Human Capital Formation in Africa: Super Technology and Mega-trends for the Twenty-first Century

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Formulates a new plan for establishing an information infrastructure thought-out Africa. First, takes a deep look at the current crisis in Africa: human resources, infrastructure, education, politics, and economics. Next, it examines major trends that can be leveraged to the benefit of Africa. Finally, formulates a plan of action and calls for the transformation of capacity in information technology, agriculture and governance.

Keywords: Information technology, infrastructures, human resources

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Introduction

Africa is a continent evolving in the throes of protracted crisis. It is the least developed part of the world, characterized by constant political impasse, instability and insecurity. Poverty, death and underdevelopment are the regular visitors to most homes. These and other related issues impedes and undermines the active participation of the region within the international arena. The continent is unable to forge meaningful development for the benefit of its citizens.

Presently, squalor, abject poverty, escalating population growth, dwindling agricultural output, undemocratic governance, stagnant economic growth, and marginalisation combine to paint a bleak future for Africa. There is little reason to believe that the current development policy strategies will reverse the adverse trends. The situation is getting worse as the world moves into the twenty-first century.

This paper addresses the fundamental development challenges that face present and future generations. It calls for resolute measures to be taken now. The manner in which this challenge is resolved now will shape and save the continent of future generations. The paper adopts a critical examination on poor and inadequate human resources development, and addresses this in the light of emerging information communication technologies; how information and knowledge constitute vital resources for the socio-economic development of a society. The argument and impetus of the paper stem largely from a pragmatic viewpoint concerning how Africa can begin to solve its multifarious and multifaceted problems in the present and future world system by being a part and not apart of the evolving global mega-trends in the information and communication super-highway; and utilizing these developments in addressing socio-economic, cultural and political development issues confronting the continent.

Finally, it advances some useful suggestions and recommendations for arresting current negative issues underlying the development of the continent.

A Multifaceted Crisis

The continent of Africa unquestionably poses the greatest development challenge confronting the world today. While other regions are making progress, Africa is not. These problems which are deep-seated and multifaceted include amongst others:

1. Poverty: The most outstanding problem is abject poverty, squalor with the chain effects this entails. By the year 2000 Africa will account for 32 percent of the world's poor. Child mortality rate per 1000 will by the year 2000 hover around 30 for East Asia and 135 for Sub-Saharan Africa, the highest in the world. Most regions in the developing world are expected to achieve universal primary education enrollment by the end of this decade. Sub-Saharan Africa is the exception.

2. Population: Africa's population is expanding at a rate rarely, if ever, seen in any large region in the world, about 3.1 per cent per year. The continent has twice the population it had in 1965. African populations are currently doubling in about twenty-five years. There is no sign of a decline. Rapid population growth poses serious development problems.

3. Agriculture: Agriculture constitute the backbone of Africa's economy. The mass of the population still dwell in villages. They earn their living through subsistence farming - cultivating between 5-10 acres of family farm land. Agricultural productivity has not been able to keep up with population growth. Famine and drought persist. The continent has to depend on "food aid" for the survival of its population. Women bear the greater share of the brunt of the problems as mothers, providers and workers in the subsistence agricultural sector and petty trade.

4. Human Capital Formation: Human capital formation is low compared with other developing areas of the world. Majority of the people, especially women are still illiterate. They are unable to exploit available knowledge and information for the socio-economic development of the society.

There are other economic indicators of the African crisis, for example, Africa's debt problem which has risen more than twenty-five folds since 1970. The region's terms of trade have dropped by 10 percent. Africa now accounts for less than two percent of world trade, placing the region at the very margin of the global economy. Democratic governance is faraway from the corridors of the political landscape of the continent. Political instability and insecurity reigns high. Africa is a boiling political pot engulfed with ethnic cleansing, (Burundi and Rwanda) confrontation over natural resources (for example the Nigeria-Cameroon conflict over the oil rich Bakassi peninsula).

The general picture of the continent is a gloomy one. As with any general picture, it does not tell the entire story. The need to embark on a radical restructuring policy strategy, though this may be extremely difficult and painful, is imperative.

Issue in Question - The Nexus

Africa must grapple with at least three major trends which deeply affect its current state of underdevelopment which if not resolved will largely determine and enhance its poor future. The three fundamental issues being:

- human resources development and institutional infrastructure/capacity building;
- improving the agricultural sector through scientific, technological and industrial development;
- establishment of democratic governance.

The three factors are interrelated. In different ways they contribute to the pace of human capital formation within the framework of the evolution of super-technology and mega trends for the 21st century. Though emphasis will be focused on human resources development, and of its impact on information technology and vice versa, it is imperative to keep at the back of our minds the influencing impetus of two factors.

Poor human capital formation in Africa imply that the people are unable to collect information and to use available knowledge for development purposes. Secondly, the literacy gap between males and females is just as wide as the disparity in the enrollment of students in the arts/social sciences, and natural/engineering disciplines. In the majority of cases, the infrastructural capacities are non-existing or are out-of-date. They cannot therefore offer the necessary conducive enrollment for the needs of an escalating student population increases. In addition to these set backs is the insufficient financial investments toward building the necessary critical human mass.

The vicious cycle spins in different ways, different speed and in different places. There are important country variations. Some countries are making progress, others are not. Because of poor human resources development, the agricultural sector on which Africa depends for foreign exchange earning is hampered.

As earlier indicated, the continent is unable to produce enough food to feed its rapid population growth; secondly, it is incapable of processing its raw materials due to a weak and deficient scientific and technological base. An undeveloped scientific and technological base constraints the process of industrialization. Africa is not moving into areas of high agricultural, industrial and economic potential, thanks to its lack of skilled

human resources and poor scientific and technological underdevelopment. Yet these are crucial sectors necessary for advancing development, improved administrative and political structures in Africa - better governance. Good governance being necessary for the continent to address most of its underdevelopment problems.

The challenge to build long-term African capacity is an acid test for the continent. Human resources development and capacity building should be a priority included in every development activity in Africa. It should be a major focus now and in the twenty-first century. Progress will no doubt take time. A determined and sustained effort over several decades is required.

Human Resources Development (HRD)

The United Nations Conference on Science and Technology for Development (UNSCTD 1979) noted that:

> *"For development to proceed equitably all sectors of the society must be involved in the choice of science and technology, all must be aware of its limitations and all must enjoy its benefits."*

In the same vein, the Harare Conference of African Ministers of Education (1982) went further to recommend that education policies in African countries should regard as priority, the improvement of the command of scientific and technological knowledge and that the foci of such effort should be girls and women. Similarly, the United Nations Conference marking the end of the World Decade for Women (UN1994) recommended:

> *"Remaining barriers to higher education should be removed and the education of girls in science and technology encouraged."*

The high illiteracy rate in Africa at time of independence forced a form of human capital formation oriented toward mass production emphasizing on numbers rather than skills and quality. Secondly, greater emphasis was focused on the liberal arts and other social science subjects. Natural sciences and engineering subjects were either not encouraged or did not attract the interest of potential candidates. Finally, disparity between male and female gender in human resources development is

very pronounced in Africa (Forje 1996). The outcome is that Africa has the least number of scientists and technicians per 1000 inhabitants. See Table 1:

Table 1 Number ot Scientists and technicians per 1000 inhabitants in African Countries

Rank	Country	1	2	3
59	Libya	17.2	-	0.6
60	Seychelles	29.0	-	0.3
69	Algeria	70	50	-
78	Tunisia	3.5	27	0.5
100	South Africa	-	-	0.4
106	Egypt	20.9	18	0.8
110	Swaziland	1.4	43	-
120	Gabon	20.6	-	0.2
127	Cameroon	18.0	28	-
128	Kenya	1.6	22	1.3
137	Nigeria	3.9	36	0.1
148	Central Af Rep	7.1	9	0.1
150	Madagascar	5.0	23	0.1
153	Senegal	3.3	20	0.6
154	Benin	6.1	16	0.2
160	Guinea	9.5	46	0.3
166	Burundi	12.8	31	0.1
174	Niger	1.1	21	
All development countries		7.3	30	0.8
Least development countries		5.1	23	-
Sub-Saharan Africa		6.6	3.0	-
Industrial countries		-	21	46

Source: John W. Forje (1996) Human Capital formation - Super Technology and Mega Trends for the 21st Century (ACDESS) Ijebu-Ode. Compiled from UNDP 1996 Human Development Report.

note:1 = Secondary Technical Enrollment (as percentage of total Secondary 1998-1991;
2 = Tertiary natural and applied sciences enrollment as % of total tertiary, 1992
3 = R & D scientists and technicians per 1,000 people 1998-1992.

At the same time Research and Development Expenditure (R & D) on education in Africa is still low. For example public expenditure on education as percentage of total government expenditure in 1990 were

as follows:

Table 2 Public expenditure on Education as Percentage of Total Government Expenditure in 1990 in African Countries

Rank	Country	1	2	3
60	Mauritus	11.8	81	7
121	Zimbabwe	-	85	10
123	Cape Verde	19.9	72	3
124	Swaziland	22.5	62	21
127	Cameroon	19.6	70	30
129	Ghana	24.3	64	11
130	Kenya	16.7	77	15
131	Lesotho	13.8	76	18
136	Zambia	8.7	66	17
140	Togo	24.7	56	29
143	Zaire	6.4	77	23
147	Tanzania	11.4	63	17
154	Djibouti	10.5	80	12
156	Rwanda	25.4	82	16
157	Malawi	10.3	55	30
158	Uganda	22.5	81	13
161	Gambia	11.0	63	18
165	Burundi	16.7	76	22
167	Mozambique	12.0	66	10
168	Guinea	21.5	42	31
169	Burkina Faso	17.5	68	32
171	Ethiopia	9.4	82	12

Source; Forje (1996) Human Capital Formation in Africa - Super Technology and Mega Trends for 21st Century, ACDESS Ijbeu- One. Compiled from 1995 UNDP Human Development Report.

note:1 = Education as % of total government expenditure 1990

2 = Primary and secondary education as %of all levels 1990

3 = Higher education as % of all levels 1990

Even though there has been substantial increase in the number of educational establishments (primary, secondary and tertiary) in most countries since independence, it still does not reflect in real terms the increase in the natural sciences, mathematics and engineering sciences and other related subjects and disciplines. The education imbalances (male-female ratio and social sciences/natural sciences and engineering

disciplines) impedes advances in science and technology related activities. It places female gender at a disadvantage in effectively participating in the socio-economic development of the society.

The tendency so far is that women are more inclined towards disciplines essentially related to the continents burning issues - food production, health-care and education. However, such female gender inclination should be viewed more positively. But measures should be articulated to encourage as well as remove impediments inhibiting them to excel in scientific and technologically related activities; and to enhance their contribution to the solution of scientific and technological problems confronting the society.

On the whole, human resources building represents a major resource for national development and women should be encouraged to be active participants in the process. To address the structural problems with the seriousness they deserve, new policy measures should be formulated and implemented to facilitate their participation also in an export-oriented manufacturing economy. The development of an export-led technology in Africa requires that education curricula be geared towards science and technology and also to incorporate the female gender in the manufacturing and technology oriented service sectors.

By 1992 only seven percent of African women were employed in industry-related activities compared to 17 percent for men. Sub-Saharan Africa has a very low percentage of women in technological-industrial oriented activities than anywhere in the world. More skilled female labour force is required to engineer Africa's participation in the globalisation of science and technology and in particular, in the field of information technology. Women should intensify their onslaught for greater involvement. This implies shifting from the traditional social sciences, arts, home economics, nursing subjects to effective enrollment in natural sciences and engineering subjects; and to develop technological ability in every discipline and at all levels of society, public and private sectors.

There is concern over the relatively low proportion of graduates in the natural and engineering sciences. This has great consequences for the industrial sector. Economic development and technological-industrial advancement depend critically on the quality of human capital. Lindani Ndlovu (1996:171) points out that "African economies facing a lack of appropriately skilled personnel have resorted to the use of expatriates who are not effectively replaced when they leave and remove their skills, which require local skilled personnel. There is the shortage of professionals and technicians in plant supervision and quality control, in

management, marketing, finance, repairs and maintenance.

Mega-Trends in Information Technology

The gap between Africa and the industrial world is constantly widening as the result of the rapid technological changes taking place in the industrial nations. The emergence and use of the information technology super-highway is widening the gap even further. The implications of microelectronic based innovations are felt in every aspects of daily life the world over. These new emerging technologies are influencing development process and attitude of work and leisure. The importance of information technology for development is now recognized. Unfortunately, Africa is vulnerably placed in the development trend and use of the emerging information technology super-highway which promise vast opportunities in solving most of the continent's underdevelopment problems.

The use of information and communication technology/electronic communication (e-mail) has reduced the entire world to a small community. Information technology cuts across every aspects of development; gathering, storing, retrieving, analyzing and disseminating of information and knowledge are fundamental to resolving problems, enhancing productivity and accelerating the pace of economic growth and social welfare. The challenge for Africa is to place information and communication technologies within the wider framework of the entire spectrum of science and technology and to move towards an accelerated development within the discipline. Appropriate measures must be taken to reverse Africa's technological backwardness now or the continent will continue to remain a passive onlooker as information and communication accelerates the improvement of the quality of life for citizens in the industrial nations and in other parts of the world.

This brief outline on the importance of mega-trends highlights the unfolding nature of information and communication technology and of its effects and impact on African countries; the challenges it poses to existing development strategies. As already indicated, scientific and technological advancements are affecting and influencing the international division of labour. Equally important in this direction, is that developments in micro-electronics, genetic engineering, and biotechnology are changing and influencing the nature of society and the future of the social, economic and political structures of African countries.

To develop scientific and technological capability at various levels, it is necessary to increase the number of personnel with technical and scientific skills. Facilities for training should be expanded and existing ones improved upon. There are essentials for information and communication technology in order to boost the continents technological developments and competitive edge in world development.

Challenging Issues

Information is knowledge, and knowledge is power. The information technology system is imbued with the capacity to improve the quality and the timeliness of the information available to administrators to improve decision-making and resource allocation in the public as well was private sectors, for researchers to up-date and exchange information, for individuals to communicate with each other. The failure or success of an information system is dependent on the relationship between those responsible for the development, operation and usage of the information system. There is no doubt that the absence of information or wrong information constitute a major hinderance to the development of the African continent.

Flawed or poor information can lead to wrong decisions and wasteful resources required for development purposes. In the context of Africa, such waste further impacts the development process. Scarce resource such as skilled human capital formation and foreign exchange are often short in supply to acquire. These new technologies facilitate the provision of information much easier, cheaper and more widely disseminated. Therefore development and usage of information communication in Africa is of vital importance. Without accurate and up-to-date statistical data bases and other relevant information, it is difficult to see how the continent can progress or bridge the existing gap between North and South. Statistical base of most African countries are either weak or non-existing. Even where they are available, it is often impossible to have access, retrieve or disseminate to a wider audience. Both knowledge and information exchange are constrained so also policy makers are inhibited to making correct policies due to the lack of initial and solid information bases.

The core of the statistical structure (office of statistics) in many African countries are ill-equipped lacking both the skilled manpower capacity and the requisite tools for gathering, processing and maintaining an

up-to-date statistical base necessary for planning and development needs of the country. A good overview and strict control of commercial stocks, imports and exports, tax collection and national accounts would be of great value and benefit, while at the same time saving scarce foreign exchange in many sectors.

Information concerning revenue collection, population growth, urban-rural migration, city density, water and energy supply, health-care, educational infrastructures, roads and transportation, agricultural output, metrological data amongst others are necessary to give the planner and policy-makers an accurate perspective of the needs of the society, the constraints and resources available to attained perceives objectives. In the private sector - especially the commercial sector, the automation of the banking sector will go a long way in offering better services to customers in Africa, bringing the banking sector in line with development in other parts of the world.

Apart from South Africa, Egypt, Tunisia, Algeria, Kenya and a few other countries, modern methods of data processing, storage as well as retrieving and disseminating are still underdeveloped. Given the very nature of today's society compared to some years back, the multifarious issues involved, it is only reasonable and most appropriate that mechanisms that can effectively and efficiently aid in the process of information analysis, storage and exchange be put into use. There is hardly any area of our daily life that the new information technology super-highway cannot be used. Needless to bother you on this. However, at least one example may suffice - an example in the educational sector. The use of the e-mail gives access to various library depositories world wide, or specific journal articles. Most newspapers, journals, for example, the Economist, Wall Street Journal and the Encyclopedia Britannica are now available electronically, making it easier for readers and researchers to get instant information. Fellow researchers across the world are in contact and can easily share experiences, information and knowledge as well as keeping abreast with developments in other parts of the world and in their discipline or areas of interest.

For African countries where the educational sector has been subjected to serious cuts in financial investments, access to this world of information is a big relief in maintaining academic contacts and excellence in spite of the dwindling financial inputs. For example, the University of Ibaban (Nigeria) and the Regional Centre for Information Services (ARCIS) and the scientific data base in the department of Chemistry of Ibaban University are linked through Fidonet codes and

CGENTT respectively which helps to keep them up-to-date with developments in other parts of the world. Research results can easily be disseminated to a wider audience of researchers, for example, the International Institute for Tropical Agriculture (IITA). Ibaban using the CGNET internet connectivity can be reached by many researchers. The African Association of Universities (AAU) in Accra, Ghana can supply information to other universities and interested bodies through the internet.

Many examples can be cited in which the information technology super-highway is making the world a global village, or more accurately put, an expanding "Global Information Village" (GIV) which with the ongoing development trends will soon merged into a "Global Information Home (GIH)." People can stay home and conduct business, conferences, office work and international banking or commercial activities, thanks to the penetrating impact of the internet as repository for a wide variety of topic, information exchange and so on.

Fundamental Constraints

While the benefits to be derived from information technology are many and varied, Africa is currently handicapped in taking advantages provided by these emerging technologies due to the following issues, amongst others, namely:

- Poor and unreliable infrastructure for example: (a) inadequate or erratic electricity supply; (b) insufficient telephone lines and connections - in short, the existence of a poor, inefficient telephone communication network and electricity supply constitute a major bottleneck for the proper utilization of information and communication technologies.

- Poor and inadequate human trained resources and weak institutional capacity; There are insufficient training facilities available in most countries.

- Improper prioritising of socio-economic development policy strategies which often results in the extensive under-utilisation of equipment and human resources.

In addition to this, and as earlier stated, Africa's technological de-

ficiency in the globalisation of science and technology remains a major obstacle for the proper use of information technology. Africa has the lowest percent of the world's total of researchers and technicians per 1000 inhabitants. The continent's literacy rate is the lowest, so also the average level of income which is the lowest in the world. The continent has 12 percent of the world population and only 2 percent of the world's main telephone lines. To crown it all, 35 of the world's 44 in least telecommunication countries with the world are in Africa. So also the largest number of countries classified by the United Nations as least developed counties are in Africa.

The use of information technology (e-mail) requires access to a functional telephone network system and computer. In Africa, 35 countries have less than one telephone per 1000 people. A computer and its accessories cost less that a month's middle-income salary in the industrial world. In Africa, obtaining one amounts to several years of a monthly salary. Not many people have access to the information technology in Africa. Yet it constitute a very vital tool that is radically reshaping the world in all aspects of development and existence on planet Earth (Forje 1996). As previously stated, the information technology super-highway transcends every aspect of our daily life and existence on this planet - education, world of work, economic and industrial activities, agriculture, social life and leisure hours. Computer technology is influencing every sector of society. But Africa seems to be a passive onlooker which will only further marginalized and isolate the continent from the rest of the world.

These and other related facts poses a critical threat to Africa's development in the twenty-first century. The absence of any clear policy decision and honest commitment in Africa by Africans, particularly to understand, master and judiciously adopt the new and emerging technologies for the benefit of the continent and its population, these technologies will become threats to the very existence and survival of the continent. Overcoming these constraints requires proactive policy measures for example, concerning human capital formation. Human resources are extremely important factor for the implementation of any policy. An education and training policy for informatics which satisfies the needs of the market is therefore necessary.

The potential benefits of information technology for Africa can only be realized when the series of barriers, social, cultural, economic, political and technological are eradicated. The political barriers include instability of governments, constant changing of priorities. These barriers

are major impediments for the successful adoption and implementation of information technology. However, the first step in this direction of redressing these obstacles lies in human resources development and training as advanced by Thorpe (1984). It is only reasonable for African countries to articulate and implement technology policies which should ensure full internet connectivity possible in each country thereby preparing the country for the challenges of the super-highway of the twenty-first century and beyond.

Some countries in the region, for example, South Africa, Egypt, Tunisia, Algeria, Kenya, Morocco, Zimbabwe, Zambia have made sufficient efforts in obtaining connectivity. Others like Nigeria, Senegal and Ethiopia have also joined the connectivity bandwagon. South Africa has advanced further, ranking sixteen in "respect of the most wired countries in the world, that is, with the greatest number of host computers interacting on the internet. In the context of the communication revolution, South Africa takes its place at the top of the list for developing countries, following 15 industrialized nations" (Johnson 1996).

According to a survey undertaken by the weekly Mail and Guardian between 1-7 September 1995, of 2000 users of the internet, 76.2 percent were male. The survey further revealed other characteristic features in respect of primary users of the internet being as follows; (Johnson 1996)

- Research 36.4percent
- Entertainment 26.5percent
- Communication 18.8percent
- Sales/marketing/PR etc. 11.4percent
- Education 6.5percent

The Georgia Institute of Technology (USA) which conducted the survey on the profile of internet users largely in the United States, showed that female users contributed only 10 percent as against 90 percent for men. Male-gender disparity as reflected in the United States survey correlates with existing disparity in Africa. Taking into consideration the existing disparity between male and female in Africa in the education sector, it means that only a small proportion of females use the internet in most African countries. Existing disparities highlight the need to incorporate and encourage the female gender to be part of the evolving information technology super-highway. Secondly, it shows the importance of the new technology for researchers. With the right connectivity, all research centres/institutes can be connected to encourage the exchange

of ideas - for examples, all research institutes dealing with Food and agricultural related activities (IITA, Palm Oil research institutes, cocoa research, rubber research, roots and tubers, horticultural research, forestry etc). can be linked together. So also fisheries and marine, livestock, medical, civil engineering, industrial etc, within and between nations can be kept abreast with ongoing research activities and for researchers to collaborate with each other in respective disciplines or areas of interest.

Capacity Building and Connectivity in Africa

Capacity building and connectivity is still poor in Africa. Even though efforts have been made to (a) improve on telephone lines and (b) energy supply; the two inherent driving components ensuring the functionality of the internet, much has yet to be accomplished for the information technology super-highway to have a meaningful impact on the various spheres of activities, commercial, agriculture, health, education, transportation etc.

Africa is presently fraught with communication problems. This helps to isolate the continent from the global community. For example, in the period 1978-88 the Transport and Communication Decade of Africa ended with only 1.1 percent of the world telephone lines allocated to Africa. More that half the 4.3 million lines were and are still located in South Africa (UN Doc.1993). Furthermore, in respect of the continent's communication infrastructures in comparison to the developed world, there were in 1961 58 newspapers, 94 radios, 13 cinema seats and 32 television sets per 100 inhabitants in the developed world as compared to the minimum Unsoc's requirements of 10 newspapers, 5 radios, 2 cinema seats and 2 television sets per 100 inhabitants for the developing countries. Thirty-five years after independence these figures have not been attained in many African countries.

These basic and yet fundamental communication infrastructures have to be improved upon for the continent to be part of the evolving global information and communication super-highway technology. Some countries with existing E-mail networks include as per table 3.

Table 3 Existing E-mail Networks in African Countries

Country	Organisation	City
Algeria	Algerianet	Algiers
Angola	Development Workshop	Luanda
Botswana	University of Botswana	Gaborone
Burkina Faso	ORSTOM	Ouagadougou
Cameroon	ORSTOM	Yaounde
Congo	ORSTOM	Brazaville
Cote d'Ivoire	ORSTOM African Development Bank	Abidjan
Egypt	Egyptian Universities Network	Cairo
Ethiopia	PADIS	Addis Ababa
Gambia	African Center of Human	Banjul Rights (ACHRDS)
Ghana	FOE-Ghana, Ghastinet	Accra
Lesotho	National University of Lesotho	Maseru
South Africa	Sangonet / Worknet; Uninet	Johannesburg Pretoria
Swaziland	University of Swaziland	Mbabane
Tanzania	COSTECH	Dar es Sslaam
Uganda	MUKLA	Kampala
Zambia	UNZA	Lusaka
Zimbabwe	MANGO-University of Zimbabwe	Harare

Source: John W. Forje (1996) Information Technology and Communication Revolution ACDESS, Ijebu-Ode Nigeria.

According to a survey conducted be UNGLS/Friedrich Ebert Stiftung (1995) on network providers and users in African countries are still less than in a single European country.

Table 4 Network Providers and Users in African Countries

Country	Type of network	Registered Users
Angola	Ridsang (SDN Network)	-
Cameroon	Hnet	30
Ethiopia	Padisnet - ECA	300
Senegal	ECDADAKAR	60
South Africa	SANGONET	500+
Zambia	Zangonet /Zament	na
Zimbabwe	MANGO	250

Source: John W. Forje (1996) Information Technology and Communication Revolution ACDESS, Ijebu-Ode, Nigeria.

It is necessary that national, regional, and continental wise, communication networks be developed or improved upon to facilitate the use of these emerging technologies. For example, Pan African Telecommunication Network (PANATEL), The Regional African Satellite Communication System (RASCOM). The ARBSAT and the AFRIST which is a private US company with the goals of establishing a commercial satellite for African use. At the national levels communication establishment such as Nigerian Telecommunication (NITEL), Cameroon Telecommunication (Intelcam) and telephone systems in other African countries should improve on their connectivity services.

The capacity building for electronic communication in Africa (CABECA) executed by the Pan African Development Information System (PADIS) of the United Nations Economic Commission for Africa (UNECA), funded by the Canadian International Development Research Centre (IDRC) is one of the few networks which many African countries should exploit. So also the Regional Informatics Network for Africa (RINAF) developed by the Inter-governmental Information Programme (IIP) of Unesco with the purpose of enhancing basic internet services (e-mail, bulletin boards, access to data bases etc.) to serve many African countries. The Regional African Satellite Communication System (RASCOM) is intended to provide a unique opportunity for the 52 nation-states in Africa to examine their future telecommunications requirements with a view to evaluating the types of technologies that would best meet their needs now and beyond the twenty-first century.

Technology Desert and Opportunities

This brief status review and evaluation of the state of information and communication technology in Africa not only highlights how deficient the continent is in terms of the new technologies but also streamline the vast opportunities that exist in this technology desert continent for the development and utilization of information and communication technology. In a way one can say that the technology desert continent awaits the new empire of information/communication technology super-highway.

For example, the Africa One Project if properly realized will link Africa's 41 coastal countries and islands to each other and to rest of the world. The Africa One project constitute a gateway to the Global Fiber Optic Cable Network. By this, it will integrate the continent into the global telecommunication network and attract MNC investments Africa. It will link African traffic to international cable systems.

South Africa already well placed in the sector is expected to extend its connectivity facilities to other African countries, from Cairo to the Cape, from Dakar to Dar es Salaam, is indicative of the network growth necessary for building a strong and healthy "Common Home Africa" dream for the continent in the twenty-first century. (Diamini 1995) elaborates on this fundamental development as a positive sign for the future. "South Africa's contribution in this area has already gone beyond the Southern African region, as leased line between the East African region and South Africa are being proposed. The development could put most of the Sub-Saharan Africa on the long awaited information superhighway."

It is forecasted that teledensity in Africa will grow 74 percent by the year 2000 compared to 32 percent world average. As such there is strong demand for intra-regional communication. This demand is not being met with the existing facilities. The advent of broadband (multi-media) traffic will lead to further demand. Implying that as a latecomer, the African telecommunication demand will unleash pent up demand and stimulate additional need for telecommunication services which will eventually enhance the information technology impact on the process of development throughout the continent.

As a research desert, Africa offers vast opportunities for the expansion of the communication network and of the use of information technology super-highway. But these opportunities and developments require proactive strategic policy measures and a determined political will

to set the trend of development on the right track. Of course, constraints exist. But these constraints can be overcome provided the political will is there to seriously address the reality of the issues in question. Some of the proactive policy strategies and recommendations include:

- The urgent need for establishing an enabling an environment in which many ideas flow together, fertilize each other and challenge each other for the ultimate goal of building a strong, united and developed continent that has the competitive edge and stamina to participate actively in the community of nations;

- Policy strategies for information technology evolving within the much broader framework of a coherent national science and technology policy strategy. A master science and technology plan is necessary and which should have a vision of about fifty years on - the goal 2040;

- Enhancing female gender resources development and active participation in the information technology super-highway;

- Regional and national centres for information technology should be established and existing institutions reinforced with substantial funds, manpower etc.;

- Measures should be taken at the national levels to promote computer literacy and to cultivate a science and technology culture in the society. The goal should be total literacy (computer as well) for all by the year 2020;

- Cooperation - networking within and across national frontiers should be encouraged;

- Human capacity development (HCD) should strive towards encouraging female gender development , and interests in the natural sciences, mathematics and engineering disciplines should be promoted.

Conclusion

Africa's state of the information technology super-highway is grossly under-developed with devastating consequences for the continent's tran-

sition to an industrial polity and good quality life pattern for its citizens. Not only are telephone lines inadequate, electricity supply erratic, but human capital formation has yet to be properly developed.

Designing the future requires proactive strategic policy measures now so as to get the continent as part of the evolving globalisation of science and technology. The pace of change has never been so fast and its magnitude is undoubtedly unprecedented. The first industrial revolution did not unleash the kind of developments currently taking place throughout the world and almost at the same time. No nation has any monopoly to the various mega-trends in the empire of information technology. As a result, the wind of change have not left any aspect of our life untouched and while some have chosen to stay on spectators side, concerned institutions and individuals are mapping out new strategies and means to bring these developments to the reach of many.

The gap between the industrial and developing world is widening; the information gap if not properly addressed will widen further the existing gap to the greatest disadvantaged of the already marginalized part of the globe. Female gender, which constitute more than fifty percent of the world population, should not be left out in the bid to give Africa the connectivity and advantages that are inherent in the new technologies for development and social transformation.

Unless African countries start moving in the direction described (which is not exhaustive) they will not have much hope for attaining sustainable development, but will rather be reinforcing the present international world order of marginalization and the non-participation of the continent in the globalization of science and technology. The continent has to develop a system of scientific and technological awareness forecasting and policy making in the interest of the people and taking advantage of mega-trends around the world.

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