



Distribution: GENERAL

E/ECA/CODI/4/50

26 April 2005

**UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL**

Original: English

ECONOMIC COMMISSION FOR AFRICA

**National Knowledge Systems and the
Status of Information Access Policies in Africa***

* Paper originally presented at the Fourth Meeting of the Committee on Development Information (CODI IV), Addis Ababa, Ethiopia, 23 – 28 April 2005

INTRODUCTION

Knowledge is increasingly perceived as the principal driver of economic growth and development in both developed and developing countries. “Africa’s most urgent need is knowledge for production and development,” was the central theme of the conclusions reached by a group of economists and development experts, after deliberating on strategies for Africa’s development at the dawn of the millennium (ECA, 2000). Consistent with the consensus on knowledge, the United Nations and other major international development agencies have initiated efforts to develop indicative frameworks for national knowledge strategies to inform country-level knowledge policy formulation and implementation. (World Bank, 1999; ECA, 2001; UNDESA, 2003). The main objective of this report is to contribute to the deepening and extension of these efforts.

From Data to Development by the Means of Knowledge

2. To illustrate the evolving meanings and relationships of the various concepts related to knowledge production and use, the following definitions are offered, starting from the simple to the complex concepts.

3. *Data and information*: Data and information are often used interchangeably in economics and information sciences, but operationally they differ in important ways. *Data* are neutral values or facts; while *Information* is an aggregation of data about a social or natural entity (or entities) in a way that can convey meaning, and stimulate human understanding and action. This property makes information useful for decision-making.

4. *Knowledge*: Knowledge is the capacity to recognize patterns and actionable values in pieces of information or events, and the capacity to use the information productively in various and appropriate ways, including the ability to innovate - that is, to restructure things and processes so as to produce useful effects, products and services.

5. *Innovation*: Innovation has been defined as the creative process through which additional economic value is extracted from a stock of knowledge (OECD, 1995). Innovation is not just a matter of technology, but also of the management change in ways that work in economic terms, and at the same time meet other human needs and justified aspirations. (Portnoff, 2003).

6. The “Data” to “Development” continuum emerging in the above analysis may be represented as follows:

Data \leftrightarrow Information \leftrightarrow Knowledge \leftrightarrow Innovation \leftrightarrow Value Creation \leftrightarrow Development outcomes

7. While the sequence looks linear, the natural progression from data to development is iterative, and involves complex processes, especially at the macro-social and national levels - the important events being the transformation of information into knowledge, and the use of knowledge to generate value-adding innovation that results in positive development outcomes.

WHAT CONSTITUTES A NATIONAL KNOWLEDGE SYSTEM?

8. A national knowledge system is made up of knowledge functions, institutions, relationships, enabling policies and practices, and socio-cultural dynamics (“FIRES”) - a dynamic interconnection of knowledge-related components - which combine to manifest the characteristics of the knowledge-based economy and culture at the national level. The challenge of a knowledge-enabled development is therefore to ignite and harness the “FIRES” of the knowledge system to propel the innovativeness of the population to create and exchange value - locally and globally - for their individual and collective welfare and wealth. The elements of the “FIRES” functions mentioned above are enumerated on the table below:

The “FIRES” framework of a national knowledge system

Dimensions of a knowledge System	Elements of a national knowledge system
Functions	Library and information services, adult literacy, basic education and vocational training; higher education and basic research, including social research, science and technology; industrial research and development; communication of information; information and communication technology; indigenous knowledge; intellectual property rights (IPR); commercialization of ideas and innovation; and foreign direct investment
Institutions	Schools and colleges; universities; firms; national academies; libraries and information centres; research centres; government ministries; regulatory agencies; funding agencies; and international organizations
Relationships	Knowledge networks and knowledge sharing; production networks and partnerships; public-private-people partnerships; and interaction among institutions and governments
Enabling policies and practices	ICT Infrastructure and policies; information access policies; science parks and industrial clusters; and economic and institutional policies
Socio-cultural and political dynamics	Social capital; cultural values; civil society; good and open governance of institutions; and positive political dynamism

What is a knowledge-based economy?

9. The recognition of knowledge as a key economic resource is not entirely new. It started in a significant way more than four decades ago, with the publication of Fritz Machlup’s 1962 work: *The production and distribution of knowledge in the United States*. This work characterized the knowledge industry, and determined that a developed country’s economy is predominantly knowledge-based (Machlup, 1962). Though, knowledge had always made contributions to economic effectiveness, for example, the traditional factors of production: land, labour and capital, always required the effective application of knowledge of the right way to grow crops, use tools, and raise funds – but the new place of knowledge in economic activity has markedly increased in

importance. It is now at the heart of value and wealth creation. Knowledge is the fuel of development. When properly put to work, it efficiently powers human activity to produce innovative and transformative choices and actions.

10. Poor countries and poor people are left behind by rich ones not only because they have less capital but because they have less knowledge (World Bank, 1999). There are two major forms of knowledge:

- a) Knowledge about techniques, usually called know-how or technical knowledge, enhances the capacity to act correctly, while a lack of, or inadequate possession of, results in *knowledge gaps*.
- b) Knowledge about “how things are and behave,” or phenomenological knowledge, relates to the attributes of natural and social entities, and is information related. Hence the richer the information possessed about an entity or a condition, the more knowledge about it one would have, while its insufficiency results in *information problems* (World Bank, 1999). For most development related cases, Africa suffers from inadequacy of both types of knowledge.

11. It is knowledge embodied in goods and services through innovation that make the difference between the most competitive and the least. This development has led to the new phenomenon referred to as the knowledge economy. The knowledge economy is one in which knowledge acts as the main engine of growth. Research has identified four preconditions of the knowledge economy, as:

- a) An economic and institutional regime, which provides incentives for the efficient use of existing and new knowledge, and the flourishing of entrepreneurship.
- b) An educated and skilled population, which creates, shares and uses knowledge well.
- c) A dynamic information infrastructure to facilitate the effective communication, dissemination, and processing of information.
- d) An efficient innovation system of firms, research centers, universities, consultants, and other organizations to tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new technology.

12. Strengthening the above four pillars of the economy, will lead to an increase in the quantity and quality of the pool of knowledge available to it. This will consequently increase productivity, and thus economic growth and development (Chen and Dahlman, 2004).

FUNCTIONAL ELEMENTS OF A KNOWLEDGE SYSTEM

13. The functional elements are the substantive elements of a knowledge system, and may be broadly referred to as national knowledge assets - “intangible assets” of a country that have significant implications for future national growth, and the increase in potential future value of the country to various stakeholders. Their contributions and management within a national knowledge strategy are outlined below.

Libraries and Information Services in Economic Growth Equation

14. A key element of a developing country’s innovation strategy is to find the best ways to tap into the growing global knowledge base. One way recommended by neo-classical economists is to import goods, since goods embody technological know-how (Grossman and Helpman, 1991).

Based on this line of argument it has been demonstrated mathematically that increases in imports should lead to increases in *total factor productivity* (TFP) - defined as output growth not accounted for by the growth in inputs (Hornstein and Krusell, 1996). TFP is significantly higher in developed economies than in developing ones – a demonstration of higher contribution of intellectual inputs to economic value creation.

15. One may further argue that if goods embody technological know-how, then information on how the goods are produced is the real entity for which goods are proxies. Hence, a country may pursue increases in total factor productivity, hence economic growth, through the importation of technological and production information instead of their proxies (goods). This would place information in its rightful place in the economic growth equation.

16. And, as information can be shared widely and converted to knowledge on how to make the same goods and similar goods, the importation of information should contribute significantly more to economic growth and development, than importation of goods. Further, as information can multiply exponentially in a population, if its use as a resource, achieves progress in any field, that progress is bound to spread in exponential proportions (Azubuike, 1985). This is consistent with results of research which used academic scientific papers as proxy for the stock of knowledge, and found that technical knowledge contributed significantly to the total factor productivity growth of the U.S. manufacturing industries for the period 1953-1980, and hence demonstrated that published research is the conventional way of acquiring fundamental stock of knowledge, and a route to future economic growth (Adams, 1990).

17. Libraries and information centres are the main repositories of academic and technical information resources – hence the core source of fundamental stock of knowledge. An effective system of national library and information services for economic, scientific and technological development is therefore a most important element of a national knowledge system. Library and information services – including professional knowledge services and financial information services - acquire, process, interpret, and ensure the availability of information and knowledge sources from within and outside their countries of location.

18. Generally libraries and information services:

- a) harness information and knowledge by transforming ideas, data and other primary intellectual outputs through professional processing, storage and dissemination;
- b) contribute to the effectiveness of the education process and continuing development of a country's human capital by providing resources for the deepening of learning and knowledge;
- c) provide the catalyst for economic development at the local and national levels by providing access to new ideas, knowledge and information resources to the fullest extent, especially with regard to electronic resources;
- d) bring about improved productivity and good decision-making of organizations by providing the right information to information workers; and
- e) bridge the digital divide along with the economic gap by providing access to ICT to disadvantaged populations such as the poor, the elderly, the physically disabled, and the unemployed, as well as small businesses, who cannot afford it.

19. By serving the above functions libraries make important contributions to the process of transforming our society into an Information Society based on a strong foundation of knowledge

which is universal, objective, timely and drawing from a variety of sources. In the Information Society, information services are needed at all levels and by every sector of the economy. Lack of information impairs the capacity of a community to produce minimum levels of goods and services for its basic needs. Hence for small or under-resourced communities, the use of community information resource centres to provide information and knowledge services as illustrated below is a logical alternative.

Community Information Resource Centre (CIRC) may serve well at the grassroots

Information for development goes beyond traditional libraries. Where resources are inadequate to provide for the broad range of information services, and private initiatives to fill the gaps are limited, the establishment of a community information resource centre – a multipurpose information and knowledge centre for the local community – is recommended. A CIRC can provide library services; local knowledge repository; audiovisual services; meeting arena; telecentre services; and specialized information services, for example, on HIV/AIDS, youth employment, and poverty alleviation.

As a tool for development, a CIRC can be an innovative post-literacy means of focusing on daily problems of the local community, and represent a form of social movement. Developed in conjunction with the people, and sustained by them, a CIRC reflects real information needs of its clientele, in form and content. Access to services at CIRC is more of participation in exploration of ideas and information, as clients tend to come in contact with information materials in groups, hence share their questions and understanding with one another. In other words, the development of knowledge becomes a process. In this case, the definition of knowledge as a process of questioning and reflection is different from knowledge as a finished product ready to be transferred, or used.

CIRCs of varying degrees of comprehensiveness have been established in Mozambique, Tanzania and Ethiopia with the support of CODE, a Canadian NGO and Oxfam's Horn of Africa Programme. (Adapted from Mchombu, 2004)

OTHER FUNCTIONAL ELEMENTS OF A KNOWLEDGE SYSTEM

Adult Literacy, Basic Education and Vocational Training

20. As Fritz Machlup put it, “the work performance by schools and other institutions of (basic) education is essentially the reproduction of knowledge, its production in new minds - that is to say, its transmission from “knowledge-haves” to “knowledge-have-nots” (Machlup, 1962). A literate, well-educated, and skilled population is essential for the efficient creation, acquisition, dissemination and utilization of relevant knowledge. In the new knowledge environment, new entrepreneurial opportunities and jobs being created tend to require a higher level of basic skills than was the case before. Therefore, schools and employers in every community should work together to ensure coherence between knowledge acquired at school and knowledge required for gainful employment and innovation (ECC, 1992). The experience of Germany which has less population with higher education than United Kingdom, but better technological performance, shows that high quality and widespread general and vocational education enables a country to

achieve more robust technical change. This is because of the preponderance of the capacity to absorb new knowledge for innovation, and for adaptation to changing technological environment.

Higher Education and Basic Research: Including Science, Technology, and Social Research

21. The main economic value of knowledge from higher education and basic research is in the capacity to generate fundamental knowledge; solve complex technical and development problems involving tacit research skills, techniques, and instrumentation; in the ability to tap into national and international research networks; and the know-how to conduct and use social or scientific research. [Bush, 1945, Metcalfe, 1995, Mowery, 1983). Science and technology knowledge is inextricably bound up with the society's economic and political fabric (Berlinguet, 1981), and the way it is integrated in the overall policies of a given country can lead to development failure or success. Empirical evidence from detailed examination of time trends in scientific publication, patenting, and output in chemical industry show that industrial innovation and growth tend to be "knowledge-led." Hence the task of a policy maker is to understand the nature and the heterogeneity of the various forms of scientific and technological knowledge to enable proper policy framework for their harnessing and use in innovation for economic and human development (Faulkner, 1994; Mayr, 1982).

Industrial Research and Development (R&D), Including in-house Research

22. The dyad - research and development – refers more typically to industrial research and product development for the markets. As an investment category, the return is extremely high. In the U.S., the rate of return of research on hybrid corn was estimated to have been 700 percent per annum. R&D is the dominant internal source of knowledge for innovation in industry. This can be explained by the need to appropriate knowledge product at a direct cost, by the cumulative nature of innovation, and by the importance of specific knowledge. Significantly, though, industrial R&D activities demand a synthesis of tacit and formal knowledge from internal and external sources (Faulkner, 1994).

Communication of Information

23. The communications industries carry out the vital function of distribution of knowledge. This function is carried out through books and pamphlets, scientific, trade and news periodicals and newspapers, the stage and the cinema, radio and television, telephone and telegraph, the Internet and the World Wide Web, and postal and courier services. The functions carried out by communication industries, include the conveying of knowledge from person to person - or to masses of persons, as is the case of the mass media. Communications ensure that knowledge is shared, distributed and propagated. It is the key to the effectiveness of all other knowledge functions. Education, R&D, science and technology, etc, all rely on some aspect of communications. A national knowledge system would be as weak or strong as the communications industry that supports it.

Information and Communication Technology

24. Information and communication technology (ICT) is the circulation system of a national knowledge system, without it, the knowledge economy and Information Society would be immobilized. ICT producing sectors have experienced major technological advancements, which have showed up as large gains in total factor productivity at the level of the economy. One of the most obvious benefits associated with ICT usage is the increased flow of information and knowledge. ICT allows information to be transmitted relatively inexpensively and efficiently. Its usage also tends to reduce uncertainty and transactions costs - leading to a higher level of output and productivity (Chen and Dahlman, 2004). Apart from increasing the supply of information and knowledge, ICT is able to overcome geographic boundaries, and hence enable remote populations to participate in the global knowledge economy. An important step in the development of a knowledge system is to ensure that all knowledge institutions, and persons involved in knowledge work have access to ICT in their various forms.

Indigenous, Local or Traditional Knowledge

25. Indigenous knowledge is the "the unique, traditional, local knowledge existing within, and developed around the specific conditions of men and women indigenous to a particular geographic area" (Grenier 1998). The basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities, it contrasts with the mainstream knowledge system generated by universities, research institutions and private firms. Indigenous knowledge is an important part of a national knowledge system and should be protected and further developed through awareness-raising, international property rights arrangements, and validation procedures. Indigenous knowledge may contribute to improved development strategies in several ways such as by helping identify cost-effective and sustainable mechanisms for poverty alleviation that are locally manageable and meaningful; by a better understanding of the complexities of sustainable development in its ecological and social diversity; and by helping to identify innovative pathways to sustainable human development that enhance local communities and their environments. An example of good practice is the farmer-scientist knowledge sharing in plant breeding research adopted by the CIMMYT (International Maize and Wheat Research Centre in Mexico) aimed at improving the effectiveness of knowledge input and use in breeding crops for traditional ecosystems (Cash *et al*, 2003).

Intellectual Property Rights

26. Protection of intellectual property rights (patents, copyrights, trademarks, brands and trade secrets) is an important function of a national knowledge system. If unprotected, the information generated by research and development, cannot be effectively appropriated by a single firm. This makes the production of new knowledge for products economically unattractive for profit-seeking firms, a situation that discourages firms from investing in knowledge development at a socially optimal level, and resulting in market failure (Arrow, 1962). Intellectual property regimes are weak in most African countries, and this hampers dissemination of new knowledge. Strong opinion has been expressed to the effect that Africa missed industrial revolution because of the absence of intellectual property protection across the continent. Using African medicine as an example, it has been illustrated that traditional medical scientists resorts to secrecy as a means of intellectual property protection and appropriation, hence perpetuating centuries-old market failure, generational knowledge gaps, and progressive knowledge losses and erosion (Nwokeabia, 2001). IPR is therefore an important area needing concerted policy attention. In response to global

trade's reliance on innovative ideas, the World Intellectual Property Organization (WIPO) has expanded intellectual property rights with the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) which became enforceable in all countries in 2005.

Commercialization of Practical Knowledge and Innovation

27. Related to intellectual property rights is the need for opportunity to commercialize practical knowledge and innovation. The possibility that new technical knowledge can be commercialized is a prerequisite for growth of knowledge. Commercialization has a snowball effect on knowledge development and economic growth, because incidents of appropriation become stimuli for further innovation and knowledge diffusion. Therefore appropriation of the gains of knowledge results in social benefits, and hence constitutes an important function of a national knowledge system. In advanced economies private venture capitalists have strong incentives to fund commercialization of new ideas and innovation, unlike in most African countries where capital venturing in risky innovative projects is almost nonexistent.

Foreign Direct Investment

28. Currently, the majority of technical knowledge is produced in developed countries - more than 70 percent of patenting and production of scientific and technical papers are credited to researchers in industrialized countries, therefore, domestic technological innovation cannot be the sole source of technical knowledge. One factor that affects the extent to which an economy is able to tap into the global knowledge base is the economy's openness to international trade and foreign direct investment (FDI). Foreign direct investment brings in new know-how and experience, hence is a major source of knowledge transfer in both technical and managerial spheres. Knowledge spillovers from FDI from multinationals can be significant enough to be a major element of a national knowledge system.

A KNOWLEDGE-LED APPROACH TO THE ACHIEVEMENT OF THE MILLENNIUM DEVELOPMENT GOALS

29. To implement the current global development strategy enunciated in the Millennium Development Goals (UNDP, 2000), Africa must make knowledge its core instrument for progress, as only knowledge-based development programmes can reach the root causes of underdevelopment. For example:

- a) To eradicate extreme poverty and hunger: we must provide more opportunities for people to use knowledge and information to increase agricultural productivity, and gain the capacity to avoid or come out of poverty.
- b) To achieve universal primary education: the knowledge of the value of education must permeate the fabrics of the entire society.
- c) To promote gender equality and empower women: we must have the knowledge and appreciation of the gains of universal equity.
- d) To reduce child mortality: we need the knowledge of simple hygiene, and where and how to obtain health information and services.
- e) To improve maternal health: we must empower women with knowledge about their health, their human rights, and what options they have to improve their wellbeing.

- f) To combat HIV/AIDS, malaria and other diseases: we will have to generate and share greater amount of knowledge about the causes and epidemiology of the diseases, and how to prevent their development and spread.
- g) To ensure environmental sustainability - including access to safe drinking water, and improved human habitat: we will have to understand the biosphere and how our quality of life depends on our interaction with nature.
- h) To develop a global partnership for development: leaders and the led, will have to understand how to operate in the open trading and financial systems, practice and demand good governance, act to ensure decent work for the youth, know how to increase access to essential drugs, as well as understand and deploy information and communications technology effectively.

30. The achievement of these goals requires the adoption of a new approach to development, a development paradigm that imbues people and their leaders with heightened awareness and know-how in very specific and general ways. Development as usual, the neoclassical strategies - aptly described by Joseph Stiglitz as “development as a technical problem requiring technical solutions” – will not suffice for these enormous challenges (Stiglitz, 1998). A more sustainable, equitable, and democratic growth and development require a holistic and participatory approach ensured by placing emphasis on knowledge in its simple and complex forms.

HOW EFFECTIVE KNOWLEDGE SYSTEMS ARE DEVELOPED

Build Effective Institutions

31. The performance of knowledge functions in most African countries are constrained by political and institutional anomalies (Engerman, 1994), and governments determine whether the constraints remain or are removed. Political constraints are better managed with democratic processes, while effective institutions deal with others. Institutions are rules, enforcement mechanisms, and organizations that make them work. When the state acts as an agent that shares the objectives and beliefs of its citizens –and implements rules consistent with them – it is more likely to build effective formal institutions (World Bank, 2002).

32. How do you build effective knowledge institutions? By focusing on identifying needed knowledge functions that are missing and why, and then designing structures and institutions to ensure that they are performed. Four key approaches towards building institutions hold across sectors and countries:

- a) complement what exists;
- b) innovate to identify institutions that work;
- c) connect communities through information sharing mechanisms; and
- d) promote competitiveness for sustainability (World Bank, 2002).

33. In the knowledge and information area, the main roles of government are to establish or facilitate the establishment of the relevant institutions, lay down the broad policies for inter-organizational relationships, and fund selected strategic programmes adequately. Such institutions include: schools and colleges; universities; firms; national academies; libraries and information centres; research centres; coordinating ministries; regulatory agencies; funding agencies; and mechanisms for working with international organizations. There is strength in numbers and

diversity. This holds in achieving development goals through institution building. Take funding for example. An institution fails when it lacks adequate funding. One way to guard against funding failure is to ensure multiple and diverse sources of funding – and this is largely true of all other functions of institutions.

34. Research results suggest that effective management of complex systems like national knowledge systems depend on effectiveness of institutions that carry out "boundary management" functions: system-wide communication - to build mutual understanding among institutions; translation to and from expert knowledge and practitioner knowledge; and mediation between difference agencies and individuals with differing perspectives. These "boundary organizations" - e.g. national research councils and industry-universities consultative bodies - mandated to act as intermediaries between knowledge systems actors (Cash et al, 2003), have at least three features:

- a) they involve specialized roles ... for managing the boundary;
- b) they have clear lines of responsibility and accountability to distinct social arenas on opposite sides of the boundary; and
- c) they provide a forum in which information can be co-produced by actors from different sides of the boundary through the use of "boundary objects" (Guston, 1999).

Ensure Knowledge Sharing and Collaborative Relationships across the System

35. At the heart of a successful knowledge system is the willingness to share knowledge - to communicate. While information and communication technology enables the collection, storage and access to explicit knowledge that has been codified, much knowledge remains tacit, embodied in individuals and institutions. Knowledge networks and communities of practice enable the sharing of tacit knowledge and informal capacity building. By so doing information and knowledge networks carry out boundary bridging functions, that bring about intelligent interfacing among specialists organizations as well as between each organization and its environment.

36. Knowledge networking and information sharing can be used to meet the institutional and participation challenges inherent in the new vision of the knowledge society, by using them as a means of engaging grassroots, encouraging democratic debate, and creating new coalitions of partners and collaboration. It can potentially represent a model of inclusiveness and better capture social and cultural processes of knowledge development. In addition, networks help bring together participants with complementary knowledge and experience to deal with development issues of multidisciplinary nature. They also enable public-private partnerships - including cooperative research development activities among industry, universities, and government laboratories.

37. A key element of knowledge-based firms is their network of relationships with other businesses. Such relationships are fostered in industrial clusters and science parks. Clusters crystallize the new economics of industrial development on a municipal, or at most a regional scale, where the region might embrace a number of contiguous centers that are all part of a local network.

38. For universities and large research centres, local knowledge sharing goes hand in hand with international networking and mobility. This dynamism enables leading universities and research institutes to maintain global connections with partners in the North and South, as well as attract

the best talent, stay abreast of the latest advances, and forge the alliances intrinsic to cutting-edge research (Yusuf and Evenett, 2002).

Put Enabling Policies and Practices in Place

39. National knowledge systems are complex systems as are other development constructs. Ironically complexity is best managed by simplicity. Just as a bird weaves a nest, one straw at a time, with each straw linking several others, so should knowledge system be build with separate but interlinked institutions, policies and programmes aimed at creating an enabling environment for using knowledge to innovate for survival, development and wealth creation.

40. Institutions are important for knowledge-based development, but even more important is having “the freedom of the economic sphere” from political influence and cultural restrictions. Perhaps governments in Africa should heed Adam Smith’s advice:

“Leave me alone and I will make you rich.”

It is said that the emerging countries, especially those in East Asia, which did so have reaped the fruits (Engerman, 1994).

41. The following is a sample of enabling policies and practices that can work together to enable an innovative knowledge environment:

- a) Maintaining a stable macroeconomic environment that encourages long-term investments by knowledge producing and innovative agents
- b) Competition policies to increase innovation-driving competitive pressures as well as facilitate collaborative research and knowledge
- c) Regulatory policies with sufficient flexibility to lessen administrative burdens and institutional rigidities
- d) Financial, fiscal and administrative measures to facilitate the flow of capital and know-how to small and medium firms
- e) Labour market policies to increase the mobility of personnel and strengthen tacit knowledge flows
- f) Communications policies to maximize the dissemination of information and enable the growth of electronic networks and commerce
- g) Regional and local development policies that improve complementarities between government, private and civil society initiatives at different levels
- h) Protection of intellectual property, but with mechanisms and safeguards for preserving local and traditional knowledge, and for encouraging the use of foreign knowledge in appropriate situations
- i) Development and maintenance of an efficient transport and communications infrastructure to facilitate movement of people and ideas
- j) Creation of information centers where domestic firms can access information and knowledge on foreign technology markets as well as on production systems and methods, thus reducing information asymmetry and inadequacy.

[Adapted from Kuramoto and Sagasti, 2002 citing Casabonne and Sagasti (2000)]

HARNESS SOCIO-CULTURAL AND POLITICAL DYNAMISM

42. Institutions are important for knowledge systems but without positive socio-cultural and political dynamics, a system will inevitably be ineffective. An important contributor to this catalytic dynamism is social capital. In contrast to the human capital, which focuses on the individual, the focus of social capital is on collective action and outcomes based on the themes of cooperation, collaboration, and coordination. Social capital represents social structures and underlying attitudes based upon social interaction, trust, and reciprocity for producing results through mutual empowerment.

43. Akin to social capital are cultural values. A complex construct, they are the foundations of automatic individual and group response to change. For a new knowledge object to be accepted, it must become culturally legitimate. Effective boundary communication and grassroots involvement through civil society, for example, increase the chances of success. What is culture in one place is essential new knowledge elsewhere, hence the need to appreciate alternative cultural values and diversity as sources of knowledge. That is to say different ways of knowing are given value and upheld as meaningful.

44. Development has tended to be two-sphere affair of public and private sectors. However, the recognition of the role of the third sphere - the people - has led to the strengthening of civil society. By embodying participative development, civil society organizations (CSO) have strengthened the ability of the citizen to take a greater stake in the affairs of the state. Hence, sustainable human development would depend, more and more, on the contributions of civil society. Improving the capacity of the civil society to participate in the shaping of the information and knowledge society would therefore improve the outcome knowledge-mediated development activities.

45. Another frequently cited element that contributes to dynamism in knowledge is freedom. The sustained economic expansion the West can be traced to its expansion of political freedoms, and improved economic circumstances of the less well-off members of society (Rosenberg and Birdzell, 1986). This is to say that transformation requires a population capable of exercising critical thinking and dynamic knowledge with personal responsibility, equality of rights and opportunities for both men and women, rich and poor (Hamel, 2004). African nations can therefore fare better in future by the use of policy of inclusion in its knowledge strategies.

STATUS OF ACCESS TO INFORMATION IN AFRICA

46. Having illustrated how knowledge and information determine the course of economic growth and development, and the way information forms the thread with which knowledge possessed by individuals and organizations is woven, it can confidently be said

that reliable access to information is the key to progress. Access to the right information for all groups in the community (including women, the youth, policy makers, researchers, and rural and urban poor) is therefore necessary for reaching our development goals. However, the level of information access in a country depends to a great extent on its information infrastructure and services - the national capacity: to make knowledge and information accessible, for transfer of knowledge; and to put knowledge to work (Xuechen, 1983). To effectively facilitate access, a system of information infrastructure and services must have the following elements:

- a) a nucleus of physical information resources, including libraries, documentation centers, and specialized information analysis and services centers in the various economic sectors;
- b) a steady supply of qualified information professionals and support personnel;

- c) a corpus of professional knowledge-based consultancy services, including those run by lawyers, scientists, technical consultants, financial advisers, etc;
- d) active linkages among significant decision-making bodies, government agencies, economic sectors, trade bodies and groups, educational institutions, research and development centres, and firms;
- e) legislatively mandated funding system that guarantees that information resources are acquired and made available to all users, and monitored by a two-way communication process between service providers and other stakeholders;
- f) an organizational system that brings together and energizes these resources, professionals and linkages; and
- g) national policies that promote the systematic development of facilities and services.

47. Having an access framework such as described above, is the road to the Information Society. This road is not however a smooth one for many African communities, as information providers and users in most African countries are faced with numerous difficulties in the delivering and obtaining relevant information due to inadequacy of facilities, resources and services. This situation may be summarized as follows:

- a) Libraries and information services across Africa are undergoing rapid decline due to gross insufficient funding.
- b) The costs of maintaining effective libraries are often underestimated, hence inadequate funding lead to lack of the capacity to use ICT to expand access to information.
- c) International donor and multilateral involvement in their development is rapidly disappearing, because as public goods, it is rarely possible to use them to show quick results needed by donor agencies.
- d) Professional information capacity in many African countries is not developing in congruence with rapid developments in information processing.
- e) The dependence on information sources from the developed nations means that the costs of acquisition of research publications and high quality databases have become very prohibitive.
- f) Poor facilities constitute strong barriers preventing many libraries from using high quality information sources sponsored by a few donor organizations which continue to persevere in assisting them (Arnold, 2002; ECA, 2003b).

INFORMATION POLICY ENVIRONMENT IN AFRICA

48. A national information policy is defined generically as: "...a set of interrelated principles, laws, guidelines, rules, regulations, and procedures, guiding the oversight and management of the information life cycle: the production, collection, distribution/dissemination, retrieval, and retirement of information" (Duran, 1991). It can be viewed as the embracing framework to put into practice the basic notion that social and economic systems will function more efficiently if the right information resources are available to individuals, households, civil society, businesses and government agencies whenever they are in need of them (Lamberton, 1974).

49. Placing libraries and other repositories of knowledge prominently in this framework is the pragmatic starting point. But studies show that in Africa, libraries are not in the mainstream of issues addressed, as policy directions tend to neglect information content and its delivery. (Arnold, 2002). In spite of the difficulties in their operating environment, libraries in Africa have a growing

role to play in organizing and providing widespread and mediated access to globally available digital resources, in order to enhance the acquisition of knowledge for development.

50. In general, national information policies in most African countries are not holistic in design and not strategically linked to development needs of the various sectors of the populations and economic sectors. Creating the enabling environment for increasing access to information and knowledge sources through broad-based policy formulation and implementation should be a national priority, as fragmentation of policy instruments, lead to ineffective coordination and strategies. The national information policies in other regions reveal more robust trends, such as a number of South American countries, which pay adequate attention to the role of the library, the promotion of books, reading and information content; and North American countries that pay attention to access to government information, freedom of the press, and intellectual freedom.

51. Since a government passes legislations and formulates public policies on issues and problems it values, the starting point for every interest group should be to ensure that government has a 20/20 vision of the country's knowledge and information needs before it determines policy action to take. A national information policy should be based on following concerns and dimensions:

- a) What information should be available to ensure economic growth and human development;
- b) How information can best be described, analyzed, organized, and made available for best effect;
- c) How certain policies and practices of various stakeholders affect access to information;
- d) How best to deploy ICT to aid research, scholarship, learning, governance, and the public well-being;
- e) The options available to information providers and funding agencies given the prevailing economics of information acquisition and use;
- f) The effect of inter-organizational relationships on information sharing, and information diffusion and assimilation; and
- g) The socio-cultural and political dynamics operating in the country that may constrain policy change.

52. These issues are usually covered with separate sets of policy instruments, which may be categorized into four broad groups:

- a) Policies to ensure adequate provision and access to information for fundamental knowledge, such as would support disciplinary academic, scientific and technical education and research carried out in institutions of learning of all levels and specialization. This would include national policies for libraries and documentation services of all kinds, including special information analysis centers; life-long learning; and information literacy.
- b) Policies to ensure public access to government, civil and commercial information to reduce information asymmetry among stakeholders engaged in public and commercial affairs. Such policies would support broader participation in democratic processes, greater awareness and access to development resources, and equal opportunities for participation in entrepreneurial and commercial activities. These include policies and laws relation to public access to government and organizational information, government communication, censorship, and freedom of speech.

- c) Policies to enable the building and provision of access to physical and virtual facilities and infrastructure necessary for acquisition, processing, storage and communication of information across space and time. This category includes policies on ICT infrastructure, regulation and capacity building; and
- d) Policies related to organization, enforcement and access to rules and regulations governing commercial competition, quality standards, and rights to tradable ideas. This group includes intellectual property rights covering copyrights, patents, trademarks, brands and trade secrets, as well as technical standards of tradable goods.

53. Of these four categories, good progress is being made in the area of building and providing access to physical and virtual information facilities and infrastructure. With the support and urging of ECA and other international organizations, more than half of the countries in Africa have completed their National Information and Communication Infrastructure (NICI) policies, strategies and plans, and almost more than two-thirds of the remaining half have been making good progress towards the completion of theirs (For more information on the status of NICI plans and strategies, please see *Policies and Plans on the Information Society: Status and Impact* (ECA, 2003a).

54. In the area of intellectual property protection and access policies, the pressures of globalization of trade have provided strong stimuli for many African nations to start paying serious attention to them, but the practical effects have yet to be appreciably felt in the economic sphere.

55. An analysis of the national information policies indicates that highly industrialized countries such as Japan, the United States of America, the United Kingdom, and France address the need for information for research and development with great attention. Amongst the African countries, Algeria was found to stress the need to co-operate on issues concerning national information while the countries in South America stress the role of libraries in the provision of information in general. National information policies in many countries include legislation on national and/or public library services, however, in most cases they are fragmented in disparate instruments, leading to limited coordination and ineffectual strategies for sustainability and impact. See *The Value of library services in development* (ECA, 2003b) for detailed policy guidance of this issue.

56. The North-South technical information divide problem appears to be well known in countries of Africa. Many of the countries suffer from a shortage of books and available information sources and a general poverty of information due to the fact that only a small number of book and research articles are published in Africa annually (Lor, 1996). Similar divide exists for Internet content. These problems has sufficiently high implications for economic development, but no legislation or measures seem to be in place in most countries to ameliorate the effects.

57. Public access to government information is an issue that is generally addressed in national information policies, but not usually backed by law. Access to information may be facilitated or restricted by a government. In many countries, the right to information is a constitutional right. Abuses of information by infringing on the privacy of individuals, and issues such as decency are other issues that call for restrictive legislation. These issues are also relevant to the information industry, such as the press (Malley, 1990). Public access to information policies - supported by freedom of access to information laws - are in their infancy in Africa. Of the few countries that

have enacted related laws, only South Africa is actively engaged in the required public awareness efforts.

58. An analysis based on the generalized criteria discussed above found that only ten African countries have broad-based national information policies (Arnold, 2002). Of course this situation must have changed drastically within past few years, especially in the light of the widespread realization of the value of information and knowledge. A major research project is needed to fully map out the policy situation in this area.

STRATEGIC IMPLICATIONS FOR ECA PROGRAMME MANAGEMENT

59. The emergence of knowledge as a key development resource has profound implications for ECA programme in the area of harnessing information for development. It presents an opportunity for a strategic re-orientation, with new emphasis on national knowledge strategies for development. To effect the change, two options appear viable:

a) Reposition the entire area of information for development managed by the Development Information Services Division (DISD) to deal with the development of policy frameworks, advisory services and advocacy instruments to promote holistic national knowledge strategies in Members States. This option would integrate the existing activities in ICT, geo-information, statistics, libraries, and information services into the framework with new areas that may include mapping of national knowledge systems, facilitating the conduct of national knowledge assessments, and knowledge policy analysis.

b) Use the existing structure to initiate national knowledge activities and form a new CODI Sub-Committee on Knowledge, Libraries and Information Services (CODI-KLIS) to provide policy oversight in the area. This sub-committee would propose and advocate knowledge policies and strategies for Africa's development at the national and regional levels, including – among others - raising of awareness of the value libraries, knowledge and information in economic growth and human development; promotion of the development of national knowledge systems in member States; identifying priority issues in information and knowledge policies and institutions; examining and reviewing progress made by member States; facilitating capacity building with regard to development of systems and services for the Information Society and the knowledge economy; reviewing recent and proven technical trends and status of knowledge and information practices in global context; developing and supporting the establishment of national, regional and global networks and partnerships; and reviewing of ECA work programme in the area.

60. Option two would be more practicable, as it would not involve lengthy organizational change process. The ECA Library could be made responsible for carrying out the activities, which would include:

- a) promoting knowledge networking and sharing by providing technical support for the development of digital and virtual library services and networks, using the African Virtual Library and Information Network (AVLIN) as the main platform;
- b) developing, maintaining and providing access to online databases and content to enhance global accessibility of African development information;
- c) promoting the application of international standards and best practices in information processing, product development and exchange of information in Africa;

- d) advocating the value of broad-based information access and knowledge related policies and strategies in socioeconomic development; and
- e) establishing and maintaining strategic alliances and partnerships with regional and international development organizations in the social and economic information services area, with a view to promoting the role of libraries and similar information services in development.

POLICY RECOMMENDATIONS

61. Based on the analysis herein the following recommendations are made:

- a) To kick-start a national knowledge system, the use of national knowledge assessment is recommended. Knowledge assessment is an analytical tool used for country-level analysis of national capacity for participating in the knowledge revolution. For a full guideline on how to conduct a national assessment please see *Prospectus for National Knowledge Assessment* (NRC, 1996).
- b) Governments can develop a national knowledge system as a broad-based framework to actively pursue an integrated knowledge strategy to carry out Information Society schemes, and pursue economic and human development, including strategies aimed at meeting the Millennium Development goals.
- c) As every country has a “national system of knowledge” in form of institutions, policy instruments, and networks of various sorts, etc, it would be advisable for governments to introduce boundary bridging organizations and programmes to bring about intelligent interfacing among the these existing institutions through active communication, translation and mediation on knowledge acquisition, creation, exchange and use.
- d) Knowledge strategies should aim go beyond economic and technical innovation, to include sectors that engage in other forms of creativity and innovation for development. This can be pursued through the formalization and institutionalization of cross-sectoral use of public-private-people knowledge partnerships to empower the youth, women and other sections of the society - including the civil society to identify and solve critical development challenges.
- e) In embarking on knowledge strategies, chances of success may be improved by learning from policies and practices of successful and geographically comparable countries. Therefore, strategic benchmarking could be used to provide structure for the complex programme of developing a national knowledge system.
- f) Governments in Africa should regard international development organizations as part of their national know systems, and hence develop a systematic programmes for seeking for and obtaining new ideas, policy frameworks and advice to improve their institutions.
- g) African countries should heed the call at the World Summit on Information Society (WSIS) Geneva 2003, for all stakeholders to work together to improve access to information and knowledge through building of capacity for and creating the enabling environment at all levels by developing national policies and laws to ensure that libraries and other information institutions can play their full role of content providers in the Information Society. In this regard, governments in Africa could adopt a holistic

framework of national information policy to ensure completeness of their Information Society strategies.

CONCLUSIONS

62. All human communities have always developed, acquired and used knowledge for their survival and progress. However, due to globalization and increased competition brought about by greater openness of the world trading system, in recent times, it has been realized that knowledge determines who gets richer and who gets poorer. This realization has led to the call for governments to design knowledge strategies to enable their citizens acquire and use knowledge more effectively to improve their well-being and their capacity to generate knowledge-intensive competitive products and services for local and world markets.

63. A national knowledge system embodies a high degree of complexity and adaptive processes as it involves managing a broad mix of knowledge functions (education, industrial research, ICT, intellectual property rights, etc.) produced, managed or used by disparate forms of institutions - hence the need to lay emphasis on the management of boundary relationships among stakeholder institutions and individuals, using enabling policies and practices, and mediating the socio-cultural dynamics.

64. Strategies and programmes designed to deepen the information society in Africa could be based on the national knowledge system framework since it is broad-based enough to include the various functional and structural elements that affect decent existence, productive knowledge sharing and participation, and innovativeness for the markets. The greatest benefit from such a participatory process is the creation and strengthening of a national constituency for better access to information, stronger institutions that promote assimilation of knowledge, and a climate that promotes diffusion and expanded utilization of knowledge for industry and society.

65. Building effective knowledge systems in Africa will take time, great efforts and perseverance of leaders and other stakeholders. Strategies to promote such systems require sufficiently long-term perspectives that take account of the complexity of a people-centred approach of this nature, the generally slow impact of ideas on practice, the need to learn from experiences of successful and comparable countries, and the time scales involved in enhancing human and institutional capital necessary for acting surely and fairly. The use of national knowledge assessment to initiate a national knowledge system is recommended, as it generates participation and motivation that can sustain the momentum to carry on the activities required on a long-term basis.

REFERENCES

1. Adams, James. 1990. *Fundamental Stocks of Knowledge and the Growth of Inputs*. Chicago: University of Chicago-George G. Stigler Center for Study of Economy and State from Chicago - Center for Study of Economy and State.
2. Arnold, Anna-Marie. 2002. Difficulties faced by librarians in Africa – a comparative analysis. 68th IFLA Council and General Conference; Glasgow, Scotland. August 18-24, 2002.

3. Arrow, K.1962. In: Nelson, R. ed. *The Rate and Direction of Inventive Activity*. Princeton: Princeton University Press, pp. 609-625.
4. Azubuike, Abraham. 1985. Information approach to human resource development: a viable option for developing countries. Paper presented at the Nigerian Library Association Conference; Owerri, Nigeria; 17-20 March, 1985.
5. Berlinguet, Louis. 1981. Science and technology for development. *Science*, 4 September, pp. 1073-1076.
6. Bush, V. 1945. *Science and the Endless and Frontier*. National Science Foundation, Washington, DC. reprinted 1960.
7. Casabonne, Ursula and Sagasti, Francisco. 2000. *Policies for building science and technology capacities in developing countries*. A working paper.
8. Cash, David W. et al.2003. *Knowledge systems for sustainable development. Proceedings of the National Academy of Science of the United States (PNAS)*, 100(14): 8086-8091
9. Chen, Derek H.C. and Carl Dahlman. 2004. *Knowledge and development. A cross-section approach*. Washington, DC: The World Bank (Policy research working paper, 3366).
10. Duran, C. 1991. The role of LIS education. In: McClure, C.R. & Herson, P. ed. *Library and Information Science Research: perspectives and strategies for improvement*. Norwood: Ablex: 152-153.
11. ECA. 2000. Report: Ad hoc Expert Meeting on Africa's Development Strategies. 22-24 March 2000, Addis Ababa, Ethiopia (ECA/ESPD/AD-HOC/EXP/04/2000).
12. ECA. 2001. Knowledge management for decision-making: tools, institutions and paradigms. Report to the Committee on Development Information (CODI) of the Economic Commission for Africa, Second Session, Addis Ababa, 4-7 September 2001.
13. ECA. 2003a. *Policies and Plans on the Information Society: Status and Impact*. Addis Ababa: ECA.
14. ECA. 2003b. *The Value of Library Services in Development*. Report to the Committee on Development Information (CODI) Economic Commission for Africa, Third Session, Addis Ababa, May 2003.
15. ECC. 1992. *A Lot to Learn: Education and Training in Canada*. Ottawa: Economic Council of Canada.
16. Engerman, Stanley L. 1994. The big picture: how (and when and why) the West grew rich. *Research Policy* 23(5): 547-559.
17. Faulkner, W. 1994. Conceptualizing Knowledge Used in Innovation: A Second Look at the Science-Technology Distinction and Industrial Innovation. *Science, Technology, & Human Values*. 19(4): 425-458.
18. Grossman, Gene M., and Elhanan Helpman. 1991. *Innovation and Growth in the Global Economy*. Cambridge, Mass and London: MIT Press.
19. Grenier, L.1998. *Working with Indigenous Knowledge - A Guide for Researchers*, IDRC, Ottawa.
20. Guston, D. H. 1999. Stabilizing the Boundary between US Politics and Science. *Social Studies of Science* 29:87-112.
21. Hamel, Jacques. 2004. *Knowledge policies for sustainable development in Africa. A strategic framework for good governance*. Draft working paper (SDD/ECA, Addis Ababa).
22. Hornstein, Andreas, and Per Krusell. 1996. " Can Technology Improvements Cause Productivity Slowdowns? In *NBER Macroeconomics Annual 1996*, eds. Julio J. Rotemberg and Ben S. Bernanke. Cambridge, MA: MIT Press.
23. Kuramoto, Juana and Francisco Sagasti. 2002. Integrating local knowledge and global knowledge, technology and production systems: challenges for technical cooperation. In:

- Fukuda-Parr, Sakiko, Carlos Lopes and Khalid Malik. Capacity for Development: New solutions to old problems. London: Earthscan and New York: UNDP.
24. Lamberton, Donald M. 1974. National Information Policy. *The Annals of the American Academy of Political and Social Science*. 412: 145-151 (Special issue on The Information Revolution).
 25. Lor, P.J. 1996. Information dependence in Southern Africa: global and sub-regional perspectives. *African Journal of Libraries, Archives and Information Science*, 6(1): 1-9.
 26. Machlup, Fritz. 1962. *The production and distribution of knowledge in the United States*. Princeton, New Jersey: Princeton University Press.
 27. Malley, I. 1990. National and international imperatives of a UK national information policy. *Aslib Proceedings*, 42(3): 89-95.
 28. Mayr, O. 1982. The science-technology relationship. In *Science in context: Readings in the sociology of science*, edited by B. Barnes and D. Edge, 155-63. Milton Keynes: Open University Press.
 29. Mchombu, Kingo J. 2004. *Sharing knowledge for community development and transformation: a handbook*. Ottawa: Oxfam Canada.
 30. Metcalfe (1995) in *Handbook of the Economics of Innovation and Technological Change*, ed. Stoneman, P. (Black Blackwell, Oxford), pp. 409-512.
 31. Mowery, D (1983) *Policy Science*. 16, 27-43
 32. Nwokeabia, Hilary. 2001. *Why Industrial Revolution missed Africa: A traditional Knowledge perspective*. Addis Ababa: Economic Commission for Africa (ECA/ESPD/WPS/01/02).
 33. NRC (National Research Council). 1996. *Prospectus for National Knowledge Assessment*. Washington, DC: National Academy Press. (<http://books.nap.edu/html/prospectus/>) Accessed 4 April 2005.
 34. OECD. 1995. *National innovation systems (DSTI/STI/TIP(94)16/REV1)*. Work plan for pilot case studies. Paris, OECD, Directorate for Science, Technology and Industry.
 35. OECD. 2001. *OECD. Knowledge and Skills for Life: First Results from PISA 2000*. Paris: OECD.
 36. Pavitt, Keit. 1996. National policies for technical change: where the increasing returns to economic research? *Proceedings of the National Academy of Science of the United States of America (PNAS)* 93: 12693-12700.
 37. Portnoff, André-Yves. 2003. *Sentiers d'innovation = pathways to innovation*. Paris: Futuribles.
 38. Rihani, Samir. 2005. Complexity theory: new framework for development is in the offing. *Progress in Development Studies*, 5(1): 55-61.
 39. Rosenberg, Nathan and LE Birdzell, Jr. *How the West Grew Rich*. New York: Basic Books, 1986.
 40. Stiglitz, J. 1998. *Towards a new paradigm for development: strategies, policies, and processes*. Prebisch Lecture. United Nations Conference on Trade and development 19 October 1998.
 41. UNDESA. 2003. Ad hoc Expert Group Meeting on National Knowledge Systems for Development, United Nations, New York.
 42. UNDP. 2000. *Millennium Development Goals - The global challenge: Goals and targets*. <http://www.undp.org/mdg/abcs.html> (accessed 31 March 2005).
 43. UNDP. 2004. *Cultural liberty in today's diverse world*. Human Development Report 2004. New York: United Nations Development Programme.

44. The World Bank. 1999. Knowledge for development (*World Development Report 1998*). Washington, DC: The Bank.
45. The World Bank. 2002. Building institutions for Markets (*World Development Report 2002*). Washington, DC: The Bank.
46. Xuechen, Sun.1983.Technology policy trends and information services in Sweden and China – a comparison. Lund: Research Policy Institute (*Technology & Culture: occasional report series, No. 9*)
47. Yusuf, Shahid and Simon J. Evenett. 2002. Can East Asia compete? Innovation for Global Markets. Washington, DC: The World Bank.