# Strengthening the interactive capabilities of public research institutes in South Africa

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## 1 Context

In South Africa, public research institutes (PRIs) face the dual challenge of linking their national system of innovation (NSI) to global knowledge flows and the frontiers of science, while seeking solutions to context-specific development problems. This study examined how five research-performing and -funding PRIs, responded to these growing demands of responding to the country's growth and development agendas. It draws on research that explored the changing roles of science councils in the NSI by analysing patterns of interaction, and the organizational, institutional, and policy factors that constrained and enabled these interactions.

The international literature on PRIs reveals a recent concern to understand their shifting mandates, roles, funding, and organization in a number of countries. Innovation policymakers have sought out research that focuses on identifying how PRIs can play a more effective role in economic development, and how firms, government, and other knowledge actors can form more effective links with PRIs. Academic research has examined these policy-oriented concerns by : investigating the transformation of, and changing roles of, public research institutes ; examining how PRIs can function more effectively in relation to firms ; and by looking at mechanisms that can enhance both the organizational effectiveness and transformation of PRIs. Policymakers and researchers continue to grapple with contemporary shifts in the social contract between knowledge institutions, public and private users, and society.

## 2 Empirical Approach and Main Findings

The research design and methodology focused on interaction, capabilities, learning, and innovation to identify forms of interaction, and their associated benefits or risks for institutions and the NSI as a whole, for both private and public goods. The

framework for this study was situated in a body of research in developing countries designed to investigate the types of relationship, channels, outcomes and benefits, and barriers to university interaction with firms. To be more appropriate to Southern African contexts, the framework was extended to include social and economic inclusive development imperatives, and in addition to firms and the industrial sectors, included a wider range of external partners (e.g., farmers, the informal sector, and government and civil society actors).

The framework classified interactions based on the goals that motivated firms, universities, and PRIs. Firms are driven by either passive (to meet immediate needs of a specific firm) or proactive (longer term and in sectoral interests) innovation strategies; whereas, universities and PRIs are driven to interact by financial (funding) or intellectual (academic and scientific discipline related) imperatives. A third driver was added for academics and scientists — a commitment to inclusive development or research that is socially useful.

It is important to focus on the substantive nature of universities and PRIs. For universities, the analytical framework builds on the premise that responding to external actors is of greater benefit and less risk when collaboration expands the knowledge base of a discipline. Interaction with external partners and users is integral to the mandate of PRIs, and their knowledge-related activities span the full range from basic and applied research to technology development and innovation. PRIs performs a variety of roles, in complex combinations, with a trend toward increasing diversification in response to multiple demands. In late-developing countries, universities and PRIs were the first channels to link these countries to international flows of science and technology (S&T), and initially relied on and absorbed knowledge generated in the advanced economies. As new demands and opportunities have arisen, PRIs and universities have become more complex, and more differentiated. While maintaining international connections, they strive to solve more complex local problems. At the same time, they face direct demands from government to support private sector development.

The research examined the capabilities of PRIs to build links and flows of knowledge and technology across the NSI. Based on an empirical understanding of the organizational conditions in PRIs, the analysis of interactive capabilities studied the will to interact, as reflected in mandates and strategic policy; and the capacity to build links, as reflected in specific organizational structures and incentive mechanisms that promoted and supported the interactive activities of scientists.

In-depth qualitative case studies were conducted for five agencies (Agricultural Research Council, Council for Mineral Technology, Council for Scientific and Industrial Research, Medical Research Council, and the Water Research Commission). Government policy documents and secondary sources were analyzed to situate the case studies in historical context. Semi-structured interviews with senior managers, heads of units, and directors were conducted in each science council to gain insight into the strategies, structures, and mechanisms instituted to promote interaction. This was complemented by analysis of key documentary sources to provide insight into organizational history, mission, and structures.

**History and policy imperatives** — The interactive capability of a science council is shaped by its history and by the traditional knowledge and technology practices and priorities built up over time. There have been three main periods in the history of growth and development of universities and PRIs in South Africa. In the first period, the late nineteenth century, PRIs were established in response to local developmental challenges. Many current PRIs can trace their origins back to this period of responding to mining and agricultural concerns in a resource-based colonial economy. The second period from the 1940s onwards saw the creation of science councils in their current form, and was shaped by the industrialization of the economy and the global rise of big science. Period three was shaped by marketization and calls for greater public accountability. From the late 1980s, the apartheid government created new science councils oriented to the minerals and agriculture sectors, and compelled science councils to seek independent sources of income to complement their statutory grants. This ended the system under which science councils had been completely funded by government. After 1994, PRIs were redefined in a reconfigured S&T landscape. Science councils were to undertake research activities that the private sector or universities could not. The post-apartheid government, concerned that science councils were not responsive to new inclusive national development priorities, sought to forge new forms of interaction with actors in the informal sector and impoverished communities, in relation to livelihoods and the welfare of citizens.

**Balancing and prioritizing roles** — Science councils currently have a three-fold mandate : contribute to science and the body of knowledge, connect to global knowledge systems ; contribute to technology, innovation, and competitiveness of the private sector to promote inclusive economic growth ; and contribute to innovation of government and of communities in relation to the quality of life and to promote inclusive socioeconomic development. A review in 1998 suggested that most science councils needed to reorient their organizations and scientific activity to align with this new policy mandate.

**Balancing strategic roles and multiple imperatives** — Common to the new mandates of each science council was that research should provide solutions to identify tangible problems, whether for government, industry, or the communities they serve. Each science council was challenged to extend and shift its traditional scientific mandate, orientation, and focus to respond to the new inclusive developmental demands, the reduced core public funding allocation, and the imperative to strengthen their scientific contribution. Scientists, managers, and leaders grappled to balance the simultaneous demands, and researchers often experienced a sense of being pulled between contrasting mandates, particularly between inclusive development and market drivers. The Agricultural Research Council (ARC), for example, grappled with a new mandate to support small-scale, resource-poor farmers. The Council for Mineral Technology (Mintek) illustrated the challenges of serving the interest of national priorities by taking public users and beneficiaries into account. The analysis of the five science councils revealed that three PRIs grappled to reorient their mandates, and reconcile the tensions between multiple imperatives. A second set had clearer organizational mandates, facilitated by strong historical links to mining and industrial value

chains, and were oriented more strongly to the mandates of global competitiveness and scientific excellence, and driven more strongly by financial imperatives.

**Interactive capabilities** — Each organization's mandate has unique imperatives, which drive interactions with a different set of actors and require different interactive capabilities. Internal structures and mechanisms that promoted and supported interaction were for the most part tacit and ad hoc. There were varying degrees of fragmentation and a lack of internal coherence and coordination between units. For example, the Council for Geoscience (CGS) was dispersed across six provinces, with a high degree of unit autonomy. The Agricultural Research Council (ARC) was also dispersed geographically. Long-established identities of these research institutes reflected specific regional, agricultural, or environmental problems and priorities. In both cases, lack of centralized coordination led to fragmentation and incoherence. The analysis of the Medical Research Council (MRC) revealed a virtually identical pattern, with units and scientists operating in silos in an unstructured manner. The Mintek model was most structured and formalized, with a strategic mix of centralized and decentralized structures and decision-making mechanisms, and was most effective in supporting interactions to achieve strategic mandates. Weak internal mechanisms led to fragmentation and a lack of coordination, particularly in periods of organizational flux.

In terms of knowledge and industry partners, most science councils had external mechanisms that promoted formal contracts with knowledge partners (i.e., universities and other PRIs). External structures to interact with small-scale economic agents, marginalized communities, and related civil society partners were not well developed. The reach and practices of the technology-transfer and innovation-oriented mechanisms were not extended to include interaction with small-scale farmers, informal firms, cooperatives, or community-based livelihood projects.

Incentive mechanisms took the form of performance monitoring and promotion systems that included criteria to promote interaction. However, incentive systems were not transparent and changed frequently, which reportedly caused resentment and conflict. Publications and contribution to science were rewarded most highly, and hence in practice, interaction with universities and firms was promoted most strongly. This was particularly true in science councils that were attempting to improve scientific quality and grow reputations. Incentives like special awards for patents or collaboration were evident on a very small scale. Some had specific incentives to promote interaction with small-scale informal producers and communities, but these were not as highly valued as the intellectual incentives.

In practice, most scientists were driven to pursue interaction by their individual or unit interpretations of intellectual, financial, and developmental imperatives, for intrinsic rather than extrinsic reward. Organizational structures and mechanisms that can promote a better balance, or greater responsiveness, to government and market imperatives are embryonic or missing, particularly those that orient research to inclusive development priorities and to internal alignment of research priorities with strategic goals.

**Constraints in the NSI** — This examination of the five science councils points to blockages and risks at the macro-level. These may constrain the leadership and management of a science council from achieving their mandates, despite their best organizational efforts, which in turn, may constrain the S&T system within the NSI. With a decline in core public grants, financial imperatives drive scientists to seek funding from private sources, whether donors, clients, or other stakeholders. This leads to the risk of funder- and individual-driven research agendas, which potentially leads to organizational incoherence and misalignment with strategic goals. It can also constrain applied research from developing solutions in the public interest or block the use of funds to maintain infrastructure and equipment. One distinctive role of PRIs in the NSI is the maintenance of national collections and repositories, which require dedicated funding streams and consistency over long periods of time. The risk to the NSI of inadequate funding is substantial, as these repositories are used for regulatory and safety purposes and provide crucial services to firms, local government, communities, and individuals. This issue of continuity of funding is equally important. Rapid changes in organizational fortunes were often in response either to a lack of funding or to new funding sources. This creates a risk for promising scientific work that may require longer periods to mature.

Mission overload on science council leadership, cascading down to scientists, was evident. Expectations are that science councils will respond to initiatives from multiple government policy actors, and there is evidence of a constant cumulative addition of requirements, without prioritization, alignment, or coordination across government to respond to new national policy frameworks. A related potential blockage is the capability of government departments to focus research agendas. The potential for synergy and building a critical mass of scientists from distinct disciplinary traditions to address more strategically complex social and economic problems is comprised.

## 3 Main messages for policy and practice

This research provides a basis for policy actors at the national and organizational level to introduce change in a manner that addresses gaps and blockages in existing practice. The science councils generally had weak internal mechanisms to coordinate scientists and align research priorities with a set of external mechanisms. Individual intellectual and financial imperatives drive interaction more strongly than socioeconomic development imperatives or strategic organizational mandates. For organizations without strong interactive capabilities, national funding constraints and over-burdened policy expectations make a strategic balance even more difficult to achieve.

**Incentives** — Policy instruments are needed to promote a more effective balance among the three core substantive roles of science councils. The challenge is to integrate and balance activities and functions by generating, transmitting, applying, and preserving knowledge and technology for the direct benefit of external audiences in ways that are consistent with science council and unit missions. At a systemic level, a positive intervention would be to convince scientists that such partnerships and networks have value, while not being detrimental to their scientific reputations. In this regard, there has been extensive debate about the need to integrate outreach

with the core missions of teaching and research. There has been much active policy development, advocacy, and experimentation around community engagement within South African universities, and consensus is emerging around the value of working within a framework of engaged scholarship. A similar national debate, coordinated vision, and strategic instruments to promote engaged S&T is missing from the science council space.

**Enhancing interactive capabilities** —Dynamic interactive capabilities are important if science councils are to be active agents within the NSI. Science councils need to balance their functions and activities in a more strategic manner, and manage the potential tensions between multiple imperatives. A number of structures and mechanisms are within the power of science-council leadership and management to change : strengthening internal coordination and alignment between individual business units in alignment with organizational goals ; prioritizing (and giving organizational authority to) structures and mechanisms that support scientists to extend their research outward, and to link different kinds of external partners and beneficiaries into their knowledge and technology opportunities in appropriate ways ; and providing incentives for individuals and units to engage with organizational mandates in a more strategic manner.

**Framework of innovation and inclusive development** — All science councils accepted the policy imperative that their work should contribute to inclusive socioeconomic development, which was evident in their expanded mandates, strategic objectives, or dedicated programs. If South African science councils are to balance their mandate to link to global knowledge flows, enhance economic competitiveness, and address complex problems arising from high levels of poverty and inequality, they will need to develop their capabilities to interact with marginalized and vulnerable communities and informal sector actors. What is needed is a national policy framework or strategy, aligned with existing mechanisms and linked to public funding programs that can promote and support ways to extend the benefits of research and technology development in a more inclusive manner.

## Related Resources

Kruss, G., Haupt, G., Tele, A., and Ranchod, R. 2016. *Balancing multiple mandates : The changing role of science councils in South Africa*. Cape Town : HSRC Press.

Kruss, G. and Haupt, G. 2016. Luring the academic soul : promoting academic engagement in South African universities. *Higher Education Research and Development*, 35, 755–771.

Kruss, G., Visser, M., Haupt, G., and Aphane, M. 2013. *Academic interaction with social partners : investigating the contribution of universities to economic and social development*. Cape Town : HSRC Press.