards herself as partly successful because of the goals she has achieved in her studies. However, she feels her career is only starting now so she has new goals to strive towards.

**(c) Did you find it difficult as a woman to achieve success in your career?**

When she started university and it became known that her majors were chemistry and physics, people were very sceptical of her ability to finish physics. However, she was determined to move into the field and did not let the negativity sidetrack her.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She did well in school and was motivated by her principal to study maths. She told her story of how she struggled financially to get through school and the first three years at university in detail. Going to a farm school she faced many hardships and obstacles to complete her school years and go to university. She accredits her brother for support, himself making many sacrifices, that enabled her to reach university. She regards him as a role model. She studied education with chemistry and physics as major subjects. She joined the physics society and had a life changing experience when the society and an excursion to Koeberg. She also became involved in other activities that furthered her interest in physics.

She did her honours part time because she had to work, got married and later started her M-degree in physics. She got a scholarship to study overseas.

**(e) Which factors contribute towards you remaining a professional in this field?**

Not answered

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She had to leave her baby at home when going overseas.

**(g) How did your personal life influence your professional life and vice-versa?**

When she got the scholarship to study overseas her second child was just born so she had to leave when her baby was five months old. She had to work very hard to catch up with the programme because she was already three months late due to her circumstances. However, her family and her husband supported her with the kids while she was away. The people where she studied were very supportive as well and she managed to bring her family as well after a year. However, she experienced some problems with the one child getting sick and she faced many challenges before she could take her PhD examination.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She regards herself as a mentor. She has some students that she mentors. She believes there are three groups of students, those that have an interest in the field of science, those that have an interest but do not know how to do it and those that do not have an interest but have to be exposed to instil interest. Some of the students do not know how to balance work and personal life and she shows them that it can be done.

Her advice to young girls who want to follow a career in science would be to have self-motivation and determination. When they encounter challenges they need to overcome them. One should also be able to work hard to reach one's goals.

Because one does not know the background of students one should never pick one to mentor just because he/she has good grades. One does not know the reason for poorer grades so one should be fair in choosing students to mentor: everyone deserves a chance. In her own example she came from a rural area and had all kinds of obstacles so her grades were not good. However, she had a chance to study further and she achieved her goals in the end.

#### **6.4.8 Mohlala**

**(a) Tell me about what your current career entails**

She is a research scientist doing mostly research. The research is metallurgical and in their unit they do surface analysis of metal (and other material) panes and the like. It is problem orientated because the analysis is aimed at solving failure problems amongst other things.

**(b) Why would you regard yourself as successful in your SET career?**

She does not feel very that successful at the moment – she is still learning and growing. To the question about what would she regard as success she said:

*"For me, in my career, I'll say I'm successful if maybe one day when I get into a room and handle a problem, I wouldn't feel like I'm a woman, I wouldn't feel the barrier of being a black woman – I would feel accepted as a scientist. You know, that assurance, I would feel like... okay, then maybe I have come a long way here."*

Despite these feelings, she says her manager supports her career; she feels that she has space to grow in her career and that her career is progressing well.

She enjoys her work and enjoys the structured nature of planning, executing and seeing the fruits of her labour.

**(c) Did you find it difficult as a woman to achieve success in your career?**

Being a young PhD it is lonely as a woman: she does not find much support because there are not many women in her field; it is a male-dominated environment.

She was the only black women in her class when she started her degree at university. However, she took it as a challenge and to prove a point that, as a black woman, her degree and subjects are achievable. In her Honours study, she was also the only black woman amongst three white males and again the determination to show that she can do motivated her.



She had to do her undergraduate subjects in Afrikaans but she managed this difficulty. Even when it was difficult to obtain information she was determined to succeed.

In her workplace (Iscor) when she started she found it difficult as a black woman to make recommendations to people that had already worked in the organisation for 20 years. She had to work very hard to prove herself.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She became interested in science when she participated in the science fair and progressed to provincial level. She met like-minded school children at this fair. She feels that children in high school should be targeted to increase interest in science.

Her maths teacher at school, who was also the principal, mentored her and acted as her role model. He always gave her science related material to read and encouraged her: *"So, those people are the ones who actually instilled in me the interest, because they saw some potential which I didn't know I had. So, like I... I really wanted to make them proud"*.

**(e) Which factors contribute towards you remaining a professional in this field?**

She wants to be an example to people in the rural area she came from – she wants to show the girls from the area and school she comes from that one can achieve something even if there is a lack of resources. This motivates her to succeed and stay in her career.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She feels that women have a lack of support; they constantly have to prove themselves. She did concede that this particular pressure on women helps them to achieve their goals and reach their potential.

She said that working in her field there are things that you need help with as a woman, such as lifting heavy things. Her approach is to always be helpful so that she can expect help from others in return.

She thinks that scientists are viewed as anti-social because they work hard, are always working and in the process tend to isolate themselves by not maintaining friendships.

**(g) How did your personal life influence your professional life and vice-versa?**

She regards her responsibilities at home as mother and wife as part of her life and she has made peace with it. She also tries not to bring work home too often.

She finds support from her family, especially when her child was still young and she had to go overseas.

She also formed a good friendship with another woman at work, which helps with support in her circumstances.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She does not really regard herself as a role model although she goes back to where she came from to encourage girls to study science.

She thinks scientists must be emotionally stable in order to handle the pressure of the work and criticism of your work. She thinks this is why some women give up their careers.

She feels that women should be encouraged to perform well; they should not break each other down but rather support each other. One should develop one's abilities to the fullest and not limit oneself.

She thinks it is important that there are female role models because it motivates one to work harder and achieve more. They are examples of what they had to overcome and what they have achieved - this serves as motivation. One of the strategies to get more women involved in science is to have role models they can admire. Their achievements can serve as motivation for the younger women. One of the important lessons should be work-life balance, i.e. that you can be successful at work and at home.

Furthermore girls should be encouraged to study science and the role models can emphasise that science is not difficult and that one should not be afraid to study science.

#### **6.4.9 Mosia**

**(a) Tell me about what your current career entails**

She is responsible for developing programmes for the advancement of women's careers in the CSIR.

**(b) Why would you regard yourself as successful in your SET career?**

Initially she did not regard herself as successful but feels that her career path (from doing her PhD to being promoted) can be seen as an indicator of success. She feels that her continued involvement in the technical side of her career, as well as the things she does over and above what is expected of her, make her successful. Her involvement in making presentations at her high school and inspiring students is also indicative of her success.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She found that perceptions of her ability as a women scientist changed as soon as she obtained a PhD. It seems as if she is concerned about the perceptions surrounding young black women and felt that their promotion possibilities are limited. She found that she had to work harder to prove herself. She feels that a university education does not equip one with practical skills for the workplace, such as making presentations.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She says that she ruled out certain options in high school and 'landed up' in the science stream. She was interested in chemistry and biology. However, at university, biology was ruled out due to her not wanting to perform dissections. She was left with chemistry and so continued with that.

Her family especially her mother, expected her to do well at school. These family expectations probably assisted her to do well.

**(e) Which factors contribute towards you remaining a professional in this field?**

She worked in a lab for 10 years and although she found the work satisfying, she finds much more satisfaction in working to inspire women to embark upon SET careers.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

She categorises the difficulties into general and personal difficulties. A general difficulty is, for instance pregnancy: if a woman in a lab gets pregnant she has stop working there for

about a year. Thus, family responsibilities can interfere with her work. One has to aim for work-personal life balance.

Other problems relate to how one markets oneself. One must be proactive and let the organisation get to know you. One also creates one's own opportunities. She says one cannot expect that your supervisor forward your career – you have to do it yourself.

**(g) How did your personal life influence your professional life and vice-versa?**

Because she lives alone, she can spend more hours at work. She has respect for mothers that study, as well as fulfil the house and work obligations. She refers to her own mother as an example of a woman who did just that.

She finds time for relaxation within her family home and environment.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

She wants women and girls to know that it is possible to become a scientist. One does not have to lose one's femininity when working in a lab. One's personality has to fit the job, and since she was not satisfied with a lab job, she looked for greater challenges. She has started studying again – an MCom-degree in leadership. She does admit that other people would like to stay in the lab solving particular problems, and will be satisfied with that.

She also wants the girls in matric to know that one has to go and study, rather than sit at home. There are so many opportunities for study and work that one has to grab them.

#### **6.4.10 Singh**

**(a) Tell me about what your current career entails**

She is an operations specialist at Telkom. She is involved in product development and interacts with marketing and the technical side of Telkom. They need to find out what the customer wants and then come up with a product.

**(b) Why would you regard yourself as successful in your SET career?**

Not answered.

**(c) Did you find it difficult as a woman to achieve success in your career?**

She said that at university she did not experience real problems. However, she found the work situation hard, first as a young person and then as a female, to gain the trust and respect of the older employees. After a year she had in a sense proved herself but she feels that the older persons have the perception of young persons as being lacking in knowledge. She does, however, work with a wonderful team.

Despite the resistance from people that do not know her well enough to know that she has informed opinions, she regards this difficulty as something that one has learn to manage because it helps one to grow as a person. If she attends meetings where she experiences a lack of knowledge she afterwards finds the information. In this sense she deals with some difficulties actively.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

She was interested in science since early childhood. She and her brother wanted to know how things work and took radios apart. She loved physics at school and thus studied engineering at university and then did a Masters in telecommunications.

She had support from her family and her older cousin who studied engineering. She was very adamant that she wanted to go into science and engineering. At first her mother did not understand her passion because she felt it was a career for males but eventually she understood and supported her daughter.

She regards herself as largely self-motivated. She does mention that she had good teachers at school.

**(e) Which factors contribute towards you remaining a professional in this field?**

She loves her job and what it involves. She finds satisfaction in her current job. She also mentions that there is so much she still wants to learn and achieve. She likes to think up new ideas and solve problems. She mentions that she does have a bursary at Telkom with the usual obligations.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

At university one would find the odd lecturer that thought women should not do engineering. She found this very demotivating, but in the end hard work pays off and people admire what one has achieved. Thus the resistance she experienced inspired her to work harder. She thinks that the resistance is good for growth.

**(g) How did your personal life influence your professional life and vice-versa?**

Even though her boyfriend and family are in Durban she enjoys her work at this stage and learns much. However, she does feel conflicted at times.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

Teachers and parents should play a role in inspiring children to be interested in science. Where parents cannot, the teachers have to play a role. Children need to be exposed to practical science experience and not only lectures and tests.

Students at university also need to know that science is fun and they have to participate in excursions. Lecturers do not have to convey the message that engineering and science is that hard.

She thinks a role model should encourage people and children to do science. She has a cousin whom she tries to motivate to become interested in science. She thinks a role model should emphasise passion for science and issues that matter such as the future of the planet and the environment.

She also thinks that one can hold talks for children but it should be more than that – it must be exciting. She thinks involvement in practical activities should be worthwhile than mere talks.

## 6.5 General themes

The general themes extracted from the interviews are discussed in this section. This was executed according to the question structure of the interviews.

### (a) Tell me about your what your current career entails

**The details of the women's careers and fields are summarised in Table 1 and**

Table 4. The women in the sample have very different career paths and development. The fields that they work in are diverse. Those from Phase 2 have careers ranging from nuclear physics, mechanical engineering, metallurgical engineering, chemistry, human capital management, astronomy, electrical engineering and telecommunications. However, when responses are analysed in terms of important life events such as entering and exiting primary school, high school, university, the first job, getting married, and starting a family, certain patterns emerge. The difficulties and the positive moments in their interest and career development surface in relation to these significant life-events. They either experienced financial difficulty or support, discrimination against them as women with particular interests, and success as SET women at similar junctions in their lives. It is these critical junctions that cause the well-known leaky pipeline phenomenon which will be discussed below.

### (b) Why would you regard yourself as successful in your SET career?

One can make a distinction between (i) intrinsic and (ii) extrinsic indicators of success when classifying the responses of the participants.

(i) Intrinsic indicators refer to measures or standards pertaining to self development and feelings of achievement. For instance, some interviewees indicate that success is being happy in one's work, enjoying one's work, finding it stimulating, developing and reaching one's potential. Other indicators include working hard, believing in oneself and being determined.

Intrinsic indicators are found in the majority of the responses of the sample. One such indicator which relates to values is making a contribution to humanitarian values. This becomes evident in examples such as developing people's expertise in South Africa and contributing to conservation. Even though these are extrinsic indicators of success, they are attached to a personal value system.

Some women in Phase 2 did not answer this question but those that did invariably did not think of themselves as successful. They all regarded themselves as on their way to success. This is probably due to them still being relatively young and in the process of establishing their careers. Some did regard themselves as partly successful because they have completed their studies. It is worth quoting one of the more telling responses to this question:

*"For me, in my career, I'll say I'm successful if maybe one day when I get into a room and handle a problem, I wouldn't feel like I'm a woman, I wouldn't feel the barrier of being a black woman – I would feel accepted as a scientist. You know, that assurance, I would feel like... okay, then maybe I have come a long way here."*

Although not representative of the other responses to this question it does reflect an internal focus to success, namely, a feeling of having achieved a certain standing in the

professional community. The remainder of respondents focused on the external indicators of success namely achieving certain goals some time in the future.

(ii) Some interviewees refer to concrete extrinsic indicators such as leaving a legacy of students that are successful, achieving good NRF-ratings, being regarded as an expert, being consulted, being invited to conferences and the like.

In contrast to external acknowledgment of one's position, some participants regard success as being tangible, but define it in terms of efficacy, i.e. what they can achieve, do change or control. Thus, some define it as moving into management; others as achieving results in the workplace and effecting change. Some indicate the enjoyment or satisfaction of seeing their ideas translated into concrete products. One can regard this as an intrinsic indicator, because of the emphasis on satisfaction. One or two interviewees indicate monetary results as an indicator of success.

To summarise: the sample's responses as intrinsic indicators are aimed at personal developmental aims, the satisfaction the job provides, and values which are outwardly aimed. The extrinsic indicators identified refer to concrete issues such as acknowledgment from outside to making an impact on their world.

**(c) Did you find it difficult as a woman to achieve success in your career?**

The difficulties experienced by the women can be broadly classified into experiencing challenges while studying and difficulties experienced in their careers. It should be noted that the interviewees from Phase 1 all invariably start with the observation that they did not really experience challenges as women. Only when they begin speaking about possible difficulties do they begin elaborating on what they regard as minor issues. Some women from Phase 2 experienced difficulties at school where girls were regarded as less competent in certain skills (especially science and maths) than boys. Girls were also discouraged to move into the fields of boys. One respondent described it as difficult to break through this barrier.

The majority of the women point out that they did experience discrimination as women in their careers. Most of them indicate experiencing some discrimination from males whilst studying. Two women from Phase 1 indicate that the challenges they experienced were as a result of their race and not gender. One of these women pointed out that she felt as if she had to lose her identity as an African woman in order to adapt to a situation where she is accepted as a leader in her field. This remark refers to her adopting another culture within which she can practice her career. One interviewee notes that the real discriminatory problems she encountered were not from men, but mainly from other women. Doubts were even expressed about some respondents' ability to finish their degrees. Some found themselves in competition with the male students and said they had to work consistently much harder to prove themselves. It seems as if the women were always the minority in the class, some even had to study their subjects in Afrikaans but through hard work they succeeded. It also seems that as soon as they have shown themselves as capable that the negative perceptions subsided.

The discrimination experienced in the workplace was mainly limited to the commencement of the interviewees' careers. They had to tolerate comments about being physically weaker than males and thus not able to execute certain tasks. Some women were confronted with remarks about women not being suited for certain jobs and others mentioned general negative comments. However, it seems as if negativity was regarded as a challenge that motivated these women to prove themselves and to perform better. Determination, believing in one's abilities and working harder seem to be the values spurring them on to perform.

The discrimination experienced by some women early in their careers came from older males in the companies. Other interviewees state that they experienced the problem of entering male dominated environments that did not make allowances for females (such as no toilets at plants, ablution facilities that were far away, dirty environments and so on). Some of the younger females mention that they did not experience gender bias from younger males at work because of changes in perceptions of women. One interviewee mentions that she did not experience problems because the previous generation of women broke down the barriers.

From respondents in Phase 2 it seemed that the one consistent factor raised at the workplace was age. Almost all these women obtained their qualification at a young age and embarked on their careers while still young. The opposition they have encountered was mainly due to their age because they were confronted with older, established employees that were entrenched in certain ways of doing things. Thus, on the one hand conveying knowledge and skills became difficult because the women were regarded as young and inexperienced. On the other hand, gaining trust and learning from the senior people were also difficult because they reluctantly shared their knowledge. One respondent mentioned the difference between the specialised skills of older employees and more general skills of new incumbents which can lead to communication problems.

There are two interviewees that regard challenges for women as personal, i.e. as standing in the way of personal development. Thus, by regarding females in a particular area as special, i.e. with the potential to excel, they are pushed in positions for which they are not quite ready. In this way their studies and career development are hampered. Another interviewee relates the challenges to the type of career one chooses, namely, that it will be difficult to stay clean and dress up because the environment requires overalls and boots.

On the positive side, most of the participants regard any kind of obstacle such as male negativity and male dominance in a field as a challenge that motivates them to work harder and achieve more. Some interviewees mention that as women, they have more opportunities to excel, receive funding more easily, and are able to attract other women to their fields.

Overall, for the majority of the women in the sample, it seems as if the times changed for females in the SET environment. Despite it seeming that it has become easier for women to enter the field of SET, one should realise that in certain environments initial resistance may be experienced. These challenges can be overcome by the determination to succeed.

**(d) What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?**

From the responses, it seems that (i) parents played an enormous role in motivating the women to study in certain fields and to excel. With the exception of about three women who say that they cannot point to particular persons that motivated them to study science, most elaborate in detail on persons who motivated them. Parents, either both but mostly the father, played a significant role in stimulating them in math and science. One or two mention the strong role the mother played in instilling a love for science and mathematics.

Fathers did not only motivate them to study science, but also instilled in them a belief that they could do science. Values such as hard work, perseverance, self-confidence and voicing one's opinions were instilled. One remarkable example in the sample is that of a woman of Indian descent whose father, contrary to custom (see Lau, 2006), encouraged his daughters to be individuals, self-confident and strong. Another interviewee mentions that her father emphasised that women and men were equal in ability.

One respondent mentioned that she had a natural curiosity and her interest developed by itself. The same respondent also said that her mother was initially against the idea of a science degree which she regarded as a career for boys. However, her mother eventually supported her decision to study science which emphasises the strong theme of family support enabling these women to move into science.

(ii) The second aspect that emerged was the strong role mentors such as parents, teachers and others played in the lives of interviewees on their way to a career and during their studies. Some women mention specific mentors, while others mention the role good teachers played in encouraging them to believe that they could succeed in math and science. There were, however, exceptions to this. At least two respondents complained about poor teachers who actually were negative in their attitudes towards girls being able to do well in math/science. One interviewee states that she interpreted this as a challenge, focussed on science through sheer stubbornness and excelled in the end.

(iii) The third aspect that motivated some of the interviewees was a stimulating environment. One or two participants mention the fact that an academic environment motivated them to move into academia, while another elaborates on the interesting world of science and engineering that was brought to life by the stories her mother told. Participation in science fairs and excursions were mentioned as important factors stimulating interest in science.

(iv) Additional aspects that are mentioned by the sample were (a) the difficulty of mastering science became a motivating factor; (b) one or two women state that their dislike of social science motivated them to move into the natural sciences; (c) one woman mentions that her interest in being an educator and the fact that her parents motivated her to study as a way to overcome prejudice, motivated her to study further.

Thus, a distinction in the sample's responses can be made between cognitive stimulation and "idiosyncratic" personal motivation that influenced career decisions. In one or two cases it seems as if serendipitous circumstances played a role in career choice.

**(e) Which factors contribute towards you remaining a professional in this field?**

The issue that most women mention is that of a support system that enables them to remain in the field. A number mention that their partners are supportive of their careers.

Another major issue that contributes to many of the interviewees staying in their respective fields is their enjoyment of their work and the fact that they love what they do. Passion is oftentimes mentioned.

One respondent said because she did not yet reach her goals keeps her in the field. She also wants to contribute to solving some problems in the world as an engineer. Another said that she is good at what she does therefore she keeps on doing it. She also wants to transfer some of the skills and knowledge to others. In this regard another woman said she enjoys giving presentations and inspiring others. In a similar vein one respondent said she wants to be an example to the area she came from and show them what can be done despite lack of resources.

Some women note that their work environment is comfortable, provides them with freedom, and good remuneration. Other participants focus on what their work/career means to them personally. For example, some state that they still have much more to achieve or that they currently enjoy acknowledgement of their success.

Some participants mention humanitarian goals such as the development of South Africa, development of women, social justice and so on. One or two interviewees cite field-



orientated goals such as the current progression and development of their fields and claim that they would like to remain in their career in order to contribute to the field.

**(f) Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?**

This question overlaps with question (c) to some extent, but it probes for specific ways of overcoming difficulties. Some issues are thus already addressed above. The additional aspects that emerge are (i) the work environment of women in non-traditional roles and (ii) their reactions to these difficulties.

(i) The reactions to women in non-traditional roles (such as women in engineering or management) mentioned include discriminatory and negative remarks (which was already dealt with above); one respondent mentions a lack of support and another refers to poor infrastructure (such as toilets) at plants and sites. One candidate says that the traditionally male dominated world of work is adapted to male personalities, which causes clashes with the female personality that is more nurturing. However, another interviewee reacts strongly against the perception of the stereotypical female personality/ character as nurturing, emotional and so on. Another refers to the usual discriminatory idea of women as not being capable of doing certain things in a male dominated environment and the restriction of females to traditional roles (such as taking the minutes at a meeting or making tea). Another interviewee wonders to what extent her position as chair of meetings in her company is mere tokenism. Some respondents claim that current managers are more open-minded (see question (c) above as well).

One other work related difficulty mentioned was that in the past, the culture at a particular university was such that women had to find a voice through alternative channels.

From the respondents in Phase 2 one person said that women find it difficult at the workplace because of the existing stereotypes. These stereotypes include views of women exiting the workplace when they become pregnant. For some reason pregnancy poses a great threat which means they have put up with constant negative remarks about the possibility of pregnancy. An effect of this perception is that women do not receive the responsibility that they should. One respondent said the workplace can be adapted to accommodate women with babies.

(ii) The reaction of the women to these difficulties was one which involved working harder, establishing credibility, turning challenges and difficulties into motivations, remaining focused and generally ignoring the problems. Two persons mention that the process of overcoming the obstacles is a continuous one and one of these women says that one should aim to overcome the anxiety that comes with the demands of atypical women's roles. Another interviewee says that she enjoyed taking on these challenges. Another participant states that she experienced a turning point in her career when she realised that she is actually *good* at what she does and she *can* do what she wants to do, as opposed to merely trying to establish credibility and pleasing others by working hard and not believing in herself.

**(g) How did your personal life influence your professional life and vice-versa?**

The responses of the sample can be divided into (i) personal/work life balance and (ii) personal or private issues.

(i) Most of the responses focus on the relationship between personal life, i.e. relationship context, and work life. Some interviewees (7 out of 19 or 37 % for Phase 1) said that they

have supportive partners enabling them to juggle household duties, children and their work. Most of these women mention that they have a good support system which also includes help with the children. The support system can include friends or having the same interest (including work related interests) as their husbands. Some of the interviewees' husbands have flexible jobs i.e. they can be available to care for children and household duties. Most of the women work long hours and travel extensively.

Some of women state that they strictly separate their personal and work lives, i.e. by making sure that work is done at work; deciding whether additional tasks are really important to take home; or by delegating work.

Most of the married women have children and they have support systems at home such as a person helping with the children and a flexible and helpful husband. Those that are single with no children all cite their marital and family status as a reason why they can work later, over weekends or travel considerably.

Seven of the nineteen women from Phase 1 impart that they struggle to find balance between their work and personal lives.

There is a clear difference in the responses of the younger women from Phase 2 when compared to the responses of women in Phase 1. Some of the participants from Phase 2 perceived their control over personal/work life balance as precarious compared to respondents from Phase 1. The unmarried women in Phase 2 said that it is fortunate that they do not have the responsibilities of a married life and children and they get to spend more time at work. Some of the women from Phase 2 had to make great sacrifices on their way to achieve their goals such as leaving their family at home for a time, one even working a long distance away from her loved ones. Spouses support them and when they are married the spouse's role is essential for survival. They take care of children when required and take over duties whilst the women study or work. A few women from Phase 2 balance work and personal life well, making time for their families, spending time with them and trying not to bring the work home. Others follow strict regimens to allow them to finish their work even when children demand their attention such as when hospitalised.

One can assume that the personal/work life balance issues are not yet settled for some women from Phase 2 because they are fairly new in their careers compared to the women from Phase 1.

(ii) The second category of responses fell into personal or non-relationship issues. One respondent explains that her personality characteristic of reacting emotionally to criticism has influenced her work. She is learning to separate criticism of her work from personal criticism. Another interviewee says that issues such as resilience and the ability to function under pressure are important. Other women state that engaging in relaxation activities such as running is important.

**(h) In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?**

The responses of the sample can be categorised into (i) personal characteristics of a role model they would like to see advertised, (ii) life-style aspects and (iii) a focus on learners at school.

Three participants from Phase 1 mention that they do not really regard themselves as role models but are on their way to success. Like most of the women that did not regard themselves as successful from Phase 2, most do not regard themselves as role models. These two aspects are probably related because viewing one self as successful provides

more reason to present one self as a role model to others. However, when prompted most of the respondents did mention examples of situations where they regarded themselves as role models. Usually it was in the context of going back to their home environment and giving talks to girls and other groups about the success they have achieved – usually in terms of completing their studies and starting a career in science. Thus, role modelling consists of the example of being able to achieve certain goals despite setbacks and obstacles. In this regard one woman said that one must be careful to only mentor those students that do good – she takes herself as an example of someone that obtained her PhD despite obstacles, hardship and not outstanding grades at school.

(i) Personal characteristics women should foster as scientists are hard work, being open to new experiences, intelligence, enthusiasm, passion for what one does, self-confidence, high motivation, being bold and unafraid, perseverance and determination. This should be bolstered by a strong belief that one can do anything one sets one's mind to and that anything is possible. Further, women should take control of and responsibility for their careers, amongst others by networking and healthy self promotion. Issues such as race or gender should not stand in the way of success. Negative characteristics such as rudeness, being selfish, and disorganised should not be part of the role model's characteristics.

(ii) Females should be made aware that a balanced family life is possible whilst having a successful career. Some persons explicitly mention that a woman aiming for a professional science career should choose their partners carefully: they must be able to support them, encourage them and want them to succeed.

(iii) The stereotypical images of women scientists as grey-haired with no social skills should be broken down. The media all too often promote negative and stereotypical perceptions of female scientists. Thus, changing these images in the media is important.

Many proposals are given for advertising science to children, with the most salient points being highlighted here. Firstly, it is necessary to realise that children have a natural curiosity which one can focus on. Children's interests differ according to their age, which means that the way material is presented should differ. Children also share the perceptions of their parents and their environment, so the false idea that females ought to be weak at math and science should be broken down. Most of the respondents from Phase 2 could list a number of issues they would convey to the girl-child such as believing in yourself and that you can perform, that science is not difficult, and that one should have motivation, work hard, and stay focused.

Children should be targeted from a very young age to break down the gender barriers in terms of abilities: it should be emphasized that girls can do just as much and perform just as well as boys. One respondent said the negative publicity about maths and science as difficult should be reversed by the teachers.

One participant suggests that a good understanding of the problem field, namely, why girls do not enter into SET careers, is required, and that this can be acquired by means of a proper social/psychological analysis. It might be, as one respondent mentions, that females and males differ in terms of what they are attracted to in a particular career such as chemical engineering. If it is found that females are generally more creative, nurturing, and compassionate, then specific aspects of SET careers that appeal to those characteristics can be emphasised (such as doing something for the planet or achieving social justice). Proper understanding of why people enter into careers can also alleviate the problem of entry into certain careers for the wrong reasons, such as social status. Oftentimes, students become disillusioned because their career content and context is not what they expected. In this regard, it is important to expose children to actual careers and applications. Some respondents comment that there is a discrepancy between what one learns at university

(such as math) and its application. However, they admit that it is necessary to have the correct tools to be able to reach the goal in the end.

These ideas provide some guidelines for how campaigns such as road shows, science fairs, talks by prominent SET women and even children's books can be better structured. A one-fits-all campaign will not work. It is interesting to note however, that one respondent feels that road shows are a waste of time and two persons agree that one should rather focus on students than scholars. One proposal is that students with potential should be provided for in terms of bursaries that cover all their needs whilst they are studying. The motivation is that it is no use getting children excited about science, when they later cannot enter university because of a lack of funds.

Some respondents agree that parents and teachers should be the targets of some of these campaigns. They should be exposed to science, its applications and various SET environments, because if they become excited, they will transfer their enthusiasm to the children. The basic principle is that if one is interested and excited about a subject, it will be fun.

## 7 DISCUSSION

The leaky pipeline metaphor (referred to above in paragraph 6.5(a)) illustrates that women in SET careers drop out of the process of career development at various points in their life histories for various reasons. The critical periods for leakage are (a) early childhood, (b) adolescence, (c) entry to undergraduate studies, (d) the remaining part of graduate studies, (e) and the job entry time (Pell, 1996). From the remarks made by the sample on targeting schools in order to stimulate science interest, and the fact that some of the participants in the sample fell into the negative stereotype trap at school, one can infer that some girls will be lost for science and math at phases (a) and (b) above. Pell (1996) relates the reason for leakage at the stage of primary and high school to a lack of self-confidence. Although girls perform well on math initially, studies in the US (Pell, 1996; see also Penner & Paret, 2008) show that later in school the gap between boys and girls on math and science scores widens markedly. In Pell's overview, it was also found that entry into college was marked by a loss of focus and self-confidence. If a girl's confidence and performance is not boosted in high school, she enters university with self-doubt about her abilities. If she manages to enter into graduate studies, self-doubt about her degree is expressed as the *"imposter phenomenon"* where women ascribe their success to *"luck, hard work, being at the right place at the right time, knowing the right people and interpersonal skills instead of to ability or competence"* (Pell, 1996, p. 2846). The next phase where leakage occurs is when females enter into relationships and try balancing the demands between family, children and career.

This study investigated the stories of nineteen women that can be regarded as successful and it will be illuminating to compare their career stories to the crucial segments of the leaky pipeline.

The participants in the study have diverse careers and despite some similarities in the themes that will be pointed out below, their stories about entering into their careers are very different. Some had an interest in science from school, whilst others did not realise at school that they would like to enter into science careers. Some did not have an interest in social science and for this reason gravitated towards science and technology. Some of the respondents emphasise the context and environment that played a role, such as living in an academic environment or having parents who worked for industry. Besides one respondent who cites stubbornness against the view that math and science are not choices for females as her reason for taking math at school, most did not refer specifically to gender as a

motivating factor in choosing a career in SET. This stands in contrast to the motivation for career choices some international women made: "*In my case, it actually was a gender related decision ... women were considered too delicate for that kind of work. I had a rebel mentality from an early age, so I decided that I had to become an engineer*" (Chowdhury, Hoo, & Pasik-Duncan, 2007, p. 138).

Despite their different stories, most of the women had someone, be it a parent, teacher or other person, motivating them to aspire for science fields of study and careers in science and technology. These women also survived the critical phases in their life histories. Where other women dropped out of the race, they carried on. There are certain characteristics that probably distinguish them from others who have not continued, but of course, without comparing their stories to those that did not make it confounds the isolation of those crucial aspects responsible for success. However, as Pritchard (2006a, p. 4) states: "*Though each career is distinct, successful women in science share many qualities, attitudes, and goals that can be instructive to aspiring scientists*". The common themes that can be identified are discussed below.

## **7.1 Indicators of success**

Indicators of success for the sample can be divided into two categories, namely, intrinsic indicators and extrinsic indicators. Intrinsic factors relate to those issues a person experience in one's career, namely personal developmental goals and job satisfaction. Thus, if a participant enjoyed her work, this satisfaction could be a personal indicator of success. On the other hand extrinsic indicators are visible to people, such as getting acknowledgment for expertise and doing work that one can see makes an impact on one surroundings and the world.

The women in Phase 2 had fairly little to show in terms of extrinsic indicators except completed studies and some success in their current careers. Most of them regarded themselves as on the way to success. This group clearly showed that they have intrinsic motivators for success.

Thus, the women from Phase 1, who have established careers, were able to indicate concrete and external indicators of success as opposed to the women from Phase 2 who are at the start of their careers.

## **7.2 Obstacles**

What obstacles did they face? Most women, when confronted with this question, immediately indicated that there were no real challenges as a woman. However, Marchbank (2005) noted that she was also not able to immediately list problems in her career when confronted with a similar question and the reason probably was that discrimination against women is embedded in structures and are far more subtle than we are led to believe. However, in the current sample, one participant has focused her career on social justice, prejudice against women and racism; and most respondents could remember discriminatory attitudes and remarks at some time in their studies and careers.

Most women in the study point out that discrimination was experienced on tertiary level and in early stages of their careers. Male students and older males were responsible for negative comments and attitudes and in general the reaction was to ignore it (cf. Chowdhury et al., 2007, p. 140). It could well be that most of these successful women are not aware of discrimination because of a combination of turning a blind eye, but also because the times have changed. As one or two of the participants point out: younger males in industry have

changed attitudes towards women. However, it is more likely that most of the women in this sample have such strong focus and determination that issues which normally derail females in these crucial life moments are simply ploughed through.

In contrast to the position above, the younger women in Phase 2 experienced the entry into the work environment as difficult. University knowledge and skills do not necessarily prepare the incumbents for the work place. Their initial difficult incorporation into the workplace is strongly related to their age and gender. When they as less experienced staff are confronted with entrenched staff the difficult transition can all too easily be depicted as a gender issue. These remarks from the respondents point to a form of institutionalised gender bias in the labour market that is much more subtle than mere gender under representation in certain market segments. The transition from tertiary education to the job seems to indicate a real problem for women in SET careers. This transition seems difficult and women are not adequately prepared to take this important step. Women encounter difficulties that require mentoring from more experienced role models that is planned and structured and not merely on an ad hoc basis.

One should realise that the transitional phase probably is universal and applies to men as well. However, one of the respondents mentioned explicitly that when males have problems at work it is seen in a total different light than when women experience problems. Men are assisted and accommodated whilst women are confronted with their gender.

### **7.3 Overcoming obstacles**

The women in the sample have strong opinions about overcoming obstacles. First of all, obstacles are regarded as challenges. Some reiterate the importance of self-confidence and the belief that one can do anything one sets one's mind to. The sample also, more than once, mentions hard work, perseverance and the impetus to prove one self. The initial struggle of the women from Phase 2 when entering work shows that they probably need communication and negotiation skills in this particular phase. Serious consideration should be given to providing communication/negotiation skill training.

The importance of self-confidence cannot be emphasised enough. As stated above, Pell (1996) indicates that loss of self-confidence is one of the causes of losing girls for math and science. Another study shows that there is a significant relationship between what an adolescent believes about her ability and what she eventually does, i.e. self-estimate of ability is relatively accurate to discriminate between those having math and science career aspirations and those that do not have math and science career aspirations (Hollinger, 1983).

Strong self-confidence and tenacity (which is implied in the use of "stubbornness" by one respondent) can also be subsumed under what Pritchard (2006b, pp. 133-134) calls "mental toughness": it does not refer to an uncaring attitude or insusceptibility to criticism but it is about

*... learning to view situations objectively, responding consciously, rather than reacting mindlessly, and using the power full energy of our emotions as positive motivators in our lives, rather than allowing ourselves to feel helpless in their grip.*

The qualities these women exhibit are in line with the current emphasis in positive psychology (Seligman, Steen, Park, & Peterson, 2005) on qualities such as optimism and self-efficacy. Optimism is the belief that good things will happen rather than bad (Carver & Scheier, 2002) and self-efficacy is the belief about what one is capable of doing (Maddux, 2002). According to positive psychology's tenets, some of these characteristics are part of a personality structure, but some can be learned (Seligman, 2002). The skills and mental

attitudes part of a successful woman's repertoire can be emphasised in campaigns and support structures.

#### **7.4 The role of parents and teachers**

The powerful role of parents in the lives of women is emphasised in a number of the interviews. Many participants mention that their fathers were significant role players in their choice of study and career. Shackleton, Riordan and Simonis (2006, p. 578) refer to similar trends when analysing successful business women. Fathers motivated, made science and math interesting and instilled other values important for performance. Some also mention their mothers who played a role in supporting and guiding them and instilling interest in math and science. Even in these examples, the father's role was one of highlighting the importance of discipline, hard work and perseverance. The role of a parent on a child's interest in science and on the success of their eventual careers cannot be emphasised enough.

#### **7.5 Support structures**

Support structures and systems feature widely in the narratives. From having a supportive husband that can look after the children, and believing in a women's ability to succeed (also Chowdhury et al., 2007, p. 141) to the support of friends, family and colleagues are mentioned. Similar trends are evident in a study among female university professors in Turkey (Özbilgin & Healy, 2004). It is clear that the women regard hard work as essential in their success and that this cannot be achieved if there are no support structures in place. Thus, those with families and children relied on their family systems, whilst those not married with no children cited their marital status as why they have the opportunity to succeed.

Support structures at work also emerge as important. One of the reasons cited for remaining in their current jobs was feeling comfortable in the work environment. In a study examining turnover of professional women in IT, it was found that the tension between work and family responsibility was to blame for job turnover (Armstrong, Riemenschneider, Allen, & Reid, 2007). Flexible work schedules countered this threat, but then impacted on promotion opportunities.

#### **7.6 The reproductive role of women**

The work environment does not make provision for the reproductive role of women; it focuses mainly on women's productive role. Almost invariably the respondents from Phase 2 with children mentioned this as an issue. Because the reproductive role is one that is socially expected from women, a discrepancy in the workplace regarding this role exists (See Urry, 2008). No one else can fulfil the reproductive role but in a sense women at work are punished for this role by negative remarks, discriminatory attitudes and lack of responsibility for work and projects. Although maternity leave is provided by companies its value is almost negated by the discriminatory attitudes towards the reproductive role of women. Thus social, financial and workload support for women should receive urgent attention in the workplace. Women that go on maternity leave, have to relinquish projects and work for the time that they are away from work. They also have to start from scratch when coming back from maternity leave. One participant clearly stated that she cannot risk having a baby because she then would have to start her career over again. This point further supports the existence of institutional gender bias in organisations mentioned above: *"Despite women's full-time labour commitment, traditional gender role*

*arrangements are still very much entrenched. Women are still those who bear domestic and family duties, look after children , the ill and elderly in addition to their paid work outside of home or activities that earn money to provide for the family” (Unifem, 2004. p.5)*

## **7.7 Focus**

The women in the sample exhibit a strong sense of focus and commitment to their careers. Some with families manage to separate their personal lives from their careers, whilst others struggle. Some even assert that women interested in SET careers must be told that it is possible to achieve a personal/work life balance. However, it should be made clear that maintaining balance is hard work; some even struggle with personal issues such as becoming emotionally involved with the work. Other women mention the discrepancy between study and job content: what one studies and what one expects from the job environment can be two different things. Another respondent mentions that the type of environment might not be what a woman expects it to be, such as having to wear boots in muddy places. Prospective SET women ought to be well informed about their options, and that when that decision is made, they should remain focused and determined. Similar characteristics of success in their respective fields were pointed out by Kass, Souba and Thorndyke (2006) for women in successful surgical careers, namely: perseverance, drive, good communication skills, passion for the particular field, stable home life and a positive outlook.

## **7.8 Role-models**

Some of the women in the study are reluctant to identify with the role-model idea. Most of the women from Phase 2 did not regard themselves as role-models because they are commencing with their careers and are on their way to success. Despite this, most respondents indicate a number of issues important for establishing role-models. Personal characteristics were deemed important. Passion, enthusiasm, high motivation, and determination are characteristics mentioned by the women. In their study at a prominent South African university, Shackleton et al. (2006, p. 579) interviewed female students and female lecturers at the engineering faculty and concluded amongst others that “... *the powerful impact that women exert as role models to other women and students cannot be overemphasised.*”

It is well-known that personality plays a role when selecting careers (Rubinstein & Strul, 2007) and students in different faculties express different characteristics (Rubinstein, 2005). In this regard, some of the respondents claim that those characteristics that make a particular career interesting for males and females should be exploited. Rather than matching personality characteristics and career (such as social work for “nurturing” women as opposed to physics for men), the characteristics that different personalities might find interesting in a specific field could be emphasised (Rosenbloom, Ash, Dupont, & Coder, 2007).

## **7.9 Negative stereotypes**

Most women agree that negative stereotypes exist at schools, namely, that girls cannot do math and science (cf. Penner & Paret, 2008; Plumm, 2008). As one respondent said:



*"You have to believe 'No, I can do it. I don't need someone else to tell me that I'm not capable of doing it.' Because when I was at school, there was this idea that girls are not as smart... are not smart enough..."*

Similar views are still prevalent in many other countries (Papastergiou, 2008). Research has shown that women indeed fare poorly when impressed with the perception that females do poorly in math (Good, Aronson, & Harder, 2008). To a large extent, negative stereotypes create beliefs and behaviour that conform to negative expectations. The negative stereotypes are probably embedded in views people learn at home and at school; in fact one study showed that peers play a larger role than teachers to create and perpetuate gender bias in the classroom (Plumm, 2008). Research indicates that the images learners have of stereotypical students influence their choice of subjects and even careers (Hannover & Kessels, 2004). It is therefore important to be aware of these issues even in the media and the way female scientists are portrayed (Jones, 2005). Research shows that by minimizing "disruptive social forces" women can perform just as well, if not better, than males in mathematics (Good et al., 2008).

## **7.10 Making science visible**

It was agreed by most respondents that visible marketing of one form or another should be embarked upon. Similar sentiments were expressed in a study of how to attract women into cardiology (Warnes et al., 2004). The support that the women in the sample gave to the idea of marketing science to children of various ages is also reiterated by international women scientists. For instance Andrea Brand, a molecular biologist, said: "*Speaking to younger girls, who unlike graduates haven't decided on a career, is crucial*" (Shetty, 2008). Chowdhury et al. (2007, p. 142) highlights helpful comments that emerged in their interviews with women in SET: to attract women in science one should (a) pay attention to recruitment. Depending on the field, whether industry or academia, women should do the recruitment, search for women and sit on selection committees; (b) pay attention to retention, i.e. careers should be made attractive for women. Thus, women should be able to fill the prestigious posts, cater for motherhood and other life-changing events in the institution. A good example was the division of Anglo Research headed by one of this sample's participants: in her division, allowance was made for gender, religious and cultural issues. (c) In the last instance, the development of women must receive attention. Workshops to educate women in aspects of their jobs can be held, and mentoring, and coping with the demands of their jobs can be supported by various means. In general, networks of support can be established and examples of international networks exist (Leicht-Scholten, 2007).

A focus on parents and teachers to stimulate a love of science is proposed as a result of in this study. The argument that if parents and teachers are excited about science, learners will also become enthusiastic is mainly formulated from some of the respondents' experience. One should keep in mind that there are many factors in the classroom that either perpetuate or break down gender biased performance in math and science. A holistic grasp of the problem and some effort from the teacher's side probably would make a difference as recent research shows (Mayer-Smith, Pedretti, & Woodrow, 2000). Training of teachers in science is probably necessary for effective impact on learners (MacLeish et al., 2001)

Most of the women interviewed agree that there is a willing audience out there. The following points need to be taken into consideration:

- Children have different interests at different ages and campaigns should allow for this.

- Children can be easily enthused because they are naturally curious and they take their teachers and peers seriously. Thus, teachers (and parents for that matter) must be trained and/or exposed to the world of science and applications.
- An effort should go into breaking down the gender discrimination barriers, but breaking down other prejudices is equally critical. Cultural, racial and gender issues can easily stand in the way of children's enjoyment of and access to learning.
- It is important to have supporting networks for women interested in SET and female students. Role-models seem to be very important to show them that it really can be done.

## 8 CONCLUSION AND RECOMMENDATIONS

Although the literature is replete with examples and research on why women do not enter and stay in SET careers, the current study deals with 29 successful women who entered into the field and are currently working successfully in SET careers. The following characterises them:

- The majority indicated intrinsic factors that indicate their success such as development and job satisfaction.
- Despite a number of different factors that could have impeded their performance, they maintained a strong belief in themselves.
- Obstacles were seen as additional challenges.
- In more than one way, these women create supportive environments, albeit in the form of family, friends or a supportive work situation.
- They enjoy their work and more than once talked about passion for their work.

A few issues pertinent to the younger group from Phase 2 came to the fore:

- Most of them experienced discrimination in the beginning of their careers. The discrimination comprised negativity towards them as women (rather than race) in their particular fields. They managed to overcome this barrier. However, one should note that the discrimination experienced by these women emphasises the prevalence of gender bias in society; women are still regarded as inferior to men.
- Although most of them do not regard themselves as successful yet, they have a strong focus on the goals in their careers. They all have an attitude of expecting success in the future.
- Some regarded obstacles as the ignorant perception of others and they believe in themselves to overcome these. The ten women are driven and highly motivated and obstacles were seen as opportunities.
- Most of the women in the study spoke about the working conditions that do not allow for their reproductive role. The implication is that they have to choose between work and a family. On a subtle level discrimination against women is institutionalised because the productive role is preferred to the reproductive role in organisations.
- Several of the women experienced problems with initial adaptation to the workplace. They found it difficult to apply theoretical knowledge to the workplace. This transition combined with gender perceptions complicates their adaptation in the work situation. It seems as if support for these women is required when entering into careers.

Negotiation skills, communication skills and enhancing self-confidence are necessary in the transition phase from training to the work place. Although most of them coped in the end this could indicate a crucial phase where women tend to exit SET careers.

The following can be proposed:

- The problem of the lack of women in SET careers must already be addressed on primary school level where children are exposed to the notion that girls cannot do mathematics and science in the same way as boys. This notion that women are not competent is unfortunately transferred to the university environment and to the phase of entering into a career. Thus, already on school level, but on other levels as well, gender equality should receive attention.
- Role models seem to play an important role in studies and career choices. Thus, focus on programmes and campaigns that promote the visibility of role models, such as what the Science, Engineering and Technology for Women (SET4W) committee does, must be encouraged.
- The viability of induction programmes for women to assist them with the transition from tertiary studies to a job can be explored. However, one should be aware that if this is done only for women, the labelling of women as not competent can be perpetuated.

Despite the evidence that women do not enter SET careers in sufficient numbers, especially in South Africa, there are some women that do, and who make a success of their careers. Our study included examples of exceptional women in SET careers who have managed to evade the threats of the leaky pipeline. This not to say that they have not experienced difficulties along the way: they have all struggled with prejudice, discrimination on some level, lack of support, and the struggle to find balance in the lives because of family responsibilities and personal issues. However, their overwhelming belief in themselves, determination and ability to work exceptionally hard are among the factors allowing them to succeed. Obstacles are regarded as challenges and in a sense there is a stubborn streak in most of them which causes them to persevere. The sense that they enjoy their work and are very enthusiastic about science and their fields also emerges strongly. In addition, the belief that they are contributing not only to their own lives, but also to the lives of others, seems to be an important motivational factor. Their message for girls at school and women aiming for and already in SET careers is simple: "Anything is possible!" Immediately this slogan negates whatever discrimination there is: they choose to ignore people's "silly" and petty prejudices. If they were self-conscious or had a lack of confidence, this quickly was consumed by a desire to succeed, grow and reach their respective goals. In a sense, they are like the students one of the respondents describes: something just clicks and you know that this person has the desire, ability and drive to succeed.

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# 1 APPENDIX: INTERVIEW SCHEDULE

## INTERVIEW SCHEDULE FOR Women in Science

*The interview will be conducted in about an hour. It is divided into two sections, namely, a personal detail section, and some questions about your career and opinions about women in science.*

### SECTION A: PERSONAL INFORMATION

*There is some personal information that we would like to record. Could you provide me with the following details?*

- 1. Interviewer \_\_\_\_\_
- 2. Support for Interviewer \_\_\_\_\_
- 3. DATE of interview \_\_\_\_\_
- 4. PLACE of interview \_\_\_\_\_
- 5. Full Name: \_\_\_\_\_
- 6. Current Company \_\_\_\_\_
- 7. Current Position \_\_\_\_\_
- 8. Years in current position \_\_\_\_\_

- 9. Telephone (Home) \_\_\_\_\_
- 10. Cell phone \_\_\_\_\_
- 11. Telephone (Work) \_\_\_\_\_
- 12. Email \_\_\_\_\_

- 13. Postal Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 14. Gender 

Male	<input type="checkbox"/>
Female	<input type="checkbox"/>
- 15. ID Number \_\_\_\_\_
- 16. Age \_\_\_\_\_

17. Please indicate your home language

- English
- IsiNdebele
- IsiXhosa
- IsiZulu
- Sepedi
- Sesotho
- Afrikaans
- Setswana
- SiSwati
- Tshivenda
- Xitsonga
- Other (Specify)

- 18. Indicate your marital status
- Married
- Single

Divorced	<input type="checkbox"/>
Widow/widower	<input type="checkbox"/>
Married (traditional)	<input type="checkbox"/>
Living together	<input type="checkbox"/>
Other (Specify)	<input type="checkbox"/>

19. Indicate your highest educational level or equivalent (tick one)

Grade 12	<input type="checkbox"/>
Technikon Diploma	<input type="checkbox"/>
B-degree	<input type="checkbox"/>
Honours degree	<input type="checkbox"/>
Masters degree	<input type="checkbox"/>
D or PhD degree	<input type="checkbox"/>
Other (Specify)	<input type="checkbox"/>

20. Indicate the field of study of your current career

---

21. Indicate the field of study for your highest qualification

---

22. Any special awards/honours in your field of work?

---

*This is the end of the first section.*

## SECTION B INTERVIEW SCHEDULE

*In the second section I would like to ask you some questions about your career.*

### 1 Main questions

- 1.1 *Tell me about your what your current career entails*
- 1.2 *Why would you regard yourself as successful in your SET career?*
- 1.3 *Did you find it difficult as a woman to achieve success in your career?*
- 1.4 *What and who motivated you to choose a career path in Science, Engineering & Technology (SET)?*
- 1.5 *Which factors contribute towards you remaining a professional in this field?*
- 1.6 *Did you experience difficulties as a woman on your way to success and how did you overcome these difficulties?*
- 1.7 *How did your personal life influence your professional life and vice-versa?*
- 1.8 *In what way would you regard yourself as a role model for women and girls wanting to embark on the same road? In other words, what would you like to emphasise as a role model?*

### 2 Early developmental history

- 2.1 *Do you recall the first time you started becoming interested in SET? How old were you?*
- 2.2 *Do you think there is an age at which women loose interest in SET and WHY?*
- 2.3 *Did you have a woman (or male) role model WHO ENCOURAGED YOU to become interested in SET? Tell me more about them.*
- 2.4 *How did school (primary and secondary) influence your perceptions about women in science?*
- 2.5 *How do you think women's perceptions of SET are influenced by their teachers?*



### **3 Tertiary training**

- 3.1 *Can you divide your career development into phases? What are they?*
- 3.2 *Which phase is more important to you as a woman in SET?*
- 3.3 *Do your studies relate to your current career?*
- 3.4 *What motivated you to pursue/ choose your field of study?*
- 3.5 *Did you encounter difficulties as a woman in your studies at your tertiary institution? What were they and how did you overcome these difficulties? (these could be psychological, institutional, cultural or technological)*
- 3.6 *Were there any support structures in those times? What were they and how did they support you?*
- 3.7 *During your training, have you ever being marginalized because you are a woman? How and why?*
- 3.8 *What are the barriers women face today in SET studies?*
- 3.9 *How do you think these barriers may be overcome?*

### **4 The beginning of the your career**

- 4.1 *Were there any factors that hindered your career choice in SET? (for example, socio-cultural perceptions, i.e.: women should stay at the home to cook and clean or they should study to be a nurse / teacher)*
- 4.2 *Do you think males/females should be assessed for appropriate SET careers? Explain.*
- 4.3 *Are there SET careers more appropriate for males or females? Explain.*

### **5 Development of a career identity**

- 5.1 *Did you take specific steps to develop your career as a woman? What were they and how did they assist you in building your career?*
- 5.2 *Do you think that being a woman made a difference in your career success? In what way?*
- 5.3 *In developing your career, have you seen a dominant understanding or (mis)understanding of SET as a career for women by women themselves and by the society? I do not understand this question?? Can it be reformulated?*
- 5.4 *Did you experience difficulties as a woman on your way to success?*
- 5.5 *How did you overcome these difficulties?*
- 5.6 *Can you indicate extrinsic and intrinsic deterrents that can lead to SET-career avoidance by females?*
- 5.7 *What do you think are the factors in society's expectation of women that prevent them from pursuing SET careers? In other words, are there things about women's behaviour, competencies, psychological makeup or whatever that prevent them from pursuing SET careers?*
- 5.8 *How can women deal with these expectations and prejudices?*
- 5.9 *Are there certain expectations from other males/females in your professional environment regarding how you (as a SET professional) should or should not be or behave?*
- 5.10 *Do you think that females in SET face different difficulties from those encountered by their male counterparts? (Factors like maternity leave and office culture that hinder women's progress in SET careers)*
- 5.11 *Describe any support structures in place to assist females in SET?*
- 5.12 *How would you advise women to take control of their lives to ensure a successful career? This is a bit of a loaded question – I would respond rather aggressively! Can it be reformulated?*
- 5.13 *Do you think women in SET careers emphasize masculine traits and down play feminine traits?*

### **6 The emergence of a professional image**

- 6.1 *What are the negative perceptions surrounding women within SET?*
- 6.2 *What are positive perceptions surrounding women within SET?*
- 6.3 *Do you think that there are female role models in the field of SET? Explain why you regard them as role models?*
- 6.4 *Are they visible and supportive?*
- 6.5 *How do you perceive women in sestet as portrayed in the media, institutions and society?*
- 6.6 *In your opinion, what are the possible intervention strategies that can be used to increase interest in SET:*
- 6.7 *For school going girls?*
- 6.8 *For university students?*
- 6.9 *For women that have left the field?*
- 6.10 *How can one retain women in the field of SET?*
- 6.11 *Does your company offer any unique programmes / support services for women in SET? If yes, please discuss.*

## **7 The construction of a successful SET career**

- 7.1 *What strategies do you use to ensure that your voice is heard in strategic discussions and decision making?*
- 7.2 *What do you think should be done to reduce the gender stereotypes held by individuals and communities in South Africa ?*
- 7.3 *Do you think that your conception of SET is different from that of women not trained in SET?*
- 7.4 *How can institutions of higher learning increase enrolment of women in SET programs?*
- 7.5 *What changes can institutions of higher learning make in order to make the SET programs attractive to women?*
- 7.6 *Can you name at least three things that SET role models can do to help women choose the appropriate career path?*
- 7.7 *How would you motivate a girl at school to consider Mathematics, Engineering and Science as subjects or interests?*
- 7.8 *What have been the most enjoyable aspects of your professional career so far?*

<p><i>This is the end of what I need to know. Thank you very much for taking part in the interview.</i></p>
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## 2 APPENDIX: CONSENT FORM



### INSTITUTE FOR WOMEN'S AND GENDER STUDIES UNIVERSITY OF PRETORIA

#### LETTER OF CONSENT FOR WOMEN IN SCIENCE STUDY

**Project Leader:** Marinda Maree

**Contact Details:** Tel: 012 420 3898

E-mail: [marinda.maree@up.ac.za](mailto:marinda.maree@up.ac.za)

You have been indentified by the *National Advisory Council on Innovation* (NACI) (<http://www.naci.org.za/>) as a prominent and successful person in your field who can contribute immensely to a study on women in science. The aim of this study is to obtain information from successful women in science and technology careers. This information will be used by NACI in marketing campaigns to motivate women and girls to enter the field of science and technology and to study mathematics and various science related subjects. In addition, a ministerial advice on these issues will be generated for the Minister of Science and Technology from a research report on the results of the study.

The emphasis of the study is on the factors that made you a successful woman in a SET career and how you have (or have not) overcome obstacles in order to achieve the success that you have. It also aims to find out what you think about how women can be motivated to be involved in SET careers.

The study will thus make your information available to NACI for their use. However, prior to the use of any information which may result in you being personally identified, you will be contacted for consent. You may allow the use of information, or parts of information edited by you, or you may refuse use of the information by NACI.

Information from all the interviewees will be collated into a general profile of successful women stipulating the important themes and factors making them successful, how they overcame obstacles if any and how they are role models for potential students in various careers. In this regard, your information could be kept confidential, unless you explicitly request to be identified. Again, such information will be presented to you for final consent.

An interview will be conducted with you and your responses will be recorded by means of note taking and the use of a tape recorder.

I, \_\_\_\_\_, have read and understood this form.

By signing this form, I choose to participate in this research project.

\_\_\_\_\_  
Participant signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Place

\_\_\_\_\_  
Researcher signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Place