



# The long walk to STI policy coherence

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### Significance:

The 2022 Decadal Plan for Science, Technology and Innovation intends to shape innovation activities and their contribution to development out to 2031, serving as government master plan and pivoting the National System of Innovation to mitigate the socio-economic, health and environmental challenges of times that are volatile, uncertain, complex and ambiguous. But in trying to be all things to all people, the Decadal Plan avoids prioritisation, reading more as a Vision Statement than an Implementation Plan.

The 2022 Decadal Plan for Science, Technology and Innovation ('the Plan') intends to shape innovation activities and their contribution to development out to 2031. It has been produced in these 'worst of times' of rising global and domestic uncertainties, weak domestic growth, policy instability and strife. This Commentary has the task of analysing the substance and intent of the Plan, with its many voices and goals. Given the constraints facing its authors, one must commence with a statement of appreciation for their work. As Prussian military strategist Von Clausewitz observed, "The enemy of a good plan is the dream of a perfect plan."

Eliciting the underpinnings and philosophy of the Plan is no mean task. Recognising that bounded rationality applies to the process of the construction of the Plan<sup>1</sup>, a process of deconstruction, drawing on radical structural analysis was employed for the task. Ardolan teaches that "the radical structuralist paradigm assumes that reality is objective and concrete, as it is rooted in the materialist view of natural and social world"<sup>2</sup>. To this add the cosmos of interests, explicit and implicit, that shape this reality. In South Africa the cosmos includes the corporatism of the Tripartite Alliance of the African National Congress (ANC), Congress of South African Trade Unions (COSATU) and the South African Communist Party (SACP) and combines with the voice of business in the form of ethnic and plural associations, lobby groups, academia, political parties, think tanks, civil society, and the dispossessed. This makes tight coordination of policy difficult to scope, let alone to achieve in practice.

## Context

The post-1994 government pushed an agenda of redress and modernisation, with the hybrid Department of Arts, Culture, Science and Technology issuing its White Paper on Science and Technology<sup>3</sup> that introduced the idea of a national system of innovation and motivated for new organisations. It argued the need for competitive research while reserving attention to the 'flagship' sciences of physics and astronomy and supporting Polanyi's notion of the 'Republic of Science'. In retrospect, the MeerKAT array is the ultimate commitment to such flagship science.

Upon its 2002 establishment, the standalone Department of Science and Technology (DST) set out the National Research and Development Strategy (NRDS) that inter alia moved the CSIR to DST, proposed a Foundation for Technological Innovation (today's Technology Innovation Agency), and scoped a new Strategic Management Model that abolished the Science Vote.<sup>4</sup> The NRDS declared four S&T missions along with 14 indicators and stretch targets for R&D inputs and scientific and innovation outputs. The ratio of gross expenditure on research and development (GERD) to GDP was to reach 1% by 2008, with government expenditure on R&D to double in current rands. The latter target was achieved, but GERD:GDP saturated at 0.92%. The 1% target was never attained.

The subsequent Ten-Year Innovation Plan 2008–2018 (TYIP)<sup>5</sup> was generated immediately before the Great Recession terminated the commodity super-cycle. In parallel, DST requested the Organisation for Economic Cooperation and Development (OECD) to conduct a review of innovation policy that found that policy downplayed the role of business, and that there was a design and engineering chasm and dangers associated with the fraying social fabric.<sup>6</sup> The TYIP proposed four Grand Challenges with links to the previous Missions, to be measured by some 50 indicators and targets, with GERD:GDP to reach 1.5% by 2018. This also proved a target too far.

The roll out of the TYIP coincided with the Mbeki Administration morphing into the Zuma Administration, on whose watch state capture intensified and innovation activities in the state-owned enterprises declined. From its 5.6% peak in 2006, economic growth entered a period of long decline with rising unemployment and dependency on the social wage, even though absolute poverty was reduced. Technical recessions occurred from 2007 onward with the 2020 COVID-19 pandemic driving steep losses. While mortality due to HIV/Aids declined through the roll out of the world's largest ARV programme, non-communicable disease morbidity grew.

DST gained the role of co-chair of the Economic Cluster and expanded its reach, working with the National Treasury to introduce an enhanced R&D tax incentive and with the Department of Trade and Industry to regulate intellectual property arising from publicly funded R&D. Come 2009, Minister Pandor asked a Ministerial Committee to assess the OECD recommendations and review the STI landscape.<sup>7</sup> On the global stage the BRICs (Brazil, Russia, India and China) surged, with South Africa joining the club in 2012. The same year saw the Paris Declaration on Climate Change; in 2013 the African Union announced Agenda 2063; in 2014 came the launch of the African Union STI Strategy for Africa 2024. A further influence came from the UN Sustainable Development Goals that were adopted in 2015.

These instruments and reviews form the policy background to the development of the White Paper on STI that entailed self-assessment, situational, performance and scientometric analysis, and the conduct of foresight studies in the hands of local and international consultants and stakeholders.<sup>8-10</sup> The White Paper on STI, in line with the 1996 White Paper, reiterated that

*The newly elected government inherited a fractured society, a fiscally drained state and an unsustainable, resource-intensive economic growth path. The pre-1994 STI system*



*was small, exclusive and in line with the agenda of the apartheid state, rather than oriented towards inclusive, sustainable economic development and social equity.*<sup>11</sup>

Business and consumer confidence have eroded, and emigration of the highly skilled has risen. The rebased GERD:GDP fell from 0.83% in 2017 to 0.62% in 2020, although aggregate scientific output was maintained and expenditure on basic research rose. Most critically, the full-time equivalent number of permanent and pensionable researchers rose by a mere 30% over the preceding two decades. The White Paper diagnosis might be re-phrased: “we remain a fractured society, with a fiscally drained state and an unsustainable, resource-intensive economic growth path. The STI system remains small, exclusive, and follows its own agenda.”

The most comprehensive overview of the NRDS and TYIP is that conducted by CREST of Stellenbosch University for the National Advisory Council on Innovation (NACI).<sup>12</sup> Its main findings were that most of the organisational and financial proposals of the NRDS and TYIP were implemented, but the extent to which subsidiary strategies and interventions achieved their intended outcomes and impacts was more nuanced. A scoreboard of 60 strategic objectives was compiled and scored as follows: largely achieved (22), moderately achieved (21), poorly achieved (12) and unknown (5). The highest scores relate to support for framework conditions; the lowest scores to implementation of the Grand Challenges. The lesson for policymakers is that it is easier to conceptualise interventions than to drive them through to intended results. This is far from unique to South Africa.

## Philosophical underpinnings

The Decadal Plan was in the making from 2016, accelerated with the approval of White Paper 2, and then slowed as the pandemic interrupted. The virtual Cabinet meeting of 24 March 2021 approved the Plan, noting that

*The policy responds to the rapid technological advancement and harnesses STI for the socio-economic development of the country. This Decadal Plan will serve as government master plan, which will incorporate other departments such as Departments of Agriculture, Land Reform and Rural Development; Mineral Resources and Energy; Health, and Trade, Industry and Competition. The implementation will be in collaboration with all the relevant departments.*

The Plan is expected to pivot the system to mitigate the socio-economic, health and environmental difficulties in times that are volatile, uncertain, complex and ambiguous.

All government policy instruments, legislation and regulation, involve innovation with intended and unintended consequences. Government initiates change, that once disseminated is an innovation, whether the change is internally driven or placed in the hands of agents. Various methodologies may guide these interventions, such as management by objectives, logical framework, results-based management, and more recently theory of change, that links intended impacts and the actions assembled to achieve them.<sup>13</sup> In the attempt to focus its policy intent, the Plan declares its theory of change. This behooves consideration of the implicit or explicit theory of change of preceding STI policy instruments.

The 1996 White Paper proposed the innovation system approach that rests on complex, self-organising behaviours, and the necessity of linkages among its actors<sup>14</sup>, but its implicit theory of change is a linear model of innovation. The explicit theory of change of the NRDS is also a linear model of innovation coupled with the idea of the ‘innovation chasm’ between research and valorisation.<sup>15</sup> This idea is quite different from the concept that Moore<sup>16</sup> popularised. The NRDS ideas replicate in the TYIP and have then influenced DST, the Technology Innovation Agency (TIA), National Intellectual Property Management Office (NIPMO), NACI and related organisations.

The theory of change of the White Paper on STI is laid out in its §1.4. and may be summarised as follows: STI, in partnership between business, government, academia and civil society, through a coherent whole-of-society agenda can shape a different South Africa, if skills and funding, operating constraints, and appreciation of its value are addressed. This comprises a vision statement, not an actionable theory of change.

## The Intent

The Plan sees government as the guiding hand of the innovation and research system, hence the reference to a master plan across all government departments, in line with the doctrines of the industrial policy action plans and master plans of the Department of Trade and Industry.

At this point it is appropriate to refer to the sentinel recommendations of the 2012 Ministerial Review, namely first to establish a broad-based National Council on Science and Innovation (NCRI) to determine the priorities and set the agenda; second to transform the NACI into an arm’s length Office for Science and Innovation Policy with the roles of measurement, foresight and M&E; third to establish sectoral innovation funds fed by resource rents that would support the research and innovation agenda of the NCRI; lastly to carry out a fit-for-purpose review of the public research organisations. To date, only the third recommendation has acquired traction.

In contrast, persuaded by the statism of government, the Plan commences by declaring what must be done, with joint agenda setting, prioritisation and M&E relegated to its final chapters, and this in contradiction with the theory of change of the White Paper on STI. While acknowledgement is given to Mazzucato’s critique of neo-liberalism<sup>17</sup>, her insights are appropriated to argue for statism, similarly the notions of Schot and Steinmuller<sup>18</sup> on Transformative Innovation Policy. In effect, the contract between the Department of Science and Innovation (speaking for government) and society is one that relegates the private sector to a secondary role, reflecting the ideologically driven mistrust between the Tripartite Alliance and business.

The contract between science and society is always subject to the political.<sup>19</sup> In the apartheid years, ‘science walked on two legs’ – the Republic of Science being one leg, and science for the warfare state the other.<sup>20</sup> It is averred that it still walks on two legs, with flagship science replacing the war machine, and the Republic of Science articulating the case for empirical evidence, as for example through the Academy of Science of South Africa (ASSAf) during the HIV/Aids debacle. It has since gained volume through research achievements in infectious diseases, radio astronomy and high-energy physics (witness the election of three of our scientists as Fellows of the Royal Society).

That noted, the Plan sets out to define STI priorities in agriculture, manufacturing, mining, health, and energy, and to harness prospects of the circular and digital economies. The Plan sets out to build a capable state, with economic inclusion, all the while addressing the Societal Grand Challenges of climate change and environmental sustainability, future-proofing education and skills, and the future of society. The Plan identifies nine megatrends: growing unemployment, megacities, climate change, COVID-19, migration, multi-polar world, growing inequality, new wars, and the hollowing out of nation states. A set of future priority domains further shapes the Plan, along with the associated measurement regime. These are important contributions to framing the shape of future interventions, but the mix lacks prioritisation and leaves the reader struggling to understand where the Plan is heading. To add to the confusion, and in its own words, “the Decadal Plan sees STI missions not as single projects, but as portfolios of actions involving grants, prizes, new forms of procurement and financial instruments”. It is unsurprising then that the Decadal Plan lays out some 391 indicators to track its progress.

Last is the matter of strategic internationalisation. South Africa hosts five of the leading universities in Africa and retains the lead for the ‘quality’ of science outputs. This is to be expected as we remain a sub-metropole even though South Africa has slipped from producing the largest GDP on the continent to third place after Nigeria and Egypt. Until recently, South Africa acted as the higher education hub of sub-Saharan Africa, educating thousands of postgraduate scholars for the hinterland north



of the Limpopo. This, together with visible participation in Big Science and the flair of many trans-national corporations across the globe, rightfully persuades the authors of the Plan to think global. A crucial gap in the Plan is innovation in the ‘third economy’, that rests on the attainments of our transnational corporations such as Bidvest, Naspers, Derivco, Datatec and AECI. What could and should a Decadal Plan say to these corporations?

But there are contradictions – how can one conduct ‘strategic internationalisation’ while excluding international students and skills? Rising xenophobia has coloured politics and community life for more than a decade. Restrictions on the mobility of international staff and students will do serious injury to the Republic of Science. It is somewhat disingenuous to speak of open science when borders are closed to the highly skilled.

## Reprise

The politics of the Plan, especially the thinking that informing the Compacts, public procurement, “leakage” and “retaining Local Patents and Technologies” echoes themes of earlier techno-nationalism. Likewise the fixation with the merits of competitive advantage in the call for the beneficiation of locally abundant fluorspar, titanium and platinum. Beneficiation is fine in theory but comes with risk and externalities. So, for example, Sasol beneficiates coal into some 200 chemicals. The environmental damage is massive. Iscor beneficiated iron into steel, but Iscor is no more. The Hillside aluminium smelters at Richards Bay used the cheap electricity of the 1980s to beneficiate imported bauxite that provides the stock for today’s aluminium building products industry. Respected economists Hausmann and Klinger<sup>21</sup> aver that the country might achieve a stronger growth path by focusing on manufacturing for exports – *vide* Sasol and Hillside. The disappointment in exploiting the appetite-suppressing properties of *Hoodia gordonii* notwithstanding, policymakers maintain the hope of identifying and exploiting medicinal plants to produce safe and responsible health innovations. The luck of nature does not a product innovator make.

In effect, the Plan tries to be all things to all people. It reflects a committee approach, is repetitive, and lacks a critical perspective on how business works. The drafters misinterpret both political and economic history.

On the positive side, the Plan has abandoned reference to the notion of the innovation chasm. Another positive that has since emerged, and this before finalisation of the Plan, is the realisation that the R&D Tax Incentive is not having its intended effect, so proposals for amendment are now being circulated for public comment. This is testimony to policy learning, and acceptance that experimentation and adjustment are absolute necessities. It is expected that the Decadal Plan will align itself with the goals of the NDP, recognising that a capable state rests on the impartial actions of people who demand the best of themselves, their peers, and service providers and who work with competitors to ensure a better life for all.

The challenge is to integrate innovation and industrial policy, to recognise that one size does not fit all, and to seek policy coherence rather than organisational coordination. Julius Nyerere understood the challenge of development, offering two gems of advice: “To plan is to choose” and “Your budget is your plan”. Let us see the budget please.

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