CHAPTER SEVEN

SOUTH AFRICAN DEMOCRATIC POLITICS OF TECHNOLOGY

Introduction

Technology and democracy are two interrelated variables in the South African political system. The relationship between technology and democracy in South Africa is an essential component of government's strategy for growth and economic development in creating a better life for all. The advent of democracy in South Africa has seen initiatives taken by government to review and reform the country's technology approach. In 1996 the government published South Africa's Science and Technology Policy, which envisages a future where all citizens will enjoy a sustainable quality of life, participate in the economy and share a democratic culture.

The South African government's technology approach highlights concerns about improving the wellbeing of society. Such concerns inversely question the certainty of whether technology can support democracy. In view of these concerns, the scope for assessment, monitoring and evaluating the impact of technology has grown enormously in response to the demand for democratisation and the increasing challenges for the provision of goods and services in meeting the basic need.

Technology is one of the main drivers of economic growth and prosperity [in a democratic political system]. (Pistorius, 1996). It is also widely recognised as being one of the most important contributors to competitiveness, whether at international level, national level, or organisational level. Numerous studies have been performed to investigate the effect that technology has on [society's] productivity, and one can safely say that there is general consensus that technology can, in principle, contribute significantly to [national] productivity.

The purpose of this chapter is not, however, to expand or elaborate on technology itself. It is to put the role of technology in perspective vis-a- vis the extent to which

South Africa as a political system is playing a role in creating a conducive and enabling environment for political decision-making in terms of the science and technology policy in order to support an endeavour to enhance democratisation. In other words, the role of technology is investigated to determine whether political decisions on science and technology policy have any influence on democracy in South Africa. In order to do so, however, it is necessary that the concept of technology and democracy be considered in context and not interpreted narrowly. It will be shown that technological advance is one of the central aspects that can enhance democracy in a political system.

A general overview of technology approach

There is abundant literature available on technology policy. Since early in the 1980s technology approach in developing countries centred around the concept of "appropriate technology" where there was a need to move away from capital intensive technologies towards more labour-intensive technologies which were more suited for local environment. (Chang and Cheema, 1999). The debate around the concept went through transformation and was more about why some countries were more successful than others in absorbing imported technologies. There is a common understanding that there is a need for a technological capability in order for countries to be successful in choosing their approach to technology. It is also emphasised that there is a need for investments in building technological capability, and that policy actions have an important role to play in the process of supporting a particular policy decision. (Fransman and King, 1984).

There is a more advanced understanding, especially as presented by Nelson and Winter (1982), and also by Freeman (1982), which emphasises the importance of institutional and policy factors in the evolutionary nature of technological process. (Dosi et al (eds.), 1988) These developments in technological evolution culminated in the introduction of the concept of "national systems of innovation", and emphasised the importance of institutional factors, and the inter-relationship between the constituent parts of the institutional complex, in the determination of technological progress. (Lundvall, 1992, and Nelson (ed.), 1993).

The concept of a national system of innovation is also embedded in the South African science and technology policy which seeks to harness the diverse aspects of science and technology through the various institutions where they are developed, practised and utilised.

The above theoretical concept influenced, and was also influenced by, the literature on technology policy, which produced a new breed of theoretically sophisticated and empirically well-grounded literature that may demand a clearly focused policy execution. (Lall & Teubal, 1998).

South Africa, having adopted this concept, may have difficulty in generating a socially desirable degree of technological progress and the type of policies that may be necessary to resolve this problem of having a clearly defined policy execution. The reason for this problem can be related in two areas that have been relatively ignored in the existing literature, namely the political and the institutional aspects of technology policy design and implementation.

It would be wrong to suggest that those who have contributed to the debate on technology policy in developing countries have completely neglected these two aspects. However, it would not be too much of an exaggeration to say that most literature has paid relatively little attention to the political aspect of technology policy design and implementation. Likewise, it would be wrong to suggest that institutional factors have been neglected in most literature, especially given the numerous writings on national systems of innovation. However, it would be fair to say that far more attention has been paid in the literature to the institutions related to knowledge generation and diffusion (e.g. the educational system, linkages between firms and research institutions), rather than to those directly related to policy design and implementation (e.g. bureaucracy, industry association).

In determining the impact of technology on democracy, this study puts emphasis on the analysis of the political and institutional aspects of technology policy design and implementation in South Africa.

South Africa's technology policy approach

The technological skills and the ability of a nation to improve are important to its overall development and have led governments to adopt more comprehensive and forthright policies with regard to technology. The purpose of a national (science and) technology policy is defined by UNESCO (1990:9) as "…the development and fruitful use of national scientific and technological resources in order to promote the advancement of knowledge, encourage innovation, increase productivity and to attain the objectives of the country's economic, social and cultural development more quickly and surely". Much emphasis is on the structure in terms of methods and legislation. (Kaplan, 1995). In South Africa's context technology policy has three principal concerns, which are:

- to enhance capacities for invention and innovation;
- to ensure access to international technology; and
- to enhance the diffusion of new and appropriate technologies and technological best practices.

The democratisation process in South Africa has seen the transformation of the science and technology community. The transformation involved that the government departments, in particular the Department of Arts, Culture, Science and Technology (DACTS), had to restructure and transform their structures and implement policies and programmes. In January 1996 DACTS published a Green Paper on Science and Technology. This was the result of consultation with stakeholders in the science and technology community. A further process of consultation culminated in the publication of the White Paper on Science and Technology in September 1996.

The above process took account of , among other things, the results of two studies of the science and technology policies of five decentralised states, viz. Belgium, Canada, Germany, India, and the USA, in which the HSRC (Prinsloo and Pienaar, 1993) investigated the functioning and implementation of science and technology policy. The study noted that:

- In countries where the private sector involvement in science and technology was less than that of the government, the country's science and technology system was generally inadequate. All five countries display systematic and concerted efforts to encourage the private sector to invest more in science and technology research so as to achieve a higher level of technological advancement.
- The creation of a solid and effective education system to provide the required number and quality of scientists and technologists is a *sine qua non* of science and technology development.
- There is a trend to a greater centralisation of science and technology policy. This trend is mainly the result of worldwide recession and thus economic constraints, and brings with it the risk of the politicisation of science and technology policy, generally regarded as undesirable.
- Financial constraints are compelling industrialised nations to actively increase the pace of international scientific and technological collaboration.

The Council for Scientific and Industrial Research (CSIR) commissioned a study of science and technology policies in sixteen countries (CSIR, 1991). The sample included the USA and Canada, countries in Eastern and Western Europe, the former USSR, some Pacific Rim countries, and Botswana and Kenya. In the process a number of policy instruments were identified that directly affected science and technology. These instruments all have a direct influence on science and technology policies and ultimately on economic prosperity and development in general. From a national economic development perspective, the study also highlighted the fundamental importance of the following aspects:

- Distinction between technology and science, and the fact that competence in the former may not be dependent on, or even related to, competence in the latter. Indeed it is possible in the short term for a country to be competent in utilising and adapting technology development elsewhere without itself having a strong science base.
- The strategic capacity to manage technology effectively at the level of overall economy as well as that of the individual (and sometimes at sectoral and

regional levels). The most successful economies are those that use technology best across a broad spread of industries – as exemplified by Japan and the former West Germany.

- An efficiently functioning national innovation system properly connected with outside systems, and in which the science, technology, market and finance "pole" interact readily with one another. (The market refers not just to regular commercial markets, but also to all applications opportunities in sectors such as health, education, environment, and national security where commercial markets may not exist.)
- The role of government in exercising overall leadership, in creating a macro-economic and regulatory framework conducive to technological innovation, and in affecting, within the overall pattern of resource allocation, the appropriate volume and quality of investment in education and training in physical infrastructure. In some cases government can become the driving force for innovation in a particular industry at a particular time.
- The role of the private sector in identifying and responding to applications opportunities and, especially in the case of large companies, in participating in the policy process. The private sector is usually, but by no means always, the principal engine of the technological innovation process.
- A rapport between government and the private sector, which allows each to play its role appropriate to evolving circumstance of the industry in question.

Developments towards formulating the South African science and technology policy began by re-examining its science and technology policy with the publication of a report in 1992 entitled “Towards a science and technology policy for a democratic South Africa”, which was sponsored by the International Development Research Centre (IDRC), Canada. Its findings were that:

- There was a crisis in the educational system at all levels and this crisis was at its worse when it affected the teaching of mathematics, science and engineering.
- South Africa should see itself as a participant in joint ventures in S & T on the continent of Africa, but not as an automatic leader.

- In various individual institutions in South Africa R&D funds tended to be allocated for inappropriate activities.
- There was vacuum in leadership on issues dealing with science and technology at ministerial level.

The government's policy approach was intended to meet the challenges of stimulating development and overcoming the biases and entrenched ideas prevalent about the nature of science and technology, while on the other hand it was also the government's role to promote and develop the science and technology sectors. The process of implementing government's policy approach included numerous programmes, *inter alia:*

- The formation of the National S&T Forum (NSTF) composed of members from all sectors, including business, acting as an advisory to the Minister of Arts, Culture, Science and Technology.
- Appointment of the National Science and Technology Council from government and private sector.
- The commissioning of the National Research and Technology Audit for South Africa in late 1995, as a national stocktaking exercise of all science and technology skills and capabilities resident in South Africa, taking January 1996 as the base date.
- In 1996 the government established the Academy of Science of South Africa, its purpose being to ensure that leading scientists, acting in concert and across all disciplines, can promote the advancement of science and technology and provide effective advice, and can facilitate appropriate action in relation to the collective needs, threats, opportunities, and challenges of all South Africans. (Document circulated by the Facilitating Committee, 28 Nov. 1992).
- A National Research and Technology Foresight programme was completed in 2000.
- Establishment of the National Advisory Council on Innovation (NACI), whose role will be to support the Minister of Arts, Culture, Science and Technology.
- The review of the science councils and related institutions (SETI) in South Africa was completed.

- The tabling of the White Paper on Science and Technology, preparing for the 21st century (SA Department of Arts, Culture, Science and Technology, 1996).

The White Paper on Science and Technology saw the promotion of the effective distribution of available knowledge as a critical function of a national system of innovation; a well-functioning process of technology diffusion which could boost progress in South Africa through appropriate combinations of domestic and imported technologies. But it was expected that this in turn would be highly dependent on the ability of South African firms to absorb such technologies (DACTS, 2000-2001).

The White Paper on Science and Technology

As discussed earlier in this chapter, the White Paper on Science and Technology presents a salient feature, which is its most important aspect. It deals with the concept of "National System of Innovation (NSI)", which is concerned with ensuring a sufficient supply of new knowledge and new technologies, as well as supporting and promoting the attainment of national objectives. (DACTS, 1996). The concept of a national system of innovation is an important basis for policy formulation. The use of this concept as a framework for policy was influenced by the 1994 Report of the Auditor General of Canada, which highlights South Africa's courage which she would like to see spread through the science and technology policy. (DACTS, 1996). The government introduced a new view of the role and status of the sciences, engineering and technology in the context of socio-economic development. Many countries have accepted that technological change is the primary source of economic growth, which means that economic and science and technology policies have to recognise that innovation and technology diffusion are central concerns as they are the agents driving that technological change.

The national system of innovation is described as a set of functioning institutions, organisations and policies that interact constructively in the pursuit of a common set of social and economic goals and objectives.

There are three key interests that the government described in the White Paper:

- to ensure that South Africa has in place a set of institutions, organisations and policies which give effect to the various functions of a national system of innovation;
- to ensure that there is a constructive set of interactions among those institutions, organisations and policies; and
- to ensure that there is a set of goals and objectives which are consonant with an articulated vision of the future which is being sought.

The White Paper is the result of five basic requirements that are in line with a vision for innovation in South Africa intended to achieve excellence in serving the national objectives. These basic requirements are priority areas that a sound science and technology policy needed to cover:

- Promoting competitiveness and creating employment.
- Enhancing the quality of life.
- Developing human resources.
- Working towards environmental sustainability.
- Promoting an information society.

There are also crucially important dimensions of science and technology that inform South Africa's strategies:

- The importance of knowledge generation.
- The role of the human sciences in innovation.
- Finance, management and performance.
- Promoting competitiveness and creation of employment.

Promoting competitiveness and creating employment

These are the most important requirements that recognise that, in the face of the

growing globalisation of the world economy, technological innovation and support for South African enterprises need to be encouraged; that business is the driving force behind the economy, and that government must provide the leadership, incentives and support that the business sector needs to meet the new challenges posed by highly competitive markets. This will involve developing a shared vision of South African innovation, and its support structure for creating and sustaining micro-enterprises and small businesses will require a strong technology component. Public investment in R&D needs to be redistributed away from the support of activities within the government's own facilities and towards more comprehensive support of R&D executed in the private sector.

This long-term need must be seen in the light of the government's current responsibilities, namely to take a lead in pre-competitive research, until a culture develops in the private sector where such research is seen as a business imperative where entry barriers relating to equipment and human resources are high in areas where the activity is considered to be a service which the government has a duty to provide, and in areas of public good in which, to achieve the greatest benefit, the research results and technology transfer need to be placed in the public sector.

A prime objective of the NSI is to enhance the rate and quality of technology transfer and diffusion from the science, engineering and technology (SET) sector by the provision of quality human resources, effective hard technology transfer mechanisms and the creation of more effective and efficient users of technology in the business and governmental sectors.

The development of entrepreneurship needs to be fostered throughout South African society, particularly among those historically excluded from the formal economic sector, and this entrepreneurship needs to be linked to the promotion of innovation. Government, via the Growth and Development Strategy and the Macroeconomic Strategy, is seeking to achieve an annual economic growth rate of 6%. In a country which is currently under-investing in science and technology and innovation, this target will require a greater than 6% per annum growth rate in the national investment in these activities. In particular, those sectors destined for export growth will not achieve their targets if this investment does not occur (DACTS, 2000-2001).

Enhancing quality of life

The means must be established to ensure that the governmental research portfolio gives due attention to those areas of R&D with the capacity to affect quality of life, and specifically in domains where market failure is high, such as environmental sustainability, provision of health care, meeting basic needs at community level, reducing the total cost of infrastructure provision and providing safety and security to all who live and work in South Africa.

It is imperative for the government to ensure that an appropriate portion of the money it spends on science is utilised in these areas. Urban and rural communities need to be assisted and encouraged to adopt social and technological innovations to assist them in decision-making and to enhance their ability to make informed choices.

Developing human resources

In line with a dynamic vision for innovation-assisted economic growth, greater equalisation of income and economic opportunities need to be facilitated and the legacy of apartheid-based disempowerment of individuals and institutions needs to be addressed within a national system of innovation.

The lifelong processes of scientific and technical education, training and learning among the workforce and among South Africans in general need to be promoted as an essential response to the forces created by the dynamic changes of the global economy. This is a necessary response to enable those made redundant in one circumstance by these changes to continue making an active and creative contribution to the economy, their own wellbeing and that of society.

New approaches to education and training need to be developed that will equip researchers to work more effectively in an innovative society. This will require new curricula and training programmes that are comprehensive, holistic and flexible, rather than narrowly discipline-based. Education and training in an innovative society should not trap people within constraining specialities, but enable them to participate and adopt a problem-solving approach to social and economic issues within and across discipline boundaries.

Working towards environmental sustainability

South Africa's economic growth must be reconciled with considerations of environmental impact, resource constraints and conservation, and must further be determined by human needs and safety. Sound regulatory mechanisms are necessary to ensure that the positive aspects of technology introduction, transfer and diffusion are maximised and the negative aspects minimised.

Environmental research, monitoring and control require ongoing support and encouragement, as do the development and improved availability of environmental technologies. Economic and environmental efficiencies are interrelated, thus innovative practice needs to include environmental management. It is important that South African enterprises are able to adopt and implement best-practice technologies for environmental management and waste minimisation.

A national strategy is required to implement the terms of agreement on environmental sustainability adopted at the United Nations Conference on Environment and Development in Rio de Janeiro in 1994 (Agenda 21), and specifically to develop an understanding of the problems of climatic change, desertification and loss of biodiversity.

Promoting an information society

Development of the South African vision of the information society is necessary and should seek to ensure that the advantages offered by the information revolution reach down to every level of society and achieve as best a balance between individuals and social groups, communities and societies as is practically possible. The vision would seek to ensure that there is the creation of an equitable information order nationally, regionally and internationally. It should take into account the potential of communities at various levels to cooperate, to bridge differences, to work for mutual upliftment and meeting basic needs, and to redress the social imbalances of underdevelopment. The development of such a perspective would aim to ensure that the information revolution benefits society as a whole.

The potential of information technology (IT) needs to be captured to serve people issues such as supporting education, providing household services and enabling social

development. As a developing country, South Africa needs to determine what should be done to prevent it from being marginalised by the accelerating rate of innovation in information technology. How can she participate globally without merely throwing open her markets to foreign products, thus increasing her dependency on the developed world? How can she empower herself with a capacity for technology innovation?

The importance of knowledge generation

The wellbeing of scientific activity in South Africa is intimately linked to material factors. There is a clear trend worldwide for curiosity-driven research to increase as a function of national per capita income. There is also a danger of adopting too economistic a viewpoint. Currently though, there is a need to recognise the importance of the knowledge-generating function of research, particularly in the higher education sector. Human curiosity and the ability to recognise unexpected discovery account for much of scientific progress. Basic enquiry, as opposed to a formula-driven approach, is absolutely essential, particularly at the universities and technikons. It is important that fundamental research activity not to be regarded as impractical, because it is the preserver of standards without which, in the long term, the applied sciences will also die. Scientific endeavour is not purely utilitarian in its objectives and has important associated cultural and social values.

The role of the human sciences in innovation

The importance of the human sciences in South African society needs to be documented. The four important roles in the context of innovation that need to be highlighted are human resources in understanding the social processes and problems as a source of social innovation, in facilitating appropriate technological change within society and within the economy, in providing the basis of policy analysis, and as a source of new knowledge and informed critique of the transformation of South African society and its economy.

Finance, management and performance

The limitations imposed on research, technology development and technology transfer by the fiscal problems of the day need to be addressed. This will require a co-ordinated approach, which recognises in general the less wasteful nature of a simpler fiscal policy, while appreciating the absolute necessity of encouraging innovation in the private sector.

There is also a need to identify a framework to promote linkages between universities, science, engineering and technology institutions (SETIs) and the private sector, with a view to sharing risks, resources and insights with respect to pre-competitive research.

There is also a need to meet the internal challenges of governing a healthy science and technology system. This includes managing the problems of big science, fundamental research and service-oriented science and their relationship with technology development, infrastructure, the provision of basic needs and human resource development. It also includes the comprehensive measurement of the inputs and outputs of science and technology research and development, and its impact on the goals of national policy objectives, both in science and technology and in other fields.

International cooperation, interaction and institutional arrangements

Since 1993 South Africa has on a regular basis entered into bilateral agreements with foreign countries in the fields of science and technology, as well as agreements that include cooperation in science and technology. A policy framework to guide South Africa's participation and cooperation was to formalise and promote bilateral co-operation so as to derive maximum benefit from such interaction. The policy framework proceeds from the basic view that science and technology cooperation is crucial in the age of globalisation and that its impact on South Africa's democracy would be positive for the development of science and technology human resources, socio-economic development and the optimisation of financial and other resources for research and development.

By the end of 1993 bilateral scientific and technological agreements had been concluded with most countries in the world. Science and technology cooperation with these countries are being pursued in a wide range of fields that include material science, manufacturing technology, biotechnology, information technology and

systems, sustainable management of the environment, exploitation of natural resources and minerals, medical research, and public health, engineering science and advancement of technologies, water supply projects, agriculture, mathematics and science education, amongst others.

International cooperation, in science and technology, is enhanced by the funding of lead programmes that reflect national priorities. South Africa identified five priority fields:
Biotechnology – food production, agriculture, health;
Development of new materials and manufacturing;
Information technology and systems and the information society;
The sustainable management of environmental issues and of natural resources; and
Mapping and exploitation of natural resources and minerals.

The first, multilateral, meeting of the European Commission-South African Joint Science and Technology Cooperation Committee was held in Brussels on 3 June 1998. Co-operative ventures were highlighted and included the participation of South African scientists in projects under the Fifth Framework Programme, and the involvement of European researchers in South African science and technology programmes. Multilateral and multinational cooperation was promoted as well, inter alia with UNESCO in the areas pertaining to regional policy development and co-operation in science and technology within the context of the Southern African Development Community (SADC). Science and technology cooperation was also under discussion at the Summit of the Non-Aligned Movement (NAM) held in Durban from 29 to 3 September 1998. South Africa has been afforded observer status in the Committee for Scientific and Technological Policy of the Organisation for Economic Cooperation and Development (OECD). Observer status gives South Africa access to a considerable pool of expertise in S&T policy development, implementation and evaluation.

Institutional arrangements: In support of the NSI the following institutional initiatives were undertaken by government: the National Advisory Council on Innovation Act no 55 of 1997 (NACI Act), in terms of which the Council would advise the Minister on issues of science and technology policy. The members of the Council comprise

individuals from industry, academia and science councils. The human resources capacity has clearly been identified as one of the key constraints in South Africa's goal of establishing a truly democratic country based on equity and human rights (DACTS, 2001-2002).

The National Research Foundation (NRF) was established, which will promote research through funding, human resource development and the provision of the necessary research facilities in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including indigenous knowledge, and thereby to contribute to the improvement of the quality of life of all the people of South Africa. It was created by bringing together institutions and programmes that dealt with scientific human resource development along interdisciplinary structures. It is believed that the most important innovations occur at the confluence of and interface between disciplines.

With regard to the funding of the science councils, over the past years the government has been able to redirect and redistribute approximately 49% of the Parliamentary research grant funding to science councils, approximately 10% of which has been re-directed to the broader science and technology community. The framework within which science councils secure funding, both from the state and private sources, is set out in terms of a three-stream funding approach in the White Paper on Science and Technology, September 1996. This approach was later incorporated into the Financing and Reporting System (FRS) for science councils and was adopted by Cabinet in April 1998. In addition, the Ministers Committee on Science and Technology, chaired by the Deputy President, accepted the phasing in of the proposed approach of the White Paper. In terms of this, councils receive support for core responsibilities and have to compete for support of programmes that could be undertaken by other research bodies with the same competency. (White Paper 1996.)

In terms of the funding framework, the science councils can access parliamentary grant funding for their mandated core activities. The framework requires that the core activities for funding be identified and subjected to a medium term, cyclical review by the peer-research and technology development and user/stakeholder communities, while at the same time the institution is subjected to a management efficiency

assessment.

Competitive funding

The White Paper on Science and Technology states: "A national system of innovation benefits from knowledge practitioners being located in multiple knowledge generating sites and institutions such as higher education institutions, government and civil society research organisations, private sector think tanks and laboratories." (White Paper 1996.) A major initiative introduced through the White Paper is the establishment of the Innovation Fund. It promotes large-scale projects, involving participation from throughout the National System of Innovation, and focuses attention on the major themes of competitiveness, quality of life and environmental sustainability.

The third stream of funding from the public takes the form of "contract income". Government departments from time to time put out to tender projects that are essential for the fulfilment of their organisational objectives but for which they do not require long-term capacity. The nature of the contracts is typically short term with a highly specific performance contract, and the performance capability is not confined to the science council community. Science councils therefore have to compete for this source of funding and are expected to adopt a “full-cost-recovery” approach when tendering.

The White Paper emphasises the need for policy instruments to give effect to the concept of innovation. The Innovation Fund offers a new lead in encouraging and enabling longer-term solutions to problems that are serious enough to impede socio-economic development or that affect our ability to compete in products and services.

The principle objectives of the Innovation Fund are to permit a reallocation of resources from the historical patterns of government science towards the key issues of competitiveness, quality of life, environmental sustainability and the harnessing of information technology, to increase the extent to which funds for the activities of government science, engineering and technology institutions are obtained via competitiveness processes, and to promote increased networking and cross-sectoral

collaboration within South Africa's national system of innovation.

An annual call is made for proposals to be submitted for support from the Fund. The proposals must involve projects that generate products/processes for commercialisation or new methodologies for development programmes orientated towards service delivery (DACTS, 2000-2001).

The Innovation Fund was first piloted in the area of Crime Prevention in 1997/98 after it was officially launched with a limited amount of R30-million in 1998/99 in support of the three focal areas of crime prevention, promotion of an information society and value-adding for products and processes. An amount of R10-million was used for the pilot programme. The end results of some of those projects were very useful. For example, in KwaZulu-Natal the police utilised entomology techniques to provide an accurate time of death of a badly decomposing corpse that was found in a sugar-cane field. The accurate time of the crime was vital to the police in solving the case.

In the second term the Innovation Fund has been increased to an amount of R75-million. The thrust areas for round two are the promotion of an information society, biotechnology; and advanced technology for materials and manufacturing(DACTS, 2000-2001).

The South African technology approach also ensured that, in addition to making funding resources available, the government also makes provision for institutional support, which will enhance democracy. Such enhancement should be through the involvement of these institutions that have been created by government, which are also intended to enhance South Africa's democratic aspirations.

Enhancing democracy through technological involvement

Technology diffusion programme: The South African Government expressed a strong commitment towards strengthening the capacity and capability of the small, medium and micro enterprises (SMME) sector to contribute to higher economic growth rates. Access to technology and an innovative mindset are crucial for small and medium

enterprises to become more competitive and to shape out niche areas. One of the concerns expressed in the White Paper was the poor capacity of small, medium and micro enterprises in technology assimilation. Efforts to promote a culture of research and development through other programmes such as the Innovation Fund will be bolstered if the market has the technically absorptive capacity for application of research results.

Technology stations programme (TSP): The government has established a TSP involving a shared-use cooperative arrangement with technikons, in terms of which the technikon's facilities are used for the diffusion of technology through demonstration and other stimulation techniques. For management of the programme, a Technology Advisor works with the technikon, with shared-use aspects as regards the equipment and arrangements for students to acquire hands-on experience in the selected SMME sector. The following technikons were selected in SMME sector specific areas: The Technikon Free State for metal works/value-adding; Mangosuthu/North West for chemicals, and Technikon Pretoria for electronics.

The German experience in technology transfer programmes was drawn on to refine the TSP concept and operational framework. It is anticipated that the German Economic Co-operative Development Programme will be making technical assistance available during the life of the pilot TSPs.

Innovation centre, technology demonstration centre & technology incubator: As part of its wider strategy of technology diffusion, government has secured support from the European Union (EU) for testing the feasibility, sustainability and replicability of SMME-targeted technology transfer models such as Innovation Centres, Technology Demonstration Centres and Incubators. The Innovation Centre will be established with the focus on optimising and commercialising newly developed technologies.

The Technology Demonstration Centre will be established in a particular manufacturing area. It will accommodate the dual purpose of training students in the practical applications of courses for which they are registered and providing SMMEs with levied access to equipment in cases where they intend moving into new markets and need to do market testing first.

The Technology Incubator will provide a protected environment for an industry-focused cluster of new technology-based start-up entrepreneurs and enterprises. Tenant enterprises will be nurtured for a definite period by way of easier access to technical assistance and training and support services such as assistance with market development. In addition, communal facilities will mean lower overheads, which in turn will improve cash flow in these enterprises.

CAD/CAM/CAE facility: An initiative in this area involves providing seeding support to a pilot computer-aided design/computer-aided manufacturing/computer-aided engineering (CAD/CAM/CAE) facility established by the "Make-it South Africa" initiative. This will enable the development of technical expertise, infrastructure and capacity for rapid prototyping. As a follow-up of the workshop, a market survey was conducted amongst a number of companies within the South African automotive industry in response to a question as to what the companies perceived in 1997. Companies in the automotive industry identified the CAD/CAM as their most urgent technology requirement.
The CAD/CAM/CAE facility will provide a range of services, aimed at addressing the needs of the South African manufacturing and design industry. In particular, through the establishment of a number of regional resource centres, the initiative will focus on assisting the industry to develop world-class computerised product design, engineering and manufacturing expertise. A "hub" operation is located at the CSIR Manufacturing Excellence Centre. Regional outreach centres are located at: Technikon Witwatersrand; Eastern Cape Technikon or Port Elizabeth Technikon; and Mangosuthu Technikon.

Establishment of a satellite laser ranging (SLR) system: The National Aeronautics and Space Administration (NASA) in the United States offered to provide an SLR system to South Africa, including initial training support and ongoing maintenance. South Africa will have to provide and fund the personnel to operate the SLR station (approximately R1-million per annum). It was decided to accept the offer of NASA and the SLR system will be established at the Hartebeesthoek Radio Astronomical Observatory National. An SLR is used, inter alia, for mapping changes in global ocean levels. Such data are vital in following the potential effects of global climatic

change and for long-term weather predictions (e.g. with regard to El Niño events).

Southern African large telescope (SALT): To fully exploit our advantage of being in the Southern hemisphere, the building of a new large telescope was commenced at Sutherland. Owing to substantial developments in the field of astronomy, South Africa's capacity, previously on the forefront, is lagging behind. The government committed R50-million over 5 years to the establishment of a 10-m class Hobby-Eberly telescope. A further R50-million will be raised internationally. Both South Africans and international researchers from the Northern Hemisphere will utilise the facility.

Pro-active approach to international S&T cooperation: With a view to effectively targeting specific countries or regions for possible S&T cooperation, a survey was initiated in 1998 to establish the potential for such cooperation. An understanding of the S&T strengths and weaknesses of these countries or regions will be of assistance in making strategic decisions on new areas of cooperation or redirecting areas of cooperation.

Automotive manufacturing initiative: In 1997 a workshop on the automotive engineering sector was held with South Africa and international partners, industry, institutions from research, technology transfer and automotive manufacturing companies from Germany.

Public understanding of science, engineering and technology (PUSET): The public understanding of science, engineering and technology (PUSET) is identified in the White Paper on Science and Technology as a fundamental requirement and a key thrust for establishing a successful National System of Innovation in South Africa. To kick-start the programme for public understanding of science, engineering and technology, the government declared 1998 the Year of Science and Technology. This involved running a major national awareness campaign involving all stakeholders in order to generate the nation's interest in science, engineering and technology.

The Year of Science and Technology: This project was an initiative of the Parliamentary Portfolio Committee on Science and Technology, Language, Arts and

Culture. The year was launched on 5 February 1998 and on this day the then Deputy President, Mr Thabo Mbeki, accepted patronage of the project. A focus week of activities in a particular month was dedicated to each of the nine provinces, during which close to 200 000 learners, teachers, families and individuals were reached. These activities were kick-started in the Western Cape and concluded in Gauteng. Various stakeholders, science councils, the Science Councils Communication Forum and embassies formed partnerships and assisted the Department of Science and Technology to realise the Vision of the Year, which was to create a special period during which much of the attention of the nation and the media focused on science and technology.

The Department of Arts, Culture, Science and Technology, in addition to provincial activities funded four major initiatives to celebrate the Year of Science and Technology. These ranged from television and radio programmes to the conference on Women in Science and Technology, the second national conference on PUSET and the science journalism awards. Details of the above initiatives were captured in TV and radio programmes. A major publicity and promotional campaign was also undertaken through radio programmes on science and technology in partnership with the SABC. The main focus was on community radio stations, while others were also taken on board. The aim of these programmes was to reach the wider community, especially women, rural communities and people previously excluded from science, engineering and technology activities.

South Africa's involvement in technology saw her taking initiatives towards the Conference on Women in Science and Technology in September 1998. The purpose of the conference was to create an enabling environment for women in the science and technology fields, to contribute to the promotion and improvement in terms of access, communication, knowledge transfer, training and quality of life, and to raise awareness and public understanding of gender issues with regard to science, engineering and technology. Commissions on Agriculture, Business, Education, Energy, and Health also focused on issues of access, training, knowledge transfer and quality of life. The outcomes of the conference informed the Department to develop a policy framework on gender issues in science, engineering and technology programmes and opportunities that raise awareness and promote the role of women,

and to develop a framework and guidelines for implementation. The main recommendations arising from the Conference focused on policy, strategy and programme development.

The South African Science Journalism Awards 1998 were another area of involvement. These awards are in recognition of the pivotal role of the mass media in promoting public awareness, understanding and appreciation of science, engineering and technology, and are presented to those journalists who have made outstanding contributions to this field. Awards in seven categories were presented to journalists on 12 March 1999 for excellence in science, engineering and technology reporting during 1998. This initiative is in keeping with the vision of the Year of Science and Technology to engage the media in science and technology activities.

The *Foundation for Education, Science and Technology (FEST)* is an organisation created to render a vital service to scientific societies by publishing research results in sixteen widely distributed journals. It contributes in many ways to the goals of PUSET. It does so by popularising science and technology, especially in disadvantaged communities, and providing enriching educational material in support of science education. FEST initiated a process of establishing a comprehensive national science centre at the existing Museum of Science and Technology, where enhancing courses are offered for science teachers in the classroom and laboratory practice.

Conclusion

It is evident that the South African technology approach departs from the premise that knowledge and development of capacity in science, engineering and technology are central to promoting social, environmental and economic well-being in a democratic political system. The vision, the role and contribution of science and technology in achieving South Africa's national democratic objectives remain priorities. (DACTS, 1996.) An analysis of the White Paper has highlighted sensible standards for government and society to consider when investing in technology to meet basic needs, develop human resources, build the economy and democratise the state and society. The broad technology policy approach as outlined, presents a clearly defined vision

for a democratic South Africa. Given the imperatives of the White Paper and in order to achieve any objective in the approach, it is imperative that South Africa should ensure that democratic values are prevalent and that citizens have access to technology with a view to the provision, availability and accessibility of basic services such as health, education, water, housing, etc. Through technology the availability and accessibility of these basic services will give South Africa a basic ground to consolidate its democracy.