

SYNTHESIS REPORT



PART I

INTRODUCTION AND BACKGROUND TO THE STUDY

INTRODUCTION

On a worldwide scale, science – and even more technology – is still a man's business. This situation is no longer acceptable. It is economically unacceptable because of the waste of human resources that it entails; it is humanly unacceptable since it prevents half the population from taking part in building the world; it is intellectually unacceptable as it deprives scientific and technological research of ideas and methods, in a word, of creativity. Furthermore, it mortgages the future since it nullifies any prospect of a general mobilization in support of science in the service of a lasting peace and sustainable development.

– Federico Mayor (1999)

Background

In an era where a country's highly skilled workforce is one of its most valuable assets, maximum participation (the 'critical mass') and productivity in the skilled human resource base have become critical issues on national agendas. More specifically, it is that portion of the highly skilled population involved in scientific knowledge production, technological development and innovation which increasingly is regarded as essential to the development of a nation as a 'knowledge society' and, therefore, to global economic competitiveness. The OECD's *Canberra Manual* (OECD 1995) refers to this portion of the skilled workforce as 'human resources for science and technology', which includes people with higher education degrees who are employed in science and technology occupations that require these qualifications.

At the same time, gender equality has been receiving global attention over the past few decades. Within these contexts, the issue of girls' and women's participation in the world of science, engineering and technology (SET) has come into focus. As Geoffrey Oldham (2000:347) has argued, it has become imperative for countries to address issues relating to women and SET, in relation to human rights and social justice, for scientific and socio-economic reasons, and in order to enrich the pool of insights and motivations in relation to the production of scientific knowledge and technological development. As such, the gender dimension of the SET workforce has increasingly been receiving

attention, especially in countries such as the United States, Canada and the United Kingdom, but also at the international level in organisations such as the United Nations and the European Commission.

In South Africa, the issue of increasing and diversifying women's participation in SET has received attention at the national policy level. For instance, the *National Research and Development (R&D) Strategy* (Department of Science & Technology 2002) points to the under-representation of women within the SET workforce, while the *National Plan for Higher Education* (Department of Education 2001) highlights the under-representation of female students within the SET disciplines and at the postgraduate level.

Both documents outline strategies to address these deficiencies in the system. The *National Plan*, for example, requires higher education institutions to develop clear targets and timeframes to increase and diversify the participation of designated groups of learners, including women, within the Natural Sciences & Engineering, amongst others, and at the upper postgraduate levels.

The *R&D Strategy*, on the other hand, calls for a human resource strategy for the national system of innovation that takes into account the gender dimension of science. The *R&D Strategy* also called for the establishment of a South African Reference Group (SARG) on women in SET. The SARG was proposed as a group of local and international "stakeholders and representatives of organisations with interest in the progress of women in science,

to monitor and advise the Department of Science and Technology on relevant issues” (DST 2002:36). The SARG was established in March 2003 as a sub-committee of the National Advisory Council for Innovation (NACI).¹

The participation of women *in* SET is not, however, the only concern. In recognition of the fact that women and men occupy different roles in society, have different degrees of access to SET, and utilise the products of SET activities in different ways, some countries have begun to develop strategies to ensure that women benefit from SET.

These concerns are also raised in South Africa's *R&D Strategy* and its associated *White Paper on Science and Technology* (Department of Arts, Culture, Science & Technology 1996), particularly with regard to poverty-stricken and marginalised women living in the rural areas of the country. In this regard, the *R&D Strategy* (DST 2002:44) indicates that

“The mission to reduce the impact of poverty needs to deal with the causes of poverty and the impact of poverty on women and the disabled, since they carry the greater burden. Innovative technologies need to be harnessed to positively impact on their daily lives.”

This investigation into *Women in Science, Engineering and Technology (SET) in South Africa* addresses both these perspectives on women in SET. The study was commissioned by the National Department of Science and Technology (DST), and undertaken by the Centre for Research on Science and Technology (CREST) at the University of Stellenbosch between January 2003 and January 2004.² The primary purpose of this research is to inform the activities of the South African Reference Group (SARG). Given that this study is the first of its kind in South Africa, planners and policy makers within government, higher education institutions and government SET institutions should also find the research findings useful in terms of initiatives around women in SET in these sectors.

¹ SARG web site: <http://www.sarg.org.za/>.

² The final report was peer-reviewed in February 2004, and revisions were made in March 2004.

Aims and objectives of the study

The overarching aim of this investigation has been twofold:

1. To develop a sex-disaggregated profile of the human resources for science and technology in the public science system in South Africa, and
2. To explore the nature and extent of the contribution of research in the public domain to understanding the specific needs and problems of women in general.

In other words, the research aims to develop an understanding of the *status of women in science*, and the *potential benefits of science for women* in this country. These aims translate into the following objectives:

- To provide a detailed profile of the sex distribution of postgraduate enrolments and graduations in the higher education system
- To provide a detailed profile of the sex distribution of the human resources in the higher education sector and within government SETIs
- To provide an indication of the number of women who are the principal investigators of research programmes/ projects in the public science system
- To provide a detailed overview of the sex differences in publication output of South African scientists
- To provide an overview of the sex distribution in funding allocations for research and advanced studies, as well as in the rating of scientists by the National Research Foundation (NRF)
- To provide a profile of the emigration of highly skilled women from South Africa
- To identify the range and scope of initiatives in the public science system in South Africa which are designed to promote and support women's participation in SET
- To identify initiatives for women in SET in other countries, and

- To analyse a sample of research projects conducted in higher education institutions and government SETIs in terms of the extent to which they have women as their primary users or have the potential to make a positive impact on the lives of women in this country.

Structure of the synthesis document

This document synthesises the main findings of the final report. It is intended to provide a snapshot of the current (2001) profile of women in public sector SET and to highlight significant changes since the beginning of the 1990s. This synthesis develops an integrated profile of women in SET, rather than merely summarising each of the chapters in the final report. In this document the study also highlight the policy implications of the core findings and areas for further research.

Part I concludes with a brief overview of the range of data sources used in this study. It then turn to the findings relating to the participation of women in public sector SET (Part II). First, the study look at the overall gender profile of the current SET workforce (instruction/research staff in higher education institutions, R&D personnel in government SETIs, and publishing scientists and publication outputs), and the potential future SET workforce in terms of student enrolments and graduations in the higher education sector.

Second, the study explore women's share of scientific recognition and rewards, in terms of their rank, their funding and their scientific ratings.

Third, the study investigate women's participation – as staff, publishing scientists and as Doctoral students – across the different scientific domains, and within the Natural Sciences & Engineering in particular.

Fourth, the study report on initiatives to promote the participation and progress of women in SET in South Africa and internationally. Brief overviews of relevant initiatives for women in SET are provided at the end of each section in the document

In Part III the study then turn to a consideration of gender and research in South Africa – specifically, the extent to which a subset of research projects in the public sector have a gender focus, whether this gender focus targets women or men in particular, and what the gender focus addresses.

Bearing the overall profile of women in SET in mind, in Part IV the study consider the issue of science indicators – in particular, those indicators which will assist us in monitoring the participation and progress of women in South Africa.

Before presenting the core findings of this investigation, a brief overview of the sources of data relied on for this report is provided. The limitations of these data are highlighted throughout this report.

DATA SOURCES

This study relied on a variety of data sources, each of which has its own limitations. A detailed discussion of the data utilised in this study is provided in Section B of the main report.

Student enrolments and graduations

The higher education sector student enrolment and graduation data were drawn from the SAPSE/HEMIS3 datasets of the National Department of Education. These data, which cover the period 1990-2001, are disaggregated by sex, race group, institution type (universities and technikons), level of study, and major/area of specialisation.

Human resources for SET

The permanent instruction/research staff data for universities and technikons were also drawn from the SAPSE/HEMIS datasets. In particular, the data include sex-disaggregated figures by race group, by age group, by rank, by highest qualification, and by scientific domain. The figures for non-permanent instruction/research staff were requested directly from institutions.

Both the permanent and non-permanent R&D personnel data in the government science, engineering and technology institutions (SETIs) in the sample were requested directly from these institutions.

Publication outputs

The data on publication output patterns is drawn from SA Knowledgebase housed at CREST. SA Knowledgebase is a database of South African research, researchers and research institutions. The database has been developed over a period of more than seven years using data from a variety of sources.

3 South African Post-Secondary Education (SAPSE) and Higher Education Management Information System (HEMIS).

Data from 1990 onwards are included, and at present is fairly comprehensive up to 2001, although most of the data for 2002 and some for 2003 is also included.

A major part of the database deals with scholarship in the form of published articles in accredited scientific journals. There are more than 90 000 such articles, which are currently in the process of being linked to biographical data. To date, 68 184 'authorships', i.e. links between articles and the authors (and ultimately to biographical data), have been completed, out of a possible 170 000+. These represent 48 740 distinct journal articles.

SA Knowledgebase contains articles from both ISI-journals⁴ (approximately 55% of all articles) and accredited South African journals which are not indexed in the ISI. Given that citation data from the ISI-databases are not captured and no such data is available from SA journals, no citation analyses can be undertaken on the data in SA Knowledgebase.

Funding allocations and scientific rating

The funding allocation data disaggregated by sex, for the period 2000-2002, were requested directly from higher education and government SET institutions. The breakdown of NRF-rated scientists by sex was obtained from the National Research Foundation. The NRF's Key Performance Indicator Report (2003) was also consulted for figures relating to funding allocations and scientific rating.

4 Institute for Scientific Information (ISI).

Initiatives for women in SET

Information pertaining to preferential policies, programmes and funding mechanisms for women in SET in South Africa was requested directly from higher education and government SETI institutions.

The Database of Initiatives for Women in SET internationally was compiled from two sources: the global, regional and national initiatives in other countries were identified via an internet search; the South African initiatives included in the Database were drawn from the survey of initiatives mentioned above as well as a web-based search.

Research projects with a gender perspective

The analysis of research projects with a gender perspective is based on the analysis of five different datasets which, together, include 17 500+ research projects in the public sector and across all scientific domains. These five datasets include:

- The CREST Research Utilisation Study commissioned by the National Advisory Council on Innovation (NACI, 2002). The survey component of the study generated data on more than 1 800 research projects. Data include project titles, project descriptions, how research was utilised, start dates and end dates and demographic information of the researchers.
- The 1995 National Research and Technology Audit (NRTA). The survey covered all higher education institutions and captured data on more than 4 000 research projects. Data include project titles, project descriptions and demographic information of the researchers.
- A recent study by CREST (2002) on the research priority areas funded by SANPAD. This project generated detailed information about 67 SANPAD-funded research projects. Data include project titles and demographic information of the researchers.

- Selected records from the NRF Nexus Database. The dataset contains information on 11 118 current and completed doctoral and non-degree research projects from 1998 to 2003. Data include project titles, start dates and end dates and demographic information of the researchers.
- Institutional data. Limited research project information was obtained from science councils, national laboratories and national research facilities. Data include project titles, project descriptions, purpose (Doctoral or non-degree), status (current or complete) and demographic information of the researchers.

Next is an overview of the gender profile of the public sector SET workforce.
