Chapter 3

REGIONALISM AND TECHNOLOGY DEVLOPMENT IN AFRICA

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Introduction

In the past four decades, a number of regional co-operation and integration schemes have been adopted by many African countries. There are currently more than 20 regional agreements that aim at promoting co-operation and economic integration at sub-regional and continental levels. A common feature of these agreements is their appreciation of the role that science and technology play in national and regional economic development. Indeed most regional trade, economic, political, environment and security agreements have provisions for science and technology co-operation.

This trend is based on the recognition that their individual economies are small and are poorly endowed with human, physical and financial resources necessary to develop and harness science and technology for economic change and growth. Thus, economies of scale dictate that such countries pool their resources together. Despite this, there are few concrete examples of how African countries have collectively harnessed science and technology to solve their common developmental problems. Science and technology co-operation provisions have largely remained statements of intent. The few attempts at making the transition from policy (as embodied in regional treaty or agreement provisions) to action have not been really successful. This is due to the absence of appropriate regional science and technology institutions and the failure to adjust regional economic bodies. The situation, however, is starting to change with a new wave of regionalism characterised by deliberate efforts to design and implement plans for the application of science and technology to development.

The evolution of regionalism in Africa

Regionalism[1]—a process of opening up and integration of national socio-economic and political systems—is receiving renewed interest of many African countries. Regionalism is not a new phenomenon in Africa. It can be traced to the 1960s when the newly independent African states saw opportunities for economies of scale in production and trade from a larger regional economic bloc. By engaging in regionalism, African countries wanted to break three main barriers to development: small size of their

1. For a conceptual discussion or treatment of regionalism, see Weiss (1999).

individual economies; dependence on import of high value or finished goods; and dependence on a small range of low-value primary exports, mainly natural resources.

Regionalism in Africa also emerged out of the pan-African political aspiration for a continental identity and unity as well as the need to build hegemony that would intimidate the former colonial masters. This aspiration was pronounced with the creation of the Organisation of African Unity (OAU) in 1963, transformed into the African Union (AU) in 2001. Following the creation of the OAU a plethora of regional treaties and institutions emerged including the Customs and Economic Union of Central Africa (UDEAC) established in 1964, East African Community (EAC) 1967-1977 and re-established in the early 1990s, Southern African Development Community (SADC)[2], the Economic Community of West African States (ECOWAS) established in 1975, the Common Market for Eastern and Southern Africa (COMESA) in 1995[3], and the Arab Maghreb Union (AMU) in 1989.

The UN Economic Commission for Africa (ECA), established in April 1958, was instrumental in the establishment of the regional economic groupings of Africa. The main objectives of the regional groups were the eventual elimination of all tariffs and barriers between members, the establishment of a customs union, unified fiscal policy and co-ordinated regional policies in the transport, communication, energy and other infra-structural facilities.

However, in spite of these efforts, regionalism has remained elusive to Africa. A variety of institutional, political and geographical factors have made its attainment difficult. These factors include weak regional institutions, rigidity in leadership's appeal to nationalism, intra-state conflicts and wars, the East-West Divide during the Cold War that pulled African countries to the either of the two ends, and structural barriers to trade and industrialisation.[4]

Previous efforts to promote and use regionalism in Africa have not contributed to the economic transformation of the continent. For intra-African trade to be mutually beneficial in line with economic integration goals, there should be substantial intra-regional trade. If African countries are competitive in their production of similar goods, there will be many opportunities for the substitution of the commodities of one country for another leading to more trade creation than diversion. Technology plays a major role in stimulating and sustaining economic diversity and trade creation, thus underpinning regional integration. Rather than promoting economic integration, regional economic communities have spent the last three decades resolving political and social conflicts in some of its member countries such as Angola, Rwanda, Burundi, Liberia, Sierra Leone, Guinea Bissau and Niger.

Science and technology in regional agreements or treaties

Regionalism is receiving renewed attention of African countries. The number of regional economic and trade agreements has increased in the last decade. The past several years have witnessed a plethora of proposals for new bilateral and multilateral preferential trade arrangements. There is also increasing attention to bilateral and

2. Formerly the Southern African Development Coordinating Conference (SADCC) established in 1980.

3. Existed earlier as the Preferential Trade Area (PTA) established in 1981.

4. For a comprehensive review of the performance of regional economic communities see UNECA, (2004).

multilateral science and technology co-operation. Science and technology co-operation is increasingly being written in economic and trade agreements. This trend is taking place at a time of the economic globalisation and the associated rapid advances in technology. Regionalisation is being driven by advances in the technology of transport, information and communications as well as policy and politics. This is evident in the increasing trans-boundary movement of people, finance and products in the region. Intra-regional foreign direct investment flows are also increasing.

Africa has a wide range of regional instruments that articulate the importance of science and technology co-operation. Most regional and sub-regional economic, political and trade treaties make explicit reference to the need to strengthen co-operation in various science and technology fields. Article 13 of the Constitutive Act of the African Union (AU) gives authority to the Executive Committee of the AU to formulate policies that promote science and technology co-operation. The Declaration and Treaty establishing the Southern Africa Development Community (SADC) aims at promoting the development, transfer and mastery of technology. The Treaty Establishing the East African Community (EAC) contains several provisions on science and technology. Similar provisions are found in the Common Market for Eastern and Southern African (COMESA).

Regionalism offers platforms on which scientifically and technologically weak countries articulate their demand for technology, innovation policy and related institutional adjustments. It can provide a good foundation for restoring and enlarging Africa's confidence in its own abilities to generate and manage knowledge for economic change and human development. African countries have signed and ratified a wide range of other multilateral agreements that contain provisions on international scientific and technological co-operation, including the Convention on Biological Diversity (CBD), the United Nations Framework on Climate Change (UNFCC) and the Montreal Protocol. Many are also members of the World Trade Organisation (WTO) where issues of technical co-operation and technology transfer preoccupy most of the negotiations.

International co-operation in science and technology is increasing in intensity and complexity. Recent studies show that co-operation in scientific and technological activities has increased among developed countries and between some developed and developing countries.[5] This is stimulated by a variety of factors, including globalisation and increasing recognition of benefits of such co-operation. Most recent international and regional economic, trade, security and environmental agreements or treaties contain provisions on co-operation in science and technology. In Montreal Protocol (1987), the CBD (1992), the UNFCC (1992), the Trade Related Intellectual Property Rights (TRIPS) agreement of the WTO (1994) and the Cartagena Protocol on Biosafety (2001) the contracting parties are obliged to invest in joint science and technology programmes and engage in co-operation through exchange of expertise and information as well as sharing of research facilities. Also, Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 devotes a lot of attention to the need for international co-operation in science and technology. The Johannesburg Plan of Implementation adopted by governments at the World Summit on Sustainable Development (WSSD) is largely about the role of science and technology in meeting sustainable development goals. Many of its recommendations are about mobilising and directing science and technology to solve problems associated with energy deficiency,

5. See, for example, Advisory Council on Science and Technology (2000); also see C. Wagner *et al*. (2000).

food insecurity, environmental degradation, diseases, water insecurity and many other sustainable development challenges.

There is increasing recognition and articulation of the role of co-operation in fostering the application of science and technology for sustainable development. Scientific and technological development is a learning process that is largely achieved by countries through co-operative or collaborative efforts of sharing experiences, information, infrastructure and human or financial resources. The ability of countries and firms to innovate is largely determined by strategic alliances forged both within industry and across sectors. Furthermore, for industrial firms to become successful in generating innovation, they often have to create partnership with public R&D institutions. This is clearly manifest in such fields as biotechnology.

Co-operation in science and technology can take various forms, including joint science projects, sharing of information, conferences, building and sharing joint laboratories, setting common standards for R&D, and exchange of expertise. Its advantages for developing countries, particularly those of Africa include:

- Access to new knowledge, foreign skills and training opportunities.
- Access to large and often expensive research facilities.
- Avoiding the costs of duplication of research.
- Enrichment of political and social relations between countries.
- Opportunities to establish multidisciplinary research activities and teams.
- Favourable basis for international funding.
- Building or strengthening domestic R&D institutions.

In addition to multilateral instruments, many countries have exchanged a number of bilateral science and technology co-operation agreements including Egypt, South Africa, Nigeria and Kenya. South Africa alone has entered into bilateral co-operation agreements with at least seven African countries, the European Union, Poland, the United States, France, Germany, United Kingdom, Belgium, Hungary, Italy, Norway, India and several other countries. To implement its agreement with the EU, South Africa established a special fund to enhance existing co-operation in the fields of biotechnology, new materials, information and communication technology, environmental management, rural development, and urban renewal.

Most African countries recognise that international co-operation in science and technology does matter. However, there is little evidence that many have instituted specific programmes and institutional arrangements to implement the provisions of the agreements. Some of the reasons for this are:

- Inadequate financial resources.
- Lack of explicit linkages between science and technology policies and foreign policies.
- Weak capacity to effectively negotiate and monitor implementation of co-operation agreements.
- Weak national science and technology systems.

For African countries to achieve high levels of scientific and technological development to enhance economic growth and environmental sustainability, reduce poverty and improve health, they need to place increased emphasis on pursuing science and technology in regional and international contexts. National approaches isolated from regional and international programmes will not provide opportunities to benefit from the globalisation of science and innovation. Increased regional co-operation can facilitate access to scientific and technological advances that are made in other regions of the world. A large portion of all scientific articles and patents are generated outside Africa. Most African countries do not have the necessary research facilities in such areas as genomics since these tend to be relatively expensive. International and regional collaboration is necessary in order to enable Africa to access such facilities. For this, Africa needs world-class researchers who collaborate with the best scientists around the world. The challenge is for the continent to invest in creating a cadre of scientists that will be able to peer with developed country scientists on specific international projects.

From policy intentions to practice: illustrative cases

Agricultural research and technology development

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is a non-political organisation of the National Agricultural Research Institutes (NARIs) of ten countries: Burundi, D.R. Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It aims at increasing the efficiency of agricultural research in the region so as to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture. This regional association was built on positive experiences of regional collaboration in achieving economies of scale and facilitating technology spillovers across national boundaries.

ASARECA was established, following the approval of the "Framework for Action for Agricultural Research in Eastern and Central Africa". This had three broad objectives: to improve the relevance, quality and cost-effectiveness of agricultural research; to establish and support regional mechanisms to reinforce and improve research collaboration among the National Agricultural Research Systems; and to improve the delivery of new appropriate information and technology.

ASARECA carries out its activities through regional research networks, programmes and projects. Twelve of these are currently operational with seven due to begin soon. However, before ASARECA came into existence, there was already some collaborative research within the region which was brought under the ambit of ASARECA. These are the research networks on potato and sweet potato, agro-forestry, root crops, and beans. The second-generation networks on banana, post-harvest processing, animal agriculture, maize and wheat, highlands, technology transfer, agricultural policy analysis, and electronic connectivity were established in 1990s.

African laser technology

Initially designed for a few countries, African Laser Technology Centre (ALC) has acquired a continental outlook. The vision of the ALC is to "Boost Africa into the forefront of science and technology." Its mission states: "Enable African nations to collaborate with each other and internationally to play a major role in utilising light to advance science and technology, thereby contributing to the strengthening of their

economies, their global competitiveness, education and welfare of their people. This co-operation will take place in the spirit of NEPAD and an African Union."[6]

The ALC is a virtual centre of excellence for the African continent. It has been designed as an open non-exclusive partnership to stimulate innovation, research and technology development in lasers and their application. The ALC is actively promoting collaboration among laser researchers throughout Africa and between African laser institutions (see Table 3.1) and their international counterparts. One novel aspect of the ALC is its reliance on African governments that are hosting the facilities as the main sources of funding.

Table 3.1. African Laser Technology Centre (ALC) facilities

Facility	City and country	Field of Specialisation
National Laser Centre	Pretoria, South Africa	Manufacturing, Machining, and Materials Processing
University of Cheikh Anta Diop	Dakar, Senegal	Atomic and Molecular Physics and Laser Spectroscopy and Processing
Laser and Fibre Optics Centre	Cape Coast, Ghana	Agricultural and Environmental Science
National Institute of Laser Enhanced Science	Cairo, Egypt	Medical and Biological Applications of Lasers
Tunis el Manar University	Tunis, Tunisia	Plant and Environmental Science and Molecular Spectroscopy
Advanced Technologies Development Centre	Algiers, Algeria	Laser Spectroscopy and Surface Studies

Regionalism for renewed focus on science and technology

Africa entered this millennium with renewed determination to secure sustainable development. After many decades of economic and social marginalisation, political instability and conflicts, the continent and its people are now more than ever determined to eradicate poverty and be fully integrated into the global knowledge economy. Their leaders have set ambitious sustainable development goals embodied in a new framework: the New Partnership for Africa's Development (NEPAD).

The creation and evolution of NEPAD is a clear manifestation of the determination of African leaders to institute measures to increase agricultural production and food security, stem environmental degradation, improve infrastructure and communication, fight disease, end conflicts, and increase industrial production. African leaders have also subscribed to the United Nations Millennium Development Goals (MDGs). Realising NEPAD goals and the MDGs will require science and technology. Indeed science and technology play a central role in meeting human development needs while maintaining the integrity of the natural environment. The gap between poor and rich countries in terms of real income is largely accounted for by differences in the accumulation and utilisation of science and technology. Closing this gap will require deliberate measures to build scientific and technological capabilities in the poor countries.

In the past, African countries have not done much to harness science and technology for their development, due largely to the following factors. *First*, in most countries the links between science enterprises and political institutions are weak. Political organisations have not accorded science and technology much attention in their manifestos and parliamentary activities. Technological change is a complex process that is influenced by many political factors, and to manage this process, countries require the support of high-

6. *www.csir.co.za*

level political institutions. These institutions often determine the nature and levels of resources that go into public research and development activities and the overall governance of science and innovation. There is a need to build strong political constituencies for science and technology development in Africa.

Second, most African countries formulated their science and technology policies in the 1970s and 1980s when priority was placed on organisational aspects rather than programmatic issues. Countries have been preoccupied with the creation of commissions or secretariats to promote science and technology, and have paid little attention to long-term programmatic aspects of science and technology development. These commissions and secretariats never really built the necessary programmes to anticipate and respond to emerging scientific and technological developments.

Third, African countries have devoted considerably low, and in many cases declining, funding to research and development (R&D) reflecting the low priority that countries have given to science and technology. Most of them spend less than 0.5% of their gross domestic product (GDP) on R&D. This is so despite the declaration in the Lagos Plan of Action and in national science and technology policies that each country would allocate at least 1% of its GDP to R&D. In agriculture, R&D funding has declined to the extent that the region's ability to achieve and sustain food security is being impaired.

Fourth, there is declining quality of science and engineering education at all levels in Africa. Student enrolment in science and engineering subjects at primary, secondary and tertiary levels is also falling. These developments undermine the continent's aspiration to build up its numbers of scientists, engineers and technicians.

Fifth, the number of African scientists and technicians leaving the continent for employment abroad is growing. This 'brain drain' is caused by a variety of factors including poor research infrastructure and remuneration packages. While other regions, *e.g.* Asia, have developed and adopted strategies to mobilise and utilise their diasporas, Africa lacks such measures. It needs to design ways to tap and use the enormous scientific and technical talents of Africans abroad for its own scientific and technological development.

Sixth, African countries need to strengthen and/or build institutions dedicated to scientific and technological innovation. In fact, R&D institutions in many countries are getting weaker. Most countries have not organised their institutions in such ways as to efficiently mobilise their scarce financial and human resources. They tend to spread their resources thinly across the institutional terrain. The region has a whole has not been able to grow 'centres of excellence' in such areas as biotechnology, space science and information and communication technologies (ICTs).

Seventh, links between public R&D institutions and industry are generally weak. Research results of public R&D do not often get accessed and used by local industries, particularly small and medium-sized enterprises (SMEs) despite most African industrial policies of putting emphasis on building and strengthening SMEs. Thus, there is mis-match between R&D activities and national industrial development goals and strategies

Sources of optimism and action

African policy-makers and politicians recognise that the barriers to the continent's scientific and technological development need to be removed if NEPAD goals are to be realised. They have embarked on a collective effort to establish foundations for science and technology at the first NEPAD ministerial conference on science and technology in November 2003 through specific commitments and actions.

First, the African Ministerial Council for Science and Technology was established. This high-level forum has started to critically examine and dialogue on emerging science and technology questions and their implications for Africa's sustainable development. It provides policy and political guidance on the development and application of science and technology in Africa.

The second major set of actions is the creation and strengthening of networks of centres of excellence in science and innovation. In addition to the ALC, African countries have launched the NEPAD Biosciences Network. This is a new initiative to support African countries to develop and apply bioscience research expertise to produce technologies that help poor farmers to improve agricultural productivity. NEPAD has been instrumental in mobilising resources to upgrade and network world-class laboratories in East and Central Africa. The initiative, Biosciences East and Central Africa (BECA), was launched because of the need in biosciences research for a critical mass of infrastructure, equipment, services, and support technicians to provide an environment conducive to high quality research. There was a lack of such facilities in the sub-region and since it was not realistic to develop individual national institutions with such capacities; thus leading to the concept of a strong shared hub.

In subsequent deliberations spearheaded by NEPAD, it was recognised that for the hub to produce research outputs with impact on development, laboratories with complementary capacities to transform research results into concrete products was required. The network concept was thus seen as composed of a hub, nodes and a broader set of members. The nodes would provide certain services to other members and receive certain critical investments to make them effective in their specific service. BECA is an investment to enable the region to do strategic research that addresses poverty. The laboratories are being dedicated to research and innovation in such areas as genomics and proteomics.

In addition to the above efforts, African countries have also committed themselves to improve science, technology and innovation policies. Specific actions include the establishment an advisory panel on biotechnology, working group to design common African indicators or benchmarks to assess the status of science and technology, and a task force to promote African women's engagement or participation in science and engineering. The countries have also committed themselves to increase their national annual public expenditure on R&D to at least 1% of their Gross Domestic Product (GDP). These efforts will be bolstered with the proposed establishment of a continental financial mechanism for regional research and innovation programmes. There are now concerted efforts to promote science and technology in Africa. Its leadership has pronounced commitment to ensure that science and technology are harnessed and applied to promote human development and the continent's integration into the global economy. What is need are measures to sustain and enlarge these developments.

Strengthening science and technology focus in regionalism

One of the reasons that the African aspirations to use regionalism for technology development have not materialised is the lack of institutionalisation of science and technology programmes into Regional Economic Communities (RECs). Such bodies as SADC, ECOWAS and EAC do not have offices or departments dedicated to science and technology matters. To enable them to build capacity for science and technology, NEPAD has facilitated the organisation of regional workshops that have identified concrete projects and programmes. A key outcome of these workshops is the establishment of science desks in each of the RECs in Africa. NEPAD plans to mobilise and provide resources for the establishment and sustenance of the Science Desks.

Another important factor is regional leadership. Technology is crucial to increase the region's economic productivity and political stability. African leaders need to put more emphasis on the role of technology in national and regional development. Establishing a culture committed to technological innovation and development requires political leadership. Examples of Asian industrialisation show that political leaders are crucial to establish and sustain a national vision of a technology-led development strategy.[7] NEPAD is starting to play a major role of building national political leadership for technological development in Africa. However, to effectively play that role, it will require support in terms of policy research and analysis. The United Nations agencies and international universities as well as regional centres such as the African Technology Policy Studies Network (ATPS) and the African Centre for Technology Studies (ACTS) can support NEPAD in this.

7. See Anyang' Nyongo and Coughlin (1991).

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