KNOWLEDGE AND TECHNOLOGICAL INTERACTION: A POLICY ORIENTED STUDY OF THE AFRICAN UNION

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ABSTRACT

Powered by developments in new technology applications, the world is moving rapidly towards knowledge-based economic structures and information societies that comprises networks of individuals, firms and countries that are linked electronically and in interdependent relationships. Knowledge, education and technological innovations present opportunities for "leapfrog" strategies that could accelerate the development of the African continent. This paper therefore argued that without innovative public policy, innovative technologies could become a source of exclusion and conflict; and if any form of development is empowering in the 21st century, it is the acquisition of knowledge and the creation of technological capacity for the newly emerged African union.

1.0 INTRODUCTION

In an increasingly globalize economy, modern technology is one of the key determinants of competitiveness and growth of firms and countries. Thus, economies are becoming more competitive on the basis of their knowledge, rather than on the basis of natural endowments or low labor cost. However, the true revolutionary aspect of modern technology (IT) is believed to be the possibility it offers to unbundled information from its physical carrier and this means that the economics of information can be separated from the economics of things. Technology has an enormously important role to play in building the social capability to generate information and to apply knowledge for sustainable development. By social capability, we mean the levels of general education and technical competence that complement technological capabilities, to generate economic growth.

National scientific and technical innovations systems are the foundation for selecting areas of formation production or use in which to concentrate scarce economic and knowledge resources. This concept refers to the processes of technological and institutional capability building and policy-making that enable effective choices to be made and implemented. In relation to social capability building, it encompasses the social, political, and economic features of the institutional context in which learning takes place. Learning is not something that only people in firms do but very important for public and private sector organizations and institutions. Learning is as important for effective policy-making as it is for the competitiveness of firms or the effectiveness of local community groups. It is both a formal and informal process and the outcomes of policy-making and the management of new technological innovations are designed and articulated in the everyday interventions and experiences of information and communication technology, producers and users (Silverstone and Mansell, 1996).

Indeed, the role of education in development has to be assessed across a broad range of development objectives. Clearly, f one of the important objectives of development in Africa is to be greater self-reliance and autonomy from outside influences and resources, the mobilization of Africa's human resources through expended programs of education and training must play a key role in achieving this objective. And as Africa faces the challenge of unprecedented scientific advancement and technological change while, at the same time, seeking to maintain both its own cultural traditions and the integrity of its environment, education at all levels is bound to be a critical variable in

resolving this formidable task. While it is importance to recognize and better understand the impart which education is capable of having on development, it is equally important to realize that this relationship between education and development is reciprocal, and that the development of education systems, is in its turn profoundly affected by changes in its demographic, social, political, economic and technological environment. Thus, any attempt to expand, improve or reform education in a given society depends for its success on an understanding of a rather broad range of conditions in that society which determine both the possibilities and the limitations for educational policy.

So with the Internet and biotechnology advances reaching the market, it is time for a new partnership between technology and development. This paper is intended as the manifesto for that partnership. But it is also intended as a source of cautionary public policy advice to ensure that technology does not sweep development off its feet, but instead that the potential benefits of technology are noted in a pro-poor development strategy. And that in turn means that technology is used to empower people, allowing then to harness technology to expand the choices in their daily lives. While it is undeniable that many of the high-tech marvels that dazzle the rich north are inappropriate for the poor south, it is also true that research and development addressing specific problems facing poor people (from combating disease to developing distance education) have proved time and again how technology can be not just a reward of successful development but a critical tool for achieving it.

Our challenge therefore, is to map a path across this fast-changing terrain. Not just to put to rest the debate over whether technological advances can help development but to help identify the global and national policies and institutions that can best accelerate the benefits of technological advances while carefully safeguarding against the new risks that inevitably accompany them. It is against this background that our paper is divided into five sections. Following this introduction, the next section examines the new revolution by looking at its three components (knowledge education and technology). Section three examines the formation and composition of the African union, section four outlines policy proposals and challenges for the emerging union. The conclusion of the paper is provided in the last section.

2.0 THE NEW REVOLUTION: KNOWLEDGE, EDUCATION AND TECHNOLOGY

Knowledge has always been the driving force of change in human societies. It is a public good since one can share it with others without losing it. But knowledge is different from other public goods since it is provided mostly privately. Individuals create knowledge and this does not exclude socially created knowledge, emerging from educational systems and the cultural heritage of society. Thus, the knowledge society has one important input of production, which is unusual in being a public good that is privately produced. Essentially, the most interesting and innovative knowledge originates from human brains. Although much knowledge resides in physical and electronic media, the ability to create new knowledge and adapt or cross-fertilize across different areas resides in humans. The privacy of human capital can lead to changes in the distribution of income and wealth, incorporate structure and financial markets, and in the environmental impact of economic activity. It can also lead to new patterns of development and chart new relationships between industrial and developing countries.

Since the knowledge society is more innovative, the cross-fertilization of different ideas and ways of thinking may prove valuable. In otherworlds, the knowledge intensive development is the key to economic progress and it replaces resource-intensive growth, which dominated the world economy since World War II. Here, humans and human capital are at the center of economic progress, replacing capital and material property. Thus, knowledge means the ability to choose wisely what to produce, and how to produce it. The ability is becoming the most important input of production, and the most important determinant of wealth and economic progress. It is worth noting that the computer industry is based on information technology while other sectors (telecommunication, biotechnology and financial sectors) involve knowledge. Thus, knowledge is the content and the information is the medium. The content therefore is driving change, facilitated by the medium (Chichilnisky, 1998; Nwaobi, 2000).

For individuals and for countries, education is the key to creating, adapting, and spreading knowledge - Basic education increases people's capacity to learn and to interpret information. Higher education and technical training are also needed to build a labor force that can keep up with a constant stream of technological advances, which compress product cycles and speed the depreciation of human capital. Because each

level and type of education (basic, tertiary, and practical) plays an important role in the absorption of knowledge, the process affects all ages. Again, basic education develops a person's capability for learning, for interpreting information, and for adapting knowledge to local conditions. And through its effects on economic productivity and on other aspects of life such as health, it helps determine a person's well being.

Indeed, basic education is critical for enhancing people's capabilities to harness knowledge, particularly in the poorest countries. But it should not monopolize a nation's attention, as it becomes a player in global markets. However, countries at or near the technological frontier need strong tertiary education and research institutions to compete in the creation of new knowledge. The production of new knowledge, as well as its adaptation to the setting of a particular country, is generally associated with higher-level teaching and research. Thus, the universities serve a multiplicity of roles by not only enhancing the skills of future workers but also producing new knowledge and adapting knowledge produced elsewhere.

Distance education has been advocated as a cost-effective means of increasing the number of qualified teachers (a major bottleneck limiting expansion of formal schooling). It has been fund to reach more teachers than conventional methods using the same amount of resources. However, the most promising gains to new technology may come from its use in tertiary education. It can help developing countries with too few classrooms and teachers get around these resource constraints. Video conferencing, lets students from all parts of a country speak directly with the best teachers. Examinations can be administered on-line, and course materials and homework can be exchanged by email. The virtual classroom is more effective, however, when complemented by face-to-face interaction between teacher and student. At a minimum, there is an ongoing need for teachers capable of customizing content to local needs and requirements.

As the store of human knowledge continues to grow in size and complexity, and to be updated at an ever-faster pace, people need to engage in structured and systematic learning throughout their lives. Lifelong learning is especially important in developing countries where most adults never received basic education during their youth. For many of then, lifelong learning starts with basic literacy and numeric. Modern communication technologies will allow them to learn at their own pace outside school or the workplace. Essentially, basic education is the foundation for building a healthy, skilled and agile labor force and for competing successfully in world markets. Education beyond the basics

also has a role in securing the ability of countries to assess, adapt, and apply new, information-based technologies. Despite the expansion of enrollments in recent decades, success in extending quality education to all has been limited and new challenges have emerged. In still too many settings, some groups have not shared in the gains. Many school systems in developing countries fail to meet even basic academic standards. Meanwhile, demand for secondary and tertiary education is rising faster than the public sector can provide if. Solving information problems in education systems is the key to addressing these challenges. *World Bank, 1999).

Today, a new revolution is in full career made possible by new technologies that can shuttle vast amounts of information almost anywhere in the world in mere seconds. These advances in technologies will enable the construction of whole new societies in cyber space, linking individuals with common interests to share-views and information. People in developing countries can apply the new technologies to a vast range of activities, including education, finance, the environment, income generation by the poor and policy-making. Despite this great promise, some caveats are in order. As with the industrial revolution, gains will be fully realized only when ways of doing business have adapted more fully to the changed technology. Even with large investments in new technologies, skeptics remain unconvinced about their eventual impact on economic growth. Skepticism is even more widespread in developing countries, where use of the new technologies is still sparse. The skeptics point out the dangers, and the costs, of information overload, including the huge costs involved in absorbing and sorting through vastly increased flows of information. Another concern is that those who have access to the new technology may forge ahead, leaving those without access behind and widening gaps in well being both between and within countries. Some worry that the wider market-place of the global economy opens up opportunities for increased concentration of market power, and that the industrial, not the developing countries, will reap a disproportionate share of the profits.

Finally, even if the ultimate impart of the information revolution turns out to be something less than the current excitement suggests, it is likely to have profound positive effects on the economy and on society. Developing countries are already reaping huge benefits in areas where lack of modern communications represented a real impediment. But reaping the full benefit of these new technologies will take longer, because they will take time to fully perorate these countries. Because of this, older means of communication are likely to remain important for the

foreseeable future: radio, television and newspapers. However, the new wireless technologies will extend modern communications into areas that conventional copper wire would have taken decades reach. Indeed, to compete in the new global economy, developing counties must make the development and effective use of information infrastructure a top national priority. They have to seize the opportunities offered by the new technologies to enhance private provision of telecommunication services and extend the reach of the new technologies throughout society if done well, these strategies promise to enhance educational systems.

3.0 THE AFRICA UNION

Africa is the second largest of the earth's seven continents, covering about 30,330,000sqkm, including its adjacent Islands. The African continent is characterized by Plateau land, with a few of distinct mountain ranges and a narrow coastal plain. The continent is commonly divided along the lines of the Sahara desert, the world's largest desert, which cuts a huge swath through the northern half of the continent. As it 2001 (as shown in table 3.1) an estimated 798 million people, lived in Africa. Most of the Africa's population lives in the region south of the Sahara, known as sub-Sahara Africa. Africa has a proud and noble history. It is widely believed that human life began in Africa sometime between 5 million and 8 million years ago. The continent was home to one of the world's first great civilizations, the Egyptian Empire that was united more than 5000 years ago. Culturally, Africans are perhaps the most diverse of any continent's inhabitants, with thousands of ethnic groups and more than 1000 different languages. With ethnicities that often cross national boundaries and continual political upheavals, African National identify is not as strong as racial ties or local kin group affiliations.

Traditionally, the vast way only of Africans have been farmers and herders who raised crops and livestock for subsistence. Manufacturing and crafts were carried on as part-time activities. A few states developed long distance trade systems, and in these places complex exchange facilities as well as industrial specialization, communication networks, and elaborate governmental structures maintained the flow of commerce. But overall trade in Africa was limited by transportation and communication difficulties and by differences in currency and other incompatibilities. With European colonization came overseas demand for

certain agricultural and mineral products and internal labor migration; new and safer transportation systems were constructed; European technology and crops were introduced; and a modern exchange economy evolved. Cheaper or better European goods frequently undermined local industries and crafts. Processing industries developed, as did ports and administrative centers.

However, at independence Africans had high hopes of rapid development. New energies were released by the ending of colonialism, and African leaders were determined that their countries should catch up with the developed world. The first generation of African leaders adopted economic strategies that echoed the ideas of prominent economists of the day, industrialization was believed to be the engine of economic growth and the key to transforming traditional economies while agriculture was relegated to the secondary role of supplying raw materials and providing tax revenues to finance other development. To complement these strategies, African leaders believed that the government had to play the dominant role. Much was achieved. Starting from a low base, African countries have significantly raised life expectancy and expanded literacy and health care. There has been enormous growth in the number of trained people and major investments have seen made in Africa's infrastructure: roads, ports, telecommunications and power. Economic growth initially was moderate although shower than the average for other developing countries. The pace quickened after 1967. Record commodity prices and high investments financed from export earnings, commercial borrowing and aid helped raise the growth rate.

But then, as the 1970s advanced countries began to stumble. By the middle of the decade Africans performance had fallen below that of other developing countries. By the 1980s output was actually declining and throughout Africa much of the modern sector has been in malaise for nearly a decade. In contrast, the non-formal sector has shown remarkable dynamism. Yet Africa has witnessed almost two decades of falling per capita incomes and accelerating ecological degradation. She has also lost a substantial part of its share in the world market for its exports and some African countries have surrendered some of the gains they made earlier in human resource development.

Indeed, Africa's generally poor performance during the past twenty years has been reflected in weak growth in the productive sectors, poor export performance, mounting debt, deteriorating social conditions, environmental degradation, and the increasing, decay of institutional capacity. Some lay the lame for the regions economic decline on factors beyond Africa's control, such as bad weather, weak world commodity

prices, fluctuating, international interest rates, and too little aid. Others blame policies, especially poor management of public resources and inappropriate incentives and most recognize the importance of structural factors such as high population growth (World Bank, 1989). The various partnerships between Africa and the industrialized countries on the one hard and multilateral institution on the other have not yielded the expected development for the fifty-five nations of Africa. The existing partnerships or initiatives include the United Nations (UN) New Agenda for the development of Africa in the 1990s; the Africa-Europe summit's Cairo plan of action; the World Bank-led strategic partnership with Africa; the IMF-led Poverty Reduction Strategy Papers (PRSPS); the Japan-led Tokyo Agenda for Action; the African Growth and Opportunity Act (AGOA) of the united states; the Economic Commission for Africa and ECA Led Global Compact with Africa; UN millennium declaration' G8 Okinawa Declaration; Copenhagen Declaration; Skagen Declaration; the Cotonou Agreement; TIKAD; the SINO –African process; the Generalized System of Preferences (GSP); Everything but Arms (EBA), among others. More recently, is the formation of new partnership for Africa's Development (NEPAD). NEPAD's mission is not to replace or compete with the above initiatives, but rather to establish linkages and synergies between the new and old initiatives.

NEPAD was a merger of Senegal's millennium partnership for Africa's recovery program (MAP) and south Africa's omega plan. The merger gave birth to the New African initiative (NAI), an interim working title adopted by the OAU's (Lusaka summit). Latter, the policy framework of WAI was finalized and the committee changed the name to NEPAD. The plan, conceived and developed by African Leaders was described as "A holistic, comprehensive integrated, strategic framework of Africa. The development plan addresses key social, economic and political priorities in a coherent and balanced manner. The NEPAD document states the vision for the continent and clarifies the problems facing Africa and a program of action to resolve these problems in order to attain the vision. It contains the commitment African leaders are making to African people and to the international community to place Africa on a path of sustainable growth. The leaders have pledged their commitment to accelerate the integration of Africa into the global economy, calling on the rest of the World to "Partner with Africa in her own development on the basis of her agenda and program of action."

Indeed, the vision and commitment of African leaders to the ideals and principles of political and economic cooperation, as a means of mitigating the development constraints failed by many small-nation

economies led then to, wrong other initiatives, create the organization of African Unity (OAU) and the African development bank as instruments for fostering African development and unity. This commitment was later reiterated in the Lagos plan of action and subsequently in the Abuja Treaty which envisions the ultimate creation of the African Economic Community. The desire to overcome the economic disadvantages of fragmentation gave rise to the establishment of a plethora of treaties and regional institutions whose overriding objective was the creation of self-reliant development of member states. These include customs and Economic Union of Central Africa (UDEAC) which lather became the Central African Economic and Monetary Community (CEMAC); East African Community; South African Customs Union (SACU); Southern African Development Coordinating Conference (SADCC); Southern Development Community (SADC) Common Market for Eastern and Southern Africa (COMESA); the West African Economic Community (CEAO); the Economic Community of West African States (ECOWAS); The West African Economic and Monetary Union (UEMOA); the Preferential Trade Area (PTA) which was latter succeeded by COMESA and the APAB Maghreb Union (AMU). In addition to this first tier of regional bodies, numerous sub-regional organizations have since been established. In the ensuring period, several organizational trading arrangements were established. The aspirations and mandates of these organizations varied and included; free trade areas (PTA); Customs Unions (SACU), Common Markets (COMESA Charter) and Economic Unions (UEMOA). These integration arrangements reflect varying degrees of deepening of integration with their associated benefits and costs to participating members.

However, independent assessment of the impact of Africa's initial efforts to integrate suggests that the expected benefits have eluded the continent. Equally noteworthy is the absence of any significant change in the structure of African economies. Exports are still confounded to basic mineral and primary products. There is no clear evidence of a causal link between the proliferation of regional and sub-regional institutions and the development of regional infrastructure. In spite of the lather's enormous preferential, its development has not progressed commensurate with the expected benefits. The dismal outcome of Africa's initial efforts to integrate can be attributed to the low level of structural complementarily of the economies. This has inhibited expansion in production and opportunities for trade creation and led to unmet expectations about gains from integration. Several other factors have contributed to the poor outcome and these include: lack of political will to establish supranational

institutions and to implement agreed treaties and mandates; pursuit of import substitution policies; heavy reliance on tariffs for fiscal revenue; over ambitions goals; pervasive weaknesses in regional structures; overlapping membership; inadequate mechanisms for equitable sharing of the costs and benefits of regional arrangements; antipathy to markets; lack of policy credibility; endemic political instability; and lack of rule of law and good governance.

Notwithstanding the dismal outcome from the first generation of integration initiatives, African countries have shown renewed and keen interest in reinvigorating their integration efforts. This has been influenced by rising trends of globalization and deepening regional integration with demonstrable gains in trade, investment and economic growth in Europe, North America and Asia at the same time that Africa was becoming more isolated and marginalized. The trend in global regionalism is reflected in the creation and increase in the creation and increase in the membership of North America free trade Area (NAFTA); European Union Leading to the adoption of Euro; and Association of South East Asian Nations (ASEAN). There is a rising realization among African countries that progressive integration holds great potentials for minimizing the costs of market fragmentation and thus, represents a precondition for integrating African economies into the global economy. These observable benefits from progressive integration in other parts of the world appear to have contributed to the rising trend in the adoption of outward-looking, export-oriented development approaches.

The new integration efforts are being carried out in an environment that is considerably different from the past. Most countries are undertaking wide-ranging economic reforms and opening their economies through extensive trade and exchange system liberalization. Current integration initiatives are broadening the objectives of economic cooperation and regional integration to include and emphasize the co-ordination and harmonization of macroeconomic policies; the lowering of trade tariffs and the removal of some non-tariff barriers to trade; and the facilitation of capital nobility, the free movement of persons and improving the business environment. In addition, progress at different speeds is increasingly accommodated through the 'multi-speed/variable geometry approach' in ways that are consistent with the applicable treaties and mandates of sub-regional organizations while several functional initiatives are emerging that broaden the participation of key stakeholders in the decision-making process or economic cooperation and regional integration activities.

Recently, the constitutive Act of the African Union originated in June 2000 at Lome, Togo with the signatories of the 53 Heads of state and Government of the member states of the organization of African Unity (OAU). However, African Leaders converged in Lusaka, Zambia, for the 37th and final assembly of the OAU Heads of state and Government in July 2001, where the organization was noted out of existence. In its place, the constitutive Act of the newly formed Africa Union was formally ratified. As the African Union comes into force, the continents' Leaders have agreed that integration on the continent could be enhanced if collaboration is pursued within the framework of regional development strategies that favor member Nations. Subsequently, the first summit of the African Union took place in Durban, South Africa (July, 2002), with Lofty promises of a new era of economic development and good government on a continent plagued by poverty and oppression. The Leaders endorsed the idea of peer review, with nations policing one another to ensure responsible government. Some of the objectives of the Union include achieving greater unity and solidarity between the African countries; accelerating the political and socio-economic integration of the continent; coordinate and harmonize the policies between the existing and future regional economic communities for the gradual attainment of the objectives of the union. The union shall function in accordance with some of the following principles: sovereign equality and interdependence among member states of the union; participation of the African peoples in the activities of the union; and promotion of self-reliance within the framework of the union. The organs of the union shall be the assembly of the union; the executive council; the par-African parliament; the court of justice; the commission; the permanent representative committee; the specialized technical committees; the economic, social and cultural council, and the financial institutions. The Headquarters of the Union shall be in Addis Ababa in the Federal Democratic Republic of Ethiopia. Table 3.1 depicts the current picture of the union in relation to knowledge, education and technological parameters.

TABLE 3.1
THE AFRICAN DATA: KNOWLEDGE EDUCATION AND TECHNOLOGY

	COUNTRY NAME	INCOME PROFILE	REGION	ADULT ILLITERACY RATE (%) OF PEOPLE 15 AND ABOVE 1999	POPULATION MILLIONS 2001
1	**SIERRA LEONE**	LI	WA	-	4.87
2	**NIGER**	LI	WA	85	11.23
3	**BURKINA FASO**	LI	WA	77	12.22
4	**GUINEA BISSAU**	LI	WA	-	1.23
5	**MAL**	LI	WA	60	11.68
6	**NIGERIA**	LI	WA	37	116.93
7	**TOGO**	LI	WA	44	4.66
8	**GAMBIA**	LI	WA	-	1.34
9	**BENIN**	LI	WA	61	6.45
10	**GHANA**	LI	WA	30	20.93
11	**MAURITANIA**	LI	WA	58	2.75
12	**GUINEA**	LI	WA	-	8.02
13	**SENEGAL**	LI	WA	64	9.66
14	**COPE D'IVORE**	LI	WA	54	16.35
15	**LIBERIA**	LI	WA	-	-
16	**CAPE VERDE**	LI	WA	-	0.44
17	**MOZAMBIQUE**	LI	EA	57	20.19
18	**ETHIOPIA**	LI	EA	63	64.46
19	**TANZANIA**	LI	EA	25	35.97
20	**BURUNDI**	LI	EA	53	6.86
21	**MALAWI**	LI	EA	41	11.57
22	**RWANDA**	LI	EA	34	7.95
23	**MADAGASCAR**	LI	EA	34	16.44
24	**UGANDA**	LI	EA	34	22.53
25	**KENYA**	LI	EA	19	31.29
26	**LESOTHO**	LMI	EA	17	2.16
27	**COMOROS**	LI	EA	-	0.73
28	**ERITREA**	LI	EA	47	3.81
29	**SOMALIA**	LI	EA	-	-
30	**SUDAN**	LI	EA	-	-
31	**CHAD**	LI	CA	59	8.13
32	**CENTRAL AFRICAN EPUBLIC**	CA	LI	55	3.78
33	**CAMEROON**	CA	LI	25	15.20
34	**CONGO (REP)**	CA	LI	21	3.11
35	**GABON**	CA	UMI	-	1.26

36	**EQUAT. GUINEA**	CA	LI	-	0.47
37	**SAO T. & PRINC**	CA	LI	-	0.15
38	**ZAMBIA**	SA	LI	23	10.53
39	**ANGOLA**	SA	LI	-	13.53
40	**ZIMBABWE**	SA	LI	12	13.65
41	**NAMIBIA**	SA	LMI	19	1.79
42	**BOTSWANA**	SA	LMI	24	1.67
43	**SOUTH AFRICA**	SA	UMI	15	43.79
44	**MAURITIUS**	SA	UMI	-	1.20
45	**DJIBOUTI**	SA	LMI	-	0.64
46	**SEYCHELLES**	SA	UMI	-	0.08
47	**SWAZILAND**	SA	LMI	-	1.02
48	**ZAIRE**	SA	LI	-	-
49	**EGYPT**	NA	LMI	45	64.55
50	**MOROCCO**	NA	LMI	52	30.43
51	**ALGERIA**	NA	LMI	33	31.14
52	**TUNISIA**	NA	LMI	30	9.70
53	**LIBYA**	NA	UMI	-	5.50
54	**CONGO (DEM. REP)**	CA	UMI	40	52.52
55	**MAYOTTE**	SA	UMI	40	0.14
	AFRICA				798.70
	AFRICA				8,43.39
	ASIA				3,606.73
	EUROPE				800.42
	OCEANIA				30.86
	WORLD				6,080.10
	U.S.A				285.93

TABLE 3.1(CONTD.)

COUNTRY NUMBER	TOTAL TELEPHONE SUBSCRIBERS THOUSANDS 2001	TOTAL TELEPHONE SUBSCRIBERS PER 100 INHABITANTS 2001	MAIN TELEPHONE LINES ΓHOUSANDS 2001	MAIN TELEPHONE LINES PER 100 INHABITANTS 2001	INTERNET HOSTS TOTAL 2001	INTERNET HOSTS PER 10,00 INHABITANTS 2001	INTERNET USERS (R) 2001
1	49.6	1.02	22.7	0.47	278	0.57	7.0
2	23.5	0.21	21.7	0.19	176	0.16	12.0
3	132.6	1.09	57.6	0.47	704	0.58	21.0
4	12.0	0.98	12.0	0.98	77	0.63	4.0
5	95.2	0.82	49.9	0.43	87	0.07	30.0
6	830.0	0.71	500.0	0.43	723	0.06	200.0
7	143.1	3.07	48.1	1.03	220	0.47	50.0
8	78.0	5.84	35.0	2.62	120	0.90	19.0
9	184.3	2.86	59.3	O.92	500	0.78	25.0
10	435.9	2.08	243.1	1.16	235	0.11	40.5
11	26.1	0.98	19.0	0.72	113	0.41	7.0

12	81.2	1.01	25.5	0.32	245	0.31	15.0
13	628.0	6.50	237.2	2.45	1836	1.93	100.0
14	1022.1	6.25	293.6	1.80	3131	1.92	70.0
15	-	-	-	-	-	-	-
16	93.8	21.48	62.3	14.27	34	0.78	12.0
17	259.3	1.28	89.4	0.44	16	0.01	15.0
18	337.5	0.52	310.0	0.48	43	0.01	25.0
19	575.4	1.60	148.5	0.41	1478	0.41	300.0
20	40.0	0.58	20.0	0.29	1	-	6.0
21	109.8	0.95	54.1	0.47	22	0.02	20.0
22	86.5	1.09	21.5	0.27	11.33	1.43	20.0
23	205.9	1.25	58.4	0.36	234	0.14	35.0
24	386.5	1.72	63.7	0.28	293	0.13	60.0
25	813.1	2.60	313.1	1.00	2702	0.86	500.0
26	43.8	2.03	22.2	1.03	60	0.28	5.0
27	0.9	1.22	8.9	1.22	11	0.15	2.5
28	32.0	0.84	32.0	0.84	10	0.03	1-0.0
29	-	-	-	-	-	-	-
30	558.0	1.75	453.0	1.42	-	-	56.0
31	33.0	0.41	11.0	0.14	1	-	4.0
32	21.0	0.56	10.0	0.26	7	0.02	158.0
33	411.4	2.71	101.4	0.67	390	0.26	45.0
34	172.0	5.53	22.0	0.04	42	0.14	0.5
34	159.0	2.97	39.0	3.18	69	0.55	15.0
35	21.9	4.66	6.9	1.47	6	0.13	0.9
36	5.4	3.63	5.4	3.63	927	61.80	9.0
37	183.7	1.72	85.4	0.80	1095	1.03	25.0
38	166.5	1.23	80.0	0.59	8	0,01	60.0
39	582.4	4.27	253.7	1.86	3494	2.56	100.0
40	217.4	12.16	117.4	6.57	4632	25.91	45.0
41	350.3	21.60	150.3	9.27	1273	7.62	25.0
42	14,166.0	32.35	4969.0	11.35	238462	54.45	3068.0
43	606.8	50.56	306.8	25.56	3126	26.05	158.0
44	12.9	2.01	9.9	1.54	-	-	3.3
45	65.5	81.87	21.4	26.73	262	32.75	9.0
46	98.0	9.61	32.0	3.14	1142	11.20	14.0
47	-	-	-	-	-	-	-
48	9443.8	14.63	5550.0	10.30	1802	0.28	600.0
49	5963.1	19.60	1191.3	3.92	2454	0.81	400.0
50	1980.0	6.36	1880.0	6.04	665	0.21	60.0
51	1445.4	14.90	1056.2	10.89	218	0.22	400.0
52	660.0	11.83	610.0	10.93	70	0.13	20.0
54	170.0	0.32	20.0	0.04	115	0.02	6.0
55	10.0	6.98	10.0	6.98	-	-	-
Africa	44,237.7	5.54	20920.0	2.62	274,742	3.44	6,735.70
America	516,164.1	61.21	296327.5	35.14	112,496,1	1333.86	182,507.

					15		10
Asia	723,878.8	20.07	390,867.0	10.84	10,554,632	29.29	156,508.50
Europe	674,613.7	84.28	324,459.1	40.54	15,324,765	191.46	144,410,10
Oceania	26,133.4	84.99	12310.9	40.04	2.731,944	885.26	8,505.30
World	1,985,027.7	32.65	1,044,884.6	17.19	141,382,198	232.66	498,666.70
USA	317,000.0	110.87	190000.0	66.45	106,193,339	3714.01	142,823.00

TABLE 3.1(CONTD)

COUNTRY NUMBER	INTERNET USER PER 10,0 INHABITANT 2001	ESTIMATEI PC'S TOTAI (K) 2001	ESTIMATEI PCS PER 10(INHAB 2001	CIRCULAR MOBILE UBSCRIBER (K) 2001	CELLULAR MOBILE SUBSCRIBERS PER 100 NHABITANTS 2001	TECHNOLOGY ACHIEVEMENT INDEX (TAI) VALUE 2001	PATENTS GRANTED TO RESIDENTS MILLIONS 1998	RECEIPTS OF ROYALTIES AND LICENCE FEES US & PER 100 PEOPLE 1999
1	14.47	-	-	26.9	0.55	-	-	-
2	10.69	6	0.05	1.8	-	-	-	-
3	17.18	17	0.14	75	0.61	-	-	-
4	32.60	-	-	-	-	-	-	-
5	25.69	14	0.12	45.3	0.20	-	-	-
6	17.57	800	0.68	330	0.28	-	-	-
7	107.37	100	2.15	95	2.04	-	-	-
8	134.63	17	1.27	43	3.22	-	1	-
9	38.78	11	0.17	125	1.94	-	-	-
10	19.36	70	0.33	193.8	0.93	-	-	-
11	25.48	27	0.98	7.1	0.27	-	-	-
12	18.70	12	0.39	55.7	0.69	-	-	-
13	103.50	180	1.86	390.8	4.04	0.158	-	-
14	70.00	100	0.61	728.5	4.46	-	-	-
15	-	-	-	-	-	-	-	-
16	274.60	-	-	31.5	7.21	-	-	-
17	7.43	70	0.35	169.9	0.84	0.066	-	-
18	3.88	7	0.18	27.5	0.04	-	-	-
19	83.41	120	0.33	427.0	1.19	0.080	-	-
20	8.75	-	-	20.0	0.29	-	-	0.0
21	17.28	13	0.11	55.7	0.48	-	-	-
22	25.16	-	-	65.0	0.82	-	-	0.0
23	21.29	40	0.24	147.5	0.90	-	-	0.0
24	26.64	70	0,31	322.7	1.43	-	-	0.0
25	159.78	175	0.56	500.0	1.60	0.129	-	0.0
26	23.15	-	-	33.0	1.53	-	-	6.5
27	35.84	4	0.55	-	-	-	-	0.0

28	26.21	7	0.18	147.5	0.90	-	-	0.0
29	-	-	-	-	-	-	-	-
30	17.61	115	0.36	105.0	0.33	0.071	-	0.0
31	4.92	12	0.15	22.0	0.27	-	-	0.0
32	5.29	7	0.19	11.0	0.29	-	-	-
33	29.60		0.39	310.0	2.04	-	-	-
34	1.75	12	0.39	150.0	4.82	-	-	0.0
35	122.35	15	1.19	120.0	9.19	-	-	0.0
36	251.68	3	0.53	15.0	3.19	-	-	0.0
37	600.00	-	-	-	-	-	-	-
38	23.48	75	0.70	98.3	0.92	-	-	-
39	44.35	17	0.13	96.5	0.64	-	-	-
40	73.26	165	1,21	328.7	2.41	0.222	-	-
41	251.68	65	3.64	100.0	5.59	-	-	3.5
42	154.13	12	15.00	278.0	16.65	-	1	0.0
43	700.58	3,000	6.85	9197.0	21.00	0.340	-	1.7
44	1316.67	130	10.83	300	25.00	-	-	0.0
45	51.32	7	1.09	3.0	0.47	-	-	-
46	1125.00	12	15	44.1	55.15	-	-	-
47	137.25	-	-	66	6.47	-	-	0.2
48	-	-	-	-	-	-	-	-
49	92.95	1,000	1.55	2793.8	4.33	0.236	-	0.7
50	131.45	400	1.31	4771.7	15.68	-	3	0.2
51	19.27	220	0.71	100.0	0.32	-	-	0.0
52	412.37	230	237	389.2	4.01	0.255	-	1.1
53	35.84	-	-	50.0	0.90	-	-	0.0
54	1.14	-	-	150	0.29	-	-	0.0
55	-	-	-	-	-	-	-	-
Africa	84.71	7558	1.06	23,407.1	2.93	-	-	-
America	2,165.59	218,245	26.58	220,025.5	26.09	-	-	-
Asia	433.97	117093	3.31	333,437.8	9.25	-	-	-
Europe	1,804.60	140591	17.94	350,155.4	43.75	-	-	-
Oceania	2,771.58	11,879	39.91	13,83.0	44.95	-	-	-
World	820.82	495,366	8.42	940848.8	15.48	-	-	-
USA	4995.10	178000	62.25	127000.0	44.42	0.733	289	130.0

TABLE 3.1 CONTD

OUNTRY UMBER	HIGH AND MEDIUM ECHNOLOG EXPORTS % OF GOODS EXPORT 1999	ELECTRICITY ONSUMPTIO KILOWATT HOURS PER CAPITA 1998	MEAN YEARS OF CHOOLIN [AGE 15 AND ABOVE] 20	GROSS TERTIARY SCIENCE NROLME T RATIO (%) 1995-1997	GROSS NATIONAL INCOME BILLIONS OF DOLLARS 2000	GROSS NATIONAL INCOME PER CAPITA DOLLARS 200	R&D SCIENTISTS AND ECHNICIAN PER 100 PEOPLE 1990-96	PUBLIC EDUCATION EXPENDITUR AS % OF GNP 1993-96
1	-	-	2.4	-	0.6	130	-	-
2	-	-	1.0	-	2.0	180	-	-
3	-	-	-	0.2	2.6	230	-	3.6
4	-	-	0.8	-	3.3	450	-	-
5	-	-	0.9	-	2.6	240	-	2.2
6	0.4	85	-	1.8	32.8	260	0.1	0.9
7	0.4	-	3.3	0.4	1.4	300	-	4.7
8	0.0	-	2.3	-	-	-	-	-
9	-	46	2.3	0.5	2.4	280	0.2	3.2
10	4.1	289	3.9	0.4	6.8	350	-	-
11	-	-	-	-	1.0	370	-	-
12	-	-	-	-	3.3	450	-	-
13	28.5	111	2.6	0.5	4.7	500	-	3.5
14	0.0	-	-	-	10.5	660	-	5.0
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
17	-	54	1.1	0.2	3.7	210	-	-
18	-	22	-	0.3	6.7	100	-	4.0
19	6.7	54	2.7	0.2	9.3	280	-	-
20	-	-	-	-	0.7	110	0.1	3.2
21	-	-	3.2	-	1.9	170	-	-
22	-	-	2.6	-	2.0	230	-	-
23	3.0		-	0.4	260	13	-	1.9
24	2.2	-	3.5	0.3	6.8	310	-	2.6
25	7.2	129	4.2	0.3	10.7	360	-	6.6
26	-	-	4.2	0.3	1.2	540	-	7.0
27	-	-	-	0.0	-	-	-	-
28	-	-	-	-	0.7	170	-	1.8
29	-	-	-	-	-	-	-	-
30	0.4	47	2.1	0.7	-	-	-	-
31	-	-	-	0.1	1.5	200	-	-
32	13.6	-	2.5	-	1.1	290	0.1	-
33	2.2	185	3.5	-	8.6	570	-	2.9
34	0.0	83	5.1	-	1.8	630	-	6.2
35	0.9	749	-	-	-	-	0.2	2.8
36	-	-	-	0.4	-	-	-	1.8
37	-	-	-	-	-	-	-	-
38	-	539	5.5	-	3.0	300	-	2.2
39	-	60	-	-	3.1	240	-	-
40	12.0	896	5.4	1.6	5.8	480	-	-
41	-	-	-	0.4	3.6	2050	-	9.1
42	-	-	6.3	1.6	5.3	3350	-	10.4
43	30.2	3,832	6.1	3.4	129.2	3020	1.2	7.9

44	4.3	-	6.0	1.0	-	-	0.5	-
45	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	7.6
47	-	-	6.0	1.3	-	-	-	7.3
48	-	-	-	-	-	-	-	-
49	8.8	861	5.5	2.9	95.2	1490	0.7	-
50	12.4	443	-	3.2	33.8	1,180	-	5.3
51	1.0	563	5.4	6.0	48.3	1,590	-	-
52	19.7	824	5.0	3.8	20.1	2090	0.4	6.7
53	1.8	3677	-	-	-	-	-	2.5
54	-	110	3.0	-	5.0	100	-	-
55	-	-	-	-	-	-	-	-
Africa	-	-	-	-	-	-	-	-
America	-	-	-	-	-	-	-	-
Asia	-	-	-	-	-	-	-	-
Europe	-	-	-	-	-	-	-	-
Oceania	-	-	-	-	-	-	-	-
World	-	-	-	-	-	-	-	-
USA	66.2	11,832	12.0	13.9	9,645.6	34,260	3.6	5.4

NOTES: **LI =LOW INCOME; LMI=LOW MIDDLE INCOME UMI= UPPER MIDDLE INCOME; HI= HIGH INCOME; WA=WEST AFRICA; EA= EAST AFRICA; CA=CENTRAL AFRICA;** NA = NORTH AFRICA

SOURCES: ITU, UNITED NATIONS AND WORLD BANK DATA BASE

4.0 EMPIRICAL ANALYSIS

The information revolution actually started in today's developed counties, so it makes sense that these countries have higher levels of technological attainment and higher use of ICT products. Still, the magnitude of the differences is staggering. In table 3.1, we show three indicators of technological outputs –the products of technology that actually benefit consumers –for different African countries and regions of the world; personal computers, mobile phones and internet hosts. Our date show that although the coverage world country has roughly 10 times the per capita income of an African country, it has 40 times as many computers, 150 times as many mobile phones and 1000 times as many internet hosts. There are important gaps in ICT inputs as well. If African economies were investing more in technology than richer countries, one could anticipate that the first 'mover' advantages of the latter would be reversed overtime. However, the evidence shows that technological investment is also much higher in developed economies. As shown in table 3.1, several of the most important measures of technological inputs – Research and development scientists and technicians – are substantially higher in developed economies than in African economies. For example, United States of America invests six times as much of their income in research and development (that is, in creative, systematic activities intended to increase the stock of knowledge and on the use of this knowledge to devise new applications) and have roughly six times as much as many technicians and scientists per 1000 people as the economies of Africa. These 'soft infrastructures' are as essential for successful ICT diffusion as are the 'hard' technologies. Again, the developed nations also have about twenty times as many telephone main lines per capital (a measure of the infrastructure necessary to take advantage of communications technology advances) as Africa.

Given various parameters of technology, how then can we say that one country has made more advances than another in terms of technology? Our solution to this problem was to adapt an index of technology achievement (TAI). Our index is shown for the 55 African economies and United States of America. The level of the TAI ranges from 0 to 1, with the United States of America at the top of the scale, followed by South Africa and Mozambique at the bottom. Table 3.1 brings home strongly how the differences in technological progress are related to differences in income; rich countries enjoy higher technological progress. As others have noted for years, the level of GDP per capita is

strongly associated with the level of ICTs. However, our table also shows that being richer is no guarantee of superior technological progress. Senegal has a higher GNI per capita than Zimbabwe but lags for behind it in technological development. Our empirical investigation also shows that economies, which have technologically progressed, differ from those, which have stayed behind in two fundamental ways: an economic environment conducive to investment and a climate of civil liberties conducive to research and expansion of communications. Technological innovation results from investment so it must benefit from the same characteristics, which lead to high rates of investment generally. And there are particular synergies between technology and domestic investment. Technological improvements raise the return to capital and stimulate further investment. Likewise, a desire for high levels of capital accumulation stimulates technology as a way to counteract the force of diminishing returns. Indeed, investments in human capital (education) can be conducive to technological progress because they are conducive to higher levels of investment (as revealed by the mean years of schooling and gross tertiary science enrolment ratio). In particular, more educated workers make more productive firms and high levels of education may be a necessary condition for the use, imitation and innovation of new technologies. However, there could be a trade-off between investing in technology and investing in human capital. Resources spent building schools are resources not spent in communications infrastructure. Again someone must pay for higher investment in human capitals and to the extent that this spending is financed by taxation on producers of wealth then it may lead for lower incentives to investments in technology. Indeed, we do not find any strong evidence of such a trade-off. It is not present in the relationship between public spending on education and technological progress, which is strongly positive as shown in table 3.1.

As far as ICT and domestic income distribution are concerned, there is little to observe in African economies. The reason that computers raise inequality appears to be two-fold. Firstly, workers with greater levels of education are precisely the workers who are best able to use information technology. Therefore, the introduction of information technology widens the gaps in opportunities; it allows college graduates to earn higher wages while it reduces the demand for (and the wages of) unskilled workers with a high school diploma or less. Again, the introduction of a new technology allows firms to substitute machines for people and the people who are displaced by machines create a new mass of unemployed that depresses existing wages. In general, the logic of ICT –inequality linkages is that when a new technology is introduced into a

social setting where scarce resources and opportunities are distributed asymmetrically, the greater likelihood is that those with more resources will employ them to gain additional ones, including ICTs. Given this powerful logic and the strong empirical evidence that information technology has worsened inequality in some rich countries, what can African countries expect? On the one hand, Africa countries have much lower levels of human capital (as evident in the adult illiteracy rate) shown in table 3.1. They therefore have fewer people with the capacity to work with and benefit from new technologies. These few are likely to benefit disproportionately from the information revolution. Meanwhile, the groups of disadvantaged individuals that have not had access even to basic levels of education are likely to be out of the race from the start (as shown by levels of internet users compared to the world average of our empirical table).

On the other hand, to the extent that the information revolution allows rich countries to specialize in technology –intensive goods and brings forth more flexible production processes in poor countries, poor countries way be better able to specialize in what they can produce at low cost with low technological components. Regrettably, our cross-country data is simply too sparse to give us a definite answer to this question based on comparisons of changes in inequality and levels of technological development across economies. In any case, analysts and policy makers need to be careful about easy claims regarding the putative relationships between ICTs and other societal outcomes like productivity, investment and inequality on the other. Our data (proxies) roughly shows that the picture appears much more muddled. If anything, it suggests a much more complex pattern, likely to be mediated by country-specific characteristics and institutions.

5.0 POLICY PROPOSALS

There is nothing permanent except change (Heraclitus, 520 BC) and observe always that everything is the result of a change (Marcus Aurelius, 200 BC). Even since the days of Adam Smith's 'indivisible hand' the idea that a free and decentralized market economy will generate a socially optimal allocation has been alive among economists. Thus, a free and decentralized market economy represents a socially optimal allocation. However, conditions characterized by imperfect competition,

asymmetric information or external effects make competitive equilibria socially inefficient. Therefore, the policy trust should be to promote social efficiency by affecting either the competition strategies of firms or the organization of industries in order to reduce the distortions created by competition under such market conditions. Imperfect competition, asymmetric information or external effects characterize the core industries of the new information economy. Consequently, in many circumstances well-designed microeconomic policies, in the form of competition policies, technology policies or combinations of these, have the potential of generating welfare improvements and promoting social efficiency.

Essentially vertical or horizontal integration tends to be pro-competitive as long as the decisions of the firms as strategic complement to markets with imperfect competition. Further, mergers or strategic alliances can be expected to promote innovation activities that make use of complementary system components to create new products or new value –creating combinations of existing system component. In this respect, the increased concentration tends to enhance the innovation performance of industries. On the other hand, increased concentration enables firms to exploit bundling strategies in order to extract the increased willingness of consumers to pay for more integrated bundles of products or services. In particular, the presence of network externalities makes it possible for a firm to achieve a dominant market position, in the sense of antitrust legislation, at a lower market share than a 'traditional' industry. Similarly a firm possessing a dominant market position and operating in a network industry has access to a larger number as well as more efficient strategic instruments in order to abuse its dominant market position relative to a firm operating in a traditional industry for that reason, structural microeconomic policies in the form of competition policy and antitrust legislation can be regarded to have potentially a higher social rate of return when applied within the innovation –intensive core industries consequence thereof, the potential gains from this macroeconomic can be expected to increase relative to those associated with macroeconomic policies.

Because of the small size of individual telecom markets caused by the low levels of economic development, regional co-operation is a very important avenue, which can be used to improve the situation. If groups of countries can combine their purchases for equipment and services, costs can be cut substantially. Furthermore, scarce expertise and high cost of international links can share an appropriate technical standards developed. Funders, governments, operators and other player's involved

need to actively co-operate to rationalize competing and overlapping initiatives to achieve common technological objectives for all stakeholders.

Governments in Africa should adopt good licensing practices to encourage new investments in telecom infrastructures and competition within the sector. Often in Africa, it is not surprising to find government interests as the main determinant factor in the telecom market at the expense of competition, innovation and consumer interest. There are however common features which will help ensure the success of a licensing process: transparency, public consultation, reasonable license frees, and balance of flexibility and certainly on license conditions and effective selection criteria. However, the most appropriate approach for African governments is to use a comparative evaluation process in any future licensing process. This will help match the specific sectoral objectives with the capabilities of the prospective operators in its aim to develop a rapid telecommunication network. This will help in achieving the country's universal service obligations and help increase the overall competitiveness of the African economies.

For the construction of sustainable human development, we must advocate logic of co-operation based on the interdependence of all societal components and on solidarity in the struggle against imbalances and the vicious circle of underdevelopment. This new logic implies a quest for harmonization between the world of work and education in a spirit of partnership. That is, educational institutions must not set their long-term guidelines exclusively in the light of the labor market or of forward studies of labor requirements but of social needs. The world of work helps to create wealth that can be reinvested to meet the other needs of society but, in a society which is becoming increasingly knowledge–based, it has an creasing need for staff with high technical qualifications but a humanist view of the pursuit of their activities and ability to anticipate future need and requirement, especially those connected with constructing a more just society. Such harmonization implies that education must adapt its training structures and arrangements to the new needs or create new forms of teaching on the basis of criteria such as flexibility, employability, adaptation to a wide variety of contexts and publics, the principle of life–long training and the internationalization of training. The task is therefore to change from a paradigm centered on teaching and the transmission of knowledge to the paradigm centered on learning and the development of transferable skills in differing space and time contexts.

Indeed, these changes entail several levels of co-operation. The co-operation with the world of work by jointly defining relevant training policies, collaborating and exchanging resources for certain training modules, supplying expertise, taking part in studies of the labor market and changes in needs, evaluating alternative scenarios, seeking out and developing new technologies or transferring knowledge and studying the social and ecological impact of certain choices. Also, the internal co-operation between higher education institutions at both the national and regional levels according to the following principles: quality, effectiveness and efficiency requirements are such that not every institution can organize all training programs or maintain research Laboratories whose resources are quantitatively and qualitatively sufficient in all sectors; the organization of distance-learning schemes increasingly means that a regional outlook must be cultivated for lost reasons and in order to strengthen integration policies.

And finally, the co-operation at international level based both on solidarity and respect for differences in order to provide a relevant and equitable answer to the challenges of globalization and internationalization; and this implies a policy of quality which, when applies, will take into account the specific features of the context. This is indeed the context in which regional and international co-operation must be visualized in order not only to preserve and disseminate the different heritages but also to create a culture of peace, conceived as a world which has been liberated from all conflict and enjoys evenly- distributed socio-economic prosperity, enriched by cultural diversity and a common concern to create a global high –tech society. And although the challenge is great, it is important to stress that none of the necessary steps is beyond the reach of the governments, agencies, and networking players that are required to act. This is the time.

6.0 CONCLUSION

Two simultaneous shifts in technology and economics (technological revolution and globalization) are combining to create a new network age. But the network age is structured along horizontal networks with each organization focusing on competitive niches. Many developing countries are already tapping into these networks, with significant benefits for human development. Not all countries need to be on the cutting edge of global technological advance. But in the network

age every country needs the capacity to understand and adapt global technologies for local needs. In this environment the key to a country's success will be unleashing the creativity of its people.

Nurturing creativity requires flexible, competitive, dynamic economic environments. For most African countries that mean building on reforms that emphasize openness – to new ideas, new products and new investment, especially in telecommunications. But open markets and competition are not enough. At the heart of nurturing creativity is expanding human skills. Technological change dramatically raises the premium every country should place on investing in the education and training of its people. And in the network age, concentrating on primary education will not suffice; rather the advanced skills developed in secondary and tertiary schools are increasingly important. Vocational and on the job training cannot also be neglected. When technology is changing, enterprises have to invest in training workers to stay competitive. Smaller enterprises in particular can benefit from public policies that encourage coordination and economies of scale and that partly subsidize their efforts. More generally, governments need to establish broad technology strategies in partnership with other key stakeholders.

Indeed, the new technological revolution not to have contributed to lessening the gaps between the rich and the poor, neither within economies nor across them. Given this fact, it appears that in the absent of dramatic policy interventions, most poor countries can expect to full further behind in technology and in outputs. While these facts are striking, they should not allow us to overlook the dramatic improvement in levels of access to the new technologies that have occurred over the past decade in the world. The great majority of African countries are well beyond where they were some years ago. In other words, technology networks are transforming the traditional map of development, expanding people's horizons and creating the potential to realize in a decode progress that require generations in the past.

Furthermore, increased productivity in rich countries benefits the poor because it allows the goods produced by rich countries to be sold at lower prices. This implies that increased absolute levels of good living are ultimately, the most important base line measurement.

However, the spread of the information revolution can be accelerated. In this paper, we suggested several possible alternative policy responses to the ways in which trends in technological access and performance may play themselves out. We conclude that the guiding rule should be for policy makers, Donors and others to pursue new

technological policies with substantial equity components, appropriate to local needs and resources. Much more research is needed on the effect of new technology on inequality and productivity in African countries. It is hard to think of other questions that have such staggering potential implications but yet are so understudied and misunderstood. This is basically the subject of our research proposal to the outstanding research award competition of the Global development Network.

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