# 8. Promoting Co-operation in Science and Technology in the SADC Region

**Professor Michael Kahn**
*University of Cape Town, South Africa*

*Progress in science requires various types of co-operation at and between the intergovernmental, governmental and non-governmental levels, such as: multilateral projects; research networks, including South-South networking.*

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## Why Promote Co-operation?

One objective of the South African government is the promotion of regional development. This is a dual goal that is both altruistic and self-seeking. It has the intention of creating and enlarging markets for technological goods and services, and of promoting regional growth and stability. Accordingly, the Department of Arts, Culture, Science and Technology has taken on the responsibility to promote cross-border scientific co-operation. The Department seeks to exercise this mandate in collaboration with other government departments, parastatals and the private sector. The advent of formal apartheid led to schism between South Africa and most African states, and building new trust and relationships necessarily takes some time. It is also important to have a good understanding of what capacity for joint scientific co-operation exists, and to have clarity on the mechanisms and resources that should be put in place to give meaning to intent. Accordingly, this chapter explores scientific capacity, the policy environment and the views of those who might become involved in co-operative activities.

Thus far, the track record of science in national development in most African states has been modest, if not weak. The problems appear to begin at school level, where uptake of science and mathematics is low and performance far from satisfactory. The reasons for this failure are many. One group, arguing from the perspective of dependency theory, sees lack of resources as the problem (Ogbu *et al.*, 1995). Another claims a cultural dissonance between what is termed 'Western science' and the so-called traditional African world

view (Ogunniyi, 1996). A third, in what seems to be a modified version of the vocational school fallacy, seeks an explanation in instrumental causes (Dzama and Osborne, 1999).

Whatever the reasons, science and technology at research levels, and science education in schools, technical colleges and higher education institutions, has generally not been important in state funding in post-independence Africa. The more pressing needs of basic education, health, infrastructure and defence have consumed what budget might be grown off the local tax base. An excellent account of these difficulties can be found in a review conducted for the SADC Secretariat (Mshigeni *et al.*, 1994).

How then can South Africa, with its relatively developed scientific infrastructure, engage in scientific co-operation with the rest of the region? It is this aspect of science promotion with which this chapter will engage.

Mere popularisation of the ideas of science cannot alone change the situation. The practice of science must be grounded in the local reality, failing which it is likely to be a rich man's toy. How then to strengthen local capacity? Is it a matter of developing the necessary human resources after which an agenda for research will follow? Who determines the agenda? How is the work to be paid for? To begin finding an answer we now turn to the region.

## Science in the Southern African Development Community

The Southern African Development Co-ordinating Conference (SADCC) originated in 1980 as a political and economic response to the damaging effects on the sub-region of the ongoing wars for liberation from South African domination. The nine founding countries were Botswana, Lesotho, Swaziland, Zambia, Zimbabwe, Malawi, Tanzania, Angola and Mozambique. All these countries, except the last two, were formerly subject to British colonial rule and experienced transitions to independence without the widespread loss of life and destruction of infrastructure that characterised the experience of Mozambique and Angola. To a varying extent, institutions such as research stations and standards laboratories existed in these states before independence where they provided a service to the extractive industries and plantations of the colonial era. On the other hand, there were generally few graduates available to the new governments, let alone scientists and technologists to staff these institutions.

The various states have largely remained in the modes of production of colonial times in which a local science capacity was barely necessary. Under

those conditions national systems of science and technology did not develop and government spending on science research has thus not emerged.

Taken as a whole, in 1993 Africa had an estimated 72,000 research and development specialists of whom approximately 18,000 were in South Africa. In sub-Saharan Africa, South Africa accounts for nearly 60 per cent of research and development specialists, and in SADC probably for more than 90 per cent. There is a major difficulty in accessing reliable figures since outside South Africa no systematic auditing is carried out. Males are the dominant gender of this knowledge capital stock

The SADCC states, with the assistance of the international community, organised a range of development and rehabilitation programmes that were arranged under the sector responsibilities assigned to the various countries. So Zimbabwe was given responsibility for food security, Angola for energy, Botswana for livestock research, Swaziland for Human Resource Development and so on. However, the cross-cutting nature of S&T, whilst recognised as important, was not given the same sector recognition.

That science and technology is an important driver in socio-economic development was appreciated by SADCC scientists, technologists and administrators and they waged a long but largely unsuccessful campaign to elevate science and technology in their national government policies.

In their efforts to build the modern state, the new governments established institutions of higher education and other science and technology organs. Together, these comprise around 200 entities that support and promote research and development. While there has been some brain drain out of SADC to the West, a significant number of scientists, engineers and technologists remain in SADC. This includes those who have entered state administration, those in research and technology organisations and those in higher education.

If one needs a good example that research spending is driven by economic and social necessity, then the experience of Mauritius, with its 250 years of research into sugar cultivation and processing, is a case in point. A producer-funded research capacity was developed to the extent that through to the present day, government science research spending is dwarfed by the private sector spending on sugar research. This example also serves to illustrate that where the state cannot or will not invest in such research, the private sector, if convinced of its necessity, will do so.

While South Africa's S&T policy development, refracted through its 'total onslaught' mindset, mainly related to Europe and North America, the SADCC states looked toward the OAU and Economic Commission for Africa (ECA) for leadership. CASTAFRICA I in 1974 rekindled the debates begun in Lagos in 1964, urging that the human resource base had to be strengthened to a level of 100–200 scientists per million of population by 1980. This target eluded most SADCC states.

A more forceful move to place S&T on the agenda came through the Council of Ministers Meeting held in 1988. This meeting mandated a SADCC-wide study on S&T that finally got underway in 1991, with the study itself finally published in 1994 as the Mshigeni Report. The report begins with an overview of research capacity, noting that the commercial sector undertakes substantial research through institutes owned by specific agricultural industries often funded through producer levies. The mining sector is dominated by multinationals whose research is pursued offshore and whose local geological exploration activities frequently bypass the existing state geological surveys. Industry, on the other hand, tends to be an importer of technology and generally operates at the lower end of value addition. A complex interaction of the effects of war, hyperinflation, structural adjustment policies, unbalanced terms of trade and devaluation of currencies have eroded industrial capacity.

The report found neglect on the government side of the S&T sector. Of the 10 SADC States in the survey, only four had an official S&T policy in place at the time of the study. In the state sector, agricultural research dominated but had a poor record of impact on communal farming. Research on shelter, water, sanitation and appropriate technology was poorly co-ordinated across countries. Nor had expansion of basic education improved the persistent imbalance of scientists and engineers, technologists and technicians. The situation contrasts with that in the East, where investment in secondary education has begun to show good returns (Lewin, 1993).

In seeking measures to ameliorate the problem the report urged co-operation, gender redress and steps to limit the brain drain out of SADC. The need for investment and reform of school science and mathematics education was highlighted and in particular it was recommended that 'Science education, at all levels, should emphasise the applied aspects, and also involve linkages with entrepreneurships (sic) and joint ventures' (p. 6). While noting that a small pool of highly trained scientists exists, their work was skewed from development toward research. This in part arose since policies did not encourage participation of the private sector but was also caused by 'the lack of properly trained manpower' (p. 8). The Mshigeni Report then argued that a

precondition for driving S&T onto the national agenda was that all states should establish a National Research and Development Co-ordinating Body (NRDCB) with access to the highest levels of government. This might be termed a bureaucratic change approach.

A second S&T policy overview is that of Ogbu, Oyeyinka and Mlawa who argue the case that technology drives development. 'African economies require deep technological revolutions to bring about rapid structural shifts ... (within) an enabling macroeconomic environment and the ways that environment interacts with an effective technology policy.' For them, technology is central to the development process and long-term structural change is technology driven. Since the growth of systems is an evolutionary process, technological and organisational learning cannot be circumscribed. The authors quote evidence from across African countries to demonstrate those explicit efforts and investments that are essential preconditions for learning and development. In other words, technological capability is not an automatic outcome of capital accumulation and investment. Successful technology transfer involves and requires time, skills of adaptation and continuous learning for which investment must be provided. Technological learning is not automatic and not necessarily expensive. But it must be managed and allowed for.

Accordingly the consequences of a ' ... lack of capacity for domestic capital goods and machinery production is a singular characteristic of underdevelopment. ... SSA (Sub-Saharan Africa) is extremely weak, lacking the capacity to produce even the most basic tools for manufacturing ... [and] maintain the systems.' One of the additional factors that contributes to this weakness is the lack of, or impossibility for interaction among, a network of firms. When there is no domestic capital goods sector, linkages with firms cannot emerge. Technological learning is limited and little technical change will occur. Turnkey projects generate foreign exchange but these do not stimulate local manufacturing, human resource development or R&D. Despite turnkey projects the gap between the G-7 countries and the rest widens since industrial production today rests on a much more complex scientific, information and technological base. Accordingly the state must exercise a stronger interventionist role in the underdeveloped than in the industrialised countries. Implicitly what the authors argue for is management through a set of national systems of innovation with the state actively laying down the regulatory, physical, human and social infrastructure. This is undeniably a systems approach.

With the end of formal colonialism and the liberation of the whole region,

SADCC transformed itself into the Southern African Development Community (SADC). Up to that point no real progress in co-ordinating and developing science and technology policy had been made. However, much had been achieved regarding policy for education and training, with the SADC Protocol on Education and Training (SADC, 1997) coming into force in early 1999. Given the differences in approach across the education systems of the region, the linkage of education with local culture and language difficulties, this was no mean achievement.

The Protocol includes the undertaking that 'Member states agree to urge universities and non-university research institutes to co-operate in the area of research and to forge links with the industry/private sector and other relevant sectors ... to lay a basis for developing science and technology.' Here then is a first instrument for forging research co-operation.

## Regional Capacity and Co-operation

Written largely from the perspective of higher education, Article 8 of the Protocol lays out guidelines for co-operation in R&D. The Protocol makes provision for higher education and R&D resource sharing, and recommends that within ten years all states should have a national S&T policy in place. This will serve as the basis for formulation of S&T policy for SADC as a whole. Co-operation among the various R&D role players is urged, including the establishment of professional associations through which information might be exchanged and R&D quality enhanced.

Overall there is a call for the promotion of mobility of researchers through relaxation of immigration regulations for the purposes of 'research, consultancy work and related pursuits'. The inclusion of Article 8 in the Protocol reflects the fact that in many SADC states S&T policy and, by implication, R&D often falls within the ambit of a Ministry of Education or Higher Education. The recommendations for R&D promotion and co-operation should be read in the larger context of higher education where co-operation in capacity development is a major thrust. A starting point for an analysis of S&T capacity in SADC begins with some comparisons across the different states.

Among the four most prosperous states, Seychelles has the highest GNP per capita. The other three (Mauritius, Botswana and South Africa) are at the lower end of the upper middle-income range, the unusual case in this group being Botswana whose social composition is unusually homogeneous with a minute expatriate and settler population. Arguably, in terms of GNP/capita,

infrastructure and composition of GDP, the three settler 'islands' have most in common with each other.

South Africa and Botswana are members of the Southern African Customs Union (SACU). Both countries in the lower middle-income group (Swaziland and Namibia) are members of SACU and have 'marched together'. The remaining member of SACU, Lesotho, lies in the lower-income group and is the country least endowed with agricultural potential or mineral resources. Until the completion of the Lesotho Highlands Water Scheme its main income derived from migrant labour remissions. As a water and energy exporter one may expect Lesotho's GDP to rise dramatically from 1998 onward.

Two members of the lower-income group are the former Portuguese colonies of Mozambique and Angola, whose economies were largely destroyed during and after independence. The former Belgian colony of the Democratic Republic of Congo has since independence struggled to establish state infrastructure. This leaves the former British possessions of Malawi, Tanzania, Zambia and Zimbabwe. All have a leading university, and in some cases, more than one. While Tanzania and Malawi have predominantly agriculture-led economies, both Zambia and Zimbabwe through their mining industries have an associated manufacturing sector. In the latter case this sector developed strong self-reliance during the period of sanctions from 1965 to 1980.

Among the upper middle-income countries, Mauritius and Botswana are currently making strides in reconfiguring their S&T systems towards national goals. Both have growing economies and well-established universities. Their S&T policies are being operationalised through a small set of institutions that are being developed according to market principles.

The two lower middle-income countries, Namibia and Swaziland, have very small S&T systems and are heavily dependent upon expatriate researchers. Both have niche strengths that provide a basis for external co-operation.

Among the lower-income countries Zimbabwe, given its huge investment in education and the developments around the National University of Science and Technology, may be expected to achieve greater levels of scientific output over the next decade or so.

The institutions that could form the basis for national systems of innovation are in place, but the impact of war, political instability, the imposition of structural adjustment policies and the disastrous falls in commodity prices

mean that in many states the systems have all but collapsed. While the institutions are today largely populated with nationals, many units are moribund with demoralised staff and aging equipment. Funds for transport are limited and many scientists perform largely administrative functions.

## Promoting Scientific Co-operation with SADC

To seek a mechanism for co-operation, DACST in 1999 commissioned a study that would engage with the main role players in the SADC member states and provide guidelines for a research programme with modest funding to serve as a kick start.

A project team engaged in a series of country visits over a period of some six months and compiled a report that provided an overview of capacity and a set of recommendations. The project took care to navigate the difficult terrain of perceptions regarding South Africa. The skills and resources of the country are desirable, but there are fears that a new dominance could emerge from apparently innocent co-operation.

It is obvious that many of the lower- and lower middle-income countries have become dependent upon donors for the continued functioning of their research systems. This raises the very real concern of who controls the research agenda. Where relationships are so unbalanced, the existence of an official science and technology policy in and of itself is no safeguard against usurpation of the research agenda. A new player on the block adds to the complexity of these relationships.

On the other hand, some country economies have blossomed, institutions have grown and are performing world-class research and development. A network of SADC Centres of Excellence has been established that is actively training a new generation of scientists and carrying out relevant research. The concerns that scientists and administrators raise in regard to international co-operation must, therefore, be understood in the context of three powerful factors – decline, dependence and loss of control.

Broadly speaking the claims, issues and concerns of the major SADC role players may be summarised as:

- Donor-funded projects create well-resourced islands that lead to further fragmentation within institutions.
- The imbalances of power had made some researchers feel as if 'we have moved from being hunter-gatherers to data gatherers' who perform basic

tasks that would accrue to the benefit of academics in the North.

- Donor technical assistance consumed a disproportionate share of funds, which amounted to 'recycling', and was frequently of a nature that could well have been performed by a local researcher.
- The devaluation of local currencies and erosion of income of highly-qualified scientists has led many to turn to consulting as a survival activity. That many donor projects did not recruit local consultants is thus a further source of concern and formation of distrust of motives.
- At the level of country experience there was generally movement of researchers from North to South and students from South to North. This, too, made for a feeling of inequality. This was further exacerbated where projects were made to fit into the northern partner's timetable.
- Co-operation with external partners who had access to greater resources led to 'swamping' within projects, such that the local voice was all but lost.
- It was frequently alleged that external researchers had appropriated data or specimens. This theme was a constant background in discussions and has become an urgent issue in the age of biotechnology and genetic manipulation.
- The absence of ethical regimes for experimentation laid SADC states open to unscrupulous testing of animals and crops by foreign parties within their borders.
- Scientists face the very real prospect of becoming deskilled since they lack the necessary equipment and other resources to work in their fields of specialisation. Put simply, scientific human capital has a finite shelf life.
- There were many forms of brain drain and brain gain in operation, with scientists moving within the region and out of the region.
- Researchers in many states were frustrated that politicians had not grasped the importance of funding research and building S&T systems. They felt that leadership was only interested in activities with a high likelihood of delivering immediate results. There was a problem of managing expectations.
- Fears of dominance frequently arose, directed towards the rich countries of the North, South Africa and even East Africa.
- Some government departments felt a strong need to control research, especially where this intruded on sensitive issues such as threatened minority groups.

- A caution was frequently offered that individual researchers were prone to advocate narrow interests to attract funds toward their own areas or institutions.
- Appropriate technology was to be encouraged; appropriation of technology would be resisted.

These matters cluster around matters such as power relations, preservation of self-esteem, professional mobility and intellectual survival.

### *What form of co-operation?*

At one extreme one might argue that formal nation-to-nation bilateral agreements are needed. However, the time and effort required to establish such agreements would be an obstacle to rapid progress. Where such bilaterals exist they may be used for setting up collaboration, but where they do not exist, other mechanisms must. At the other extreme might be a totally laissez faire approach that relies upon peer-to-peer or institution-to-institution networking. The argument would be that competent scientists know one another, will make contact and will get on with the job. Sadly, where the resources available to the different scientists are highly unequal, the emergent relationship may be flawed. Somewhere between these extremes is where funding is channelled through the appropriate national research and development co-ordinating bodies. Where such bodies do not exist, the national university could assume the position of facilitator.

To the relations between individuals or nations must be added the purpose behind the relations. All countries grapple with the problem of deciding where the self-interest of researchers, both national and foreign, ends and linkage to national interest begins. Where researchers determine the goals, various forms of lack of accountability to local goals may arise. However, this lack of 'goal' accountability does not necessarily preclude funds becoming available from sources external to the state. In an attempt to keep track of such relationships, some SADC governments make use of existing statutes or are drafting legislation that requires the registration of all research projects.

Then there is possible tension between researcher goals and what national parties are prepared to fund. Given multilateral interests, such co-operation frequently involves significant numbers of expatriate researchers being on local ground. This serves to provide additional intellectual capital and project experience for local researchers, but it may feed many of the concerns that were listed above. Another situation that arises from time to time is where researchers are able to access their own funds. Typical cases are where nationals retain links with the foreign universities where they obtained their

doctorates or with the donor agency that made this possible. Fruitful work may arise out of such relationships, but they are often felt to threaten the national agenda.

For cash-strapped governments that wish to control the research agenda, there are limits to the extent to which they may be able to persuade multilateral agencies that projects in support of the national goals are what they should fund. Another difficulty lies in getting all parties onto the same timeline.

With the above in mind the following framework for co-operation emerged:

- Initially, co-operation should be sought through peer-to-peer interaction, if possible aligned with national goals and effected in co-operation with NRDCBs where they exist.
- Activities that are squarely in the public goods domain would be preferred. There are a number of reasons for this position, arising from direct historic relations as well as the general experience of the region. The primary goal must be to establish a relationship of trust with partner organisations. This may best be done through research where the fear of unilateral exploitation is kept to a minimum. By removing commercial gain from the equation along with its concomitant contractual aspects, one goes some way toward this.
- As the relationships mature and all parties become secure, more commercial benefit might be sought.
- Linkage with the productive sector should be a longer-term goal of the co-operation.
- Project identification may be based on goal-directed needs, through an expression of interest or where an existing project is recognised as having mutual benefit.
- Where potential projects involve direct social impact it would be expected that stakeholder consultation should be effected as early as possible.
- On the South African side a project champion for each project will be identified from among the Science Councils. The project champion will invite 'requests to participate' from SADC S&T institutions that have already identified goal-directed areas as important. An endorsement from the relevant NRDCB that the project is aligned with country S&T goals might be a prerequisite for consideration. The project champion will simultaneously invite participation from South African higher education institutions through open advertisement.

- Given the public goods orientation, charges for goods and services would normally be levied at cost.
- Where feasible, projects should involve postgraduate student development.
- Intellectual property rights arising from the project work will primarily be dealt with through joint publication. A memorandum of understanding (MoU) would normally suffice to protect pre-existing rights. Where a MoU is drawn up to deal with future rights, unless exceptional circumstances prevail, such MoU should be free of long-term disclosure provisions.
- A steering committee should monitor projects in terms of ethical compliance and gender balance, and will be responsible for formative and summative project evaluation. The evaluation criteria should be built into the project design at the outset.

## Giving Substance to the Intentions

The DACST study sought ways to promote research across regional borders under circumstances of severe financial constraint. Proposals in the fields of water management, cross-border pollution, food technology, indigenous knowledge protection, soil management, HIV/AIDs and Information and Communication Technology, including GIS and education MIS, were invited. The selection criteria were also made known to bidders. On the South African side, it was stipulated that the cost centres would be located in one or another of the science councils. The choice of partners was left entirely open.

That the research community desired such interchange was more than evident in that when a request for proposals was placed, more than 90 submissions for funding were received. This high response more than justified the effort that was put into canvassing the role players and scoping out the guidelines.