The Impact of Globalization on Science and Technology in Sub-Saharan African countries.

Introduction.

We are constantly bombarded with media reports on globalization in terms of its increasing process and potential effects on our lives. What is meant by this concept and why should we be concerned with its impact? The developing countries of sub-Saharan Africa should be interested in it because of the opportunities and threats offered by globalization. Globalization is a very wide topic. Using a search engine, I was able to enumerate four million websites on the Internet about the impact of globalization on science and technology in developing countries. There are several search engines for finding information and the mind boggles at the potential breadth and scope of information available on this topic. The information is literally available at the touch of a button! The word "Globalization" is derived from the transitive verb "globalize" which means "to make worldwide in scope or application". The word is now used to describe and explain the many changes that are occurring in the world. In some instances, "globalization" is seen as a logical objective of a new world order with an identifiable geo-political and domination strategy which neatly divides the world into "North" and "South" while at the same time loudly proclaiming the advent of 'one world' . In other instances "globalization" is seen as an evolutionary successor to the industrial revolution. It is perceived as a natural historical progression to the internationalization of economic (*sic* 'new economic order') and social policies, activities, ideas and the standardization of political structures and practices. This interpretation of globalization has spawned the world wide (*ww !*) and such fashionable phrases as 'structural adjustment', 'good governance' and 'information highway'.

The mother of this globalization is Science and the activator is her daughter Technology (both affectionately called science and technology). The most visible manifestations of "globalization" are in the economic and communications spheres. The most important characteristic of "globalization" is the information technology (fondly known as IT). The IT revolution has brought about most profound changes in the way human activities and endeavours are conducted. These fundamental changes range from newer methods in the industrial production of goods and services (e.g use of computer-aided design (CAD) and computer numerically-controlled machines (CNC) in the textile industry) to standardization of patterns of consumption, social behaviour and cultural expression.

The globalization process, is however, heterogeneous and exclusive because its conceptualization, definition and rationale are derived from the developed countries in the North with minimal input, if any, from developing countries called the South. This

view is backed by the obvious parallels between the current relations between the North and South and the colonial and neo-colonial experience of the developing countries. The difference in the experiences of developing countries between the current globalization and the colonial and neo-colonial period appears to be that the current control mechanism, which gives supremacy to the 'free market' is subtle, more refined and not easy to deal with. It should be underlined that the current relations and discrepancies between the North and South are dictated by science and her daughter, technology.

Euphoria in the Decade of African Independence

An understanding of the impact of globalization on the sub-Saharan countries of Africa must be understood in the context of formal education and training in science and technology. Formal basic education and training in science and technology are important. However, this paper focuses on university education and on research and development. The starting point is the euphoric 1960s, the period that may be called the "Decade of African Independence ". The achievement of independence by the majority of the sub-Saharan African countries during this period fulfilled Kwame Nkrumah's dictum, "*Seek ye the political kingdom first and the rest shall be given unto you*".

The Decade of African Independence was characterized by heroic attempts by African presidents to carve out indigenous development strategies. For example, in Ghana Kwame Nkrumah raised *Consciencism;* in Zambia Kenneth Kaunda gave a sermon on *Humanism*; in Tanzania Julius Nyerere invented*Ujamaa*; and in Senegal Leopold Senghor rhapsodized about *Negritude*.

These homegrown development ideologies were rooted in the desire to re-invent Africa's past glory so as to mould its present, and map out its future, based on indigenous initiatives. It was a matter of faith that achievement of political independence would bring development and result in economic prosperity. It was expected that science and technology would also flourish. In this respect, African governments did, and continue to, recognize the importance of science and technology and research and development (research and development) in socio-economic development.

Science and Technology in the Decade of African Independence

In recognition of the role of science and technology in socio-economic development many countries of sub-Saharan Africa established science and technology policy making bodies and research and development institutions. The United Nations Education and Scientific and Cultural Organization (Unesco) acted as a catalyst by organizing the CASTAFRICA conferences for African ministers responsible for science in 1974 and 1987. The 1979 Vienna global conference on science and technology for development organized by the united nations further sensitized and spurred african countries to action.

examples of science and technology policy making bodies and research and development institutions that were formed during the decade of independence are the National Council for Scientific Research (NCSR) in Zambia, the Council for Scientific and Industrial Research (CSIR) in Ghana, the National Council for Science and Technology (NCST) in Kenya, and the Science and Technology Commission together with its many research institutes and centres in Tanzania.
The recognition of the role of science and technology in development by governments continues to this day as exemplified by putting in place national policies on science and technology by the enactment of science and technology legislation and by the establishment of ministries of science and technology.

What Went Wrong?

In spite of these apparent commitments by governments, science and technology has not been accorded the primary priority that it deserves in resource allocation. Evidence of this lip service commitment is to be found in the absence of concrete follow-up activities to the 1980 Lagos Plan of Action. No country in sub-Saharan Africa, South Africa excepted, who have achieved the recommended allocation of one percent of GDP to science and technology. There is an irony in the 1980 Lagos Plan of Action chapter on science. In this chapter, the Heads of State call for " p*olitical will"* to enable science and technology become a true instrument for, and an integral part of, development. But if the Heads of State themselves could not, there and then, muster and effect political will, who can? As Professor Paul Vitta has observed *"leaders calling for political will are like air summoning its shadow"!*
the science and technology policy making bodies and research and development institutions were generously funded and well endowed with infrastructure when they were first established. However, there were inherent difficulties. The critical difficulty was (and continues to be) the inadequacy of human resource. As Arpád Goncz, the President of Hungary, observed in his opening address to the World Conference on Science in 1999 *"without the 'software' of the human personality, of the human soul, the human spirit, the 'hardware' of science will never function"*. Many of the policy-making bodies and research and development institutions lack a critical mass of scientists to make meaningful impact in finding solutions to *local* problems using *local raw materials.*
The approach towards the achievement of critical numbers of research scientists was the strategy of Staff Development Programme. Freshly graduated science and engineering students were recruited by universities and research and development institutions and immediately sent to universities in developed countries. The Unesco *World Science Report 1998* states that out of 61 million students in the world, two percent or 1.22 million of them study in foreign countries. Of these 1.22 million, 70 percent come from developing countries. Sub-Saharan African countries send the largest proportion (14

percent). These students were, through bonding schemes, expected to return home on completion of their studies. During the 1960s and 1970s a majority of these students returned. Today the don't. Thus graduate studies in developed countries became the main brain drain channels for sub-Saharan countries. The exodus of such a large body of highly educated human resource has had a devastating impact on the ability of the sub-Saharan African countries to utilize the opportunities offered by globalization of science and technology.

African Universities in the Decade of African Independence

The most important institutions that African governments created in pursuance of development are universities. The institutions had, and still have, the enduring universal mission of all universities: teaching, carrying out research, and public service.
In many cases, critical schools of natural sciences, agricultural sciences and medicine were among the first faculties to be established in the newly created universities. Countries like Ghana and later Zimbabwe set up universities dedicated to science and technology. In the early years following their establishment, the immediate objective of the African universities was the production of the much-needed human resource to meet the requirements of government and the public service. The African universities of the 1960's and 1970s made great strides in the fulfilment of that mission. Academic excellence was the hallmark of the African university as demostrated by their increasing share of publications during the period. Other evidence of success abounds in the large numbers of African university trained human resource working in government, the public service and the private sector. Further evidence of the excellent progress that African universities made is embodied in today's fashionable terms such as "the brain drain" from developing African countries to the developed countries and "*brain circulation"* within African countries. It is even possible to talk of the African educated human resource in the diaspora.

The Sad Decline of the African University

Unfortunately, African countries failed to enhance and sustain the early achievements of their universities. An Association of African Universities (AAU) study noted that : " the major reason for the failure to consolidate and sustain the achievements of the 1960s and 1970s was the fact that, while the political leaders had shown some appreciation of their universities, in many cases they did not match even the preceding colonial regimes in understanding and valuing universities as agents of change". The major result has been the sad decline of the African university. One of the contributory factors has been an exponential growth in demand for university education which resulted in increased in enrolments. The increased student enrolments were not matched by increases in resource

allocation to universities. The most visible evidence of the decline of African universities include:

- low financial resources and erratic funding;
- he over-crowding of halls of residence, lecture rooms and science and engineering laboratories;
- scantily equipped laboratories and workshops with obsolete equipment;
- dilapidated research infrastructure;
- poorly stocked and out-dated libraries far removed from the "information highway;
- underpaid and unappreciated professors and lecturers;
- exodus of academic and research staff;
- diminished scholarship as demonstrated by decreased publications;
- frequent student riots and lecture boycotts ;
- occasional go-slows by the now unionized academic staff and industrial strike action by support staff ; and the consequent
- university closures which have become the norm rather than the exception.

However, the saddest and far reaching impact of the decline of the African university is its loss of public image, prestige, and dignity. Such loss cannot be easily regained. Student riots and lecture boycotts occur with near predictability and regularity. When students take to the streets innocent members of the public are often viciously attacked, injured and property damaged. The picture of "the clobbered student" and the spectacle of the "unemployed graduate" has certainly diminished the dignity and prestige of the university as a centre of learning and focused scholarship. This loss of prestige is exacerbated by the university's inability to take a leading role in offering solutions to the problems of today and the challenges of tomorrow. The African university is, indeed now a shadow of its former self.

Sub-Saharan African countries have paid a terrible price for not prioritizing science and technology. Thus while the world average per capita income rose at a rate of 3.0 percent (7.0 percent in East Asia) per year from 1980 to 1990, in Africa if fell by 1.0 per cent per year. In other words, while everybody else was getting richer, Africans were actually getting poorer. The 1980s were indeed "Africa's lost decade". Owing to the neglect of science and technology and research and development and the decline of universities, African countries are ill prepared to take advantage of the opportunities offered by globalization. They are in great danger of being left behind.

Impacts of Globalization

Location on the Globalization Spectrum

The impact of globalization on a country depends on the position it occupies on the globalization spectrum. For example, although Zambia and India are both developing countries and are economically in the South, India is many ranks above Zambia on the globalization spectrum. Thus globalization has expanded the gap not only between the North and South but also between South and South. This gap has been brought about by the information technology:

Information Gapö Competitive Gap ö Development Gap

The location of countries on the globalization spectrum is determined by investment in human resource and in science and technology. Education and capacity in science are critical infrastructure requirements. Without them, no real progress can be made. For sub-Saharan African countries who are on the weak end of the globalization spectrum, prioritized investment in formal basic education and basic science education is imperative and requires utmost attention.

Human Resource Capability in sub-Saharan African Countries

The reasons why investment in human resources has not yielded better positioning of most African countries in the globalization process is attributable to the exodus of its highly educated human resource as outlined above. The brain drain has grown from a trickle in the 1960s and 1970s to a torrent by 2000. Owing to the long gestation period of investments in human capital and the continuing brain drain it would appear that economic development through science and technology will depend on well planned exploitation of the opportunities and careful avoidance of the risks posed by globalization.

The Nature of Research in sub-Saharan African Countries

The focus of the work of the research and development institutions that were established in the 1960s and the 1970s was what can be termed "developmental research". However, the actual research carried out can best be termed as "subsistence research". It should be stated, however, that this was in no way due to the personal qualities of individual scientists but rather to the way scientific research was organized. Dominance of subsistence research is one of the structural problems that beset scientific research in developing countries. Subsistence research (like economic subsistence) is concerned with serving the immediate needs of the society in which the research is undertaken. An

example of subsistence research was the development of carbonated fruit beverages from guava and pineapple which resulted in the beverage trademarked Tip Top undertaken by the then National Council for Scientific Research of Zambia. Such research does pave way for development but is not by itself a factor of development. .

International Collaboration in Science and Technology

Globalization offers opportunities for collaboration in "fundamental research" between scientists in developed and developing countries. Although this is tantalizing, it offers new difficulties. Apart from the need to bridge the gap between subsistence research in sub-Saharan African countries and fundamental research in developed countries the question of changed circumstances in which research is conducted in developed countries, needs to be tackled. In developed countries promot on to higher academic and research ranks is no longer solely based on the age-old dictum of *publish or perish*. Instead, the researcher or academic must, in addition to publishing, demonstrate ability to attract large research grants or contracts. In such circumstances a scientist in a developed country may be unwilling to collaborate with an unknown African scientist from a sub-Saharan African country.

Globalization Has Intensified As Well As Expanded Poverty

There is a tendency to perceive poverty as a problem exclusive to developing countries, especially sub-Saharan African countries where more than three quarters of the world's poorest countries are located. But globalization is expanding the gap between the 'haves' and 'have-nots' in the North also. There is an emerging class of 'haves' in sub-Saharan African countries who share more social and economic characteristics with the 'haves' of the developed countries than with their own kith and kin in the South. Their new language is not Tonga or English; it is wealth and materialism. Today, poverty alleviation provides a challenging new frontier to local problem solving.

Concentration of Scientific Innovations and Progress in Developed Countries

Scientific innovations and progress in developed countries have had a serious impact on sub-Saharan countries. For example, Africa is in crisis because of the HIV/AIDS epidemic. But the most advanced diagnostic and treatment regimes are controlled by pharmaceutical companies in the developed countries. They determine who receives HAART (Highly Active Anti-Aids Retroviral Therapy), at what price and under what conditions. Yet these pharmaceutical companies have the capacity and capability to

build, operate or upgrade existing biomedical and clinical laboratories to study HIV/AIDS in si*tu* in any sub-Saharan African country such as Zambia. As Nobel laureate Luc Montagnier observed in his address to the World Conference on Science "the relative lack of interest (in HIV vaccine development) on the part of the pharmaceutical industry and funding agencies is because the market for AIDS vaccine will reside mostly in countries read sub-Saharan African countries) unable to afford its price". The HIV/AIDS epidemic and debt crisis bedeviling sub-Saharan African countries symbolize globalization more concretely than any other examples. Africa's survival depends on surviving the scourge of HIV/AIDS but Africa has little control over many of the care and support strategies so badly needed in the sub-Saharan region.

Lost Identity Through Loss of Power To Set Standards For SCIENCE AND TECHNOLOGY in Africa

Globalization has increased the scientific and intellectual arrogance of some scientists in developed countries. Perhaps owing to the fact that globalization has been defined and rationalized from developed country perspectives, some scientists have become contemptuous of legitimate skepticism emanating from developing countries on some scientific questions. An example is the debate regarding the views of Thabo Mbeki, President of South Africa, on HIV/AIDS. HIV/AIDS is the most threatening event to Africa in living memory. It is more powerful than colonialism and will have a far-reaching impact. However, in the true tradition of science, Mbeki legitimately raised a question about the cause of AIDS. It is in the nature of science to entertain, allow and welcome different views, however controversial. Instead of presenting scientific arguments, some scientists have adopted a political perspective (i.e. power perspective) to deny Mbeki a right to voice his dissent. These scientists seem to have forgotten that for over three hundred years Galileo remained excommunicated by the all powerful Catholic Church for his views which were contrary to the then popular belief.

Market Liberalization.

Globalization has brought to the sub-Saharan countries loss of control of their own destinies. This loss of control of destiny is more evident in the economic field embodied in the cry "free market" being proclaimed by developed countries. The focus of the new economic order on deregulation and liberalization is not accidental. It is a reflection of the interests of the developed countries who are dominating the globalization process. Whereas the developed countries vigorously promote free movement of products , the same countries have not advocated liberalization of free movement of the African countries' abundant labour supply. Neither have they advocated liberalization of

scientific and technological know-how which would have a significant effect on levelling the economic field. In order to maintain the developed countries' edge and lead in international competition, the Uruguay Round Agreement on Aspects of Trade-Related Intellectual Property Rights (TRIPs) has made the transfer of technology more restrictive.

Market liberalization works well and provides healthy competition among equals. However, sub-Saharan countries have been obliged to enter into this competition with the more powerful developed countries, so to speak, " with hands down". This is because natural resources are no longer the key to effective competition in a globalized economy. The key is knowledge. For example, for the price of present household articles, 20 percent accounts for 'actual material' and a colossal 80 percent accounts for knowledge. Even investment of capital that is supposedly a beneficial effect of economic globalization has flown over the sub-Saharan countries. This is because investment decisions, which now depend on the interdependency between science and industry, are no longer based on abundant natural resources and cheap labour. Investment decisions are now based on availability of specific skills (acquired through formal education and training), scientific capability and capacity and relevant know-how. The market is not efficient in allocating resources to such areas. Developed countries have used market liberalization as a carrot for handing out "development" aid and as a bait for accessing loans. The loans are exclusively consumer oriented rather than targeting them to productive investment. The end result is that globalization and market liberalization have made it difficult for sub-Saharan African countries to create wealth.

Conclusion

If sub-Saharan countries are to take advantage of the opportunities offered by globalization, they must re-discover, albeit a with 20/20 vision, the zest that pervaded the Decade of African Independence for development using indigenous initiatives**.** They must not only will their future but must create the necessary enabling environment which will allow that willed future to be realized, concretized, nurtured and sustained. A start can be made by bringing back home the many teachers, scientists, engineers, medical doctors, and technological personnel who equal, perhaps number more than, the expatriate personnel currently working in the sub-Saharan African countries.

References

1. Mwindaace N. Siamwiza, "Commitment to Science by African Governments, Scientists and Private - Sector Stakeholders", Bulletin, Vol. 33 No.1, Unesco Nairobi Office, 1998.

2. World Conference on Science, UNESCO Publishing, 1999.
3. Paul B. Vitta, "Technology Policy in Sub-Saharan Africa: Why the Dream Remains Unfulfilled", World Development, Vol. 18, No. 11, 1990
4. Shamika Sirimanne, "The Information Technology Revolution: What about the Developing Countries"? Development Express, International Development Information Centre, http://www.acdi-cida.gc.ca/xpress/dex/dex9604.htm, 28 October 2000.
5. Globalization: What does it mean for the South? http://www.southcentre.org/papers/nam/namannex2-01.htm, 28 October 2000
6. Julius Court, T. Yanagihara, Project: Asia and Africa in the Global Economy; http://www.unu.edu/hq/academic/Pg_area4/August-intro.html, 28 October 2000
7. The University in Africa in the 1990s and Beyond, Summary Report; Association of African Universities and UNESCO Nairobi Office, Eastern and Southern African Consultation on Higher Education, Nairobi, 12 - 14 February 1997
8. Ajayi, J.F., Goma, Lameck K. H., Johnson, Ampah G. The African Experience with *Higher Education.* The Association of African Universities; Accra; Ohio University Press, Athens, Ohio, U.S.A
9. Sciences in the 21st Century: Challenges and Perspectives. UNESCO International Scientific Advisory Board. 20 -21 January 1997, Paris [Siamwiza, M. N., Personal Notes]

This paper was originally delivered as the keynote address at the 7th Annual Conference of the African Technology in Lusaka, Zambia, on Novermber 1-5 2000.

THE IMPACT OF GLOBALIZATION ON SCIENCE AND TECHNOLOGY IN SUB-SAHARAN AFRICAN COUNTRIES

Mwindaace N. Siamwiza works at the Department Of Chemistry,
School of Natural Sciences, University of Zambia. He can be reached on Tel: +260 (1) 28 13 65; Cell: +260 (1) 097 80 02 40 or on e-mail: siamwiza@zamnet.zm

Preface

Publications under the *Special Paper Series* are commissioned by ATPS as concept papers, think-pieces, leading conference papers or keynote addresses. In keeping with the network's knowledge brokerage function, ATPS publishes published or unpublished papers from distinguished academics and researchers addressing policy issues relevant to the work of ATPS in support of the Southern voice or an African perspective. Theoretical papers advancing knowledge of technology policy issues are also published under this series.

For more information on ATPS, please contact Dr. Osita Ogbu, Executive Director, African Technology Policy Studies Network (ATPS), 3rd Floor, The Chancery , P.O. Box 10081, 00100 General Post Office, Nairobi, Kenya.
Email: oogbu@atpsnet.org
Telephones: 254-2-723800/ 714168/ 714498 Fax: 254-2-714028

Dr John Mugabe is the Executive Director of the African Centre for Technology Studies (ACTS) in Nairobi, Kenya. He is a former Programme Officer of the International Diffusion of Biotechnology Programme at the International Federation of Institutes of Advanced Study (IFIAS), Maastrich, The Netherlands. He can be reached at the African Centre for Technology Studies (ACTS), P.O. Box 45917, Nairobi, Tel 254-2-524713; Fax 254-2-524701; E-mail j.mugabe@cgiar.org

Biotechnology in Sub-Saharan Africa: Towards a Policy Research Agenda

John Mugabe

ATPS SPECIAL SERIES PAPER NO. 3

Biotechnology in Sub-Saharan Africa: Towards a Policy Research Agenda

John Mugabe

February 2002

Published by the African Technology Policy Studies Network (ATPS), P. O. Box 10081, 00100 General Post Office, Nairobi, Kenya.

Formatted by Magayu K.Magayu
School of Journalism
University of Nairobi
P. O. Box 30197
Nairobi
Kenya

Printed by Mung'etho Consult, P. O. Box 57227, Nairobi

ISBN 9966-916-51-2

For more information on this series and ATPS, please contact:

The Executive Director
The African Technology Policy Studies Network
3rd Floor, The Chancery
Valley Road

P.O. Box 10081
00100 General Post Office
Nairobi, Kenya.
Telephones: 254-2-714168/092/498
Fax: 254-2-714028
Email: info@atpsnet.org

ISBN 9966-916-51-2

Contents