

NACI STAKEHOLDER CONSULTATION WORKSHOP ON THE PERFORMANCE OF THE NATIONAL SYSTEM OF INNOVATION (NSI)



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science & innovation

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NACi
NATIONAL ADVISORY COUNCIL ON INNOVATION



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1. WELCOME AND BACKGROUND BY DR MLUNGISI CELE, NACI ACTING CEO

Dr Cele thanked everyone for attending. The workshop participants must be open to new ideas and participants were urged to speak without fear.

He explained that NACI and the Department of Science and Technology (DST) are drafting a next-generation policy for science, technology and innovation (STI) in South Africa.

Purpose of the workshop

The workshop would take forward the task assigned to NACI by the Minister of DST two years previously, namely to review the White Paper drafted in 1996 and assist in crafting a new White Paper and decadal plan. Since NACI provides advice, but does not develop policy, its White Paper role is developing a framework to advise on the paper and on a new decadal plan for STI.

A review report was compiled early in 2016, but it lacked a situational analysis of the context and conditions under which the White Paper is to be implemented locally and internationally. Without this information the policies cannot be delivered or monitored. The context must consider where STI comes from and is going because the future will be different to the time of the policy's formulation. The world is in transition. South Africa is a developing country and part of the global economy.

Minister of Science and Technology Naledi Pandor acknowledged the structures and institutions presented in the report but wanted a description of their efficacy. Her expectation was that STI should not be aspirational but practical, moving from the abstract to the concrete. The Minister wanted to be informed of how innovation will resolve the key issues facing society. Some issues and considerations are contained in the handout.

However, NACI welcomes comments and input. It is necessary to explain to the Minister how the system has performed over the past two decades as the learning can be applied in drafting the Green Paper. This information is complementary to the review report.

The first presentation will describe the context and the second presentation analyse performance. Presenters will share the work done to date, albeit it not finalised. Participants were asked to scrutinise and enhance the document. Stakeholder support on the content and recommendations is required.

2. PRESENTATION ON PERFORMANCE OF THE NSI

2.1 Presentation on the situational analysis by Prof. Rasigan Maharajh

The following quotations introduced the presentation:

'Like clockwork, 11 700 years or around 400 generations ago, a regular and predictable realignment of heavenly bodies in our solar system conspired to push Earth out of a long ice age and into a new equilibrium, a warm and extraordinarily stable interglacial period'

(Milankovic, 1941; Wolff, 2011; Ganopolski et al, 2016, etc.)

Socio-economic & Political Transformations: Palaeolithic, Neolithic, Agrarian, Feudal, Colonisation, Slave, Mercantile, Racial Capitalism, Apartheid, Transitional Reforms/Transformation, Post-capitalism?

(Marx; Childe; Mbeki; Magubane; Legassicketc.)

Articulation of Modes of Production and the Emergence of the Contemporary Conjuncture

(Wolpe; Freund; Alexander; etc.)

Historical context

Periods in South Africa's history were divided into pre-1652, until the late 19th century, 1910, 1948 and the 1970s. The prevalent political economy, dominant ideology, governance framework, macroeconomic policies and microeconomic policies for each era were presented as per the table below.

	Until 1652	Until late-19th century	1910	1948	1970s
Political economy	Hunter-gatherer Agrarian Mining Exchange	Slavery, agrarian and capitalist articulation of modes of production	Settler colonialism, capitalist agriculture, minerals-energy complex establishment	Racial capitalism	Racial capitalism
Dominant ideology	Feudal/ communal	Multiplicity coexisting and competing	Imperial	Grand apartheid	Grand apartheid
Governance framework	Traditional	Autonomous though increasingly engaged	Undemocratic imperial	Undemocratic conservative	Undemocratic, increasingly autocratic
Macroeconomic policies		Expropriation and acquisition through violence	Dependency	Affirmative action for non-English whites	Import substitution, industrialisation
Microeconomic policies	Indigenous and traditional	Imperial/ colonial Rural/urban	Colonial mineral and commercial agriculture	State-aided development	Corporatism (government and private sector)

	-1989	-1990	-1994	-1997	-2001	-2007	-2012+
Political economy	Racial capitalism	Siege economy	Mixed	Mixed market-led	Mixed market-led	Mixed state-led	Mixed Market-led
Dominant ideology	Apartheid	Dual power	Post-Keynesian	Structural adjustment	Neo-liberal	Neo-liberal	Neo-liberal
Governance framework	Authoritarian - military	Negotiations	Democratic development	New public management (NPM)	NPM	NPM	NPM
Macro-economic policies	Normative economic model	Normative economic model	Reconstruction and Development Programme	Growth, Employment And Redistribution Strategy	Accelerated and Shared Growth Initiative for SA	New Growth Plan	National Development Plan
Micro-economic policies	Sub-regional industrialisation	Deregulation and General Agreement on Tariffs and Trade	World Trade Organisation	Privatisation and structural adjustment	Reducing costs of doing business	Industrial policy action plans	Infrastructure and Sector strategies
Science, technology and innovation	Science and technology discrete and stratified	International mission review and contestation	Green Paper on Science and Technology	White Paper on Science and Technology (NSI perspective)	National Research and Development Strategy	10-year Innovation Plan	Ministerial Review: of the Science, Technology and Innovation Landscape

Transitions in social economic formations drive and result in political formations. Consequently, society and economy give rise to political formation. South African history started millennia before 1652. Racialism formed over 150 years. The current era is a time of change. The future offers alternative configurations. The mode of development is not sequential. Elements of development emerge at different times.

STI evolved over time in South Africa, beginning 20 000 years ago. STI policy frameworks were not shaped in isolation of then-current events and the larger narrative. South African institutions were insufficiently capacitated for the post-1994 environment.

South Africa's balance of trade was flat until 1994 but subsequent transformation has resulted in negative balance of trade growth.

Emerging conjunctural balance was explained by dividing world economies by percentages. USA has 25% of the world trade, equal to the total of the BRICS countries combined. South Africa contributes 0.46% of the world economy. Poverty, underdevelopment, unemployment and inequality are structurally embedded in the society and economy. The minerals-energy complex is declining but there are increased ecological constraints and environmental degradation, state capacities and capabilities may be 'hollowed-out'. Corruption exists. Inherited and embedded structural legacies persist.

A conference on the Holocene interglacial period was held in South Africa in July 2016. The implications of the current, Anthropocene period, are that globally biophysical and economic demands increase while resources are finite and constrained.

The four major challenges are energy, food, water and urbanisation. A particular temperature increase must be maintained in line with the Paris Agreement. Food, and the water required to grow it, is the main reason for interstate transgressions. Transformation of the food system has the potential to improve personal, societal and planetary health and wellbeing. The rapidly urbanising population needs innovative solutions to the creation of liveable urban environments, transportation and a circular economy. Water is scarce internationally and in many parts of the world is becoming scarcer. The current conditions will not disappear. The response must be planned and innovative.

The earth shares a common future in a common era that is different to the past and present. Differences exist between the global north and south. Planetary boundaries are finite.

South Africa deposited its intended international contribution to environmental control with the United Nations this week. It provides the South African undertaking for the period 2020 to 2030 and gives binding constraints on the six goals for the adaptation objectives. The planning focus on equity must be maintained. A mitigation challenge is the South African accession to the Paris Agreement.

Sustainable Development Goals (SDGs)

The SDGs consist of 17 goals and 159 corresponding targets. The SDGs involve more than the submission of reports. The information has to improve and modify STI policies and link to the National Development Plan (NDP).

National Development Plan

Note must be taken of three NDP priorities, namely raising employment through faster economic growth; improving the quality of education, skills development and innovation, and building the capability of the state to play a developmental, transformative role.

1996 White Paper on Science and Technology

The 1996 White Paper on Science and Technology contained very little on higher education and the post-schooling level. A simultaneous focus on research and development (R&D) and on the calibre of teaching would improve the quality of higher education, but without attention, inadequate human capacity will constrain knowledge production and innovation. Universities need to become centres of excellence at the cutting edge of technology. By attracting students from abroad, universities can generate revenue and increase the skills pool. Students from abroad who graduate from South African universities should qualify for a seven-year work permit to encourage them to stay and work here. While South Africa needs to spend more on R&D in general, the institutional setup also needs to improve the link between innovation and business requirements. The government should partner with the private sector to raise the level of R&D, with resources targeted towards building the research infrastructure required by a modern economy.

Higher education institutions

The performance of existing South African higher education institutions ranges from world-class to mediocre. Continuous quality improvement is needed as the system expands at a moderate pace. A major challenge is that poor school education increases the cost of producing graduates, and a relatively small number of black students graduate from universities. Increasing participation and graduation rates, with the option of a four-year university degree, combined with bridging courses and more support for universities to help black students from disadvantaged backgrounds, is likely to yield higher returns.

Innovation

The NDP innovation requirement focuses on science and technology to continue to revolutionise the way goods and services are produced and traded. As a middle-income country, South Africa needs to use its knowledge and innovative products to compete. On its own, a more competitive cost of

production will not be sufficient to expand the global presence of South African industry. This applies to both new industries and traditional sectors such as mining. Innovation is necessary for a middle-income country to develop.

Science and technology can also be leveraged to solve some of the biggest challenges in education and health. Many parts of Africa that have never enjoyed fixed-line telephony are widely served by efficient cellular phone networks that provide a range of services. Educational materials can be delivered electronically to remote villages. Science is breaking new frontiers in fighting diseases and lowering the cost of water purification.

South Africa needs to sharpen its innovative edge and continue contributing to global scientific and technological advancement. This requires greater investment in R&D, better use of existing resources, and more nimble institutions that facilitate innovation and enhanced cooperation between public science and technology institutions and the private sector.

Information and communications technology environment

Currently about 17% of South Africa's population is able to access the internet. This is increasing by about 20% annually. The use of digital communications has changed society in ways that are not yet fully understood. It is clear, however, that young people have embraced the new media, and this represents a potentially powerful means of fostering social inclusion.

The high domestic cost of broadband internet connectivity is a major hindrance. All South Africans should be able to acquire and use knowledge effectively. To this end, the institutional arrangements to manage the information and communications technology environment need to be better structured to ensure that South Africa does not fall victim to a 'digital divide'.

Conclusion

In conclusion, Prof. Maharajh referred to the need for a social contract and institutional compact to rebuild trust between institutions. A wider system is needed to attract more innovation. Collaboration is required to achieve greater innovation. The analysis is incomplete and only certain aspects have been discussed. The report on innovation issues to be taken into account in the next-generation White Paper has not been finalised.

2.2 Presentation by Prof. Michael Khan on the performance of the instruments at play since the 1996 White Paper

Context

'Performance' in this context goes beyond the generally accepted definition of performance. The purpose of this meeting is to check the assertions made in considering performance.

The past has been taken into account. Refocus and coordination of resources were required after 1994. The International Development Research Centre and Science and Technology Initiative resulted from this period. The future must be inclusive, and involve growth, excellence, social responsibility and coordination of efforts. To assess the current situation, achievements and shortfalls have to be measured against objectives. A number of pre-1994 systems still exist, which indicates continuity. DST is the custodian of innovation but Acts and policies of other departments impact on innovation. The White Paper of 1996 introduced innovation and new organisations and instruments such as the science council enabling Acts, the National Research Foundation rating scheme, Department of Education journal subsidy, Technology and Human Resource for Industry Programme, Industrial Development Corporation, Studies in Poverty and Inequality Institute, science vote to 2005 and the Bretton Woods Conference. This happened alongside open borders and a variety of international agreements. Changes to the overarching policies occurred such as the Reconstruction and Development Programme, Labour Relations Act, Basic Conditions of Employment Act, Employment Equity Act, Broad-based Black Economic Empowerment Act, Higher Education Act, Public Finance Management Act, Auditor-General Act and National Environmental Management Act. The White Paper backs the NSI concept of supporting, managing and guiding research and innovation.

Existing R&D strategy

An appraisal of the existing R&D strategy was undertaken by extracting and reviewing statements of intent and intended actions. The manner in which to leverage technology goes back to Jan Smuts and the 'southern geographic advantage'. This was translated into research supported by the government such as nuclear engineering and the pebble bed reactor. The research resulted in achievements and failures.

The strategic management model was DST's attempt to reengineer the public research system and allocate responsibilities in exchange for abandoning the science vote to provide a cross-government approach to R&D, budgeting and expenditure. It resulted in the Council for Scientific and Industrial Research (CSIR) transfer to DST. The monitoring of R&D

budgets could not be achieved. DST was to coordinate research. Coordination is a recurring topic but has not been achieved. The Human Sciences Research Council has reengineered itself and created space between itself and government. It is unclear whether responsibility lies with the agency, the department or the Ministry.

The R&D strategy promoted innovation in biotechnology, information technology, technology for manufacturing, technology to leverage knowledge and technology from, and added value to, the natural resources sectors and technology for poverty reduction. The success of the strategy depends on higher investment. It had a 10-year plan for continuity.

A goal was to position South Africa among the top three global pharmaceutical industries, but this was not attained. Aspen is the largest generics manufacturer in the southern hemisphere. It is not known if it achieved this due to state intervention/policy or was independent of the state.

Eskom opened the energy supply to renewables. Renewables were introduced by the private and public sector very rapidly and all technology was imported. Eskom lost a huge opportunity to build R&D in renewables through a policy position taken 20 years ago.

South Africa is dependent on China for much of its technology and products. The millennium goal to half extreme poverty was met.

The research and technology audit and foresight did not take place due to the lack of donor funds. An unintended outcome of the foresight process was to bring in many young people to the system, many of whom have risen to senior positions.

The South African Research Chairs Initiative was highly successful on one level but involved rebranding. Sixteen centres of excellence are in place. The R&D tax deduction for companies has had some success but is generally considered not to work. The journal subsidy is a continuation from before 1994.

A Ministerial review was conducted in 2010/2011 and has not been reviewed. The first 10 recommendations talked to the system as a whole. Structural changes to deal with coordination, selection and funding were recommended but none were adopted. The infrastructure recommendations were enacted. Other recommendations were for state organs beyond DST and fed into the NDP.

The 1996 White Paper promoted science for social inclusion. However, the document was lost and not implemented. More recently a task team has looked at innovation for social inclusion.

Economic growth is 2% a year. Gross domestic expenditure on R&D as a percentage of GDP is a sentinel indicator. From 1991/92 to 2012/13 it dropped from 0.84%, levelled out at 0.6%, grew to 0.95% in 2006/07 and declined to 0.76%. The 1991 figure was too high and excluded the homelands. It dropped and bottomed

out, supposedly because military R&D was reduced and under-resourced. Growth took place in the new era and with the introduction of new organisations that were better resourced. The recession occurred, the nuclear programme was halted and negative growth took place. Capacity was lost and the graph remained flat.

Government controls 5% of the funding it provides for R&D because science councils and universities are independently managed without government intervention.

Research and innovation inputs and outputs use a number of metrics that are measured. Examples are business expenditure on R&D, degrees awarded to black students, female researchers, articles published, and patents and trademarks. Of the total number of PhD students in South Africa, 25% are foreign and will leave after they complete their research because they are not granted visas to remain. At the full-time equivalent researcher level, over 20 years, the number of full-time researchers has moved sideways. The system has not grown since 1996. The science system is underfunded. The ratio of PhD students to staff has increased because the number of students has grown but the number of staff has remained fixed. The transformation agenda has made progress but growth has been static.

Scientific outputs can be looked at as whole counts or fractional counts, which are more accurate. NACI uses whole counts. International co-authorship is up almost 50% for South Africa and most science-producing nations. In apartheid South Africa, scientists collaborated with international counterparts and brought technology into the country. The H-index did not undergo any change. Although South Africa is a signatory to the Patent Cooperation Treaty there is no growth in patents because it is not necessary to register intellectual property rights (IPs) as the country exports raw resources and does not do the beneficiation that requires IP. Exports mitigate the notion of a knowledge economy. The export basket mitigates the notion of a large economy.

In fields such as social sciences, South Africa has a comparative advantage and features above the international average. Yet the country is below the world average in computer sciences.

Although South Africa pushed resources in titanium research it does not feature well internationally on publications. The big titanium breakthroughs will happen elsewhere. Publications on platinum research are above the world average and reflect the support and resources the sector receives. The University of Cape Town remains in the international top 120 universities with its scientists receiving and co-authoring articles.

The 'brand trek' refers to formerly domestic companies that currently trade globally, such as Steinhoff, Sappi, Old Mutual, De Beers, Sasol and Bidvest. Examples of innovation in the public sector are sibus.net, SARS eFiling, momconnect and Denel missiles. Examples of South African social innovation are the Treatment Action Campaign and the Legal Resources Centre.

Conclusion

The research, technology and innovation glass was never full in South Africa. Prof. Khan cautioned that the danger of stagnation exists with the transformation and the loss of institutional memory. Coordination is a necessity. Co-authorship must not be confused with collaboration. Pockets of excellence must be recognised.

'The NSI is good in parts but the NSI tail can't wag the political economy!'

Dr Cele thanked Prof. Maharajh and Prof. Khan for their presentations, which had provided the context for discussion.

3. DISCUSSION FACILITATED BY DR CELE

The following questions, comments and responses were noted:

- ▶ The presentations were thought-provoking. It was said that innovation is not a linear process and focus appears to be on an evaluation of R&D and not on what it has achieved.
- ▶ The sentiments of the previous speaker were supported. The programme is producing innovation in the 200+ innovation hubs.
- ▶ Reviewing the performance of the NSI is a very big task. Some issues were covered in depth while others were surface-skimmed.
- ▶ It is important to understand what will happen to the report. It could have a disclaimer stating that the comments reflect the authors' opinions, which are not necessarily those of NACI. Not mentioned in the report was the size of the R&D system, which was developed to support five million whites during apartheid and now has to support 55 million people at different levels of development.
- ▶ The review has a solid start. NSI in the last 20 years has not been guided by a policy statement. A return is needed on the key areas of innovation, such as the drivers of postgraduate programmes. The NDP does not explain how to galvanise scarce resources for key purposes. The fact that humanity is at the centre of innovation must be kept in mind.
- ▶ The system has not grown. It was asked whether the system must be planned around limited resources or system must grow to grow the innovation system. Discussion always appears to be on the structures, not the people.
- ▶ In Uganda street-level innovation is obvious. Innovation types should be identified, such as nuclear, military, science and social.
- ▶ Stakeholders have to be identified and their requirements of the NSI understood. NSI gaps have to be known. It is necessary to look at civil society, businesses, universities and science councils and government as stakeholders. The NSI process must be inclusive.
- ▶ Negative innovation depends on the origin of innovation. Innovation is usually led, but organic innovation can also take place. The relationship between the formal and

informal sectors must be understood as much innovation occurs in the space between the extremes. Not all innovation is good or for the wellbeing of society. Some is destructive, such as drugs. Complexities exist in the concept of innovation.

Reasonable consensus might refer to the direction that the country wants to take. This cannot be determined in the abstract. In South Africa, there is no consensus on a reasonable level of development. It appears at times to be who shouts loudest wins. No national discourse is taking place, not even at the universities. The complexities are not being addressed due to a lack of capacity. Innovation is being perceived through a very narrow lens.

- ▶ NACI and DST were commended on their good work. The success stories and the essence of innovation, which is people, can be highlighted through this process. Global multinationals successfully manage innovation. They have clear strategies, understand the demand and know where to find investor funding. This anchors innovation and they manage innovation with good leadership, a culture of innovation, capability, skills and technology, and processes and tools. This process is an opportunity to study how multinationals manage innovation.
- ▶ A better future for South Africans must be provided with food security. Innovation can enable society to improve. South Africans should learn from the experiences of others.
- ▶ An innovation framework is huge. The policy intervention needs more leverage on science and technology than on innovation. The limitations need to be confronted. The government decides to do some things and not others. The decision not to act is a policy intervention. Science and technology are understood, not innovation, yet an attempt is being made to provide policy proposals on innovation. Advanced manufacturing is an example. Initially, titanium research sought to identify where South Africa can succeed. It is vital to differentiate between science and technology, and innovation.
- ▶ A pragmatic and business approach is needed. Phillip Cotter stated that 'one can make a better widget but people will not march towards your door'. In South Korea, a panel of eminent opinion leaders was established to look at trends and needs that would arise in the future. The silo approach cannot succeed. Integrated research and innovation are necessary. For example, the design and production of flatscreen TVs was coordinated using PhD students and international market researchers. The same could take place in South Africa if it was established where to direct research.

It was said that the return on government investment in STI is 5%. Who is steering NSI performance? Officials in the NRF would like to think that as role-players in the NSI that they have some control. The new White Paper must consider robust discussion and good positioning of universities and science councils to achieve NSI goals. Are those tasked with steering the system not doing it? Conflict and autonomy conflict.

- ▶ Small entrepreneurs play an important role in innovation but their inputs are not captured and R&D is missing out. Support for entrepreneurs is insufficient, yet achievements are made. The R&D system is not aligned to support informal small innovators.
- ▶ NACI needs to engage with voluntary scientific associations to understand their challenges, which include funding for conferences. NACI assists with publications but more assistance is needed. The Entomology Society, for example, can advise on crop-eating insects, but needs more resources for research that can result in secure food resources.
- ▶ Substantial funds have been spent over 20 years. It should be possible to learn what works and to focus on the correct research. Departments such as the Department of Trade and Industry and the Department of Economic Development are also involved in innovation. Coordination is essential to learn from the past and to advance.
- ▶ The missing element is what the NSI has achieved. The next generation NSI must look at the achievements that took place in the last 20 years.
- ▶ The presenters appear stuck on how to understand innovation and on looking at the past. The focus must be on the future, with its possible creations by humans and machine inventions. The fourth industrial revolution must be considered.
- ▶ The NSI, quality of life and innovations in informal spaces must be measured.
- ▶ Coordination is important. DST must look back to identify and close gaps to move forward effectively. A framework on the challenges faced must be drafted.

Response: Prof Khan:

- ▶ This is a rich and thought-provoking discussion.
- ▶ The performance analysis focus on R&D is due to the mandate, which is to review the research and development strategy.
- ▶ The Ministerial review states that a properly funded national council on research and innovation is needed. Research topics are to be informed by societal needs. The recommendations in the review still hold good.
- ▶ All the issues raised were considered.
- ▶ Post-1994, the Organisation for Economic Cooperation and Development survived and allowed the growth of multinationals. Discovery Health is a patent holder of various processes, producing up to four patents a year. The services sector accounts for 66% of the South African economy and is producing creative ideas.
- ▶ Informal sector innovation is restricted by municipal regulations inherited from the British. The municipal regulation prohibiting economic activity on the road verge, for example, must be revisited.
- ▶ All food is a South African cultivar or breed and the result of hundreds of years of research. The challenge is to open up to new crops, new space and new farmers.
- ▶ The presenters are not yet ready to make recommendations.

Dr Cele said that the essence of the questions must be recognised

- ▶ What has NSI achieved?
- ▶ How to address the problems of the majority
- ▶ Is the notion of innovation understood?
- ▶ Do we have the capability to make the progress being recommended?

The next process will be much broader than the DST and its stakeholders.

4. COLLECTING OPINIONS ON STI PRIORITIES

Ms Claire Nauwelaers introduced the 'sticker session'. Everyone was requested to identify and write down an issue, be it a problem, a way forward or opportunity that should be included in the White Paper. The ideas will be collated.

5. KEY ISSUES IDENTIFIED BY PARTICIPANTS

Ms Claire Nauwelaers and Prof Johan Schot shared the seven themes that emerged from the sticker session:

1. Coordination across government departments.
2. Inclusive innovation with public participation.
3. Innovation is not R&D and is not linear.
4. Capacity building and skills.
5. Autonomy versus control and prioritisation from above.
6. Opportunities and sustainability.
7. Policy learning, monitoring and evaluation.

6. DISCUSSION ON KEY ISSUES (MODERATED BY PROF JOHAN SCHOT AND MS CLAIRE NAUWELAERS)

The main themes were opened to the floor for elaboration and suggestions on the way forward.

6.1 Theme 1: Coordination across government departments

Sticker session quotations:

- ▶ Coordination is needed for marketing.
- ▶ Coordination is needed between science councils and the Science and Technology Act.
- ▶ Rethink if coordination is needed.
- ▶ A call for coordination was made long ago but was not acted on.

Discussion:

1. It may not be feasible in a democratic society but formal understanding of R&D is needed.
2. Coordination is necessary between the system and specialised areas or between the science councils. It must be political coordination. Several Phakisa exist such as the Mining Phakisa, which has its own focus on science and technology and some form of coordination.
3. The obsession with coordination is because an easy solution is sought. It usually refers to the need for a governance structure. The STI value proposition must be continually improved and must include the influence on the economic strategy of the time. It is difficult to find STI as a set or a combination of subsets or as cross-cutting, as these do not lead nations. More discussion is needed on what has been achieved and what is required into the future. The trade environment must be considered.
4. It is not the responsibility of the democracy to produce higher coherence. Berlin has coordinated institutions and academia. A much higher level of imagination is required to identify what is important - for example, the requirements to galvanise all inputs and logistics for STI. Currently it is a hit-and-miss approach because the NDP does not provide guidance.
5. A rural site with a biodigester producing biogas was visited. The process was successful and appropriate to the context. But the innovation could not succeed nationally.
6. Science, technology and innovation are not synonymous. Innovation refers to change in society and economy. The role of education in innovation is often denied and is not on the agenda because of silos and barriers. Coordination imposes a view. Innovation should be marketed as a means of solving the country's problems and as a vehicle for mobilisation of science and technology.
7. There was coordination in the past. Coordination occurs when there is a national issue.
8. How to coordinate the coordination?

Summary:

Top-down coordination, informal coordination and informal coordination around certain issues were raised.

6.2 Themes 2 and 3: Inclusive innovation with public participation; Innovation is not R&D and is not linear

The two themes overlap, namely inclusiveness and broader-view innovation.

Discussion:

1. It is important to understand why marginalisation exists. Participation will help with the solutions. The political economy ties South Africa into an unequal relationship. The focus should be on participating in the international value chain. It is in very few areas that South Africa plays at a higher level.
2. No innovation champion has been identified in South Africa. It is an issue of access to research technologies. The issue is summed up in the words 'accessibility and visibility'.
3. The NSI lacked top-level direction. The NDP and Phakisa are coordinated at the top. It is necessary to look at what the country needs. The exercise can involve a huge number of people. It is happening but the scope must be broadened. Approximately 500 state-owned agencies exist. The NDP must be taken seriously and that means top-down coordination.
4. It was asked who innovators are and where to invest to generate innovation. Bill Gates said that investment should be in the youth with nutrition and proper schooling as they hold the future. It is important to talk to the right people at the right level.
5. The basic issue is that the dominance and success of capitalism in South Africa have resulted in urbanisation and in-migration. A Nigerian economist visiting South Africa in the 1990s said that he had seen more poverty elsewhere in the world, but not the same level of destruction of the local economy. The manner in which to build a culture of innovation has to be decided.
6. It is not possible to innovate for someone, only with them. This is a mistake often made when referring to inclusive innovation development or innovation for inclusive development.
7. Success of an innovation is possible only if the innovation is really needed and people depend on it. The role of users must be recognised. The crime system was cited as an example as the beneficiaries of innovation produce the innovation.
8. The 1996 White Paper stated that the system will support innovation but it has been biased towards big science. Innovating with the users and for the users is important. Innovation is not the preserve of scientists alone.
9. The STI infrastructure and agenda must be linked to all levels, including national and local.
10. The iKhasilabs in Gauteng are a system of innovation and should be consulted in the current NSI process.

11. It was asked whether the IP instruments are responsive to needs and whether the South African system of innovation is helpful.
12. Ways must be found to obtain greater municipal and broader responsiveness. It was suggested that structures be created where all government levels put out their problems. Anyone who can solve a problem should apply for funding. The public and private sectors need to support open innovation calls.
13. The issues to be contained in the White Paper must be correct. The discourse must change to talk about a new space that does not look at the needs and problems of 'black people'. The issue is the language. A second issue is that innovation is perceived as change that is being imposed. Science has functioned under white domination in South Africa. It is vital to dispense with the suspicion and deracialise the issues. Inclusiveness must not mean including black people.
14. STI can assist in changing the colour of the economy. It is a serious structural issue. The mechanism of change must be on the back of STI, not the economy.
15. Not all innovation is recognised. A sanitation challenge received 60 responses, with only three ideas known to the industry. The White Paper must recognise all innovation in all sectors. The Minister asks whether there is a national system of innovation. There is but its real character and what it is supporting must be understood. Elon Musk did not invent the solar roof tile but organised it into a marketable product.
16. It is essential to create space for the innovation conversation to take place.
17. Only one private sector representative was present at this workshop. The participation and the type of representation are important.
18. It was asked how to ensure STI is prioritised for public investment.
19. Cabinet has encouraged the use of innovation to be more competitive. But it is perpetuating exclusivity in the public sector.
20. Disruption is needed to be inclusive and transformative.
21. The private sector will participate only if there is a direct payoff. Organised private sector organisations must be engaged. The private sector is not uniform and must be disaggregated. For example, new entrants needing access to STI is a single category in the private sector.
22. The science councils and the CSIR have done interesting work on the inclusion of the private sector. but focused on certain problems.
23. STI must stop portraying itself as an elite project. Very high barriers to trade used to exist for blacks. STI is perceived as being at the expense of blacks. Teachers must encourage entrepreneurship from a young age.
24. A binary approach is not used for the NSI. The base of innovation must be broadened. At present there are one million university students who need to be encouraged to be innovative.
25. The alternative is transformative change, which will make R&D more accessible to small entrepreneurs. The role of the government in innovation, and science and technology has to be clarified. It was asked how to build a culture of innovation and the role that science parks can play.
26. A challenge is the coordination of programmes that are meant to assist entrepreneurs but actually assist universities of technology. Innovation stations are poorly located and not accessible to those meant to benefit.
27. Innovation with no commercial value can have social benefit. The sun heating water directly in a mechanism made of waste materials, without solar panels, was provided as an example. The NSI does not support this type of innovation.
28. It was asked how to distinguish between good and bad innovation and how to measure both.
29. Science must be perceived as 'sexy'. Television programmes on science and the involvement of people in the arts are required. Apple made Samsung's development 'sexy' and marketable.
30. The confusion between invention and innovation must be resolved. A prototype and patent are seen as innovation. Innovation occurs where it has impact. A single definition of innovation is needed. Innovations must be measured when they work and are applied.
31. Linkages between universities, business and the state are important. The Innovation Fund provided the linkage.
32. Ideas are not innovations.
33. Self-interest is important in the system.
34. South Africa has much indigenous knowledge and the ubuntu business model.

6.3 Theme 4: Capacity building and skills

Discussion:

1. Innovation must be taught at all educational levels. Access and capacity building for the informal sector must be provided.
2. Continued professional education (CPE) for scientists is multi-faceted. Scientists must be certified. Scientists have a life cycle in natural sciences that will not be part of the 21 fields of science for which there will be CPE from 2017. A scientists' voice in government is needed.
3. The notion of citizen science is growing. It can lead to citizen innovation where citizens take control of their problems and overcome the elitism in sciences. It was asked whether an NSI is necessary.
4. Misalignment of researchers in academia with what is required and marketable has to be rectified.
5. The type of education needed has to be specified.

6.4 Theme 5: Autonomy versus control and prioritisation from above

Discussion:

1. It was asked whether science should be free and whether the focus should be only on excellence.
 2. Autonomy versus control and innovation. Academics want to do their own research. In the private sector researchers do what is required. In South Africa, if a company conducts research through a university it is not given a tax incentive. However, it receives a tax incentive and the university receives funding if they work together on the research.
 3. According to Josh Lerner in his book, 'The Boulevard of Broken Dreams', governments decide on priorities and are never successful.
- ▶ Time being constrained, the last two themes, Opportunities and sustainability and Policy learning, monitoring and evaluation, were not discussed

7. WRAP-UP AND CLOSURE

Dr Cele thanked everyone for attending and participating. A report has been produced that will be available to all participants and on the NACI website.

The key issues emerging from this workshop will be distilled and included in the framework presented to the Minister. NACI may request additional information from certain people about the unresolved conceptual issues. Some definitions are beginning to emerge, such as definition of innovation in the current context of NACI.

Contributors, the international reference group, councillors and the NACI secretariat were thanked for their input.

The open dialogue creates a community of practice with which to continue the conversation.

The workshop closed at 13:03.



