

Chapter 7

DEVELOPING KNOWLEDGE INFRASTRUCTURE AND NETWORKS FOR SUSTAINABLE DEVELOPMENT

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Introduction

Science and technology have undoubtedly become indispensable inputs into a country's economic, social and environmental development and are acknowledged as among the chief drivers of the fast evolving globalisation process. Advances and innovation in science, technology and knowledge gained from these have had profound impacts on the society as a whole and on individual members of the society. Knowledge is a critical input for global change, especially at the national level and has certainly played a crucial role in a country's economic development, particularly so in developed countries.

Nevertheless, in most African countries there is an acute lack of the appreciation of the importance of knowledge to national development. In any case, the countries have limited access to scientific information and knowledge and limited capacity to analyse, process and disseminate information and knowledge. In effect, existing knowledge infrastructure networks in Africa are simply inadequate for the tasks before them. Selected knowledge infrastructures are discussed and suggestions made on how to develop or improve them to enable African countries to better utilise knowledge for sustainable development.

Knowledge infrastructures and networks

I shall take a broad view of knowledge infrastructures or networks and take them to include the following: *i*) schools, colleges, universities and research institutions; *ii*) computer and communications technologies; *iii*) journals and books; *iv*) the media – print, radio and television; and *v*) institutions for data collection and analysis and for information processing and dissemination.

Current situation in Africa

The current situation in Africa with regard to knowledge and information availability and flows is characterised by shortcomings and inherent limitations such as: *i*) limited access to scientific information and knowledge; *ii*) poor knowledge infrastructure and networks; *iii*) limited use of knowledge to help solve emerging problems and to achieve national sustainable development goals; *iv*) inadequate reservoir of expertise in science

and technology and in knowledge-based development and management; v) limited capacity to analyse, process and disseminate information and knowledge, including the preparation of studies and reports; vi) inadequate awareness and appreciation of the importance of scientific knowledge; vii) lack of commitment; and viii) lack of knowledge policy.

The implications of the current dismal situation in Africa are stark. Developed countries are utilising the benefits of scientific and technological knowledge for their economic and social development. At the same time many developing countries are beginning to show increasing interest in developing and putting in place knowledge-based strategies for their development. Such, however, is not the case for most African countries: their economies are certainly not knowledge driven.

Developing knowledge infrastructures and networks

A number of required actions are discussed below as are other issues requiring attention.

Schools, colleges and universities and research institutions

Schools, colleges and universities and research institutions constitute a crucial knowledge infrastructure and network that must be developed and strengthened; there is also a need to develop in these institutions leadership in the promotion of knowledge management and to improve the knowledge base in the education system. The facilities should be upgraded and modernised so that the students and researchers can keep abreast of the latest developments in science and technology as well as in research and development in these areas.

Often, science is not taught well in schools; and laboratory assignments do not teach critical thinking; neither do they firm up the material taught in class. Many students frequently believe that science and technology are too difficult and are nothing but a database of facts; and that scientists' work is dull, uninteresting, monotonous and slow. Frequently, many students do not see the potential benefits of science or where a particular science or technology fits into the bigger picture. Of critical importance is the need to generate increased interest by students in science and technology so that they pursue the subjects in schools, colleges and universities and choose carriers in these areas. Students should be encouraged at an early stage to pursue studies and training in science and engineering; and to connect what they are studying to the real world. Once they opt for specific areas of study, the approach for instruction should be such as to stimulate and maintain their interest in the subjects.

Teachers are crucial link to achieving this objective. Yet many teachers feel that they are inadequately prepared to teach science. Teachers should be well trained in science and technology subjects and knowledge transfer; programmes for retraining teachers should be developed with the aim of ensuring genuine understanding of the science and technology subject matters; training material should be clearly understandable, reflecting real situations that the teachers are familiar with. At the same time, teachers should be encouraged to be innovative, and thereby to make acquisition of scientific and technical knowledge stimulating.

Journals and books

Learned *journals* have had and will continue to have a critical role to play in the flow of science and technology knowledge and as an invaluable vehicle for generating awareness of science and technology issues and problems. In general, the issue is not the paucity of journals in specific areas of science and technology but rather the message and content in many of them. In most African countries the issue of access is, however, not a trivial one. This is exemplified by the near or complete absence of these journals in the libraries even in the national universities. Many of these institutions also lack or have inadequate electronic access to the journals. Help in this area would be required in the form of additional resources, not only to improve access to journals and books, but also to train library personnel in the latest advances in library science.

Many *books* have been written on a staggering range of topics in science and technology, by the specialists themselves as well as by others knowledgeable on the subjects. Some of these books are aimed at a wide audience, the general reader, the experienced scientist in his chosen field who may not have the time to follow many of the developments in other areas. As is the case with journals, access to books in African countries is limited thus constraining the flow of knowledge to those who need it and stand to benefit the most from it. Here again, there is an urgent need for action to ensure the flow of knowledge through books.

Media (Print press, radio and television)

Many *newspapers* have over the years created sections on science and technology to provide information on the latest developments in these fields in a readable and stimulating manner. The information is widely disseminated and constitutes a valuable means of popularising science and technology and transfer of knowledge. This development has caught on in a number of newspapers in Africa, where local and international reporters have made praiseworthy contributions. The effort should be expanded: the quality of reportage in existing sections should be improved and more of such coverage provided on a regular basis.

Radio reaches far and wide and has spread to almost every corner of the countries in Africa. When used innovatively it can be an effective medium and tool in diffusing information and knowledge on a wide range of topics on science and technology. Nevertheless, not all schools are covered and more effort is required to reach that goal.

In the developed countries, *television* is the major medium for scientific and technological information and knowledge transfer. Many countries have good programmes on science and technology; some indeed have channels that are devoted to specific topics on science and technology; a few of these pieces are gradually finding their way to television programmes in African countries. But in Africa television is still a luxury; only a small fraction of inhabitants of large urban areas have access to it; those in many other areas are without it. In order for them to make the desired impact of generating public awareness on a wide scale, the number and frequency of television programmes in science and technology must be increased manifold.

Information and communications technologies

Telephones have for many years been a good medium of communication but whose infrastructure is still very poor in Africa. The availability of land lines has a direct impact on the development of the Internet: high availability portends good internet service and low availability leads to poor internet service. The landlines are inadequate for most purposes and have stagnated as a result of poor policy and lack of direction. All these shortcomings must be addressed to improve the quality of knowledge transfer.

Cell phones have transformed telecommunications beyond recognition. There is, however, need to increase connectivity between the different operators within a country; in a number of cases the charges for talking between the two operators is rendered unnecessarily expensive. The same is the case for connection between a cell phone provider and land lines.

Internet infrastructure in many African countries is meagre or absent; consequently, it takes a long time to send messages. Internet access is still unreliable and connectivity pitiable; in particular, access to international communication networks is poor and factor costs high. In many instances the problem is the unreliability or lack of electricity, inadequate number of skilled personnel to maintain the computers, lack of people with expertise to teach the use of computers. There is also the important issue of affordability. All these issues must be addressed in a concerted manner with the overall aim of strengthening or building all the relevant infrastructures to enhance knowledge transfer.

Other issues requiring attention

Enhanced awareness of science and technology

Ignorance of the importance of scientific and technology knowledge by policy and decision makers and the public at large in Africa is widespread. Moreover, the public at large is unconcerned about science and technology. It is of paramount importance that all are concerned. Enhanced awareness increases interest in the subject and leads to improved public support for government policies on, and activities in, these subjects.

Capacity development and institutional strengthening

The lack of or inadequate capacity to access, analyse, process and disseminate and put knowledge to productive use is a major obstacle to the successful development and application of science and technology and for facilitating knowledge and information flows in Africa. The building of capacity of African institutions at the national, sub-regional and regional levels in order to facilitate the implementation of desirable policies and realisation of sustainable development goals should be undertaken as matter of priority. Equally important is the development of human resources in the continent to ensure scientific and technological leadership.

Allocation of resources for scientific and technical research

This is closely related to the development and implementation of policies, discussed below. There is a strong need for governments to acquire and allocate adequate funds for education, research and development and related activities. Governments should institute and put in place required education reforms to improve science education, in primary and secondary schools, universities and other institutions of higher learning. Furthermore,

governments should design and compile science and technology curricula and incorporate these into the syllabuses. Multinational corporations and national enterprises have the potential to make major contributions in this endeavour and their active participation should always be encouraged.

Once access to, and flow of, information and knowledge are assured, it is essential to properly manage them to ensure effective use. Studies should be undertaken to identify best knowledge management practices, and under what conditions and circumstances these may be modified to meet the conditions and requirements of different countries. An important dimension of knowledge management involves keeping abreast of the latest development in information and knowledge and constant updating of these. There are also pressing issues of the organisation and management of knowledge transfer between universities, research organisations, on the one hand and industries, on the other. This should be part of the general strategy for facilitating effective diffusion of scientific knowledge infrastructure.

International co-operation

International and multilateral organisations, as well as other bilateral and non-governmental organisations have, over the years, provided resources for capacity building and institutional strengthening and building, including training. They should continue with and expand their activities in these areas.

Co-operation at the regional and international levels should be further strengthened in order to support national efforts by promoting capacity-building and technology transfer investments to Africa. There are also many opportunities for private-public sector co-operation.

Funding and investment

There is a pressing need for massive investments in knowledge infrastructure and networks, including, in particular, those for science and technology as part of a policy framework and strategy. Of critical importance in this respect is the paramount need to create an environment that encourages both domestic and foreign investment. Foreign national organisations, and as noted, international as well as multinational ones have played a worthy role, but their contribution would be enhanced when the countries come up with good proposals.

Improving job opportunities for science and engineering graduates

It is sad to see many science and engineering graduates without jobs in their own countries partly because of the lack of appreciation of their training and worth. Consequently, invaluable resources are wasted and their potential unrealised. This bad experience also generates additional negative images about choosing science or engineering as a career. Strategies must thus be put in place for stimulating the economy of each country thereby creating job opportunities for the graduates so that they may in turn contribute to the country's well being. There should also be transparency in the hiring of qualified graduates.

Development and implementation of policy

At the core of the efforts to strengthen science and technology and facilitate information and knowledge flows is the presence of an effective policy framework. There is a compelling need for each country to formulate such policies which should have clear objectives and goals as part of overall national development strategy. In many cases the policy itself might be very good, but the bottleneck is usually at the implementation stage. The often quoted problems during implementation are inadequate institutions, human and financial resources; and lack of systematic monitoring and evaluation to keep things on track and to ensure that the stated goals and objectives are met.

Governments have a decisive role to play in the formulation and effective implementation of policies. Decision-makers in the private sector, too, have significant responsibilities. Developing and effectively implementing policies demand serious commitment at the political and decision making levels. A decisive ingredient in all this is the political will to take tough decisions for the good of the country. With a better understanding of the nature and extent of scientific and technological developments, of the issues that need to be addressed, of the constraints and of the challenges, a stage would be set for formulating and implementing the right and adequate policies appropriate to the situation at hand.

Conclusion

Science and technology play a key role in achieving sustainable development, and knowledge is a vital input to this end. But in Africa there is an acute lack of the appreciation of the importance of knowledge to national development; besides, existing knowledge infrastructures networks in the continent are largely inadequate.

Nevertheless, with the suggested development, strengthening and general improvement of the knowledge infrastructures and networks, African countries would be better placed to put knowledge to use in their economic and social development. But first and foremost, each country must establish a working and effective policy framework for further development and application the knowledge; such a policy must embrace clear objectives and goals as part of overall national development strategy.

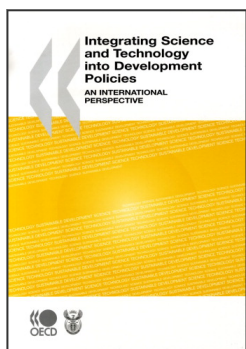
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