

DEPARTMENT OF SCIENCE AND TECHNOLOGY: NATIONAL ADVISORY COUNCIL ON INNOVATION WORKSHOP

DISRUPTIVE DIGITALISATION, TRANSFORMATIVE CHANGE AND INCLUSION: HOW DO WE DESIGN A RESPONSIVE MEASUREMENT AGENDA IN SOUTH AFRICA?

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1. WELCOME

Mr. Godfrey Mashamba, Chief Director: Science and Technology Investment, Department of Science and Technology (DST) welcomed all present.

2. OPENING REMARKS

Prof. Crain Soudien, Chief Executive Officer, Human Sciences Research Council (HSRC)

Prof. Soudien emphasised the urgency and importance of science innovation, stating that it must address inclusion. The Southern Africa Labour and Development Research Unit recently published an article by Prof Murray Leibbrandt referring to global inequality, with South Africa part of this process with its growing divide between the rich and the poor.

South Africa is an outlier, in that the rich in South Africa are among the most comfortable and prosperous in the world, and almost all white people are above middle class. Their wealth is comparable to those in Western countries such as Austria, and with the new Black middle class.

South Africa's labour costs are as low as those in Bangladesh and it is important that people do not become habituated to deprivation. Giving people dignity is an urgent task. It is not just about comfort and making people feel better, it is about dignity. Prof. Soudien cited discussions on 28 June 2018 that highlighted extraordinary innovative initiatives. A sense of urgency was stressed.

Dr Mlungisi Cele, Acting Chief Executive Officer, National Advisory Council on Innovation (NACI)

Dr Cele acknowledged and thanked all present.

He stated that a number of challenges existed and expressed the hope that the discussions would assist in understanding innovation. South Africa has a wealth of data at both HSRC and NACI and this should be transformed into evidence for policymakers to use and to help them understand how the world works – not how they understand it to be. This important distinction should be remembered in this complex environment.

Research should provide innovative solutions and there are expectations specific to science. NACI and its stakeholders must provide advice that is informed by evidence, and this needs to form part of a bigger debate. NACI strongly believes in collecting evidence to influence policy and inform decisions. Former United States president Barack Obama emphasised the importance of facts. This is related to decision making and discussing action and is partly why the workshop was convened.

NACI will assist the government over the next 10 years on science, technology and innovation (STI) priorities, particularly allocation of resources, and will conduct a foresight exercise to achieve this. Those present can participate through either web-based engagement or interviews. The task is to shape and inform the new DST 10-year policy of innovation.

Partners were invited to assist the government to select elements for inclusion. Those at the previous year's event would know what capabilities were addressed and where best performance management functions should be hosted. Dr Cele advised attendees to access the web portal and determine what content is being hosted to ensure that it perform an important function.

Further key initiatives included determining the impact of technologies, including locally produced technologies. He questioned the reasons for little confidence in local products and emphasised the importance of learning 'from the ground'. At the same time, resource capabilities should be expanded. All stakeholders were invited to partner with the HSRC and NACI in achieving these goals.

3. KEYNOTE ADDRESS: NACI 2017 SCIENCE, TECHNOLOGY AND INNOVATION INDICATORS REPORT BY DR AZAR JAMMINE, NACI COUNCIL MEMBER

Dr Jammine introduced himself as the project leader for collecting indicators for STI and stated that he would illustrate progress made in STI.

In collecting data, new ideas had been mooted that resulted in a need for adjustments. Over time it had become clear, for example, that it was not adequate to simply collect data on students moving through the system, but to look at sources of funding and how successful or unsuccessful funding had been in generating outcomes.

The manner of indicator presentation had been adjusted over the years to focus on composite indicators to better understand the total output. This was initiated by Minister Naledi Pandor to avoid a multitude of indicators that do not provide a clear picture of the total output.

Prof. Anastassios Pouris from the University of Pretoria managed to encapsulate many indicators in one measure, with inputs from many stakeholders. He argued that composite indicators should be split into three categories:

- ▶ Enablers such as inputs into education.
- ▶ Financial activities (the extent to which the business sector been brought in).
- ▶ Outputs – initiatives that have succeeded.

In setting future innovation policies, it is important first to analyse the knowledge triangle – how government, business and universities collaborate to determine policy direction in innovation. Once this was achieved, the scope should be broadened to include multiple goals such as industrial innovation, inclusion innovation and sustainable development.

Another highly important issue is the fourth industrial revolution (4IR) and how this may promote more innovation.

Innovation reaches beyond universities and, therefore, the government needs to include all stakeholders. Synergy with the private sector should be sought to generate a broader mix of policy instruments of innovation. Beyond the numbers, it is important to assess whether policy instruments have succeeded or failed, thus evaluation is essential.

The government currently faces the enormous challenges of inequality, unemployment and poverty.

While not the sole answer, the priority is education. Most South Africans are unemployed, due partly to the previous apartheid regime, but also because they have an inadequate educational background. The proportion of graduates who are employed illustrates that education is related to decent work and income. However, it goes beyond this. Self-employment is important and creating an environment where people are less dependent on others to provide employment.

Health is also important as it is closely aligned with educational achievements. A healthy society is necessary for inclusion, as is the need for an environment safe and secure from criminal activity.

South Africa needs a skilled and capable workforce to support a decent growth path. At the same time, the country should become more self-sufficient and not rely on imported technology to progress.

The recent Monetary Policy Committee (MPC) statement cited one critical weakness as workers demanding high wage increases while productivity growth declines. There needs to be a relationship between wages and productivity.

For South Africa to become more competitive, it needs a viable infrastructure. This is key to the innovation environment, which can itself contribute to infrastructural requirements.

The current land reform debate is negatively affecting rural communities and is detracting from the many economic development opportunities it should provide. Land reform can open up new opportunities. Emotional arguments should give way to a debate on South Africa's advantage.

Innovation also requires sustainable human settlements and improved quality of households, which in turn generates more innovation opportunities for those who own properties and make improvements.

The government should be accountable. State capture has detracted from innovation and adds no value to the economy.

Addressing environmental challenges globally may create opportunities in communities through new initiatives and enterprises.

The public service should be effective and development oriented. A major drawback is wasteful, unauthorised and irregular expenditure. It is important to improve the competence of government, especially local government.

Social protection services must be inclusive and responsive. The social grants system has been a success despite the criticism that it creates undue dependence on government support. One argument states that other African innovation systems have been more successful because of the absence of social protection mechanisms.

South Africa needs to move from excessive introspection to build the nation and ensure social cohesion and should move ahead unified for the benefit of all.

Progress has been made. In 2010, the National Planning Commission was established and then developed the National Development Plan. The document is sound but implementation is lacking. It is important that a framework exists to build a National System of Innovation.

More recently, the government initiated:

- ▶ The oceans economy or blue economy.
- ▶ Information and communication technology in education.
- ▶ Improved access to health with reference to a possible national health insurance system.
- ▶ Agriculture, land reform and rural development where good opportunities present themselves, including employment creation.
- ▶ Mining, where opportunities remain despite uncertainty about the Mining Charter, which has stifled investment in the sector.
- ▶ Biodiversity, chemicals and waste management, and learning about new environment-friendly initiatives globally, and significant innovation in rural areas.

Numerous legislative, institutional and policy initiatives have been introduced in the science, technology and innovation (STI) sector:

- ▶ The 2102 Ministerial Review.
- ▶ Review of the White Paper on Science, Technology and Innovation.
- ▶ The Science, Technology and Innovation Institutional Landscape Review
- ▶ The 2018 Foresight Initiative, which will be the cornerstone of work going forward
- ▶ The new STI plan
- ▶ Government understanding that it needs to respond to 4IR and ensure that responsive mechanisms are in place.
- ▶ The establishment of the Department of Monitoring and Evaluation (DPME) to ensure that initiatives are evaluated and improved.

Despite the conceptual framework for the new indicators report, it was confirmed that previous indicators reports should still be consulted. The latest report should not be used as the sole benchmark.

Dr Jamine explained how the indicators have been incorporated into the conceptual framework. To illustrate the weighting of indicators, he used the example of the debate around publications and whether they are key to determining the success of initiatives. Some argue against this and suggest that the value of publications may be less than optimal. Overall, South Africa is globally competitive in scientific publications.

Further details were provided on the three categories of composite indicators:

1. Enablers, including human resources, open and excellent research systems, financial support.
2. Financial activities such as financial investment, creating linkages to entrepreneurship and intellectual assets. This includes the extent to which business is investing in innovation rather than only benefitting from it. Business seemed to fund more education.
3. Outputs including economic and social effects. South Africa is dependent on imports rather than local technology. Questions need to be answered about uplifted standards of living, job creation and reducing the number of deaths among the HIV positive. South Africa has declined in the Global Competitiveness Report (GCR) ranking from 47 to 61. There are three main areas of decline: the institutional framework (historically one of South Africa's strengths), governance in financial development (previously seen as excellent in checks and balances) and a growing realisation that business is concentrated in a small group. This has stifled the competitive environment, the growth of small business activity, and innovation required to make the economy more competitive and resilient.

South Africa's Global Innovation Index rating decline was not as marked.

Compared to other BRICS countries, South Africa's global competitiveness ranking was sound but has still dropped. It remained more competitive than Brazil, Egypt and Nigeria but could not be compared to countries such as China. It is necessary for this to be put in perspective and to be clear about how far South Africa has been lagging.

Entrepreneurial activity can now be measured. Only Russia is as 'un-entrepreneurial' as South Africa, which may be due to its social history, while this is not true of China. Those with tertiary education perform much better in entrepreneurship. There are indications that South Africans with tertiary education are advantaged in entrepreneurial activity and perform better than similar people in other countries.

In innovating using technology younger than five years old, South Africa performs better than other countries, which is an incredible contradiction. South Africa has the potential to use technology to improve educational outcomes as it has one of the highest levels of cellular telephone ownership and internet access, yet the question is how to harness this to exploit innovation. Conversely, established South African business displays lower entrepreneurial activity, probably due to control by large organisations. Employment is seen as the path to prosperity whether in business or government, but this is not an innovative environment. It is very difficult to be entrepreneurial in South Africa and onerous regulations do not make it easier.

The conceptual framework with its enablers, financial activities and outputs is not ideal. Progress has been made in enablers and there is more detail about tertiary education showing relative success. Women in STI constitute 31%, especially female doctoral graduates. The participation of women in life sciences, health and clinical sciences is higher and there is a need to understand why women are not attracted to STI.

Activities have deteriorated, including a marked decline in innovation in the business sector. However, the contribution of innovation to economic growth has improved slightly.

South Africa enjoys relative success in publishing ability and its world share in social sciences is 0.8%, health sciences 0.63% and STI 0.37% all which are in line with the average. In social sciences, South Africa is 18th in the world in number of publications.

Organisations such as the National Research Foundation, Medical Research Council, Department of Science and Technology (DST) and Industrial Development Corporation have become more involved in funding channels in the innovation supply chain. A major weakness has been the decline of the business sector's expenditure in innovation. Business should be encouraged to assist with innovation rather than merely capitalising on it.

Dependence on imported technology is high. Exports are lower than imports, although there are some outliers such as in the automotive sector where incentives have played a major role. It was suggested that many of these incentives have been directed to the automotive industry at the expense of other sectors of the economy.

The social progress index gives a mixed picture. South Africa ranks poorly in basic human needs, especially security, and is behind most countries in water and shelter. It ranks relatively poorly in wellbeing, except for access to information, but this is not used productively. It still has a well-developed society in personal rights, freedom and access to education.

The country is successful in some 4IR areas and less so in others. There are pockets of excellence and research is not confined to the top five universities.

The opportunity is massive to capitalise on cellular telephone ownership and internet access to fast track education to feed through to the rest of the economy.

Gauteng, Western Cape and KwaZulu-Natal dominate innovation, with the remaining provinces poorly represented.

South Africa has covered much ground in recent years even though economic growth has fallen, Dr Jammie concluded. Successes include publication rates, but is the educational system producing results? In addition, business has not been attracted to innovation.

4. PANEL DISCUSSION: APPROACHES THAT PROMOTE INCLUSION IN THE PROCESS AND BENEFITS OF INNOVATION

Ms Kgomotso Matlapeng, DST (facilitator)

The panel discussion was opened by facilitator Ms Kgomotso Matlapeng and reference made to issues highlighted by Dr Jammie. A comprehensive and integrated strategy is needed across all sectors, including civil society. Panel members were introduced and their specialisations outlined.

The facilitator requested focus on:

- ▶ 4IR, its opportunities and challenges. Inequalities may arise through labour market disruption and it may benefit only those with intellectual and physical capital.
- ▶ How best to define innovation activities in the light of 4IR.
- ▶ Measurement is important to understand South Africa's competitiveness compared to that of the rest of the world. Publications are not an end in themselves. Conducting surveys should not take place in silos. In addition, there may be opportunities for collaboration.

Mr Garth Williams, Technology Innovation Agency (TIA)

Mr Williams argued that 4IR is not an issue in itself, but a word or a useful heuristic. It may be technology as usual, noting that technology is complex, requiring both tangible and intangible knowledge. How technology is applied is more important, for example, digital manufacturing made manufacturing more accessible.

Digital sophistication is needed and there is a current focus on hybrid production systems. Some task-based activities have a higher potential for automation than others.

South Africa has high unemployment and a low-skilled workforce of 7.5 million people. Seventy percent of the South African economy is in knowledge services and these are at high risk of deconstruction due to the high virtual component level.

More companies are using digital technologies and this can support inclusion by scaling the workforce.

Another important issue is growth in competitiveness.

The risk of digital corruption is high and cybersecurity threats should be addressed. It remains important to harness technology to enhance human development.

Innovation is desirable and good but there is both creative destruction and destructive creation. Sustainable development is no longer optional. Emerging technologies may disrupt existing negative innovations. There is a need for a broader and more holistic approach, including what was referred to as 'frugal innovation at grassroots level'.

'Transition' thinking is essential, especially on daily service delivery protests that reveal dissatisfaction. Resources are scarce and there is a need for socially desirable actions. Not all innovations are positive so choices must be made. Approaches should be broader and holistic rather than linear.

Innovation must be approached appropriately, which would require digital readiness and future-looking activities beyond the simple use of cellular telephones.

South Africa's capacity to make policy needs to be contemplated within a broader context of design and management from a scientist's point of view. Scientists should participate more in policy analysis as should government; this knowledge should not reside with consultants.

It is important to look at the negatives and to understand how digital services or digital goods are tracked. Public sector employment is characterised by both compliance and pressure, while capacity issues further burden the system.

Ms Jodi Allemeier, Western Cape Economic Development Partnership

Ms Allemeier focused on social economic development and inclusion, defining inclusion. Direct employment may in itself be unequal due to levels of education. If many people have similar knowledge there is little diversity, so the system remains skewed to those with specialist or unique knowledge. Indirect inclusion refers to affected sectors that may grow through investment and gross domestic product growth.

Conceptual framework indicators were excellent but with limitations. Isomorphic indicators such as the global standard for good education and capital expenditure versus learning outcomes could be used. Scales of inclusion and multiple disruptions are happening globally and it is important to understand who controls these with growing centralisation and in geographic/corporate locations.

South Africa may be excluded and at risk as a country because it is not quite ready for 4IR. This leads to the question of what the future nation state will look like. Complex questions will have to be answered. It is possible that some African countries will completely 'dedigitalise' because they are being exploited.

South Africa has high inequality and it is vital to empower the non-empowered. It is important to know what people need to plug into the economy. Understanding these barriers should lead to exciting innovation. Cost of transport and of living opportunities could be explored.

It is important to understand the whole cellular data ecosystem and determine who should address it. Focus is required on government services, data provision, and both formal and informal economies. Innovation must be regularised and registered in the informal economy. Micro-property developers and stokvels are interesting innovations and could be exported as there is no need to focus only on high-end products.

Dr Michael Gastrow, HSRC

Dr Gastrow argued that defining and understanding 4IR challenges are crucial. He agreed that 4IR is not 'real' as it requires further learning to understand conceptually. It is important to understand the difference between 4IR and digital disruption, the latter replacing non-digital solutions and quite narrow and specific, focused on manufacturing and automation. Digital disruption centres on a cluster of technologies.

4IR is very different and is much broader, including the biological, physical and cyber realms. It has been suggested that biotechnology is central to 4IR and this argument needs thought.

The World Economic Forum generated the 4IR concept and South Africa should challenge notions when necessary. 4IR is essentially about the 'how' of accelerated technological change, not about technology. It addresses complex and multiple platform developments, some promoting inclusion and transformation, and some the opposite.

Digitalisation refers to connection and knowledge of the world. It suggests inclusion, social disruption and competitiveness, and introduces cheaper products and services that are 'good'. On the other hand, advanced biotechnology is expensive and is accessible only to the wealthy. It may also reduce demand for labour in manufacturing.

Basic labour market dynamics seem to work against inclusion and this may necessitate an understanding of skills development requirements. A new focus is required in education as there is little value in competing with machines. Humans need to compete where they have the advantage, i.e. in creativity, social relations and empathy. Implications for education are significant: children are currently taught to memorise and conform whereas they should be creative and socially adept.

It was argued that 4IR is unlikely to reduce poverty but may actually increase inequality in some cases. Technological changes could increase exclusion.

Predictions about technology are usually wrong. From a social science point of view, it has reached an inflection point. New social relations and formations need to be adopted.

Digitalisation is very complex and global leaders should invest in learning. It is a race as to who gets there first. Private sector involvement will continue and biotechnology will evolve.

Rewarding innovators while facilitating public access was highlighted, as was formulating the social contract.

It is important to share understanding and consider the effect of 4IR on the informal sector, which is likely to prove very difficult.

Dr Albert Strever, Agro-Innovation Hub (Grapes & Wine), Stellenbosch University

Dr Strever shared information on research into the impact of 4IR on agriculture in the Western Cape, describing the research methodology. The purpose was to contextualise the government's role and not dictate what it should do. Focus should be on a network of stakeholders and on understanding local challenges and threats.

It is important to be industry-specific as various agricultural sectors use technology differently. The research also looked at smaller operations under pressure. Technology is expensive.

Information in this sector is often shared among operators so it is important to be part of a network, but network access may be limited to due to financial constraints. Information needs to be shared with management to be useful.

Proprietary information proved problematic, with some corporations building products using farmers' knowledge.

The land reform debate was described as controversial at a time when new ways of operating in the agricultural sector have been set up. Some farmers have based their operations on an online concept and trade online. New ways of thinking about farming as an agribusiness and trading platform have emerged. Land should be less emotive and used to expand and introduce new business.

Agriculture has always been innovative. Technology is nothing without context and could be vastly different from one country to another. The fusion of approaches comes from a multidisciplinary approach. It is necessary to rely on the fusion of agriculture, technology and scientists.

Dr Strever also referenced learnings from Africa and success stories such as village enterprises with specific contexts.

The facilitator then opened the floor and the following issues were raised:

1. The discussion was academic, which is very different from actual implementation by entrepreneurs in industry. TIA funding is available for academics and students but it is different for practitioners. Academic research is purely a means to an end, it is not an end in itself. An offer was made to facilitate and contribute to a conversation between academia and the sector.

2. The TIA is based on a difficult model that aims to bridge innovation, product and process innovation. There are different types, levels and frames of innovation. The TIA funds products and process but should think more broadly about the more complex products and systems that are appropriate to Africa.
3. The report on innovation in the agricultural sector is available on Agro-Innovation Hub website.
4. The education system is not ready except for a very small portion. It is very privileged and not ready to respond to social imperatives. This is particularly true of basic education.
5. Mechanisation had to happen in the mining industry and employees had to be reskilled and re-employed. Fifteen indirect jobs are lost for each mining job lost.
6. The need for trust in society to achieve knowledge transfer was highlighted. Collaboration and sharing are possible only when there is trust. State capture has created a reluctance to share information.
7. Learning has to happen at all levels. Children need to be curious and willing to try new things, but South Africa is a conservative society that does not support the learning essential for economic development. Changing the cultural approach to education is essential. Output in maths and science is poor. Of students who score more than 60% in mathematics, only one out of 35 does sufficiently well to add value in future work situations. Maths develops the logical thinking that is so important to innovation. Maths education should start early in life, but this is not happening and is not captured in much data collected. The need to focus on teaching content versus critical thinking skills was reiterated.
8. Problem-solving capabilities need to be developed, which should start with parents and holiday programmes. Corporate social investment may be of value. These could be supplementary to the school system.
9. An entrepreneur pointed to the lack of digitisation and uniformity in the funding system. Multiple applications have to be made. The TIA's system does not identify whether a product is innovative or not or identify the nature of a proposal. The feedback channel is not progressive and amendments to applications are not called for. The lack of funding is a significant challenge. The financial sector is well developed but is driven by profit. Taking risks with entrepreneurs falls outside this culture. The risk-taking process in financial sector, which is in the hands of the few, needs reform.
10. Attempts have been made to reduce red tape. Applying for funds is problematic and costly. There is too much focus on the highly formalised sector. Reference was made to the red tape reduction unit, which may appoint a case officer to provide assistance.

The facilitator referred questions on measurement in the informal sector to Dr Gastrow, who confirmed the challenge of collecting data in the informal sector but reiterated that remains relevant as much innovation takes place there. Whether education is central to innovation should be measured and the methodology needs to be established.

What is already in place should be understood. The process should involve multiple stakeholders to reach consensus on measures and dimensions. Agreement should be reached on the inclusion of social and cultural impacts or if there is a more orthodox reading of 4IR. If an indicator is not relevant to South Africa, it should be removed. There should be a focus on all aspects of society.

Through a protocol project, Planet, low-cost satellites take images every 24 hours. It may be possible to analyse this data and to use this approach as a model. Planet aims to map political capabilities such as the informal economy in Tembisa. It is an open platform freely available.

New economics were being formed around 'big data'. Any data used in projects would need to be good quality. The government itself holds significant data. It is important to understand different sectors and jobs and how to use the information. Standards are needed to determine what data are open and what private. The use of data at community scale should be explored.

Multidisciplinary work is needed and reports must reach policymakers. Enablers need to be linked to outputs. Minor disruptive issues must be resolved. It may be beneficial for researchers to engage directly with affected communities.

NACI was congratulated for the step change in indicators, which provided a much richer picture of what is being encountered. More data need to be included. It was highlighted that competitive and innovative indices are completely different areas. Much of the information is drawn from the financial sector and there is a significant link to crime and corruption.

5. BRINGING IT ALL TOGETHER: TOWARDS A RESPONSIVE MEASUREMENT AGENDA

Dr Glenda Kruss, Deputy-Executive Director, Centre for Science, Technology and Innovation Indicators, HSRC

Dr Kruss summed as follows:

1. The task is urgent and STI must be understood, promoted and measured.
2. Creating evidence for policy is crucial. Evidence needs to be acceptable, usable and support engagement and implementation.

3. Entrepreneurs need to be included in any agenda.
4. Innovation is crucial to all government outcomes and so needs a broader and contextually relevant measurement framework.
5. It is important to understand where South Africa is now, and address national and regional challenges.
6. A richness and complexity of perspectives had been identified.
7. The sector needs to debate inclusion at different levels.
8. It is important to understand who is benefitting from 4IR, who is being excluded and who is being left behind.
9. Composite frameworks are important and there cannot be a singular focus on economic growth. Frameworks must be systematically developed to allow for the dynamics needed for transformation and sustainable development to be clearly understood.
10. A multistakeholder process is needed to understand context.
11. Education needs to look at developing human capabilities and a wellbeing economy, and should strive to understand inequality more deeply.
12. Frameworks, measurement matrices and concepts being explored need to be further developed.

Dr Kruss thanked all participants for their contributions and urged those present to continue the discussion in their networks.



