White Paper on Science & Technology

Preparing for the 21st Century

Department of Arts, Culture,
Science And Technology
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LETTER FROM MINISTER B.S. NGUBANE

Science and Technology (S&T) are essential components of the government's strategy for creating the South Africa of the future. The importance of S&T is recognised outside government as well, by other political parties, by business, the higher education sector, the science councils, labour, NGOs and civil society.

The vision for South African Science and Technology presented in this White Paper has been developed by a consensus process between all these sectors. This vision is one where, on the one hand, South Africa uses S&T to become economically competitive on a global scale, and on the other hand to provide essential services, infrastructure and effective health care for all South Africans. We believe that this is best done by embedding our S&T strategies within a larger drive towards achieving a winning National System of Innovation. In such a System, institutions such as universities, technikons, science councils, private sector research laboratories and market intelligence divisions would cooperate in a nationally optimal way towards solving real problems, whether these occur in industry, agriculture, defence or basic research.

The changes proposed in this White Paper follow two broad themes. Firstly, they serve the need to promote cohesion between South

African S&T institutions and the programmes they form part of, in the interests of our National System of Innovation. Secondly, they support the creation of a system of output measurements for these institutions, so that the taxpayer can demonstrably be given value for money.

I would like to thank all those who contributed to the production of this White Paper, whether by participating on the task team, by responding to the Green Paper, or by consulting with my Department during the drafting process. We received well over a hundred substantial responses to the Green Paper, and we have taken considerable care in ensuring that the 83 issues raised in the Green Paper are addressed in this White Paper.

Yours sincerely,

B.S. Ngubane

LETTER FROM DEPUTY MINISTER B. MABANDLA

Technology has been a determining factor in human history since time immemorial and in the 21st Century this will be so to an even greater extent. It is imperative that South Africa makes the right choices, sometimes difficult, to enhance our adoption and mastery of the technologies which will assist us in becoming a competitive nation. Basic science also has a crucial role to play in our country, not just because it is the platform on which applied science and technology are based, but because it has cultural and intellectual foundations as profound as those underpinning music, literature and other products of the human mind.

This White Paper endeavours to promote the full spectrum of science and technology within the context of problem solving in service of national needs, currently best expressed by the Growth and Development Strategy (GDS) of the government. To achieve an optimal configuration of science and technology institutions, it is proposed that the Ministers Committee on Science and Technology embarks on a major study of the missions and governance structures of these institutions. Also absolutely essential in the implementation of the GDS are human resources and skills in science and technology. Currently the race and gender disparities in S&T are unacceptably high. We need to address this imbalance pro-actively, not just because it is right to do so, but because if we do not we will simply not have adequate human resources to deal with our problems.

I have every confidence that the White Paper on Science and Technology puts South Africa on a firm course to enable us to make

better use of our national resources and capabilities. This is the first policy document of its kind in the history of our country, and even the processes which led to its completion have served to focus debate on the importance of science, technology and innovation for our future.

Yours sincerely,

Brigitte Mabandla

Preface

My Government's commitment to create a people-centred society of liberty binds us to the pursuit of the goals of freedom from want, freedom from hunger, freedom from deprivation, freedom from ignorance, freedom from suppression and freedom from fear. These freedoms are fundamental to the guarantee of human dignity. They will therefore constitute part of the centrepiece of what the government will seek to achieve.....

President Nelson Mandela in his Inaugural Address to a Joint Sitting of Parliament, 24 May 1994.

South Africa has begun, for the first time in its history, to undertake the task of the equitable development of the life opportunities of all its citizens. It has a unique opportunity at this time to transform the means and the methods [of] through which its social goals are to be achieved.

RDP White Paper, 23 November 1994

PART ONE

CONTEXT AND SUMMARY

CHAPTER 1 The Context

Preamble Vision and Goals for an Innovation Policy for South Africa

The White Paper is based on a view of the future where all South Africans will

- enjoy an improved and sustainable quality of life,
- participate in a competitive economy by means of satisfying employment and
- share in a democratic culture.

In order to attain this vision, the following three goals pertinent to the creative use and efficient management of innovation will have to be achieved :

- The establishment of an efficient, well co-ordinated and integrated system of technological and social innovation within which
- stakeholders can forge collaborative partnerships and interact creatively in order to benefit themselves and the nation at large
- resources from engineering, the natural sciences, the health sciences, the environmental sciences and the human and social sciences are utilised for problem-solving in a multidisciplinary manner
- stakeholders, especially those who were formerly marginalised, are part of a more inclusive and consultative approach to policy decision-making and resource allocation for science and technology (S&T) activities.
- The development of a culture within which the advancement of knowledge is valued as an important component of national development.
- Improved support for all kinds of innovation which is fundamental to sustainable economic growth, employment creation, equity through redress and social development.

The concept of innovation

This White Paper is built upon the twin concepts of "innovation" and a "national system of innovation" (NSI). As an introduction to these concepts, we quote below a series of extracts from a discussion on innovation in the 1994 Report of the Auditor General of Canada, which captures a particular spirit which we would like to see suffuse through the proposed policy:

Innovation has become a crucial survival issue. A society that pursues wellbeing and prosperity for its members can no longer treat it as an option.

Innovation tends not to arise by itself; it is generated and sustained through the efforts of people: innovation is where the spirit is. It cannot be legislated, or brought about by edict. It comes from individuals and from creative and interactive communities. Like happiness, innovation wilts in a climate of criticism and repression yet thrives in an environment of encouragement and support.

Government therefore needs to work hard at creating an environment that is supportive of innovation. Otherwise innovators will either not innovate - they will "play safe" - or they will leave for more encouraging societies.

In an innovative society, individuals, groups, organizations, government and Parliament recognise that they are partners, rather than opponents, controllers or contenders. The ideas of community, networking, collaboration and common purpose

of playfulness, fun and excitement, but also of healthy competition, openness and accountability need to be guiding principles.

An important element of innovation is resolving dilemmas, that is, reconciling apparently competing values. Truly innovative societies can, at the same time, meet real needs and control costs, address individual choices and satisfy societal priorities, considering both economics and compassion.

To survive and prosper, that is, to achieve and maintain a high standard of living for its members, a society must do four things well:

- *First, it must build and sustain social, legal and economic structures and processes that support innovation, that are competitive while sustaining the natural environment, and that lead to wellbeing for the greatest number of people.*
- *Second, it must ensure that its members develop and continually update the knowledge, competencies, abilities and skills that are required to produce innovative products and services.*
- *Third, it must nourish and support the effective potential of its members [and their] commitment to a common purpose, trust, collaboration, enthusiasm, caring and loyalty; this includes defining meaningful roles for those who are outside conventional work structures.*
- *Fourth, it must build and sustain relationships, within itself and with other societies, that enable it to interact productively, both for its own and for mutual benefit; and it must do so with a long-term view, considering spans of generations.*

Furthermore, an innovative society is willing and able to discuss and examine openly all issues, even controversial matters and "sacred cows"; it retains the suppleness to explore and experiment; and it has the wisdom and persistence to pursue selected options in the quest for desirable results. It is able to envision a desired future, examine its possibilities, select preferred results, and pursue its choices vigorously.

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1. **Introduction**

The development and application of science and technology within a national system of innovation (NSI) in South Africa will be central to the success of the Growth and Development Strategy (GDS) of the Government as it seeks to address the needs of all South Africans. In keeping with a variety of political, constitutional, social and economic changes introduced by the government, the NSI[1] as an enabling framework for science and technology is intended to support the six pillars of the Growth and Development Strategy.

The stimulation of a national system of innovation will be central to the empowerment of all South Africans as they seek to achieve social, political, economic and environmental goals. The development of

innovative ideas, products, institutional arrangements and processes will enable the country to address more effectively the needs and aspirations of its citizens This is particularly important within the context of the demands of global economic competitiveness, sustainable development and equity considerations related to the legacies of our past. A well-managed and properly functioning national system of innovation will make it possible for all South Africans to enjoy the economic, socio-political and intellectual benefits of science and technology.

2. The Global Context

The setting and realisation of national goals cannot be undertaken without due regard to the implications of global imperatives. Social and economic systems "globalised" by world market forces, the information revolution and new communications technologies require constant innovative planning and monitoring in order to function optimally in the interests of their constituencies. The political transition in South Africa has projected us into the global arena, exposing us to pressures and challenges that require innovative and flexible responses to a rapidly changing global environment. The major challenge will be to integrate successfully into global systems and communities while addressing the local needs and aspirations of South Africans.

Some of the dominant trends and developments at a global level that will affect planning and resource allocation in South Africa are:

The knowledge-based transformation of many of the world's societies as a result of the increased flow of information made possible by ever-improving global communications technologies. The world is in the throes of a revolution which will change forever the way we live, work, play, organise our societies and ultimately define ourselves. Unlike previous revolutions which were focused on energy and matter, this fundamental change involves our experience of time, space, distance and knowledge. Although the nature of this information revolution is still being determined, its implications, which are global and inescapable, are being felt with increasing force. In the world-wide race for competitiveness the finishing line keeps moving away. The ability to maximise the use of information is now considered to be the single most important factor in deciding the competitiveness of countries as well as their ability to empower their citizens through enhanced access to information.

The competitive pressures on the South African economy as it opens up to global market forces. The opening up of trade opportunities in global markets in general and the requirements of the World Trade Organisation Treaty on Technical Barriers to Trade in particular pose both opportunities and dangers to the developing economy of this country. Identifying niche markets in which international competitiveness can be improved, increasing technology

investment and enhancing productivity become imperative. Policy choices about investing in infrastructure, education and training, and in research and development (R&D) will all have to be located within a framework where there is an appropriate balance between opening up the economy to global competitiveness and nurturing local initiatives. Government will have to play a key role in creating a macro-economic environment within which innovation to support both competitiveness and the quality of life can flourish.

Increased co-ordination of innovation policies and strategies in response to the complex challenges generated by global social and economic changes. A national system of innovation that addresses the needs and aspirations of its citizens, while maintaining a competitive edge, must have a high measure of strategic and creative interaction among its constituent elements. The promotion of a national system of innovation as a framework for social and economic policy maximises the possibilities for all parts of the system to interact with each other to the benefit of individual stakeholders or groupings of stakeholders and the advancement of national goals. For example, the close co-operation between government, industry and research institutions is a prerequisite for projects designed to produce growth and development in accordance with national goals. Increasingly, the co-ordination of innovation strategies and initiatives within a national system of innovation will extend beyond the boundaries of national states as regional imperatives grow stronger. The development of a national system of innovation in South Africa will have to take into account social and economic developments in neighbouring countries with a view to eventually developing a regional system of innovation as a crucial long-term guarantee of regional stability and upliftment.

A problem-solving, multi-disciplinary, partnership approach to innovation as a mechanism of growth and development. Traditional ways of producing knowledge within single disciplines and institutions are being supplemented by knowledge generated within various applied contexts. This is knowledge that is collaboratively created within multidisciplinary and transdisciplinary research programmes directed to specific problems identified within social and economic systems. 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, and private sector think tanks and laboratories. It is also strengthened by adopting a problem-solving approach that seeks to draw on multiple resources that span the natural sciences, the human sciences, and the medical and health sciences. Setting up a national system of innovation in South Africa that will stimulate such collaborative, multidisciplinary, applications-based research will require new policy, funding and organisational arrangements, including provision for training new generations of scientists and technologists oriented towards the solving of real problems.