

The System-wide Review of Public Sector Science, Engineering and Technology Institutions

(continued)

Part 2: Commentaries on the Panel Reports

The system-wide review of public sector SETIs was based on twelve reports prepared by panels of international and South African experts in the fields of activity of the institutions under review. In this element of the overall review are presented brief commentaries on each of the twelve Panel Reports, highlighting what the system-wide review team identified as the issues on which most attention needs to be focused.

Each short section provides this commentary and repeats any specific recommendations made in Part 1 of this document which relate to the specific SETIs.

1. The Africa Institute of South Africa (AISA)

Assessment of Core Competencies and Strategic Management

Of the three competencies identified for the Africa Institute of South Africa, its review panel found that only one is done well: the institute collects, but does not effectively interpret or distribute information on contemporary African affairs. Though it is, by all accounts, an excellent specialised library-cum-documentation centre on Africa, AISA's interactions, particularly with other components of the emerging NSI and with South Africa's library and research communities, leave much to be desired. AISA still serves non-South African (and non-African) scholars as a research outlet more than it serves the national research community. AISA's treatment of data adds relatively little value in terms of research, interpretation and analysis, primarily because the Institute still looks at Africa from the "outside" and has a weak research capacity – the occasional good paper from its senior researcher notwithstanding. AISA provides some value in the form of information services to the Foreign Department and has organised conferences. It has built up its own databank of names and institutions of African scholars and Africanists with networking potential, though the possibilities of South Africa's tapping into already-existing networks of African knowledge-producers needs to be explored as well. AISA does some consulting to the private sector and to embassies, though its services are under-commercialised and its fees quite modest for corporate bodies. AISA has performed far below its potential in training post-graduate students and diplomats, or offering

competitive executive courses or seminars to business based on knowledge about African trends.

AISA's allocation of resources is inappropriate; in particular, too little is devoted to research. The organisation lacks strategic vision and management, and the strategic vision which may be emerging from Council seems not to have been effectively transmitted to management. Under a paternalistic management, AISA has enjoyed managerial autonomy without accountability, and the Institute's demonstrated (rather than stated) commitment to equity and redress is still low.

Alignment with the NSI

The set of core competencies encapsulated by the rubric "African studies" has great potential alignment with the objectives of the NSI, and with national development objectives as enunciated by GEAR and the RDP. But the argument for continued public funding of these competencies needs to be more strongly stated, for the matter goes beyond the relocation of the AISA's library and database. For one thing, South Africa's growing links with SADC partners are a forceful argument for building knowledge of Africa as a complementary asset to trade initiatives and technical cooperation in many domains. There is also the critical need for all South Africans to enter a 21st century of increasing globalisation empowered by a sense of the indigenous knowledge this continent has constructed and the opportunities for innovation embodied in its resources. This is the necessary antidote to this century's wasteful marginalisation of the majority of South Africans from science and technology, from ideas and knowledge work.

Recommendations of the Expert Panel

The main recommendations of the expert panel for AISA consist of proposals for two critical turn-arounds:

(1) transformation of the institution's intellectual legacy, so that it is Africa-sensitive and Africa-literate, seeing the continent from within and South Africa's place in it; and (2) creation of management and governance structures which will imbue creative independence with quality control. These, it is argued, will be best accomplished by affiliating what is today AISA under the larger umbrella of one of the country's emerging regional consortia of higher education institutions, preferably to a consortium which has demonstrated potential for integrating African studies into other cross-disciplinary initiatives in a manner that strengthens HDIs. Such relocation would open up the route to higher-quality publishing, seminars and conferences, and give access to a pool of graduate students. AISA's interpretative research work and documentation could help feed curriculum development within the consortium, and its fellows might do some minimal teaching.

The transition occasioned by relocation, the double turn-around, and the institution of a more commercial approach with respect to some service products will require a strong change management team. DACST may wish to line up a small operative team with a suitable mix of internal AISA staff and external expertise, headed by a leader with dynamic new vision. This transition team should be drawn from business, international affairs and the social sciences, but organisational development and strategic human resource management skills will be paramount.

Recommendations of the System-wide Review

The system-wide review panel concluded that it would be wiser to go even further than proposed by the institutional review panel.

The present Africa Institute does not seem to be able to meet the challenges provided by the intellectual renaissance of post-apartheid South Africa, but in view of contemporary developments on the African continent, it is of strategic importance to South Africa that it has in place an institution which would address those developments and which ideally should combine the interpretative and advisory capacities of a modern "think tank", and the advantages of an internationally-acknowledged institute for advanced study, with close linkages to researchers in universities throughout the continent and throughout the world.

As a result of these conclusions, the Africa Institute of SA should be de-registered as a Section 21 company and its infrastructure and resources transferred into a new institution focusing on the study of change in contemporary Africa. To facilitate the formation of this new institution, a process should be initiated immediately involving eminent scholars and leading policy analysts to prepare a concept for the role and function of the new institute and appropriate modes for its operation, as well as to provide input into the definition of the complimentary research programme described below:

Earmarked funds should be provided by the National Research Foundation for a research programme specifically designed to stimulate research on cultural, economic and technological change in Africa in order to develop new research capacities within South Africa's higher education institutions.

2. The Agricultural Research Council (ARC)

Until 1992, research on agricultural production was carried out principally within the National Department of Agriculture whose mandate was to focus exclusively on the problems of white, primarily commercial, farmers operating within the narrowly-defined Republic of South Africa (a definition which did not include the so-called TBVC states or the semi-autonomous areas within South Africa.) Its program was one which focused on individual commodities and did not address any larger issues within an agricultural system. When the ARC was transformed into a statutory body, encompassing most of the staff and facilities which previously had been within the department, its mandate was extended, tacitly if not explicitly, to encompass all farmers in South Africa, including the resource poor farmers among the disadvantaged populations in the country. With the Constitutional and Government change of 1994, the mandate of the ARC to address that wider constituency became fully explicit.

The model for agricultural research which was transferred to ARC at its creation was one which was based on the application of the biological and related sciences to the problems of agricultural production in an environment in which access to inputs, such as fertilisers, pesticides and irrigation were taken as given. This approach gave rise to a simplistic notion of 'scale-neutral' technologies on which ARC planning appears to have been based. This model was operationalised within a set of extensive experimental farms and facilities within which research could be conducted under

controlled conditions. In effect, the model was one which had prevailed for many years in the industrialised world, but which even there was evolving rapidly. One important gap in the South African system was the virtually-total absence of any social science capacity within ARC.

Throughout its history, ARC has operated on the belief that the outputs of agricultural research were 'public goods' to be delivered, free of charge, to farmers. With commercial agriculture now contributing at a significant level both to GDP and to exports, South Africa needs to re-examine why only sugar producers make substantial and direct financial contributions to the financing of research.

Agricultural research does not exist in a vacuum, and so in most countries, research has close links with extension services which serve as conduits of information from research to farmers and as identifiers of pervasive problems from farmers back to research. In South Africa today, this extension function is within Provincial jurisdiction (where capacities to perform and actual performance vary widely). The relationships which ARC has been able to establish in most cases have not been strong and this has contributed to the difficulties which ARC has confronted in seeking to address the problems of the resource-poor and the disadvantaged.

Since 1994, the tentative attempts by ARC to incorporate the problems of resource-poor farmers into its research agenda have been, in fact, failures, with even the modest attempt to master the well-established methodologies of 'farming systems research' having been abandoned.

Since there is no evidence that ARC has ever considered the management of its human resources as a key strategic variable, it has not internally come to understand that the lack of transformation within its staff and its lack of good working relationships with social scientists have nullified any real hope of success of any attempt to understand and operationalise an effective approach to addressing the problems of resource-poor farmers.

Among the important deficiencies in ARC performance which have been identified are:

- the lack of any identifiable strategic vision or strategic management process which would allow the ARC to identify necessary changes in its operations and to implement those changes;
- weak linkages to sources of knowledge outside the ARC and a poor record of disseminating the results of its own research in the international literature.
- no evidence of understanding the limitations on the appropriate use of public funding with the result that a significant proportion of ARC funding is probably being used as a subsidy to commercial agriculture;
- no accountability to its clients or to government for the way it has utilised the considerable past investments in agricultural R&D;

- ARC's human resource policies and practices are out of touch with the country's political reality and with good management practices world-wide;
- Conflicting reports exist as to the quality and relevance of the outputs of ARC's current research program;

Among the principal changes needed are

- a transformation in ARC governance by, inter alia, clarification of the mandate of the Board and its supervisory function, at the strategic level, vis-à-vis management; a renewal of senior management, and establishment of a new management team; (the transformation of the membership of the ARC Board was effected in 1997)
- an internal transformation of staff against a realistic timetable agreed to by the Board and by government, in order to provide the ARC with the capacity it does not now possess to deal with many of its potential partners and clients, and to give effect to a program of equity and redress;
- transformation of the internal management system, away from the practice of being 'capacity-driven' (i.e. concerned principally with the utilisation of existing financial, human and physical resources) to one which is performance driven, and concerned with outputs and outcomes of its activities.
- the establishment of a financial system which will provide clarity and transparency in the allocation of the Parliamentary Grant
- a greater program focus on resource poor farmers and attention to new areas - such as biotechnology and food processing - in new partnerships with other SETIs, institutions of higher learning, or private sector firms as appropriate;
- establishment of much closer linkages and joint activities with other performers of agricultural and agriculture-related research, in the higher education and private sectors and within other SETIs;
- establishment of closer ties with user groups in agriculture, and a revision of the basis of cost sharing for research activities with private entities.
- re-examination of the validity of the internal structure of ARC's activities - which are located in 16 institutes organised on the basis of commodities (such as grains), discipline (such as veterinary science) or research speciality (such as 'agrimetrics').
- adoption of a policy requiring that an increasing share of the ARC research budget should be acquired via open competition, as a means of enhancing quality.

Recommendations of the System-Wide Review

A transformation team should be appointed to assist the Minister of Agriculture and the Board of ARC in bringing about a change in senior management, a change in research philosophy, a change in program structure, and any necessary changes in internal organisation to transform ARC into a modern agricultural research organisation capable of responding to the needs of both commercial and resource poor farmers.

3. The Atomic Energy Corporation (AEC)

The primary historical mandate of the AEC was to meet the total nuclear energy service and R&D needs of South Africa. This mandate is no longer appropriate as it currently stands and today is poorly aligned with the objectives of the National System of Innovation.

The AEC's uranium conversion, enrichment and fabrication plants have been closed and its flagship R&D project on new enrichment technology (MLIS) has been terminated. The AEC is trying hard, against the odds, to operate in a highly variable environment in which minimal policy direction has been given by the government during a period of rapidly-declining public financial support. The Corporation has realised limited success in this endeavour, although the human resource management component of downsizing has been effective to date. The present parliamentary grant exceeds R350 million (55% of total income) and realises limited added value. The financial difficulties being experienced are compounded by the burden of debt repayment as result of historical investments in the nuclear programme.

The AEC defines their core competencies as: -

- Management of radiation and nuclear processes including nuclear waste disposal

The key facility behind this competency is the SAFARI reactor which the AEC and the White Paper on S&T had proposed as a National Facility. This option was rejected by the AEC Review Team as well as the National Facility review team. This world-class but ageing facility is under-utilised by the research community and is not commercially viable. All over the world these kinds of reactors are subsidised. Government has to decide whether it wishes to continue subsidising its operation and the production of isotopes or to shut it down and benefit from the subsidised operations from other countries (an approach taken by the UK which has closed all such reactors). This area is best described as a key capability rather than a core competency which is internationally competitive.

On the positive side, South Africa has real needs in waste management and in the decommissioning and decontamination of nuclear facilities and only the AEC has the competence to undertake these tasks.

- Fluorination Technology

This expertise developed as a result of the AEC's experience in the preparation of UF₆ as a feedstock for Uranium enrichment. It has created the platform for the development of a range of fluorine-based chemicals. This core competency is clearly

competitive in Africa. Whether it is competitive internationally has still to be demonstrated.

The set of two areas of core competencies are supported by a strong technological infrastructure which is under-utilised. The skills base is adequate but eroding rapidly and urgent action is required to minimise negative impacts on the national skills base.

Largely due to its insular history, the AEC has poor linkages with the HES, other SETIs and industry. Commercially motivated joint ventures are beginning to be explored in a more proactive fashion. While management have set up good strategic management tools, they have lacked the leadership and vision to shake off the historical mandate and to reconceive the AEC as a dynamic contributor to the NSI. Governance difficulties have been compounded by a lack adequate dialogue with the Department of Minerals and Energy.

The first steps in appropriate human resource policy have been taken, at least on paper. HR management is conceptually good but the negative environment created by significant reductions in staffing has made success elusive. Some work has been done in capacity building. Rapid downsizing and limited culture change has made equity and redress very difficult to address successfully.

Progress has been made in the area of commercialisation with some limited successes in the introduction of new products into new markets. However, positive cash flows and profits still have to be demonstrated. Unfortunately there is still a significant degree of subsidisation of commercial services from the parliamentary grant. Losses are the norm – in spite of optimistic profit projections. The AEC has not been able to successfully marry their R&D competencies to a realistic commercial assessment of prospective markets.

The fluorination initiatives have commercial potential if adequately positioned in the context of the chemical industry. AEC management feels that SAFARI could be operated at no cost to the State, i.e. as a break-even facility. Analysis by the Review team however showed this to be unlikely. The balance of the radiation facilities will always need state support to meet an important national need in nuclear waste management and related radiation services.

The analysis by the Review Panel, summarised above, reveals that the AEC has evolved into two essentially different operations or businesses, each requiring a completely different management ethos. In the radiation field, the AEC retains an obligation to clean up and manage radioactive wastes and the future of SAFARI hangs in the balance. The second challenge for transformation lies in the fluorine chemicals area which requires vigorous new management in order to test its commercial viability.

Recommendations of the System-wide review

Government should clarify the mandate, purpose, function and structure of the Atomic Energy Corporation. It is recommended that the AEC be split into two separate organizations (with a carefully planned transition):

- *the core mandate of the AEC should be redefined to deal mainly with Decommissioning & Decontamination of closed nuclear facilities, radioactive waste management and operation of the SAFARI reactor, this latter possibility being subject to government decision with respect to the likelihood of SAFARI being capable of being operated financially at a break-even level. The reporting of this transformed AEC to DME should be reviewed in the context of its new mandate.*
- *A new public corporation, should be established to contribute to national wealth through the development and exploitation of those core technological competencies and capabilities of the AEC which can be shown to have realistic commercial potential. Government should appoint a transformation team to assist it with this task.*

The transformation team should be responsible, in particular, for evaluating the commercial potential of the current AEC activities in fluorine chemistry and radiation science and technology, and for preparing and implementing plans to commercialise and privatise into a new company those activities which have genuine market potential.

It is inappropriate to channel all government funding for the AEC through the DME. It is inappropriate to channel all government funding for the AEC through the DME. Technology support funds (phased down over a specified period in the transition to commercialisation) could be sought from other government technology support programmes such as the Innovation Fund. Remaining nuclear waste management and D&D functions could be funded through the ordinary budgets of either DME or the Department of Environment.

4. Council for Geoscience (CGS)

The essential mandate of CGS is systematic generation and publication of earth-science information. Its core competency clusters are appropriately identified as fundamental earth science mapping and geological research and its applications. These clusters include the core competencies of regional geology, regional marine geology, regional metallogeny, environmental geology, regional geophysics and national seismic work. There is a recommendation to re-establish a competence in hydrogeology and a National Geochemical Analytical Facility.

The CGS provides important support to government (seismic monitoring, land-use and geological data, shore-line erosion, etc) and provides data to allow innovation in the mining, minerals and engineering sectors (mineral exploration, land and water use, etc). It is regarded as providing a core, pivotal and valued service in the pre-competitive domain. As a geological survey it is world class. It strives to maintain a systematic approach to mapping and associated research, consistency in approach and presentation of data, retention of data for later re-use and more interpretation, maintenance of a team of credible experts, unquestioned quality of output and timely provision of useful information. The CGS could be considered a National Facility mainly collating and providing systematic and routine information, rather than a traditional SET with expectations for a high content of research and innovation.

The mandate of the CGS is captured appropriately in the Geoscience Act No 100 of 1993, although some modification might be necessary if the CGS is to be reconfigured as a National Facility. In addition, government, through the Department of Minerals and Energy, has entered into a contract with CGS specifying which services it wishes it to provide. This contract needs updating and could also include more performance objectives and measures. A Board governs the CGS at arms-length from the Department. It could provide greater strategic direction and oversight of management.

The core government grant in 1997/8 is R65 million (80% of total budget). The core functions (pre-competitive research, including systematic mapping, and research capacity maintenance) are appropriately funded by government. The Parliamentary grant should also fund some basic geological research. The statutory work could be funded through a relatively stable, multi-year contract with DME. Other work for government would be in the form of ad-hoc contracts. There is potential to grow contract research and commercial income through the sale of information and services.

Areas for change include

- **Management.** Management of CGS has been characterised as "low-key" and the CGS comprises a number of almost semi-autonomous and weakly directed groups. Strategic management systems are not evident and leadership and vision are too wrapped up in the personalised philosophy of the Director. No succession planning is evident. A strengthened leadership team will be required to complete the transformation of CGS.
- **Work Program:** The work programme needs to be restructured to clearly reflect its strategic nature, and multi-disciplinarity in programme and project management could be enhanced. Suggested benchmarks for management of performance within the work program are: publication output, level of commercial activity, relative costs and pricing, outputs delivered on time and within budget, demographic profile of staff and independent end-user review.
- **Human Resource Management:** Human resource systems are mostly limited to traditional personnel administration and HR policy has not been integrated strategically with the core business of the CGS. Little progress has been made in equity and redress.
- **Interaction with universities :** Interaction with universities has declined. There is a concern that insufficient geoscience graduates are being produced. These two problems could be tackled through improved access by research students, cadetships and post-doctoral fellowships. An acknowledgement that CGS serves as a National Facility would imply much greater attention given to user access to facilities and data.
- **Information Dissemination:** Management of two museums provides opportunities for more wide-spread information dissemination to schools and the public. Linkages with

stakeholders and potential clients needs to be stronger (not only with industry but also government departments and also the provinces). Stakeholders complain that information is not always timeously produced and is not always easily accessible. There is a lack of adequate dissemination or publicity of CGS's work and the public affairs and outreach activities should be upgraded. There is also much potential for activity in Africa, which is beginning to be realised. CGS plays an important role in SADC.

- **External Advice:** The CGS's Technical Advisory Committee needs to be reactivated and liaison meeting should be held with key customer groups.
- **Support to small-scale mining:** Greater support could be given to government's small-scale mining initiatives.
- **Commercialisation Policy:** CGS needs a consistent and transparent commercialisation policy. Contract research should not be subsidised by the parliamentary grant. It should be financed commercially through a pricing policy which involves full cost recovery and which is market-oriented. A commercialisation tax was proposed which could be recycled to the State for further financing of the NSI but this idea has not been analysed in detail Commercial contract activity is an effective mechanism for knowledge and IP transfer.
- **Foreign versus domestic focus:** There needs to be a clear rationale established, by the CGS Board, for determination of an appropriate balance between work done in South Africa and abroad. This balance should take into consideration the need to respond to domestically-identified needs and the opportunities for South African firms to participate in mining activities elsewhere on the continent. Most foreign marketing is done individually by the director which is an unsustainable position. The Marketing function needs to be better structured.

Recommendations of the System-wide review

The system-wide recommendations directed to SETIs as a group are all applicable to the CGS.

5. CSIR

The CSIR encompasses nine SET divisions which are designed to conduct research and development, and thus to provide scientific and technological solutions in order to support sustainable development and economic growth in the context of the South African system of innovation. According to the review panel the CSIR's core competencies reside in technology, namely materials, manufacturing and information technologies, and in outstanding management skills exemplified by their development of a world-class system for the analysis, distribution and content of financial resources, and for its exemplary human resource development programme. CSIR has shown a real commitment to transformation. Its leadership is considered to be mission-focused, visionary, dedicated, energetic, of high technical ability and people-

oriented. The national priorities for SET, as spelt out in the S&T White Paper are systematically and operationally incorporated into the determination of all CSIR research programmes and activities.

Despite this overall very favourable outcome of the review there are aspects of performance left which offer room and opportunities for improvement:

- A reconfiguration of CSIR's SET portfolio is recommended in order to phase out less mission-relevant activities and thus to release funds for developing significant new competencies in advanced manufacturing, especially in areas like computer simulation and virtual reality, and in some areas of information technology;
- In addition, the transfer of metrology facilities at CSIR (and associated budgets) to the SABS should be investigated.
- The divisions should focus their activities more towards innovative longer-term research projects directed towards enabling technologies on the basis of which industry can develop internationally-competitive products and services;
- Although the CSIR's management is fully aware of the need to exploit the market potential of its SET activities, incentives, training and other support for its research staff to become more entrepreneurial are still lacking;
- Within the range of its SET portfolio, the CSIR should establish itself as the leading link between the higher education institutions and the private sector in order to mobilise the respective talents available in South Africa as effectively as possible towards the objective of the national system of innovation;
- The CSIR should develop a comprehensive approach to establishing and maintaining international alliances in order to link its division more effectively to internationally renowned centres of excellence;
- In order to provide the South African system of innovation with a larger number of well-trained, excellent junior researchers, the CSIR should offer more opportunities for post-doctoral fellows to pass through its laboratories, and subsequently move on to the private sector as well as to other publicly financed institutions.
- The CSIR has well developed systems to ascertain customer requirements and levels of satisfaction. However, there is a need to engage at a much earlier stage with customers and potential customers in defining the priorities and directions of strategic research. Technical advisory committees could play an important role in this process.

All in all, the CSIR is one of the major assets of the South African system of innovation. Due to its strengths in applied SET it seems to be prepared to apply for larger parts of its budget on a competitive basis. If larger parts of the current Parliamentary Grants were to be transferred to relevant areas of the Innovations Fund,

the CSIR should be able to perform well on the basis of 30-35% core funding. In the long run, the CSIR should also be able to earn a considerable share of its overall budget from IPR income. However, this gradual shift of funding sources towards a larger share of competitively-earned income will be limited by the size of the domestic market until such time as the private sector recognises its need to invest more heavily in the promotion of technical change. CSIR should also be encouraged to expand its search for international funding for its activities and to participate where possible in international consortia which will give South Africa access to what is going on elsewhere in the world. Continued parliamentary grant allocation will be necessary in order not to harm the CSIR's impressive research base.

Recommendations of the System-wide review

- *The system-wide recommendations directed to SETIs as a group are all applicable to the CSIR.*
- *The location of coal research and of the National Metrology Laboratory in CSIR need to be examined with respect to Mintek and SABS respectively.*

6. The Human Sciences Research Council (HSRC)

While the individual review of the HSRC as a publicly-funded institution identified three core competencies—social research and coordination, data and information management, and assessment and testing—only this last meets the test of potential competitive advantage. Other organizations in the public and private sectors have relevant databases, and might easily emulate HSRC's capability in information management. HSRC's extensive infrastructure can indeed provide significant support to large-scale research. But its own mainly in-house research performance has not been marked by excellence, and other components of the wider National Innovation System, including universities, conduct much relevant social science research. HSRC's staff devoted to research—as opposed to support functions-- has been shrinking. HSRC's linkages with some critical stakeholders (higher education institutions, social service practitioners and others) has been weak, and it has lacked a multidisciplinary, strategic approach. This Council has yet to overcome the legacy of its past when, in the view of many South Africans, its intellectual work was employed in the justification of the apartheid project. As a result, HSRC's social science capability has not been widely deployed within the National Innovation System to mediate technological change, not even in opportunities so apparent as the Department of Trade and Industry's initiatives to radically restructure South African industry. Nor has the organisation's research noticeably influenced social innovation by practitioners in the new South Africa, significantly strengthened the research capacity of HDIs, brought new knowledge to the attention of decision-makers, or diffused influential insight about major social problems into the wider society. Thus HSRC's performance with respect to the role defined for human sciences in the White Paper on S&T is still inadequate, and the potentially powerful alignment of a cluster of competencies with the strategic objectives of the NSI has not been realised.

The HSRC is doing some of the right things but could be repositioned to do others differently, both to its own advantage and that of the total system. Recent or

impending strides in the direction of developing the research capacity of black staff, the appointment of new top level researchers with a different profile, provision for visiting scholars, and the involvement of outside researchers in assessment of proposal and publications quality are quite welcome, but should now be decisively reinforced—.

Social transformation and economic growth in South Africa may yield a rising need for development of the kind of psychological and educational testing tools in which the HSRC has found a unique niche, and with whose users it maintains good links. Maintaining competence and achieving excellence in tool development will depend in no small part on the organisation's being able to provide the kind of cultural insight and capability in South African languages that foreign competitors, especially--who are already beginning to erode HSRC's market--will not easily be able to provide. But at present the HSRC is itself deficient in these dimensions of human science research excellence.

HSRC's current management structure and system of governance are appropriate. Leadership has made some progress in effecting change and has provided a framework for directing the organisation. However the connection between this framework and the addressing of concrete issues in society is not clear. Despite an elaborate computerised project management system, research performance is not systematically measured or linked to strategy, and research project quality control is sub-optimal. The organisation's new human resource management plan has not yet yielded sufficient intake or mentoring of researchers from historically disadvantaged groups, though the majority of South Africa's black university graduates still receive their degrees in the humanities and social sciences. Only redress can close HSRC's gaps in cultural insight and language skills.

Management has shied away from taking confident, creative steps to reduce excessive support staff, thus perpetuating the imbalance in allocation of the Parliamentary grant between research, and administrative and overhead costs. Commercialisation strategies have not included competing aggressively for international or local competitive research funds in human science-related projects and programmes. HSRC's test business generates income but even here, in what it does best, the organisation faces growing competition.

Government has already decided to change HSRC's dual mandate of conducting and funding research by transferring the agency function. Now HSRC should begin to actively explore flexible, network-type institutional models which capitalise on the organisation's inherent competence to put into place and manage large, multidisciplinary projects.

- HSRC should retain just as much of a lean but excellent in-house research capacity as would (a) maintain the technical and professional integrity of its project management; (b) allow its participation as one of several partners in the conduct of selective, major-impact research projects; and (c) provide a "home base" to boundary-crossing social scientists working in flexible, creative arrangements across the National Innovation System and beyond it.

- Reconfigured as a smaller but smarter organisation, HSRC should then explore mechanisms to offer influential public policy and social innovation practitioners space to "think and catch up" on the latest developments in the field of social sciences, thereby diffusing practitioner knowledge to the more academic researchers flowing through the HSRC.
- In addition, the HSRC should explore the establishment of linkages with potential private sector partners to achieve better sales and distribution of its products in testing and assessment.
- These parallel changes in mandate, design and competence deployment would constitute a turnaround for the HSRC and would entail the organisation moving rapidly to implement its new framework.. A special turnaround team, with both internal and outside specialist membership, should oversee the toughest stages of the transition. Paramount in the skills set of this team to manage radical change should be organizational development and the strategic management of human resources. Among the turnaround team's first tasks will be to systematically reconnect HSRC to public policy-making, advocacy and leadership circles, in a series of facilitated conversations which should lead to the best structuring of the new design and functions recommended above.

Recommendations of the System-wide review

A concerted effort to address these needs [identified above and in Part 1 of this report] will involve the restructuring of the mandate and staff of the HSRC in order to make it more attuned to major contemporary issues. To tackle such challenges, the HSRC would need to have a staff which represents the cultural diversity of the country and which possesses modern research skills. The future HSRC should primarily operate as a manager, supporter and organiser of research and secondarily as a performer of research. Its could render great service by creating, supporting and guiding networks of researchers in HEIs and in NGOs who would undertake multi-year programs of research on key issues.

A transformation team should be appointed to assist the Minister of Arts, Culture, Science and Technology and the Board of HSRC in bringing about, a change in research philosophy and in research staff, a change in program structure, and any necessary changes in internal organisation to transform HSRC into a modern social science research organisation capable of responding to the needs of South Africa

7. MINTEK

MINTEK has a well defined mission which is "to serve the national interest through high-calibre research, development and technology transfer that promotes mineral technology, and fosters the establishment and expansion of small, medium and large industries in the field of minerals and products derived therefrom." It provides an essential repository of technological expertise that leads to innovation within a well-defined industrial sector which in turn contributes significantly to export earnings and

which has huge potential for value-added in terms of minerals beneficiation, processing and downstream products.

MINTEK's core competencies of mineral and metallurgical technology, including ore processing, are internationally respected. They have produced nearly 40 patents since 1990 but, while they have a number of successful applications in industrial practice of processes, techniques and equipment developed in MINTEK, it has often taken a long time to win acceptance from local industry. The Review recommended an increase in scientific and technological expertise in respect of environmental issues facing the metallurgical sector.

The Mandate of MINTEK is expressed adequately in the Mineral Technology Act No 30 of 1989 and accountability and transparency is required through the Reporting by Public Entities Act No 93 1992. The Board governs MINTEK at arms-length from government and plays a vital role in establishing the strategic direction of MINTEK and oversight of an operating business plan. This should be regularly reviewed, taking into account the White Paper on Science and Technology and other policy initiatives in the National System of Innovation. The Board has an audit committee, but it is inappropriate that the president is currently a member of that committee.

MINTEK is resourced from a core grant from the "Science Vote" via the Department of Minerals and Energy (R 73 million), from contract research and from the sale of intellectual property. These latter two sources combined yield only 22.7% of MINTEK's budget which is low in comparison, for example, with the CSIR's 52%. Nevertheless, in fairness it must be stated that about half of CSIR's contract income derives from Government departments, whereas MINTEK's is almost entirely derived from private sector sources.

The Review recommended the following use of funding streams.

- The core parliamentary grant should be used for strategic basic research generating knowledge that precedes application-oriented process and technology development, education and skills development, and the development and maintenance of supporting information and knowledge systems.
- The Parliamentary grant supplemented by contract income could also be used for research related to longer term projects where industry is not yet committed to full buy-in.
- Service work for outside clients, transfer of intellectual property, commissioned R&D, and all international work should be fully covered by commercial revenue. There would seem to be much room for increased contract income, at least to levels commensurate with the CSIR. There is also scope for sourcing a higher proportion of state grant funding from the Innovation Fund.

MINTEK has in place adequate systems to ensure the maintenance of high-quality standards. Its planning and internal progress reporting systems are centralised, easily accessible and provide the necessary information electronically. However, MINTEK should set measurable performance targets for technology uptake by industry, for

inventions and patents and for technical reports and publications. MINTEK's research and technology processes should be benchmarked against outstanding international institutions and it should employ benefit:cost analysis as a tool to assist in the evaluation of projects.

MINTEK has strong, confident management who have put in place good strategic management practices, however management should be restructured by the removal of two layers and some positions and by the redesignation of titles in accordance with modern management practice.

Management have a commitment to equity and redress and policies are in place. However there is much room for improvement with attention given to the retention of black scientists and engineers. MINTEK wish to collaborate with other SETIs in developing common approaches to the recruitment and training of black staff. MINTEK has an impressive commitment to education and training with support schemes for schools, technikons, universities and also in-house training.

MINTEK has good linkages with universities and has a far-sighted programme of bursars and university support. It is estimated that one in five metallurgists in South Africa have passed through MINTEK. There should be greater cooperation and joint programmes with the other "SETIs", in particular CGS, and the CSIR's Miningtek and Mattek. The anomalous position of coal preparation research in Mattek will have to be addressed. There is some concern from industrial clients that MINTEK's maintenance of strategic basic research and the retention of necessary skills is being threatened.

MINTEK should continue to provide technical support to the small-scale mining sector. It should also expand its services and technologies to the sub-region with support from SADC member states, the South African government and international development agencies.

MINTEK has given a great deal of thought to commercialisation. It is a strong drive in the organisation and they have learned from experience over the years, although there is some conflict and misunderstandings regarding its position on intellectual property rights. There is a need to communicate more flexibility on this issue. The key to success in the future is strategic partnerships and alliances, and early involvement of potential clients so that the innovation process is less linear and more interactively dynamic.

Recommendations of the System-wide review

The system-wide recommendations directed to SETIs as a group are all applicable to MINTEK.

8. The Medical Research Council, (MRC)

The MRC was established to contribute to improvement of health in South Africa through research, and came into being when this mandate was interpreted - as in other countries - as requiring a biomedical approach to the combating of disease and injury. In the early 1990's there emerged, internationally, a concern for the identification of

what was referred to as 'Essential National Health Research' (ENHR) priorities. The ENHR approach was premised on a broader view of health, which encompassed a range of issues relating to the social conditions in which health was either enhanced or damaged, and concern for the operations of health systems within which interventions were organised and delivered. This new perspective was adopted by the Ministry of Health and the MRC has engaged itself in the complex task of redefining its program structure and priorities to embrace this new approach.

There is much which is positive about MRC's performance:

- MRC acts as a performer of increasingly focused research needed to operate in an ENHR context and also provides an agency function for much, but not all, health related research;
- it provides extensive support in increasingly-well constructed modes to capacity building.;
- it maintains good to international levels of performance in most of what it does and what it funds;
- in particular, it has good capabilities in the bio-medical area, but is in the learning stages with respect to how to integrate a wider social perspective into planning, financing and conducting research on broader health issues;
- of all of the SETIs covered in this review, it has the closest operational linkages to the priorities and programs of the Ministry to which it is attached;
- the management of MRC appears to be efficient as well as effective and MRC enjoys a good international reputation;
- by embracing the ENHR approach, MRC has equipped itself with a broad tool with which to align its research with national priorities which have been systematically identified; in addition, this approach leads naturally to the use of performance indicators which are tied to the outcomes of investments in research. One caveat is important here: while MRC's plans and strategies have been quickly realigned, that is not to say that all of its resources have similarly been reallocated. The Board of MRC needs to ensure that meaningful levels of support are reallocated to areas such as health systems research, technology development, community-based epidemiology and cross-sectoral studies. Such a move would be consonant with the advice of the review panel both with respect to the substantive focus of the research needed in South Africa and with respect to the shift of resources away from in-house MRC activities towards research performed in other institutions which have successfully expanded their programs to include the newer, non-bio-medical orientations.
- its strategy appears to be well articulated, but MRC needs to implement its own strategy more vigorously. In particular the Council needs to have a more open vision of potential contributions to the Health Sector by other institutions and other areas of research. A consistent decline in the proportion of MRC-funded research which is performed in-house would

be one indicator that the necessary strategic orientation was being implemented. The comment by the Panel which reviewed MRC concerning the effective breakdown of MRC's internal evaluation of its own programs is one which should lead to swift remedial action by the MRC Board.

- its human resource policies and practices, including those relating to equity and redress are among the most effective which we have seen among the SETIs reviewed. MRC is also conscious of the fact that it needs to continue its emphasis on the transformation of the body of researchers which it supports, given the increasingly social view of health which it has espoused.
- MRC has attracted foreign funding, from both public and private sources and should be encouraged to continue with this practice; it may be capable of attracting significant levels of foreign funding, if it manages current programs well.

Against this positive backdrop, MRC has been resistant to all proposals that would see a formal separation of all of its in-house research functions from its agency function of providing grant support to research in institutions of higher education. This is in sharp contrast to the attitudes throughout the rest of the scientific community in South Africa. If it is to be permitted to maintain this position, then it should be required by government to meet carefully-defined criteria in order to make it transparently evident that its resource allocations do not constitute a conflict of interest.

Since the new National Research Foundation will be empowered to finance research relating to health, the two SETIs should arrange cross appointments to grant review panels and be open to joint financing of activities when this is in the national interest. This latter approach will be particularly important in the financing of larger groups whose research may span activities from the fundamental to the more applied. The continued existence of two agencies funding health related research should not be permitted to allow good proposals to fall between the programs of the two bodies.

MRC will need to improve its capacity for interacting with the social science community - the approach of appointing social scientists to the MRC staff is a necessary condition for bridging existing gaps, but it is not a sufficient condition.

MRC will increasingly be called upon to engage in joint research activities with other SETIs - for example in areas of human nutrition, in which its biomedical skills will need to be integrated within programs which draw on skills in the social sciences, in agriculture and related to food processing.

Recommendations of the System-wide review

The MRC should be required by government to meet the following criteria in order to make it transparently evident that its resource allocations between its own research and its agency funding activities do not constitute a conflict of interest. The criteria are that:

- *all in-house research be financed via the same competitive process which allocates resources to research groups in other institutions. (While MRC already subjects its in-house activities to review by externally chaired panels, it will be important to ensure that such panels have fully internalised the ENHR orientation into their work.).*
- *the process by which MRC allocates its budget between support of competitive funding and support of in-house operations, (which would include all of the overhead costs associated with maintaining an in-house research staff) and the annual results of such allocations should be transparent;*
- *the Board of MRC should clearly delimit the areas of research which they believe should be performed in-house, and should encourage and be sensitive to public debate on their decisions.*

9. The South African Bureau of Standards (SABS)

SABS' general mandate is in the development, implementation, regulation and maintenance of standards in the country. The maintenance is achieved through the accreditation of institutions, and the certification and testing of products and processes. SABS activities are standards development, accreditation, certification services, laboratory services, trade metrology, and specialised training in the private sector. It is internationally recognised in all of them, and offers a necessary national competence in areas of public responsibility (in trade, safety, etc). The individual activities do not offer individual core competencies in that they can be emulated, but serve taken together they constitute a cluster of core competence.

The current accreditation activity should be transferred to SANAS to ensure impartiality, since institutions once accredited then become competitors of SABS in the task of product or process certification. The present level of accreditation activity contributes insignificantly to SABS' income.

SABS has adequate technical capacity and infrastructure to support its core activities in the medium term. However, they need to embody the strategic need for succession planning if these are to be sustained.

Strategic Management is totally stifled by the bureaucratic nature and the technical intensity of the organisation. This is probably amplified by the fact that the president of the organisation is normally a technical person who comes up the ranks, and HR and Finance are also headed by a technical person who comes up the ranks. As a consequence, the organisation has failed to grasp the strategic importance of HR, Finance, and the capacity to provide visionary (not technical) leadership from the president and his team. The organisation seems to be operating only in today's time frame with little regard (if their results are the yardstick) for the environment they are operating in. In short, SABS will need to inject some visionary leadership into its structures, and adopt (urgently) the structures recommended by the peer review. These structures will in turn improve their financial systems greatly (which point the peer review raised as a major concern), and clearly focus management on which strategies will be necessary and prevalent in the long term.

The necessity to strengthen SABS' performance in the field of Information Technology does not seem to be a current strategic preoccupation of management . This issue becomes even more serious given that the standards world depends on speed of publishing, and that IT standards and certification will in future present a growing opportunity for service delivery.

SABS execute their technical mandate well, but need to infuse a private sector mindset into all members of staff in order to significantly improve their external income. Their marketing seems too technical and not well directed at the broad population. They will need to start marketing differently if they are to reach most potential clients, and the structure recommended by the review panel will help in this regard.

SABS will need to establish linkages with the Higher Education Sector, a move which could assist the organisation in regionalising some of its activities. If the HDIs can be encouraged to become partners, this would go a long way to SABS tap the skills base of the disadvantaged community which is a necessary step in programs of equity and redress. By better linking with the HES, SABS could also serve as a conduit for capacity building in the country.

SABS is neglecting several current opportunities to expand its client base in areas such as:

- the supply of Quality Management Systems that have been identified as totally lacking in some of the SETIs and government line departments ; certification of parastatals is a major opportunity.
- opportunities in SADC. SABS participates extensively in SADC committees, but does not seem to consider it an opportunity because they view other member countries as having inadequate capacity (i.e. they are unable to turn this problem/threat into an opportunity).
- the provision of standards services to SMMEs.

SABS may need to be more-fully commercialised in the medium term, leaving only the standards development and regulatory functions as National Services fully funded by government. The current funding level will be adequate if NETFA can be classified a National Facility, and if Trade Metrology is fully funded by government.

SABS internal fund allocation was inappropriate because of the discipline-based structure, but should improve once the proposed reorganisation is implemented.

Recommendations of the system-wide review

A professional team should be appointed to manage the transformation of SABS which, within the existing framework of SABS, should establish two clearly separate entities. The first would be a government-funded standards writing institution and the second would be an organisation responsible for accreditation, certification and the provision of laboratory services, all operated on a commercial basis. The basis for this change is clearly articulated in the relevant Panel Report

Beyond these structural changes which are required to meet international practice for standards bodies, internal operating changes are needed to modernise management systems and processes. Financial management systems in the SABS should be reviewed and upgraded in the context of the new structure. In addition, a fundamental change management process is required in human resource practices, policies and targets.

A detailed assessment of the metrology activities of SABS should be undertaken in order to establish the viability and cost savings of alternative provision such that a private sector company could be contracted to lease the major assets entailed and provide metrology services to the government under a long-term contract.

10. The South African Weather Bureau (SAWB)

SAWB is currently a departmental scientific activity of the Department of the Environment which is charged with provision of meteorological services, both to the general public (a public good) and to specialised interests (via value-added services). In addition, it carries out a modest program of research. The quality of its services is held in high regard, both nationally and internationally.

It faces a significant set of administrative problems due to its location within a department of government, a location which renders it subject to administrative rules, such as those relating to tendering for major equipment, which impose added costs and delays on the functioning of the Bureau.

Within its present position, SAWB has not developed a financial system which permits appropriate commercial costing of its activities, and so there is no current basis upon which to establish a defensible cost-recovery policy for its value-added services to clients such as the aviation industry. There has been an active disincentive which has limited the Bureau's interest in expanding the range of such services which it might offer: the Department of State Expenditure insists that any revenues generated by the Bureau be treated as general revenue for the State, not as income for the Bureau, while offering no compensation to the Bureau for costs involved in delivering services. As a consequence, the cost to the treasury of operating a meteorological service is unnecessarily inflated due to the impact of administrative rules and the decision on income generation.

The Bureau management have an adequate grasp of the importance of the supply of trained human resources as a strategic factor in its work and have put in place sound policies. Good capacity building systems are in place - but they are not used enough and could yield better results if expanded. There is an acknowledged need to do better in equity and redress.

Among the areas within SAWB which require attention are:

- definition of an overall commercialisation strategy is required; in particular some mechanism, such as a levy on aviation fuel, to recover costs from the aviation sector is essential;

- costing systems need to be completely redesigned to permit commercial operation; there is scope to increase external revenue as a share of overall budget;
- strategies to cope with increasing costs of foreign inputs into routine operations of the weather service; failure to resolve this issue would lead to a progressive deterioration of the services, both public and private, provided by the Bureau;
- linkages with the higher education sector, both for purposes of research and for human capacity development. Present linkages with both universities and Technikons should be expanded. There are good capacity building systems in place - but they are not used enough
- linkages with the private sector in areas of some Bureau competence (such as the development of low-cost instrumentation) are weak and need to be built up. The needed relationship is currently impeded by the Bureau's position within a line department.
- actual performance in equity and redress. - there are mechanisms in place for training which should be used for a more vigorous attack on this problem.

Many of the problems currently faced by the Bureau could be tackled with much more effect if it was granted status as a statutory body under legislation similar to that used for other SETIs such as the Council for Geosciences.

The principal steps needed to bring about this change of status, as articulated by the review Panel, include:

- provision of a Parliamentary Grant to cover the core activities will need to be the major component of the SAWB budget in order meet the statutory obligations of offering the public part of its services;
- preparation of enabling legislation, to define core activities, to identify Government's role in the funding and supply of core services, and to ensure compliance with international obligations, including adherence to the principle of the free exchange of data and products produced as part of the core service,.
- design and establishment of a Board of the new body, appropriately constituted to include members of the community, stakeholders, business people, professional scientists in the field and other experts.
- the establishment of expert task teams to plan for the transition and to train Bureau personnel;
- commissioning of further work to establish in detail what public service activities fall into the core activities for which an annual Parliamentary grant should be given.
- provision of professional advice from outside experts to assist the Weather Bureau as it prepares to commercialise its value-

- added services to identified interest groups, on a more sophisticated cost recovery basis than has been possible to date;
- preparation of a business plan for the Weather Bureau to guide its entry into the market for business-oriented projects within its technical and practical ability to sustain, in ways which will be compatible with the continued, efficient and effective execution of its public-service responsibilities.
- the design and implementation of a comprehensive programme to educate all Weather Bureau staff on their obligations and responsibilities in the new statutory body

With respect to the research program of the Bureau, it should be eligible to compete for funding on the same basis as other SETIs.

Given the nature of the extensive array of data gathering facilities operated by the weather bureau, and the unique collections of current and historical data maintained within its data bases, careful thought should be given to the possibility that some defined parts of it might be declared to be a 'National Facility', to which outside researchers would have a right of access under defined conditions, provided that such a designation would not impair its capacity to offer its core public services.

Recommendations of the system-wide review

The SAWB should become a statutory body by following the process steps set out [above].

11. The National Research Foundation and the Agency Function

The agency functions currently conducted separately by the Foundation for Research Development and the CSD of the Human Sciences Research Council are set to be amalgamated under the proposed National Research Foundation. The draft bill now rests for final decision-making with Parliament, where the new Agency's mission and modalities will take final form as legislation. The NRF's role is already presaged by the Science and Technology White Paper, and the Agency Function review team made numerous helpful specific recommendations about the formation of the NRF. Prominent among these are the recommendation to use the NRF as a strong lever for interaction and linkages in the research enterprise, and the recommendation that NRF enter into urgent discussions with the DoE to achieve greater complementarity in light of the recommendations of the White Paper on Higher Education and of DoE's preponderant role in financing university research. Thus the System-wide Review Panel, will not comment on the past performance of FRD and the CSD, or on the details of an Agency structure which has yet to emerge in final form. Instead, this Review highlights areas of strategic concern with respect to the new entity, and makes some recommendations designed to minimise those concerns.

The NRF will be an important player within the NSI, particularly with regard to helping to galvanise investment in human capital NSI-wide—a position somewhat different from the organisation-bound concerns of individual SETIs and of private knowledge-based enterprises. It has an opportunity to use the results of the Science

and Technology Foresight Exercise, and of the Audits of SETIs and of Indigenous Knowledge, in order to help identify human resource gaps in the system as a whole, including any threats to the country's indispensable basic research capacity. Here the NRF can make valuable use of the network analysis which underlay the Foresight Exercise to stimulate conversations between natural and social scientists across the NSI, and with other players such as the Departments of Education, of Trade and Industry, and of Labour, and civil society. This can be a unique, ongoing opportunity to focus attention on overall human resource needs in science and technology, and to inform deployment of the Innovation Fund accordingly.

The NRF will also have opportunity to intensify the new work begun particularly by the FRD to nourish the "baobabs"-- young black and women science and technology students, and the beleaguered HDI academic staff expected to simultaneously hone their own research capacities and uplift their students as well. For these functions to be adequately exercised, the NRF should have a lean but capable staff experienced in collecting and interpreting information from the NSI and about the education sector.

There is a danger that the complexity of merging the two parent organizations into the new body may be underestimated, with consequences which could impact upon its work. The implications of structure on the possibilities for new thinking and action in the NRF should be carefully pondered. This understanding should drive the design of institutional structures, including its division into departments or other units, and its mechanisms for ensuring the internal flow of ideas and information. As soon as the new, amalgamated staff sets up shop, two distinct organizational cultures will confront one another. Not only is some carry-over of familiar work relations—whether negative or positive—inevitable, but the old organizational cultures will still be the "filters" initially for staff and managers as they decide what to notice, and what to attend to, in the new situation. Meanings constructed over years of work in the past will not be automatically remade and shared; paradigms will not be "unlearned" overnight. Building a distinctly-NRF culture and operating style will be an ongoing task, but it should start consciously and quickly. Such an organizational change is not an easy transition, and the need for expertise in organizational development and strategic human resource management will be acute.

The review panel also notes that exclusion of the health sciences agency function from the new NRF may have impacts upon the strength and cohesion its interdisciplinary thrust. The MRC and DACST should transfer to the proposed Health Sciences Division of the NRF those programmes and proposals likely to benefit from co-operation with a broad range of scientific disciplines.

Among the necessary initiatives , the following stand out:

- The NRF should begin an early round of conversations with NSI actors and stakeholders to help inform thinking about how to use their budget in ways that promote the national interest.
- The transition period should be utilised to begin a cultural audit of the two merging organizations against an anticipated NRF, and to put into place a highly-skilled transition team comprised at the very least of the present leadership of the two organizations and high-quality outside change management expertise, particularly in organizational development and

strategic human resource management (to effectively manage the transition from both ends).

- Agreement from all the relevant Departments should be obtained as expeditiously as possible for clarity/assurance of continuity of disbursement commitments over a minimum period of two years on NRF resuming operation.

Recommendations of the system-wide review

The establishment of the new national funding agency is a logical and necessary step in the further development of the South African research base. In view of the challenges provided by the process of establishing a new institution and, at the same time, integrating the existing FRD and CSD, it will be necessary to put into place a highly skilled transition team comprised of the present leadership of the two organizations and high-quality outside change management expertise, particularly in organizational development and strategic human resource management.

The NRF should begin an early round of conversations with NSI actors and stakeholders to help inform thinking about how to use their budget in ways that best support national policy priorities and the NSI.

In addition, earmarked funds should be provided by the National Research Foundation for a research program specifically designed to stimulate research on cultural, social, economic, and technological change in Africa in order to develop new research capacities within South Africa's higher education institutions.

12. National Facilities

The strategic review of current and potential National Facilities (NF's) has emphasized the need for a framework of policy and decision-making as well as a specific mode of funding, operating, and maintaining NFs which are regarded as important elements of the SET infrastructure of South Africa.

For quite some time, and in many countries throughout the world, NFs were defined as institutions which rested on substantial instrumentation and equipment, and required a considerable amount of government resources. Due to recent developments in various areas of SET, e.g. in modern biology as well as in other data-based sciences, an increasing trend can be observed towards the creation of multi-locational networks of institutions, which collaboratively contribute to the provision of an urgently needed research infrastructure. A common feature of all of these NFs is that the respective research community has a right to access them on a competitive basis, according to their research needs.

In order for an institution to be considered as an NF, the review panel proposed that the following criteria should be met:

- The facility or network of facilities should have a unique position in South African SET;
- The core technologies, research methods, or data pools should live up to international standards;

- The goals for establishing the NF should be well aligned with the overall objectives of the South African system of innovation, especially with regard to the diffusion of new knowledge;
- Critical mass of equipment, skills, and users, especially with regard to researchers from universities and technikons, but also from SETIs and (where appropriate) from industry;
- The potential for networking and for attracting international collaborators to South Africa;
- Prospects and opportunities for human resource development; especially with regard to efforts being made to get disadvantaged researchers involved.

It is appropriate to separate the functions of policy advice to government and system-oversight with respect to National Facilities from the function of managing the system of National Facilities which may evolve in South Africa.

For the framework of policy and decision-making to be developed, it is important that government can take its decisions based upon expert advice which is institutionally independent of the researchers preparing specific proposals. In the South African context, the appropriate body for providing this advice as well as for conducting evaluations at a strategic level, is the newly-established National Advisory Council on Innovation (NACI).

The process of establishing, operating, and maintaining National Facilities, as well as the preparation of proposals to close down NFs which no longer meet the criteria outlined above, should be a responsibility of the proposed National Research Foundation (NRF). It should be delegated a coordinating role, and should also be responsible for providing the necessary core funding for the NFs, funding opportunities for users from universities and technikons, and for setting up a medium-to-long term investment plan.

As for the operational aspects of NFs, it is essential that access to the facilities be granted based entirely on open and transparent competition. This should also include the NF's own research staff, except in those areas where research is needed for maintaining or upgrading the facility.

Government should move to the enactment of a National Facilities Act to set out the definition of such facilities, of the criteria which they need to meet, of the responsibilities which they would undertake with respect to providing access to researchers from all parts of the country, and of the funding system appropriate to their support – or to a modification of an existing legislative instrument to achieve the same goals

The potential to establish a category for support or baseline information-generating facilities (such as parts of the SAWB or of CGS) should be explored.

Recommendations of the system-wide review

Legislation should be enacted to facilitate the designation and operation of National Facilities. The act should specify the criteria for selecting national facilities, the performance criteria which would need to be met to retain that status, and the funding regime which would apply both to meeting the infrastructure and operating costs of the facilities and to the financing of the use of the facilities by interested parties

NACI, with the support of DACST, should develop an appropriate funding mechanism for declared National Facilities which strikes a viable balance between providing secure infrastructural support for the operators of the facility and funding/empowering users to gain access to the facility on the basis of merit and relevance.

Appendix 1 Membership of the System-Wide Review Panel

Panel Chair: Mr James Mullin,
President, Mullin Consulting Ltd., Canada

Members: Ms. Geri Augusto,
Kennedy School of Government, Harvard University, U.S.A.

Dr Wilhelm Krull,
Secretary-General, Volkswagen Foundation, Germany

Professor Anton Eberhard,
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Professor David Kaplan,
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Dr Steven Lennon,
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Mr John Moalusi,
Director, Qdata Limited, South Africa

Mr Peter Masemola,
Managing Director, Tru-South Management Services

Appendix II Examples of Potential Key Performance Indicators

General KPI's, applicable at the level of individual SETIs or SETI core competence clusters.

- Number of new technologies developed - quantitative
- Degree of alignment to government policy - qualitative
- Degree of commercial activity against pre-determined targets - quantitative
- Jobs created – quantitative and qualitative
- Extent of interaction with other NSI stakeholders
- Sectoral GDP growth - qualitative
- Investment promotion - qualitative
- Small businesses created - quantitative
- Sustainability index - quantitative
- HR capacity – scientists, engineers, technicians trained and employed - quantitative
- Patents or other Intellectual Property registered and commercialised - quantitative
- Degree of implementation of technological outputs – quantitative and qualitative
- Licensing agreements successfully implemented- quantitative

Specific KPI's for use as Management Tools within SETIs

- *Executive and Senior Management level*
 - Affirmative Action target for organisation
 - Generic Human Resources KPI
 - Financial performance
 - Income/expenses
 - % cooperative expenditure against target
 - Pricing level compared to competition
 - Productivity and efficiency
 - Safety
 - Alignment with national priorities
 - National contribution
- *Team leader level*
 - Mentorship of trainees and staff
 - Project management performance – adherence to budget, milestones and outputs
 - Technology transfer and diffusion targets

- *Scientist/researcher level*
 - Mentorship of trainees and junior researchers
 - Publications, patents or other intellectual property produced
 - Peer interaction
 - Reputation
 - Income
 - Contract performance
 - Research outputs
 - Project discipline
 - Contribution to the science or to technological advance, as applicable

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