Careers Paths of Women in Science

Carrots or Sticks? A Study on Incentives to Attract and Retain Women in Science, Engineering and Technology in South Africa

Elaine R. Salo, Felix Liersch, Lieketseng Mohlakoana-Motopi, and Marinda Maree[1]

1 Introduction

The study reported on in this article examines the way incentives can be used to attract and retain women and, subsequently, enable them to re-enter the diverse fields of Science, Engineering and Technology (SET) in South Africa. The 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) in South Africa. This study interviewed 45 interviewees located within corporate institutions, government ministries in SET as well as in SET fields in tertiary institutions. The study contributes to a small but growing body of research in the field of women and gender in SET in South Africa and sheds some light on the gendered features of education and the workplace that enable or alienate women in this field.

1 Prof. Dr. Elaine R. Salo | salo.elaine@gmail.com | University of Pretoria | Institute for Women's and Gender Studies | Pretoria, Republic of South Africa
Felix Liersch | felix.liersch@gmail.com | University of Pretoria | Institute for Women's and Gender Studies | Pretoria, Republic of South Africa
Lieketseng Mohlakoana-Motopi | lmohlakoanamotopi@yahoo.com | Commission for Gender Equality | Johannesburg, Republic of South Africa
Marinda Maree | marinda.maree@up.ac.za | University of Pretoria | Faculty of Humanities | Pretoria, Republic of South Africa

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2 The lie of the land: a profile of gender policy and of women in SET in South Africa

Since the onset of the democratic era in South Africa, gender equity has been a central ideal of the Bill of Rights of the South African Constitution (1993). The South African state has committed itself to gender mainstreaming as a policy strategy to realise gender equity in all arenas of governance, including access to SET education to ensure a greater human resource base (Department of Science and Technology 2009). The Research and Development Strategy of 2002 noted that South Africa faces a problem in human resources because 'the scientific workforce in South Africa is shrinking and growing older' insofar as 'black and women scientists, technologists and engineers are not entering the academic publishing ranks and that the key research infrastructure is composed of people who will soon retire' (cited in National Council on Innovation report 2009: 4). South Africa has emerged relatively recently from a deeply racist history that favoured whites and men's access to public resources such as education and ensured job reservation in the professional well-paid SET sector. The effects of this legacy continue to echo in the contemporary period. The Departments of Higher Education and Science and Technology have made concerted efforts since 1994 to encourage women to follow academic and professional careers in SET. Although the numbers of women in this sector have increased steadily, this has been off a very low base. In addition, when we take race into account white women still remain the majority of women in SET, whilst the numbers of black[2] women in SET remain small albeit with a steady increase in number.

The basic education statistics of the Department of Education indicate that gender parity at primary and high school levels has been reached, as approximately equal numbers of girls and boys have access to maths and science at primary and high school level (Department of Basic Education cited in bsp Business Environment Specialists' report to National Council on Innovation 2011: 8), whilst women's enrolment in the SET sector of higher education has increased significantly. Subotsky (2003) reported that women's enrolment figures at the universities of technology range between 48 and 52%. This increase must be examined in relation to the diverse SET areas of study. Although the proportion of women doctoral graduates in the field of engineering sciences and applied technologies increased from 12 to 19% between 2001 and 2005 (NACI report

2 I use black here to encompass women who were classified Indian, coloured and African by the apartheid racist dispensation.

2009), the biological or life sciences and agriculture remain the preferred domain of study for women scientists The bsp report indicates the following trends in female doctoral graduates: 'In 2005 the majority of female doctoral graduates were in the Biological Sciences (37%), followed by Agricultural Sciences and Chemical Sciences. Compared to 2001, the most noteworthy increases in female doctoral graduates were in the Agricultural Sciences (from 7% to 15%), and Biological Sciences (32% to 37%). The percentage of female doctoral graduates in the Chemical Sciences dropped from 29% to 14% in 2005. Information, Computer and Communication Technologies produced the least doctoral graduates for both sexes' (NACI report 2009:18). These figures do not take account of variation by race or geography, but Mouton, Ritter and Boshoff report that white women dominate in doctoral studies comprising 57% of the total number of women enrolled in PhD programmes in 2005 (NACI report 2009). Subotsky (2003) indicates that in university enrolment figures overall, women, and African women in particular, continue to be concentrated in the social sciences and humanities.

Subotsky (2003) has indicated that it is not enough to expand enrolment figures in scarce skills areas such as SET if these do not translate into successful graduation and employment rates in the SET sector in South Africa. A report by the Council on Higher Education (2007) indicates that less than 50% of students enrolled in bachelors or national diplomas were likely to complete their studies, whilst drop-out rates for men and women in first year across tertiary institutions were high. The report however indicated that women were more likely than men to complete their degrees in all fields of study. Research examining whether the growing enrolment figures of women in higher education translate into successful graduation rates and employment in SET in South Africa indicates a consistent loss of women along this continuum with the greatest loss occurring at the nexus between undergraduate and postgraduate studies. In addition, research also indicates that the quality of the academic and workplace environment requires a great deal of improvement to ensure that a gender-sensitive, enabling environment for attracting and retaining women in SET is created.

The study below is located within and provides further nuances to the broader context of women in SET provided above. Our study set out to examine the factors that contribute to attracting and retaining women in SET across the private, state and education sectors in South Africa. The research was conducted in two phases, namely, a preparatory phase, which consisted of a review of the relevant literature in the field which informed the research questionnaire, as well

as identification of the participants. This was followed by a set of qualitative research interviews using an open-ended questionnaire as well as the analysis of the data, which informed the findings presented below.

3 Study research design and data collection

Data were collected primarily through interviews conducted with a sample of 45 respondents working in academic, parastatal and private corporations in the broad SET sector. The sample of institutions was constituted to ensure that we obtained information from a range of diverse professional sectors in SET, as well as from the private and public state employment arenas. We also had to ensure that the sample included the voices of white and black women in this field. The majority of informants from private SET corporations were white women. The parastatal companies, such as the state electricity company ESKOM, as well as government ministries such as the National Zoological Parks and a diverse set of universities, were targeted because they were more likely to adhere to the constitutional requirements for racial equity than the private sector. In addition, this sector was more likely to accommodate women's re-entry to the SET field than the private sector which is more driven by profit margins in the short term. We conducted interviews at seven universities of which two were historically white universities, three were historically black tertiary institutions, and two universities had been constituted from mergers between historically white and historically black universities (HBUs). In addition, the specific perspectives of the HBUs were considered to be an important window on the challenges that black women face as academic researchers and postgraduates in this field and what they would consider as appropriate incentives to attract and sustain a critical pool of women in SET.

We also sought to obtain the statistical data from the universities to establish the enrolment and throughput of women in SET studies. This was met with mixed success, with most institutions being unable to provide us with the necessary statistical data.

The interviews were conducted by a team of four researchers in three provinces, namely, Gauteng, KwaZulu-Natal and Western Cape. Appointments with all 45 respondents were secured via email or telephonically. Four interviews were conducted electronically and two interviews were conducted telephonically,

owing to the interviewees' busy schedules and the lack of time for face-to-face interviews.

Researchers explained the aims of the study to the interviewees and sought written consent to conduct the interview and record it using audio tape recorders. Interviewees were assured of confidentiality and all identities in this study remain anonymous. The interview questionnaire sought information on the following broad themes:

- Demographic information (described in the graphs above)
- Women's representation in the SET workplace
- Women's contribution to the SET workplace
- Incentives to attract and retain women in SET
- Assessment of cost of women's employment to company

Interviews were transcribed and analysed, using the qualitative data analysis programme Atlas ti 5 to code interviews and identify the thematic patterns contained in them.

Profile of research sample

The following table describes the academic institutions as well as the parastatal and corporate organisations from which informants were drawn.

Table 1: SET institutions

Type of institution	Number
Academic[3]	7 (30%)*
Government ministry	2 (7%)*
Parastatal	11 (41%)*
Private corporation	7 (26%)*
Total	27 (100%)*

* indicates percentage has been rounded to the nearest whole number, so the total is more than 100%.

3 Of these academic institutions, two are historically advantaged institutions (HAI), three are historically disadvantaged institutions (HDI), two are institutions constituted from mergers between HAI and HDI institutions, and one is a distance education institution.

Figure 1 indicates the representation of interviewees across race and gender.

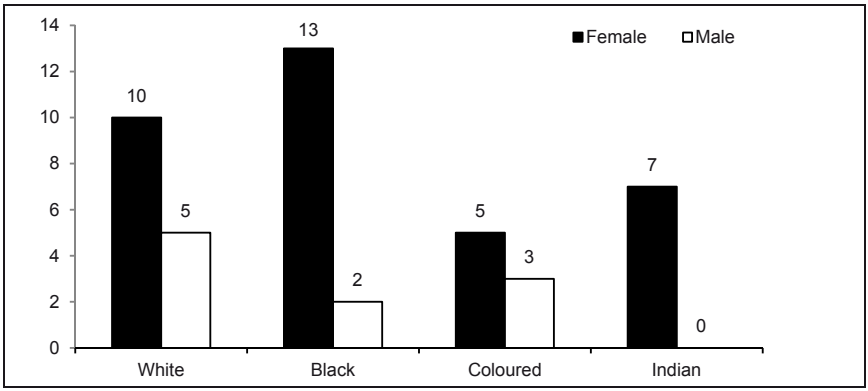

Figure 1: Interviewees' race and gender

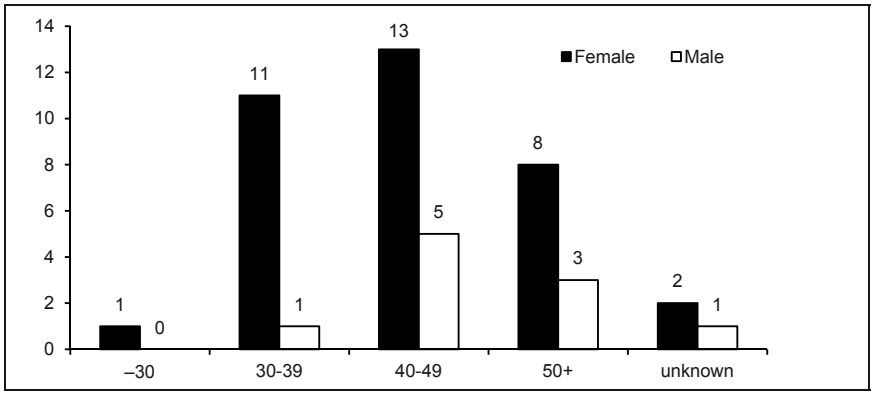

Figure 2: Interviewees' gender and age profile

Interviewees were divided into two categories, namely, key informants and general informants. Key informants consisted of men and women in senior and middle-level managerial positions across academic and corporate SET institutions. General informants consisted of women employees working in middle and entry-level positions across the SET sector in academic institutions and corporations. Figure 3 illustrates the roles and responsibilities of the interviewees, whilst Figure 4 indicates the roles and responsibilities of interviewees by gender. The sample was skewed in favour of women's representation in the sample and of academic professionals based at universities.

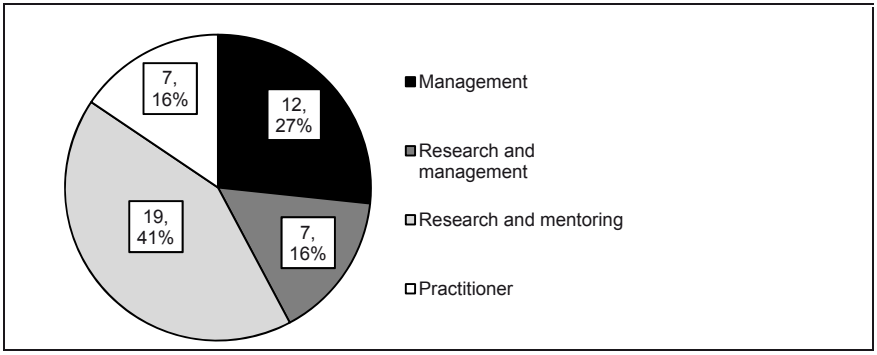

Figure 3: Interviewees' job profiles (job roles and responsibilities)

Management is defined here as those in senior decision-making roles in private corporations and parastatals, such as chief executive officers, human resource directors, and so on. Research and management is defined as the responsibilities of individuals located in tertiary education institutions who are in senior or middle-level decision-making roles and concerned with their individual and organisational research outputs. Research and mentoring refers mainly to the responsibilities of employees in tertiary institutions charged with teaching, mentoring students and research, whilst practitioners refer to employees in private corporations and parastatals, who practise their professional skills only.

Figure 4 describes interviewees' roles and responsibilities by gender – however, this table merely describes the sampling bias of the study and does not provide a basis for making a gendered comparison of the results.

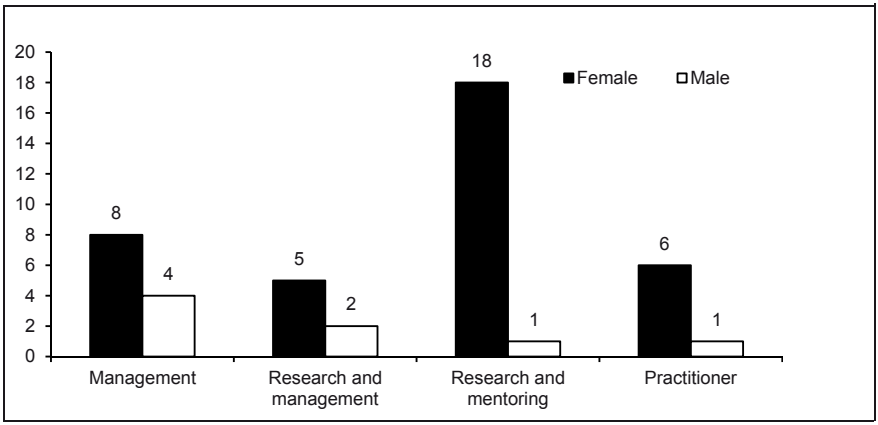

Figure 4: Interviewees' job roles and responsibilities by gender

4 Research findings

4.1 Representation of women in institutions

Most (23%) of respondents thought that women were not adequately represented in their respective organisations. Approximately 5% of respondents said that there were too few women in their organisations, while 14% of respondents said that the representation of women depended on the gendered nature of the particular sector within the organisation and the type of work done. These respondents implicitly assumed that various sectors in the SET field are gendered and recognised that the representation of women in the SET workplace would be significant in gender appropriate roles such as administrative positions, as well as in the 'clean' sectors of nuclear and energy regulation and engineering, such as management, or electrical and chemical engineering, and the auxiliary sectors of health science such as nursing, physiotherapy and so on. These respondents highlighted women's absence from the technological side of their respective fields or in the 'dirtier' fields of engineering such as civil engineering, mining and construction. Approximately 5% of responses could not be categorised. It is notable that at least 11 (24%) respondents said that there was a significant increase in the numbers of women in their respective organisations.

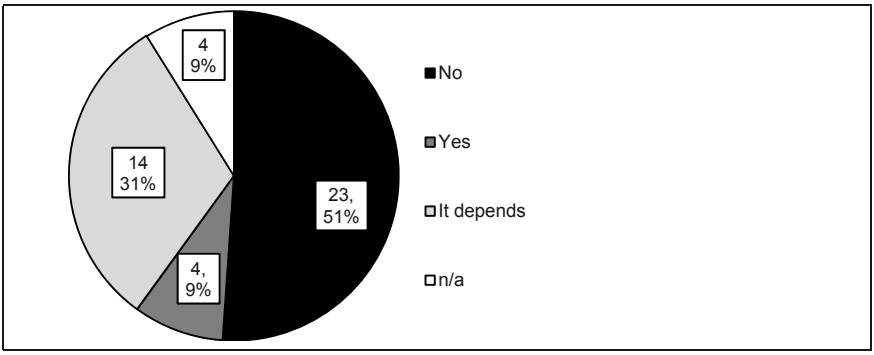

Figure 5: Interviewees' perceptions of the extent of women's representation in their organisations (Are women adequately represented in your organisation?)

They said that the improvement in women's representation was seen at middle-management administrative levels, and in certain fields that are considered gender appropriate in the SET field (such as molecular and cell biology; nursing and

adjunct medical professions such as physiotherapy and occupational therapies; general practitioners), but very few women were represented in the mining sector and the technological side of nuclear science, energy and engineering.

Those respondents who said that they saw an improvement in the representation of women in their particular sectors were from parastatals or public universities. These state-funded institutions are most likely to implement state policy requiring gender equity. At least three informants (7%) thought that women's representation was not an issue for their organisations. All these respondents were from the private sector. One respondent (a human resource manager from the pharmaceutical and beauty retail industry) said that the individual skill mattered most, regardless of gender. One respondent from a small firm of quantity surveyors said that women and men were equal in the workplace; whilst another thought that the particular industry he was based in (mining) was completely unsuitable for women to work in, and that the women who worked there 'could not be called ladies'.

The majority of respondents from all the academic institutions (51% of total respondents) said that there were too few women represented in SETs in their respective institutions or that the representation was uneven with women concentrated in the gender-appropriate SET fields, such as biology, health sciences, geography and so on. They also indicated that women were more likely to be found in lower and middle-level positions in the field. These respondents pointed to structural factors that obstructed women's recruitment into SET. These factors included the historical scarcity of women in SET due to the apartheid legislation that reserved employment within the state-run SET sector for men and for whites only, as well as the gender blindness within the workplace environment and the active gender hostility of educators.

Most of the professional SET organisational ethos was acknowledged to be dominated by a masculine organisational culture in SET. This organisational culture did not allow women who were employed in these institutions to achieve a good work-life balance. Respondents also referred to the lack of women role models in SET and the idea that women employed in these sectors were considered 'unfeminine' or unattractive. They referred to the unsafe 'dirty' nature of work in fields such as civil engineering and mining that were considered inappropriate careers for women because they conflicted with dominant ideas of femininity. Three respondents in the sample said that the under-representation of black women in SET needed to be addressed urgently. Respondents acknowledged that due to the structural shortage of women in SET, competition exists

between private industry on the one hand and the academic and public sector on the other to recruit black women from a very small skills pool. One research specialist said: *'The only thing is that the market – if there is nothing in the market – that is the problem. In the South African market there is no supply of engineers, where are they going to get engineers? Do you see my point? If they want scientists and women are not there, they would get the next best scientist who is a man.'*

One individual in management at a tertiary institution said that the sector had to be proactive in addressing the shortage. In response to the recruitment of women and particularly black women into engineering, a dean of the engineering faculty at one of the country's leading universities emphasised that a targeted recruitment strategy has to be implemented aggressively. He said that

> *We have now moved into an equity plan and we also have made our appointments mechanism more aggressive. I said there is no use getting to the stage where you have got a short list and then you suddenly realise there aren't any designated groups on the short list. Because, if there aren't, then the possibility of appointing someone in that post is zero. So I then said well, if your traditional routes of getting the advertisement out don't yield a fully constituted short list then you must either do it again or you must go target an individual. This will not guarantee necessarily that you will change the profile. In the South African context you look at South African blacks specifically in the engineering profession, and the same challenges (are faced) in industry – they also want to have those people. If your pool is generically small then industry is going to have a higher probability of getting people from that pool because they can attract them with far higher salaries. So we also have a 'building our own timber' programme and I have now negotiated with some industry and other sectors where they assist in building academia.*

He identified a number of actions such as targeting individuals and paying higher salaries that his university was considering to address the recruitment of women in the short term. He identified the 'build our own timber' strategy to address the problem of gender equity in the long term. However, he acknowledged that this required political will, a commitment of scarce material resources such as bursaries, as well as careful monitoring and evaluation of such programmes to ensure that an enabling environment for women is sustained.

The unequal histories of historically advantaged white universities and historically disadvantaged black universities also inform the racial diversity of women and recruitment strategies employed at these institutions in the recent past. However, in order to assess this representation effectively we needed to obtain the employee profile of all these institutions and compare the data. We faced a considerable challenge in this regard, as the various HR directors were

reluctant to provide us with the information, or indicated that it was unavailable. We were only able to obtain the employee statistics from three academic institutions, namely, the University of Limpopo, the University of Pretoria and the Cape Peninsula University of Technology.

The following set of graphs illustrates the representation of women at these institutions by qualification. The data are not comparable across institutions because the datasets used different variables. The University of Pretoria provided a single dataset for women staff across all the SET faculties, by race and qualifications. The University of Limpopo provided the datasets for men and women staff in SET, namely, the Faculty of Health Sciences and the Faculty of Science and Agriculture. These datasets were not differentiated by race.

Actual representation of women in SET at HAIs: University of Pretoria

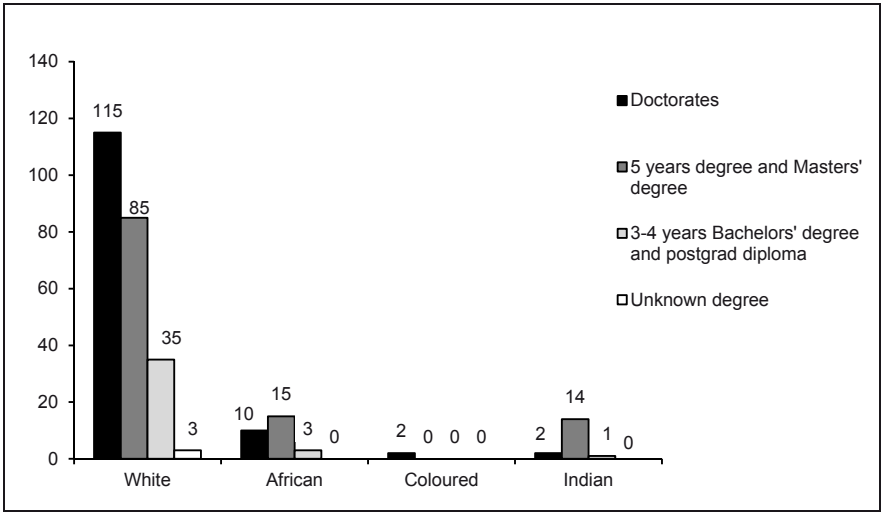

Figure 6: The representation of women in SET by race and academic qualification at the University of Pretoria, 2010

The dataset for the University of Pretoria indicates that while the representation of white women, especially with doctorates, is encouraging, the representation of black women at this institution remains woefully poor. This is due to the history of the university which was established in 1908 for white, primarily Afrikaner students only. Black faculty was appointed at the university for the first time in

the democratic era. In addition, most of the black women employed in SET here have master's degrees or five-year equivalent degrees (such as MB ChB), with a small number having doctorates. In this instance the university has to provide a careful mentoring environment that is not only sensible to gender discrimination but that also provides a supportive anti-racist environment for the few black women present, to ensure that they obtain doctorates. At the same time, the recruitment of more women and more black faculty at this university to increase diversity remains urgent if it is to become considered as a supportive learning environment for women from all race groups.

Representation of women and men in SET at HDIs:The case of the University of Limpopo

The University of Limpopo presents an excellent case to contrast with the University of Pretoria because it exemplifies the black university located in the rural periphery. The university was founded in 1959 as the University of the North. It originated as part of the apartheid policy providing separate ethnic institutions for black students and it was provided with fewer material resources compared to previously white universities such as the University of Pretoria. The institution continues to be perceived as an inferior institution with primarily black faculty members who are not as well qualified as their colleagues at historically white advantaged institutions. The data presented below capture the profile of women scientists at this university located in the rural margins of the country.

The data from the University of Limpopo indicate that in the Faculty of Health Sciences, the overwhelming majority of staff, regardless of gender, has master's degrees or an equivalent five-year qualification. However, a larger percentage of women have the basic entry-level degree (37%) compared to men (13%), with a smaller number of women holding a five-year, master's degree (52%) or higher qualification compared to men. Only 10% of women hold doctorates compared to 21% of men.

Most of the women holding doctorates are concentrated in the Department of Nursing, a traditionally feminine sector. Here the challenge to mentor women to complete higher degrees is also imperative, whilst also assisting men who hold similar qualifications.

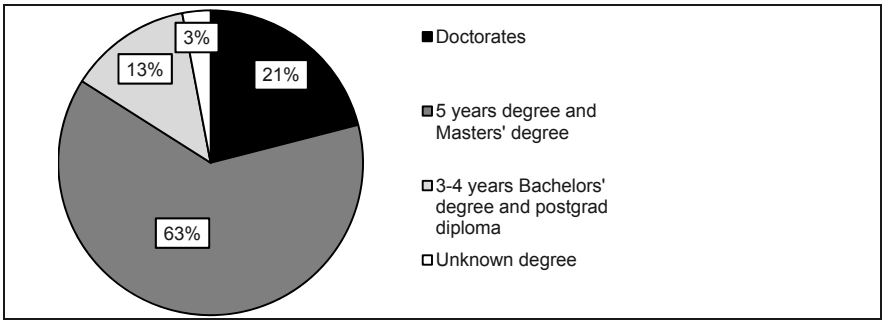

Figure 7: The representation of men by qualifications in the Faculty of Health Sciences, University of Limpopo

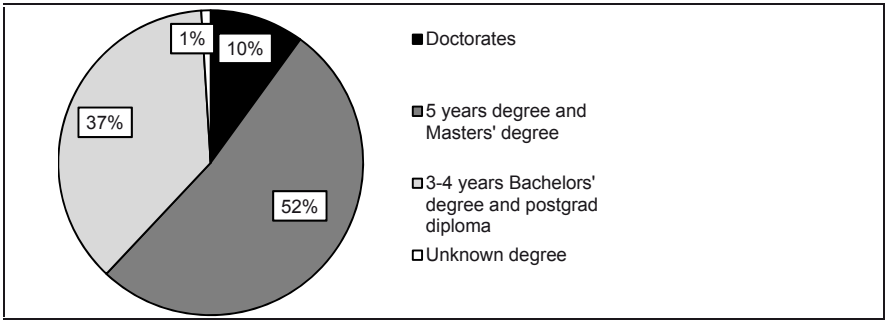

Figure 8: The representation of women by qualifications in the Faculty of Health Sciences, University of Limpopo

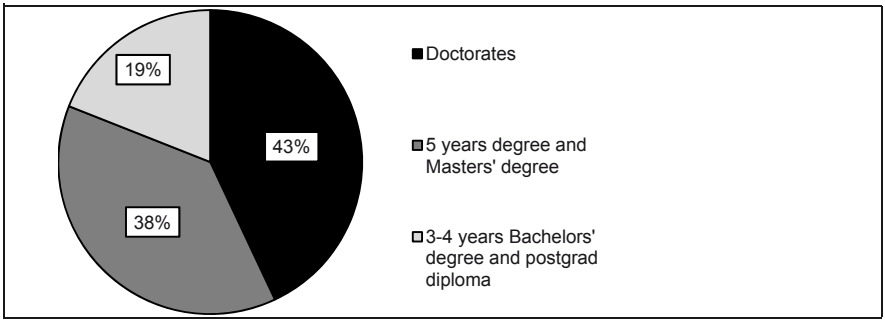

Figure 9: The representation of men by qualification in the Faculty of Science and Agriculture, University of Limpopo

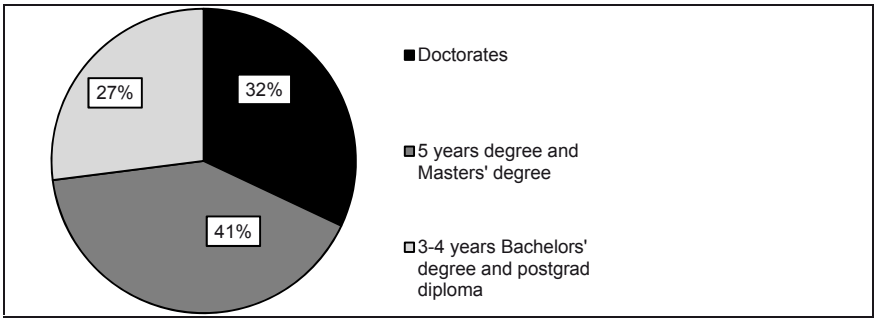

Figure 10: The representation of women by qualification in the Faculty of Science and Agriculture, University of Limpopo

In the case of the Faculty of Science and Agriculture, the data are more promising. Data reflect an increase in the numbers of women and men holding doctorates as compared to the Faculty of Health Sciences. However, once again, women tend to be less qualified than men in this faculty, with over a quarter (27%) holding entry-level degrees and diplomas, compared to only 19% of men. When respondents at this institution were asked what steps could be taken to increase the representation of women, they indicated that a more supportive mentoring environment should be put in place for women to enable them to reach the required standards in their field, while more women should be recruited to fill senior positions. However, when these responses are considered in relation to the data presented above, it is clear that more women need to be supported to complete doctorates and be encouraged to publish in their respective fields.

The profile of women faculty members' qualifications at the University of Limpopo indicates the need to provide a supportive environment for women to complete higher qualifications as well as to be mentored into the rigour of research and publication.

4.2 The importance of legislative frameworks to support gender parity in the SET sector

The majority of respondents in this study, who worked in the private sector, the parastatal companies or at universities, said that there was a marked increase in the general awareness of the legal requirement to employ more women in the workplace. Their critical consciousness can be ascribed to the requirements of

legislative framework that requires institutions to set in place gender mainstreaming and employment equity practices as a means to achieve diversity in the workplace.

The majority of respondents (57%) from private companies said that women were under-represented in their organisations. The reasons they gave included structural factors such as the scarcity of women in the labour pool for SETs; the difficulty women experience trying to sustain a balance between work and reproductive responsibilities; and the lack of political will to actively recruit women, despite the awareness of the need to do so. Two respondents (4% of total sample) said that women were adequately represented in their respective fields (accounting and quantity surveying firm) although the occupation (accounting) was really gender appropriate for men as it required long working hours. However, respondents from the small quantity surveying firm said that the firm was unusual because it was owned and run by women.

4.3 Organisational culture and women – hostile work milieus and the importance of qualitative environmental incentives

Employees' perceptions of what their respective organisations have done to accommodate women in the workplace serve as an important indicator of the relative gender-sensitive SET organisational culture or lack thereof. Consequently, respondents were asked whether their respective working environments could be considered to be supportive of women. The responses below provide a cumulative reflection of employees' perceptions. Their responses point to the great importance that transformed gender inclusive environments play in attracting and retaining women in these workplaces.

A minority of respondents (11%) said that the organisational culture of their respective workplaces were already supportive of women. Two of these respondents cited the increasing transformation of the workplace through the increased representation of women; one respondent said that the private retail corporation he worked for assisted women by allowing them a degree of flexibility around their work schedules if they requested it, and provided a wellness programme for women; another senior human resource manager in an accounting firm said that senior women were provided with flexible working schedules to assist with childcare; however, one respondent said that she did not think that organisations needed to accommodate women's specific needs. These responses should be read

against the representation of women in these organisations. However, these figures were not made available to us.

The overwhelming majority of respondents (89%) said that they thought that the organisational culture at their workplace could improve to attract and support women in the SET environment. When asked what they thought needed to be done to improve the organisational culture in the workplace, 53% said that the SET workplace should be more closely monitored and evaluated in terms of making incremental changes to improve the gender-sensitive environment of the workplace. Their respective workplaces could also ensure that women were appointed mentors who could assist them in meeting the required goals to ensure success in their careers. All these respondents said that their respective SET workplace had a male-dominated work culture. They said that this masculine organisational culture was represented by various practices that included the lack of acknowledgement of women's worth as productive workers, a generally hostile work environment that eroded women's confidence, men's refusal to acknowledge women's authority (in the context of mining and civil engineering), and authoritarian male leadership that expected women to fulfil traditional gender roles as support staff.

One respondent who had conducted independent research on women physicists in South Africa said that her findings indicated that '*they [women physicists] leave because of the hostile environment*'. By this she implied that the hostile environment incorporated lack of support or acknowledgement for work done and lack of mentorship. The various responses from respondents point to the widespread, multifaceted nature of the 'hostile environment' being referred to frequently. One respondent said: '*Yes, definitely organisational culture impacts on women. A positive environment will contribute to women staying in the job. More acceptance and flexibility will assist women in making an effort to stay*.' Here acceptance and flexibility refer to the acknowledgement of women's physical presence in and contribution to the workplace, as well as acceptance of their potential need to meet or fulfil the reproductive need to have children.

Women's exclusion from professional social networking that is key to information required for career advancement was noted. One respondent mentioned that '*the corporate world is like a boys' club*'. Some male colleagues' lack of respect for women and their demeaning expectations of women's professional roles and responsibilities were identified as a salient feature of the hostile environment. One junior lecturer in a statistics department said that her male head of department expected her to run mundane errands on his behalf such as

collecting books from his car. He was also her postgraduate research supervisor, so she felt that she could not protest his discriminatory attitude towards her. She said that she was very relieved when he left the university. Another senior associate professor said that she was subjected to a trumped-up investigation of fraud by her male head of department when she raised and managed more research grant funding than other members of her department.

Eleven percent (11%) of respondents said that they wanted their respective work environments to be more supportive of them in their efforts to balance work and other life responsibilities. Their requests ranged from a change in the organisation of work to allow greater flexibility of the physical workplace, to flexible arrangements for working hours. At least three respondents said that they thought that the request for flexibility could be facilitated by the ease of electronic communication. At least one respondent suggested that an alternative career track that included a permanent part-time career track being created for those who required it to accommodate employees with caregiving responsibilities. Interestingly, despite the perception that women would cite nurturing responsibilities as an overwhelming concern, and would therefore cite the need to create a work-life balance, this was not the overwhelming requirement that interviewees identified as the key incentive to attract and retain women in the SET workplace. This finding is in keeping with that of international literature (see literature review above).

The overwhelming number of respondents identified the need to create a nurturing, gender-sensitive and supportive environment for women employees to reach the necessary standard required of them. Respondents considered the visible lack of women in the SET workplace as a powerful indicator of the organisation's gender-blind working culture. More importantly they attributed this lack of representation to benign neglect of, or active hostility, to women, as well as the lack of necessary supportive career planning. Twenty-five percent (25%) of respondents said that their workplace could improve through the recruitment of more women, and more senior women. Potential women employees, especially black women employees, regard women's, and specifically black, women's presence in the workplace as a key indicator of a welcoming, supportive work environment. Some respondents' unhappiness in the workplace is an indicator of the direct, though invisible, cost of gendered and racial diversity. One senior black (African) woman manager in a nuclear research parastatal spoke poignantly of her loneliness as the sole black woman in her field for a long time. She attributed her willingness to continue working in the organisation solely to her strength of

character and sheer stubbornness. Her relief was evident as she spoke of the organisation's recent recruitment of more women.

These respondents emphasised the importance of women's visibility as role models in the SET workplace. A few respondents noted the significant contribution that women, especially those from previously excluded racial groups, made to diversifying and improving the organisational environment. At least two black women and two senior academic managers (deans) said that they would like to see more recruitment of black women as a means of gendering the organisational environment. In the section below we examine the ingredients identified in this study for creating such a supportive environment. These factors can be used as indirect incentives that would support women's employment in the various SET workplaces.

4.4 Career mentoring

The recruitment of women and particularly of black women is only one part of the solution to gendering the workplace – new recruits especially from excluded groups would continue to experience a qualitative sense of exclusion. In order to ameliorate and negate the effects of such perceived alienation, the necessary support structures, such as mentors, should be set in place together with a careful system of monitoring and evaluation. The importance of career mentoring and guidance both as an indirect incentive to attract and retain women in the SET environment, as well as increase gender diversity, cannot be overemphasised here. One respondent noted this point emphatically when she said that she would like to see better monitoring and evaluation of mentoring processes as a key aspect of equity policies. The black woman dean of research at one tertiary institution said that the assurance of a 'safety net' or guiding framework of mentoring practices to guide new or returning employees to the SET environment is an important means of improving the organisational culture of the workplace for women.

The commitment to invest financial resources in these indirect incentives as a means of attracting and retaining women in SET is therefore recommended here.

4.5 Employment benefits that improve the SET work environment for women

Interviewees were asked to select from a given list of benefits that they would rate as most important for improving the SET environment. These were

- flexitime
- maternity benefits
- work from home
- crèche or care for children
- conversion of full-time employment to part-time employment
- training opportunities
- leadership or other motivational courses for women
- career flexibility such as no loss of position and salary after re-entering
- other benefits including mentoring.

We provide broad brush stroke images of interviewees' responses to this question here, due to the fact that many interviewees identified a mix of benefits, thus preventing a statistical comparison. The majority of the respondents identified flexitime, training opportunities, career flexibility, mentoring and maternity benefits as the key benefits that they would like to see in the workplace and that would sustain women's presence in SET environments. The identification of training opportunities, mentoring, leadership and motivational courses for women, as well as career flexibility, alongside the needs for flexitime and maternity benefits, are instructive. The first four benefits strongly suggest that women are interested in pursuing lifelong careers in SET, whilst the latter two factors suggest a consciousness of the need for work-life balance. The identification of crèches as an important benefit was dependent upon the interviewees' workplace environment (a crèche was considered unsuitable in SASOL or the Pebble Bed Modular Reactor workplace).

Academic women's concern for mentoring and financial support in the form of scholarships or bursaries for further training and studies was elaborated on by women interviewees in particular, regardless of race or institutional affiliation. One interviewee, a senior white woman academic, noted that financial support through the provision of scholarships for women is the most important factor.

Financial support was only an aspect of the support structure, however. The age limitation placed on prospective applicants for scholarship was found burdensome for black women in particular who re-entered postgraduate studies in

SET later on in the lifecycle after childbirth and childcare. A black woman academic said that whilst the National Research Foundation[4] (NRF) provided financial support, she found the age limitation of 45 years especially restrictive. This was true for women who entered their career tracks only after childbearing. A large number of black women often completed their reproductive cycle in their twenties and thirties and returned to university to further their postgraduate studies in their late thirties and early forties. They would require research funding then. The loss of this potential skills pool was emphasised by another older respondent. This older white woman academic also noted that the lack of career flexibility during childbearing for women in the SET sector carried hidden structural costs for the country. She said

> *... you have got a woman with her doctorate, with potentially 30 years of career ahead of her; and she is dropping out (due to lack of childcare in the workplace) so what does that cost society? So if you had a structured system that ... women get their compulsory maternity leave for 4 months then say they go on 20 hours week for the next 8 months or so (she could return to a permanent position when the child is more independent).*

4.6 Questionable effects of direct financial incentives paid to SET companies by the state

When asked whether direct financial incentives paid by the state to SET companies would encourage more employment of women, more than half of the respondents (56%) said that financial incentives would not be a solution in this regard. One respondent considered the incentives as an insult to women's ability and expressed her annoyance by stating

> *You know, that is a difficult question because I think if an organisation needs tax incentives to employ more women they (the state) should not insist. Because there is something wrong that you have to buy the openness of really getting women in. It might help, but all I am asking myself is what type of organisation has such a mentality?*

Another female participant indicated that the driver for women to follow a career in SET should be their individual motivation and passion. She said that '*The money is not the issue; the issue in any career is whether you want to follow that*

4 The National Research Foundation (NRF) is the major research foundation for academic institutions in South Africa. It is supported through public funding from the state.

career?' Another female respondent argued that the qualitative improvements in the workplace environment to assist women meet their work-life balance are far more important in supporting them in the SET sector. She said that

> *'I think it is those practical things in terms of maternity leave and all that, those are we call it fringe benefits that will help them, not tax incentives'.*

These responses indicated that state incentives paid directly to companies as incentives to hire more women were considered a form of offensive tokenism by women who considered their careers to be an important aspect of their respective identities. A few respondents (15%) said that financial incentives might encourage organisations to employ more women. However, they considered the indirect incentives such as greater gender sensitivity in the workplace as well as subsidised training for individuals to be more important in this regard. Two of these respondents also mentioned that tax incentives should be used to address practical issues in the company such as building day care facilities for the children of employers.

Only 12 respondents (28%) were convinced that direct tax incentives to companies would encourage companies to employ more women.

4.7 Gender budgeting and the cost of hiring women

When company human resource managers were asked whether they thought that the cost of employing women was more than employing men, 88% of the sample indicated that they did not think that this was the case. However, the same number of respondents indicated that they had never really calculated the cost of hiring women for the company. Interviewers were required to explain to these respondents that such costs included dedicated budgets for training courses that allowed women to re-enter the workplace after time away on long maternity or childcare leave. Only 13% of company resource managers said that they had budgeted for the reskilling of women employees who re-entered the workplace after long leave or time away. This finding is encouraging but also supports suggestions from the literature that South African SET companies have not provided a budget for or calculated the cost of reskilling and retaining women in their employment.

Two of the companies that provided a budget for employing women said that the fund is part of their employment equity programme to employ individuals from previously excluded groups such as black South Africans and women.

One company indicated that the gender of prospective employees was weighted positively in selection interviews and that women were given preference in the selection of employees.

The majority of companies did not have re-skilling training programmes for women, although the minority indicated that they do and that they budget for this programme. A company that has re-skilling programmes does this for its core business and they consist mainly of refresher courses as well as international exposure through workshops and conferences.

Table 2: Cost of employing women

	Yes (%)	No (%)
Does employing women incur more costs than employing men in your company?	0	87.5
Has this been calculated?	0	87.5
Does your company distinguish between male and female employment costs?	12.5	62.5
Does your company have any policy for employing women?	37.5	50.0
Do you have a re-skilling programme?	12.5	75.0
Do you budget for this programme?	12.5	62.5

We also asked respondents whether a company would consider financial incentives paid directly to women beneficiaries. Their responses with regard to incentives are instructive and indicate that respondents wanted these incentives as a means to improve the quality of the working environment, not as an end. They emphasised the need to acquire further training or equipment that would assist them in meeting personal career goals.

Most of the respondents said that incentives should go to the individual worker/employee to augment her opportunities for progress and promotion and to improve the workplace environment. It was suggested that these incentives could include bonuses, opportunities to attend training and skills courses, and funds to obtain mentoring or to acquire equipment for laboratories. These responses support individual interviewees' emphasis on the need for financial support for training, skilling and mentoring in the workplace and highlight the importance of indirect incentivisation that inspires women to reach for higher

employment goals. The emphasis on legal commitment to gender diversity, together with flexitime and promotional possibilities for women, indicate that respondents are aware that incentives have to be used systemically. Incentives were not only financial but also indirect, in keeping with legal requirements, awareness of the need for diversity, the importance of women's careers as well as the need to find a work-life balance. Where financial incentives could be used they should be used indirectly to assist individual women beneficiaries. However, incentives should be accompanied with well-conceived systems of monitoring and evaluation. One respondent said that '*money is not the only motivation. People need to be motivated intrinsically. The organisation needs to show caring for personal development as career woman, making it the employer of choice*'.
The negative aspect of direct incentives was also identified. One respondent felt that incentives lead to tokenism. She mentioned: '*And as long as things are tokens they are going to say we have bought you and you are just a resource. People are not resources, people have capabilities, people have got energy, a resource does not have energy, unless it's an electricity resource.'* Another respondent said that research is needed before incentives are applied, *'maybe greater research around financial incentives should be done because this may drive the wrong behaviour'*.

Again several of the black women respondents in tertiary institutions mentioned the need for time and financial support for further training and research opportunities would be considered as an incentive. One overworked particularly harassed black woman academic scientist stated the value of time:

Interviewer: *And yet you have three publications in peer-reviewed journals?*

Respondent: *Yes. But that was during my postgraduate studies ... It was easier at that stage because I did not do much teaching. Now when the teaching comes into your life, and students need extra support and the university still expects you to do research and publish ... but where is the time? And I am a single person ... how do married people with children cope? It is virtually impossible I think.*

She, together with other women respondents, emphasised that mentoring and training programmes were key qualitative incentives that would encourage women to stay in the workplace.

Respondents urged us to think about incentives in a more creative manner; as rewards for transformation rather than as carrots to encourage change. The importance of a change in organisational culture was emphasised because the

action that would earn tax breaks as rewards for improving the workplace culture. One respondent said: *'So I would rather work on the internal culture of the organisation and for the organisation to earn that incentive, they need to change their culture.'*

This study has raised a number of questions and highlights gaps in the research on the cost of hiring women in the SET workplace. We examine some of these assumptions here.

4.8 Begging the question

The assumptions embedded in the notion of the costs of hiring women in SET

The use of incentives as an inducement to the tertiary education sector and to companies to hire and retain women, especially black women in the workplace, assumes that the employment of women is an inherent cost to these organisations. However, we do need to examine what we mean by the term 'cost' in relation to hiring women. The inherent assumption in this phrase is based upon the supposition that women invariably interrupt their work careers to fulfil reproductive responsibilities such as childbearing, childrearing and care of dependents, incurring an absolute cost to the employer due to disruption in the workforce, disruption in the individual career that the employer has invested in, in the form of training, as well as the cost of recruitment and hire of new employees. These costs, that are both quantifiable and qualitative, need to be assessed over the short, medium and long term, over the lifespan of the organisation and for the nation. Little or no economic research exists in this area, especially in the South African context. However, it is important to consider the meanings of cost and benefit related to hiring women in the SET sector.

The loss of women's skilled labour during their reproductive cycle, with absences related to parental leave, exist in the short term. However, these costs need to be weighed against the cumulative costs to a company and society over the medium and long term if skilled women are lost to the sector entirely. We do not know what the quantifiable costs to corporations are in the medium term with regard to absolute loss of a skilled employee if the latter is not allowed or cannot return to work. Most corporations invest in employees' training and re-skilling as they may move into the diverse arenas of the workplace. If an employee is lost to the corporation then the cost of training and re-skilling investment in her is not maximised. Secondly, we do not know the quantifiable costs to society, over the

long term (structural costs), of not hiring women in SET. However, we do know that the society suffers an absolute qualitative loss of the investment already made in these women's education, as well as the loss of potential accumulative 'interest' of their skills input. In addition, the country suffers further loss where the potential benefits of diversified personnel in SET are not realised in a globalised context where, increasingly, organisations and nations gain the competitive edge by diversifying their labour force. Costs, whether quantitative or qualitative, such as the initial cost of career and labour force disruption in the short term, have to be balanced by gains such as a woman employee's productivity and commitment to a specific organisation over the medium to long term, and an improvement in quality of life for the woman and her dependents over the long term. Later in this review, we will examine this scenario more closely (that the employment of women is a cost) to indicate that these apparent costs and therefore the notion of financial incentives are not as simple as they may initially appear to the reader.

Employing women: a cost or a benefit to the company and society?

The implications of incorporating women into the workplace fall into the broader debates about the costs and benefits of diversity in an organisation's labour force, and whether such diversity provides a competitive advantage. Until recently, these debates have been confined to northern multicultural contexts such as the United States and Canada, and focused mainly on the rather fuzzy notion of 'valuing diversity' (Cox/Blake 1991). As indicated above, the need for diversity in organisational contexts in South Africa is driven by different imperatives, namely, racial and economic redress, efficient economic utilisation of human capacity in a developing country context and the value of a diversified labour force. The debate about the value of diversity is emergent, but is often sidetracked by the argument that racial and gender redress does not allow for the employment of the most skilled personnel. Again, research which examines the costs and benefits of redress and the purported 'loss' of skilled personnel who are overlooked because of racial and gender redress needs to be done. The most dominant argument presented both by disgruntled previously entitled members and individual academics of all races on the left is that redress (erroneously termed 'affirmative action' in South Africa) lowers performance standards in an absolute sense (see Benatar 2007, unpublished inaugural address, University of Cape Town); or that it is the same type of social engineering used by the apartheid regime in the past.

Studies done in northern contexts examining the cost of hiring women indicate that costs are difficult to determine (Cox/Blake 1991) and studies on this issue vary in terms of their findings. Schwartz (1989) indicates that, apparently, the cost of employing women is much higher than that of employing men. This is due to the apparently high rate of career disruption among women as they take time out to attend to gender-specific reproductive careers such as childbearing and rearing or care of dependents. However, he argues that these costs should be measured against the yet unquantified gains to companies if they facilitate women's attempts to balance their career ambitions with reproductive careers. These unquantified gains include employee commitment and loyalty to the company over the long term, and increased job satisfaction. In addition, the cumulative national benefits of utilising women's skills over the long term in this sector remain unexamined. Similarly, Richard (2000) argues that most organisations tend to perceive diversity that includes recruitment of women and minorities in the context of the organisation as a human resource cost, rather than an asset to be fostered.

We would add that these studies do not suggest means for conceptualising or quantifying the social assets that women and minorities bring to the workplace, such as the cultural intelligence that enables them to communicate across sociocultural boundaries, thereby facilitating efficiency and creativity.

5 Conclusion: lessons learnt

The current study highlighted the following issues:

- Incentives must be implemented in the SET sector in a general drive to allow women professionals to advance in their careers and to improve gender sensitivity in the SET organisational culture.
- Incentives available in the SET higher education and corporate sector should be used to increase gendered and racial diversity to meet South Africa's constitutional and legal requirements. Our findings indicate that senior executives acknowledged that there is a dearth of black women in the South African SET sector. They acknowledged that they have to attract and retain black women with the necessary skills at senior management level because this is a legal imperative in South Africa. Sectors such as mining, civil and electrical engineering face an invidious problem in attracting and retaining women professionals due to the small pool of skills, the competition between public and private sector for this small pool of skills, as well as the

strenuous work environment. This recruitment process has to be well planned over the short and long term using multiple strategies. In the short term, women who possess aready suite of requisite skills are targeted while junior women who are recruited or employed within the company are mentored to acquire these skills. This is necessary to prevent a backlash against the women and to set them up for successful career trajectories. The women interviewees in our study insisted that they did not want to be regarded as less competent workers than their male counterparts because they accessed parental leave to balance work–family responsibilities.

- Indirect incentives should be used in multiple ways and in consultation with women employees to improve the workplace environment for women employees. Such action will ensure that they have a realistic possibility for promotion and career success. Multiple indirect incentives could be used to provide women with more time and financial support to obtain further training and qualifications, as well as to buy time out from administrative and teaching to increase research publication output.
- Incentives should be used indirectly to acknowledge the work of individual women and reward companies for improving the SET environment for women, especially women from racial minorities in the sector. The most efficient use of these incentives differs across the various SET work environments and between corporate, parastatal and academic sectors. How these incentives should be applied within these sectors should be further investigated.

In developing societies such as South Africa, we can ill afford the costs of *not* hiring women in SET for two reasons. Firstly, we would be under-utilising our human resource capacity and this would stymie innovation; and secondly, we would lose the opportunity to increase diversity in the workplace and social cohesion in a society that continues to wrestle with the legacy of the divided racial and gendered past.

References

Benatar, David (unpublished): Justice, Diversity and Affirmative Action. Inaugural address delivered at University of Cape Town, 11 April 2007.

Bill of Rights (1996): Constitution of the Republic of South Africa, 1996. Pretoria: Government Printer.

Business Environment Specialists' report to National Council on Innovation (2011).

Cox, Taylor/Blake, Stacey (1991): Managing cultural diversity. Implications for organizational competitiveness. In: The Executive, 5, 3, pp. 45-56.

Council of Higher Education (2007): Annual Report of the Council on Higher Education 2006/2007.

Department of Science and Technology (2009): Report on the Research and Development Tax Incentive Programme and trends in research and development expenditure in South Africa 2007/8. Annual Report to Parliament, available from: <http://www.dst.gov.za/>. [1 February 2010].

National Academy of Sciences (2006): To recruit and advance. Women students and faculty in US science and engineering. Guide to recruiting and advancing women scientists and engineers in academia. Committee on Women in Science and Engineering, National Research Council, available from: <http://www.nap.edu/catalog/11624.html>. [1 February 2010].

National Advisory Council on Innovation (NACI) (2009): Facing the facts. Women's participation in Science, Engineering and Technology. Pretoria.

Salo, Elaine (2009): Beyond equity committees and statistics. In: Featherman, D./Hall, M./Krislov, M. (eds): The next 25 years. Affirmative action in higher education in the United States and South Africa. Ann Arbor: University of Michigan Press, pp. 297-308.

Schwartz, Felice (1989): Management women and the new facts of life. In: Harvard Business Review, January 1998, pp. 65-76.

Subotsky, George (2003): Public higher education. Pretoria: HSRC Press.