

Education and Information & Communication Technologies (ICT) in

Africa:

Using ICT to improve education in Sub-Saharan Africa

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Abstract

This paper examines the role of Information and Communication Technologies (ICT) in expanding opportunities in education and improving access to quality education in Sub-Saharan Africa. The paper observes that the application of ICTs has become the engine of change in emerging information societies of the new millennium. While development is increasingly ICT driven, Africa still has limited capacities and infrastructures that support ICT. By use of secondary data, the conditions of ICT development and use in education in Africa are highlighted. The paper further illustrates the potential for improvement in performance of the education sector in Africa with appropriate application of ICT. The conclusion drawn is that the application of ICTs would improve the education sector in Africa in three critical areas namely; Increased access to education, improved quality of teaching and learning and improved efficiency in administration and management of schools.

Introduction

This paper, in particular, examines the actual and potential role of Information and Communication Technologies (ICTs) in improving education sector in Africa. The paper is guided by the following question: How can IT be used to improve teaching and learning in education institutions, facilitate civic engagement and help globalize the school curriculum?

To address these concerns, the paper is divided into five sections. Section one provides an overview of Africa's current development situation. Section two addresses the general theme of ICTs and the related concerns such as access and use of ICTs in Africa. In section three, the paper discusses the actual and potential role of ICTs in improving teaching and learning at high schools and universities in Africa. It also addresses the role of ICTs in the globalization of the school curriculum. Section four examines the role of IT in expanding civic engagement among Africa's citizenry. The fifth and final section offers

suggestions on how to promote application of ICTs in tackling the problem of digital divide in Africa and other development problems within and without Africa's education sector.

An overview of Africa's current development situation

Those who have written on Africa's development situation in the 1980 and 1990 decades concur in observing that while Africa is the most underdeveloped continent. Since the 1980s, the continent has experienced a deep development crisis (Cheru, 1989; World Bank, 1990; Nyang'oro and Shaw 1992; Bloomstrom and Lundahl, 1993 and Mbatia, 1996). The crisis is multidimensional as manifested in the economic, social, political, health, environmental and technological components of the African economies. In describing the worsening development situation in Africa, Bourenane (1992:49) states:

Africa has today reached a state of "development break-down", with both the states and the "people" incapable of breaking this vicious circle of regression and poverty. The policies and economic programmes applied in the last thirty years have been destructive in every respect.

Africa's poor economic performance (and development crisis in general) since the 1980s is well documented and is reflected using several conventional indicators. A few such indicators are presented in Table 1 which captures the state of Africa's underdevelopment.

Table 1: Basic development indicators comparing Sub-Saharan Africa with other selected regions

Region	Under-5 mortality rate (2002)	Infant mortality rate (2002)	GNI per capita in US\$ (2002)	GDP per capita average annual growth rate (%) 1990-2002	% of population living below 1 USD a day 1990-2001	Life expectancy at birth in years (2002)
Sub-Saharan Africa	174	106	460	0.4	50	46
South Asia	97	70	461	3.6	32	63
East Asia and Pacific	43	33	1,232	6.3	14	69
Industrialized Countries	07	05	26,214	1.8	--	78
Developing Countries	90	62	1,154	3.6	23	62
World	82	56	5,073	2.1	21	63

Source: UNICEF (2004)

Data in Table 1 clearly depicts the severe state of underdevelopment in Sub-Saharan Africa (and South Asia). For example, this region has both the highest Under-5 and infant mortality rates. In 2002, out of 1,000 live births, 174 and 106 children died in Sub-Saharan Africa before reaching ages 5 and 1 respectively. The corresponding figures for the industrialized countries are 7 and 5 respectively. The data further reveals that by 2002, Sub-Saharan Africa and South Asia had the lowest Gross National Income (GNI) per capita. Note also that between 1990 and 2001, Sub-Saharan Africa had the highest concentration of poverty as measured by the percentage of population living below 1 USD per day. Indeed, by this measure, half (50%) of the population of Sub-Saharan Africa lives below the poverty line. It is therefore not surprising that life expectancy is lowest in Sub-Saharan Africa (46) followed by South Asia (63).

A pertinent question has been raised on *whom to blame for Africa's current development quagmire?* Apparently, while there is a consensus on the nature of the on-going development crisis in Africa, scholars hold different viewpoints on who to blame and what the future holds for the continent. On one hand, the proponents of the Dependency School blame the global capitalist system (external factor) that allows the economically developed

countries to continue exploiting the economies of Africa and other developing countries (Dos Santos, 1993). According to this school, unless the structure of the global capitalist system is radically changed, the external forces of exploitation will continue to undermine Africa's development. In this context, the developed countries should be pushed to remove trade barriers and the restrictive quota system which undermine production and exports particularly from Sub-Saharan Africa. This school of thought gives credence to the dominant afro-pessimism approach that paints a doomed future for the continent. However, those seriously concerned with the (economic) liberation of Africa should use the Dependency School as "a framework for reflection, for problem-solving and for implementation" (Bourenane, 1992:48). At worst, the framework should not be used as an ideology of despair for the African people.

On the other hand, there are scholars (proponents of modernization theory) who blame the internal structures (such as poor governance, corruption, civil wars etc) for their failure to support and sustain development initiatives (modernity) in Africa. In the same vein, other scholars blame the African states for lacking the required capabilities (e.g., to penetrate their societies, to ensure social control of other actors, and to extract and appropriate resources) to facilitate development (Migdal, 1988). In general, those who blame the internal factors also hold the view (somehow implicitly) that such factors could be addressed locally and resolve the key obstacles inhibiting Africa's development. The challenge for the internalists, therefore, is to mobilize local existing resources (including trained workforce, indigenous knowledge, modern technology, and capital) to support meaningful development initiatives.

The development crisis in Africa has attracted diverse responses from various agencies at different levels. At the international level, the International Financial Institutions (e.g., the World Bank and International Monetary Fund) and donor agencies, starting in 1980s, endorsed Structural Adjustment Programs (SAPs) for African countries. As summarized by Mkandawire (1992:98),

The standard package has included reduction in public and private consumption, wage freezes, hikes in interest rates, devaluation, privatization and opening up the economy to international trade.

The persistence of poverty and impoverishment of human life, the world over, has prompted a paradigm shift in the conceptualization of the term development. By the 1980s, experts realized the limited usage of the term *development* to mean *economic development*. The usage of the latter was

restricted to macro-economic planning (advocated by such agencies like the World Bank and IMF) targeting to improve a country's per capita income. Paradoxically, some countries experienced economic development (increase in per capita income) but still remained underdeveloped. The concepts of *sustainable development* and *human (social) development* were therefore adopted to re-conceptualize (*real*) development as a more meaningful and encompassing process. This marked a paradigm shift in the conceptualization and implementation of development as the *social dimensions* of the process were given more prominence (Madruga, 2004).

Besides economic growth and sustainability, the (new) human development approach emphasizes 1) greater inclusiveness and equity in access to resources and 2) greater empowerment of the poor and marginalized.¹ Overall, the social dimensions approach to development focuses squarely on people and attempts to improve their general quality of life.²

Among the various UN Agencies, the human development approach is a popular perspective used to inform policies and programmes— at national and international levels. For example, the new perspective informed the formulation of the Millennium Development Goals (MDGs) in 2000.³ However, policies of the World Bank and IMF in Third World countries continue to emphasize the economic dimensions of development – such as per capita income and poverty levels. The two institutions are yet to fully-envisage the human face of development. This partly explains why of the World Bank and the IMF remain unpopular especially among the poor and marginalized groups in Third World countries (Bradshaw & Huang, 1991 and Cornia & Stewart, 1987).

Notwithstanding the paradigm shift in the conceptualization of development, at the national level, African governments have been struggling to adjust to meet the donor conditions and also protect local interests. The upcoming challenges of globalization have further brought about the need for adjustment at the international level. And within nation states, civil society movements – that include Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and Faith Based Organizations (FBO) -- have mushroomed to tackle development problems from within at grassroots levels.

¹ See <http://ww.adb.org/SocialDevelopment/default.asp>

² See www.kpbook.com/pdf/socialProgress.pdf

³ See http://www.choike.org/nuevo_eng/informes/302.html

In addition, local and international private organizations (e.g., Multinational Corporations) have invested in profit-oriented ventures. However, despite the multiplicity of development initiatives at different levels and to the dismay of African people (citizenly and leaders), Africa's development crisis continues unabated. What went wrong?

Many factors combine to explain the current malaise in Africa's development. First, the external factors are still operational that include:

- a) Continued dependence of African economies on the outside world.
- b) Weak bargaining position in the world market resulting to poor terms of trade for Sub-Saharan African countries.
- c) Economic and political conditions mandated by the International Financial Institutions (such as the World Bank and IMF) that distort local monetary and fiscal policies.
- d) Intensified operations of foreign private organizations (MNCs). In practice, MNCs form (triple) alliances with the local elites and the state that give them some "protection" as they exploit local labour and capital to maximize their profits (Evans, 1979).
- e) Over-reliance on foreign advisors who do not fully understand the local environment and who may not have serious commitment to solve Africa's development problems.

Second, there are numerous internal factors that include:

- a) Poor governance (as exemplified by dictatorial regimes and civil wars) resulting, inter alia, to the misuse and underutilization of resources.
- b) Weak or inappropriate economic policies to protect local interests or industries vis-à-vis the stiff international competition emanating from globalization of the international trade.
- c) Existence of many "weak" or fragile states that are lacking in many development capabilities (Banker, 1987; Migdal, 1988 and Bradshaw, 1993).
- d) Widespread corruption especially among the ruling elites.
- e) Political conflicts based on ethnic differences.
- f) Lack of political will among the African political leadership to adopt appropriate (people-oriented) policies to address the felt needs of the people.
- g) Weak structures to support and sustain the adoption of modern technologies (e.g. ICT). This explains the worsening problem of the digital divide in Africa (Okwatch et. al, 2007: 248).

The last decade has correctly been labeled the *information age* – out of which *information societies* have emerged. Indeed, the invention and application of Information Computer Technologies (ICTs) has been the most remarkable achievement during the 1990 decade (Herring, 2004.). In particular, the usage of the *Internet* such as the email system or websites to connect people globally and retrieve information, respectively, has become part of our everyday life (Haythornthwaite, 2001). The pace of a nation's development is thus determined, inter alia, by its capacities to access, apply and sustain the ICT. While development is increasingly ICT driven, Africa's still has limited capacities and infrastructures that support ICT. Why does this situation obtain in Africa?

The next section of the paper presents three theoretical perspectives reflecting on the critical challenges facing Africa in its struggles to adopt the new technologies – particularly the ICT.

Theoretical perspectives on the application of ICT in Africa

The importance of ICT in today's information society is well documented. Indeed, through the application of ICT, it is now accepted that the world has been transformed into a global village. To date, countries that have excelled in the application of ICT have strengthened their position in the global system. And as would be expected, these are the economically powerful nations of North America and Europe. Unfortunately, most developing countries have had limited success in the application of ICT. As a result, we have on one hand, the developed countries that have fully adopted digital technology (ICT) and on the other hand, the developing countries (including Sub-Saharan African countries) that have lagged behind in the adoption of the digital technology.⁴ The term digital divide is used to differentiate countries with respect to their success/failure to adopt digital technology. In clarifying this term, Wilson in Chen et. al (2002: 77) states:

The expansion of the term “digital divide” to “global digital divide” points to differences in Internet access and use between countries, as well as within countries. Such inequalities have led to substantial asymmetry in the distribution and effective use of information and communication resources between two or more populations.

⁴ According to International Telecommunication Union – ITU (2005), in 2003, Africa had 1 main telephone line available for 33 people; the ratio was 1: 2.43 for Europe. Further, Africa had 1 mobile phone available to 17 people; the ratio for Europe was 1: 1.7. In the same year, Africa had 1.56 internet users per 100 people; Europe had 24.17 uses per 100 people. Last, Africa had 1.4 Personal Computers (PCs) per 100 people while Europe had 22.43 PCs for 100 people. These empirical data affirm the persistent problem of digital divide across regions.

Countries that have been left behind in the adoption of ICT (as is the case in Sub-Saharan Africa) are now putting up efforts to bridge the digital divide. But one may ask: Why is there a need to bridge the digital divide by adopting ICT in Africa and what impact does ICT make in the context of development?

A recent study by Shrum et. al (1992: 499) captures three general arguments on the role of ICT (internet) in developing countries. First, the “elixir” perspective presents the Internet as an opportunity rather than a problem. To be sure,

The “elixir” argument asserts that the Internet does not present a potential problem but only an opportunity.

In this regard, ICT should be considered as any other developmental tool to be used to boost production. In particular, through the use of the ICT (Internet), the developing countries are provided an opportunity to participate effectively in the new global information society. For example, within the education sector, use of Internet facilitates access to information (learning and teaching materials) beyond the national boundaries by both students and lecturers. Further, through the use of the ICT (Internet), developing countries can access new information or retrieve data about themselves “that is now often controlled in research libraries in Northern countries.” This way, access to information provides developing countries with opportunities to participate and engage at the international level. However, in the African context, this line of thought is somehow weak since it places emphasis on the “end product” (application of ICT) rather than on the process of adoption of the new technology (ICT). Only when the adoption of the ICT (e.g., Internet) is conceptualized as a process, can the diverse obstacles inhibiting its adoption and application be identified.

Second, the “affliction” perspective presents the Internet as a tool for perpetuating global inequality at different levels. More specifically,

The “affliction” perspective views the Internet as an engine of global inequality that creates new technology gaps between rich and poor, urban and rural dwellers; English and non-English speakers.

The second perspective gives credence to the dependency school; the economically powerful countries from the North can use the IT (Internet) to enhance their exploitation of the developing countries. Of course, since the Internet is a brainchild of the economically powerful countries of the North, they are better placed to adopt and apply it strategically than the developing countries. And to some extent, the economically powerful countries have used Internet (or the IT) to enhance exploitation of the developing countries (e.g., they can now access all the information they need easily about a country).

Even though this perspective is realistic in presenting the nature of linkages (exploitative) between the rich and poor countries, it nonetheless tends to demonize the adoption of the Internet in the developing countries. Yet it is an obvious fact that to date, the Internet (and the IT in general) has a great potential in creating new opportunities for developing countries in the modern global information system. In the context of globalization, no country can be an effective participant in the global village without the use of the Internet/IT.

In between the first and the second perspectives, Shrum et. al. (1992) situate the “teething” argument/perspective which focuses:

On the “teething” troubles arising in less developed areas ... suggesting that a net benefit will eventually accrue to developing areas, but not without significant problems in the short term.

While this perspective is realistic in anticipating “teething” problems associated with adoption of a new technology, it is biased. It is true that there are many problems associated with the adoption of the Internet (and ICT) in developing areas. Indeed, this perspective will guide this paper in identifying the numerous “troubles” that inhibit the adoption of ICT in Africa. However, it is important to appreciate that similar “teething” problems must have been faced in the developed countries when the Internet was first introduced. Developing countries should therefore learn from the experiences and best practices of the developed countries.

Despite these theoretical arguments on role of the Internet (ICT) in developing countries, scholars and policy makers have generally continued to express their strong views in support of the significant role of IT in facilitating Africa’s development. For example, during a United Nations Population Information Network (POPIN) conference held in Addis Ababa, 1996, it was observed that:

Access to information and communications technologies is becoming increasingly critical for Africa’s participation in economic and political life at national, international, and global levels. Advances in electronic communication networks have created enormous opportunities for developing countries (UNFPA, 1996:1).

However, these perspectives notwithstanding, the application of modern ICT is making dramatic changes in African societies. First, if development is conceptualized as an increase in knowledge and application of skills to better manage one’s environment, ICT has made remarkable contributions in facilitating Africa’s development. Through the application of ICT such as the

Internet, African people can access and share with the rest of the world the massive information available in the World Wide Web (WWW).⁵

Second, application of ICT in Africa continues to produce a new “class” of well-informed and knowledgeable citizens who are empowered to actively participate in decision making at all levels. For example, ICT has exposed African people to new experiences and practices, which continue to influence their socio-political and economic organizations (Brunello et. al, 2007:67). Third, it is appreciated that the application of ICT has improved productivity in various sectors of African economies. For example, the use of desktop publishing is promising to rescue the weak publishing industry in Africa. In addition, the use of modern ICT has made library searches more efficient and effective.⁶ Indeed, through the use of computers and Internet, it is now possible for African people to access any type of information (e.g., academic, research, leisure or work-related) beyond their national borders. To date, an information-based society has emerged and Africa cannot therefore do without the use of ICT. This view is well summarized by POPIN (1996:2):

Information and technology facilitate the flow of knowledge in modern society. The failure to use information technology is becoming as negative as the refusal to attend school. It is a choice between being left out or benefiting from enormous benefits of information technology.

A strong link exists between adoption of ICT and education. First, as documented by Rogers & Williams (1986:40), computer communication does not eliminate the need for literacy. Indeed, ability to read and type enhances one’s computer literacy. Second, ICT could be applied to improve access to and quality of education -- especially among the marginalized groups like women and girls. More specifically, Morrell et al. (2007:137) state that “... ICTs also offer many opportunities for women and girls to gain education and technical skills required for them to participate equally in the IT economy.” Overall, their study emphasizes that “... ICTs represent an opportunity to ensure equal access to quality education” (ibid).

⁵ In this regard, a study by Wellman et al., (2001:440) reports that the internet provides people with an additional means of communication to telephone and face-to-face contacts. However, it is viewed as more useful for maintaining existing ties than for creating new ones.

⁶ A study by Pool in Rogers & Williams (1986:40) observed that “computers will become the printing presses of the twenty first century. Publishing is becoming electronic for both reasons of convenience and cost. Large information bases can be edited, stored, transmitted, and searched with speed and flexibility impossible for ink records on paper.” Two decades after, this prediction has become a true reality characterizing information societies of the 21st century.

Adoption of the ICTs within the education sector is therefore necessary to improve the performance of the sector. In the next section, this paper examines the role of ICT in improving education sector in Sub-Saharan Africa.

A comparative analysis of the performance of education sector

The education sector in many African countries is highly underdeveloped resulting in low education achievements at all levels – primary, secondary and post secondary. Table 2 presents data on education statistics showing the poor performance of the education sector in Africa.

Table 2: A Comparison of education achievements in Sub-Saharan Africa with other selected regions of the world

Region	Gross Primary School Enrollment Ratio 1997-2000		Net Primary School Enrollment 1997-2000		% of Primary School Entrants Reaching Grade 5 1995-1999	Adult Literacy Rate in 2000		Gross Secondary School Enrollment Ratio 1997-2000	
	Male	Fem.	Male	Fem.		Male	Female	Male	Fem
Sub-Saharan Africa	89	78	63	58	65	69	53	29	23
South Asia	107	87	80	65	66	66	42	53	39
East Asia and Pacific	106	106	93	92	94	93	81	65	61
Industrialized Countries	102	102	96	97	--	--	--	105	108
Developing Countries	105	96	84	77	79	81	67	59	52
World	104	96	85	79	80	84	74	65	59

Source: UNICEF (2004)

Definition of the indicators:

Gross primary or secondary school enrollment ratio refers to the number of children enrolled in primary or secondary school regardless of age, divided by the age group, which officially corresponds to the same level.

Net primary school enrollment ratio refers to the number of children enrolled in primary school, who belong to the age group that officially corresponds to primary schooling, divided by the total population of the same age group.

Primary school entrants reaching grade five refers to the percentage of the children entering the first grade of primary school who eventually reach grade five.

Adult literacy rate refers to the percentage of persons aged 15 and over who can read and write.

The education statistics in Table 2 clearly show the inequality in education achievements across and within selected regions. It is noteworthy that Sub-Saharan Africa and South Asia have the poorest education achievements as reflected, inter alia, by net primary school enrollment, gross secondary school enrollment and adult literacy rates.

Between 1997 and 2000, around 60% of the male and female children of school-going age were enrolled in primary school in Sub-Saharan Africa. This means that about 40% of school age children in Sub-Saharan Africa were out of primary schools. The situation in South Asia was slightly better; while the enrollment for male children of school age was 80%, the corresponding figure for female was 65. It is worth noting that in the industrialized countries, nearly all the children of school age (whether male or female) had enrolled in primary school between 1997 and 2000. Only 4% of male as compared to 3% of female of school age children were not enrolled in primary school in the industrialized countries for the same period. These figures confirm wide disparities in net primary school enrollment across and within regions.

It is also clear in Table 2 that not all those enrolled in primary school reached grade 5 – some dropped out of school before reaching this grade. Between 1995 and 1999, the dropout rate was highest in Sub-Saharan Africa and South Asia. In the two regions, about one third (35%) of those who enrolled in the first grade of primary school did not reach grade five. Even though the figures for the industrialized countries were not available for the same period,

between 1990 and 1995, nearly all (99%) children who entered the first grade of primary school reached grade five. Again these figures suggest that there are numerous obstacles in Sub-Saharan Africa and South Asia that constrain the performance of the education sector. Overall, in these two regions, many children of school age never enroll in primary school and a substantive percentage of those who enroll drop out before reaching grade five.

Table 2 further captures education disparities across and within regions at the secondary school level. In particular, the table shows that Sub-Saharan Africa has the lowest gross secondary school enrollment. It is unfortunate that between 1997 and 2000, those enrolled in secondary school (male and female) in Sub-Saharan Africa were around 26% of those who were qualified (by age) to enroll. The overwhelming majority (at least 74%) of those who qualified (were of age) did not enroll for secondary school education. Even though South Asia has relatively better gross secondary school enrollment rates than Sub-Saharan Africa, the majority of those who qualified did not enroll. On the other hand, the industrialized countries reported over-enrollment at the secondary school level for the same period. In these countries, many more people than those qualified (of age) enrolled for secondary school education for the same period. Over-enrollment occurs when those who are over-age (e.g., working people or parents) enroll for secondary school education later in their life trajectories.

Table 2 further presents the literacy situation across regions for the year 2000. It is notable that in this year, 31% of adult male and 47% of adult female in Sub-Saharan Africa were illiterate. The situation in South Asia was slightly poorer in that 34% of adult male and 48% of adult female were illiterate in the same year. Even though the figures for the industrialized countries are not reported for 2000, by 1980, the literacy rate was 99 and 97 for male and female respectively, meaning that, nearly everybody in the industrialized countries were literate. Again, these figures reflect the wide disparities in education achievements across and within the regions. It is particularly important to note the wide gender disparities in education achievements particularly in Sub-Saharan Africa and South Asia. What are the implications of these findings?

At the primary level, large numbers of school age children are locked out of school eventually joining the large pool of illiterate people in these countries. As has been documented, the large category of out-of-school children faces many challenges; some are forced into child labour where they are severely exploited while others move into the city streets to join the street families (Mbatia, 2003). At the secondary level, those who fail to enroll (who are the majority) join the labour market pre-maturely and without the requisite skills

to make them productive and marketable. As a result, most of them are unemployed or underemployed (Mbatia, 1987 and PUIB, 2006).⁷ This explains the high rate of youth unemployment in Sub-Saharan Africa.

Last, the high rate of adult illiteracy in Sub-Saharan Africa and South Asia perpetuates the prevailing state of underdevelopment that is characterized by: (a) minimal political participation among the citizenry (KEDOF⁸, 2008:185); (b) low productivity especially in the agricultural sector; (c) slow rate of technological innovation and adoption; (d) large families that put a heavy economic burden to the few family members who are employed (e) poorly informed citizens and (f) poor governance in most public institutions.

Thus far, the discussion on education disparities confirms that Sub-Saharan Africa and South Asia have the lowest educational achievements. But what factors explain the low performance of this sector in these two regions? There are many obstacles that constrain the performance of education sector in these two regions that include:

- a) High cost (financial) of education at all levels that force the poor out of the education system. For example, in Africa, only a few countries offer free primary education; people meet the cost of education even in public primary schools (UNESCO, 2005).
- b) Inadequate school facilities (e.g., classes) and equipment (e.g., desks, books, chalk and other instructional materials) especially in the countryside. As a result, the existing facilities are overcrowded and pupils have to cover long distances to access education. In addition, without adequate equipment, it is difficult to provide quality education (PUIB, 2006: xxix).⁹

⁷ This is a report by the Public University. Inspection Board (PUIB, 2006) that was commissioned by the President of the Republic of Kenya on April 19, 2005.

⁸ According to the Kenya Elections Domestic Observation Forum (KEDOF, 2008), in 2007 (controversial) elections, the country recorded unusually high voter-turnout for presidential and parliamentary elections that stood at 70.36% and 68.84%, respectively. "This is in stark contrast to the voter turnout of 57% for the 2002 general elections." In the past, voter turnout has rarely gone beyond 50% and has been exceedingly low during the by-elections.

⁹ According to PUIB (2006:xxix), "there is a widespread perception that quality of education in public universities has declined as a result of increased student enrolment, inadequate and outdated equipment and facilities and low staff morale due to poor working conditions."

- c) Inadequate teacher training facilities, which explain why in most countries, the demand for trained teachers surpasses supply. As a result, there is a perpetual shortage of qualified teachers especially at primary and secondary levels (Republic of Kenya, 2006:54).
- d) Lack of political goodwill to invest heavily in the provision of free education. In most countries, the budget allocation for education is inadequate. For some government, provision of education is not given high priority.
- e) Widespread poverty -- in many countries, the majority of the people are poor (e.g., in Kenya, 47% of the population lives below the poverty line). Many of such people cannot afford the cost of education. And unfortunately, most African states also lack the required resources (in addition to goodwill) to offer free education.
- f) High rate of unemployment especially among the educated youth. As a result, people are increasingly placing low premium to education (Mbatia, 1987; PUIB, 2006; World Bank, 2005; and Ministry of Youth Affairs (MOYA, 2006).
- g) Cultural practices that place more value to alternative lifestyles that compete with education. For example, in some communities, acquisition of traditional "life skills" is considered more important than enrolling in school. In Africa, this largely explains the wide gender disparities (lower educational achievements for females) especially at primary and secondary levels. In such communities, young girls are socialized to take up their traditional roles as wives when they mature and get married. To this extent, formal education is not considered very useful.

Unless these concerns are addressed, the problem of poor performance of the educational sector (as manifested by low educational achievements and wide regional and gender-based disparities) will persist in Africa and South Asia. What is the way forward? Obviously, there is need to rethink the traditional practices of providing education in Africa – which only cater for a small fraction of the population. A Sub-Project Proposal on Harnessing Information Technology for Development in Africa (see the electronic source in the reference) supports this view by noting:

Africa's example shows us that an enormous expansion of the formal education system alone cannot address existing, let alone future, basic needs, and even adds new sets of problems such as increased need for training and re-training of teachers, for adaptation of curricula, more

textbooks and learning materials, and for improved communications and administrative systems.

Given this situation, what are the prospects of applying modern technologies – like the ICT – to improve the performance of the education sector? More specifically, can the application of ICT make a difference in improving access to, retention and quality of education offered at different levels (primary, secondary and university) in Africa? This question forms the core theme of this paper and is the subject of the next section.

The prospects of ICT in improving the education sector in Sub-Saharan Africa

This section starts by specifying the meaning of Information and Communication Technologies (ICTs). In this context, ICTs is a term used to encompass several interrelated Computer-mediated communication (CMC) technologies that facilitate easy communication of information particularly by overcoming the problem of geographical distance. The application of ICTs is mainly done through the use of a computer, which in turn facilitates numerous connections of different information (electronic) networks. The term IT is used in this paper interchangeably with ICT. Such networks include email system, Internet, World Wide Web etc. How can these technologies help to improve education in Africa?

The call to apply modern technologies like ICTs in Africa has been sounded repeatedly by both scholars and policy makers. Such calls have underscored the prospects of adopting ICT in the education sector where it could help: 1) increase access to education; 2) improve the quality of teaching and learning and 3) improve the efficiency of school and education sector administration and management.¹⁰ In further highlighting the prospects of ICT in Africa, Daekwa and Mazibuko (2000: 4) state that:

The promise of Information Communications Technology (ICT) on the continent is enormous. ICT is expected to serve as a catalyst to African communities, allowing them to profit from and contribute to an increasingly globalized society. Emerging ICT holds much promise for breaking down traditional barriers that have limited higher education.

In the contemporary age of information-based society, there is pressure for everyone to acquire new knowledge and skills. However, the globalization of the economy has in particular “made education a crucial element of socioeconomic development”

¹⁰ See <http://inafrica.com/sector/education.htm>

(Harnessing Information Technology for Development in Africa, pp 2). Only by adopting ICT in education, can Africa manage to participate effectively in the global society. A study in Kenya by the PUIB (2006:309) underscored the importance of ICT in enhancing quality of higher education and stated:

The pervading influence and utilization of ICT in economic development make it absolutely essential that universities take the lead in imparting skills and knowledge so that graduates have competence in this area.

While the usefulness of ICTs in improving education in Africa is strongly supported, no roadmap is readily available to guide implementers on how to introduce these technologies in education institutions like schools. While one can appreciate the large number of African countries with national ICT policies as well as ICT policies in education, few countries have succeeded in the implementation of these policies fully. A study by Ferrell & Shafika (2007) reported the following findings in regard to the development of national ICT policies for 53 selected countries in Africa.

Table 3: Development of national ICT policies 2000 – 2007 in Africa

<i>Status of national ICT policy development by country</i>	<i>2000</i>	<i>2005</i>	<i>2007</i>
<i>Policy in place</i>	<i>13 (24.5%)</i>	<i>28 (52.8%)</i>	<i>36 (67.9%)</i>
<i>Policy under development</i>	<i>10 (18.9%)</i>	<i>15 (28.3%)</i>	<i>12 (22.6%)</i>
<i>No development underway</i>	<i>30 (56.6%)</i>	<i>10 (18.9%)</i>	<i>05 (9.4%)</i>
<i>Total</i>	<i>53 (100%)</i>	<i>53 (100%)</i>	<i>53 (100%)</i>

Source: Ferrell & Shafika (2007)

Table 3 depicts an increasing trend in the number of African countries with national ICT policies in place between 2000 and 2007. While only a quarter (25%) of the sample of 53 selected countries had formulated national ICT policies in 2000, the percentage had rose to slightly over two thirds (68%) in 2007. Conversely, while 57% of the sample had not started formulating national ICT policies in 2000, the percentage had dropped to 9% in 2007. Generally, countries continued to appreciate the importance of national ICT policy over time and engaged in the formulation of the same. Further, reports that: Ferrell & Shafika (2007:6)

Of the 48 countries that either have a national ICT policy in place or are in the process of developing one, 39 of them (81%) have education sector ICT policies in one form or another or are in the process of developing them.

However, despite the remarkable performance in the formulation of ICT policies in Africa, the implementation of ICT policies in Africa is hampered by myriad constraints.¹¹ The challenges of implementation are aptly identified by (Evoh, 2007: 4) who opines:

Despite the recognized role of Information and Communication Technologies (ICTs) in improving the quality and quantity of education, ICTs remain a low priority in most educational systems in Africa. Obviously many countries in the region lack the local capacity and financial wherewithal essential for a sustained integration of ICTs in education.

Beyond the formulation of ICT policies, the adoption of the ICTs entails structural, cultural, behavioural and attitude changes. The adoption of ICTs in the educational institutions -- including schools and colleges -- is a complex process that should not be taken for granted.¹² The process entails: 1) investment in the appropriate infrastructure; 2) resources to purchase essential equipment (like computers) and 3) capacity building efforts to create the required support technical team. Indeed, the adoption of ICTs is a complex process that should be well planned for and managed. The Information Technology Advisory Group (ITAG) further underscores the complex nature of ICT adoption in the education sector and cautions that:

Improving the use of IT in learning in schools requires a combination of actions ... Installing computers with no other support to schools is not particularly effective, and neither is merely training teachers without sufficient IT being available to them in schools (ITAG, 2001:2).

¹¹ A survey by Ferrell & Shafika (2007:7) succinctly captures this reality by noting that: "the development of plans doesn't necessarily equate with implementation and results on the ground. In most cases implementation remains very dependent on the support of partners from donor community and the private sector.

¹² In reporting its survey findings, the Ferrell & Shafika (2007:7) observed that "it is also the case that the process of developing an ICT policy for education is complicated. In many instances, the policies that have recently promulgated are the results of several years of consultation with stakeholder groups."

Overall, the benefits of ICT in education can only be realized “through proper planning, staying focused on educational objectives and understanding the limitations of their capabilities.”¹³

To what extent has Africa adopted ICTs in the education sector and what are the potential challenges? The remaining part of this paper critically examines the diffusion process; it also reviews the potential challenges in the application of ICTs in Africa’s education sector.

Theoretical and practical challenges in ICT adoption in Africa

The widespread and intensive usage of ICTs worldwide has transformed industrial societies into information societies. Rogers and Williams (1986:10) define information society as:

a nation in which a majority of the labour force is composed of information workers, and in which information is the most important element. Thus the information society represents a sharp change from the industrial society in which majority of the work force was employed in the manufacturing occupations ...

Information workers are therefore engaged in the production, processing and distribution of information using modern ICT. During the information age, a compliant education sector should therefore train, deploy and retain information workers including teachers and administrators. Such workers should have the capacity to adopt, control and direct modern ICTs. On the other hand, learners should access modern ICT and would need to be empowered to apply it appropriately. But how can schools and colleges adopt modern ICTs to overcome the many challenges facing the education sector in Sub-Saharan Africa? We can draw from the diffusion theory of communication to address adoption of ICTs in the education sector in Africa.

Diffusion theory of communication has dominated the literature on adoption of technology for a long time. Its conventional thesis is to inform the process through which an innovation is introduced to its potential users who are provided with more information required to enable them to adopt or reject it. According to Rogers and Williams (1986:117), the main elements in the diffusion process are:

¹³ See <http://ictinafrica.com/sector/education.htm>

a) An innovation – this constitutes the new idea to be adopted. In the education sector, it includes modern ICT such as computers and use of new teaching technologies such as Power Points.

b) Communication Channels – These refer to the various means through which information is distributed or shared. In the education sector, the commonly used media channels include radio, TV and increasingly, mobile phones and the Internet.

c) Time Dimension – Any innovation takes time from the time it is introduced to the point of adoption or rejection. The time taken depends, inter alia, on the complexity of the innovation.

d) Targeted Adopters or Social System – Typically, an innovation targets individuals or organizations that are likely to adopt it. How fast it is accepted and adopted depends on the characteristics of the potential adopters or the social system within which they operate.

e) Adoption or Rejection of Innovation – The final stage of diffusion process is marked by the decision to adopt or reject it. The decision to adopt an innovation is a complex one that is a function of its perceived relevance, complexity and costs.

Within the African education the ICT diffusion process is faced with myriad challenges at every stage. First is the challenge of understanding the true meaning of ICTs. According to (Evoh, 2007: 13):

Conceptually, there is a broad misunderstanding of the true meaning of "ICT" among policy makers in Africa. Many technology policy makers tend to interpret the "C" in ICT as "computers," hence there is lack of multiple conception of ICT and a focus on computers for educational enhancement in African school. In reality, ICT is not limited to computers or satellite and internet technologies.

The second challenge pertains to the inadequacies in ICT capacity in Africa's education sector. It is evident that most teachers and learners are not computer literate and in many countries, the sector lacks a supportive technical support team to drive the new technology. More specifically, a recent study in Kenya reviewing the quality of higher education found that "there is an acute shortage of qualified staff and facilities." (PUIB, 2006: 309; see also Republic of Kenya, 2006:39). To address this concern, many countries have relied on ICT foreign experts. For this reason, Evoh (2007: 14) highlights:

... the urgency for training and development of indigenous skills and capacities in various African countries to service the emerging ICT sector in the region.

The third challenge relates to implementation. Due to the limited ICT infrastructure and equipments (including connectivity to Internet and computers), even countries with fully developed ICT policies in education cannot fully implement their policies. A recent study by Ferrell & Shafika (2007:9) summarizes the typical implementation constraints faced by African countries by noting that:

Access to a reliable supply of electricity is a general problem but is particularly severe in rural areas because of the difficulty of connecting to national electricity grids. There is a general lack of human resources capacity to provide ICT training and equipment servicing, and there is also a lag between availability of ICT infrastructure and the ability of agrarian societies to integrate it to benefit national development.

The fourth challenge is that of general poverty in Sub-Saharan Africa. By 1994, the incidence of poverty was 47% among rural populace in Kenya and by 1997, the incidence of poverty was deepening (PUIB, 2006:262). This explains why a large percentage of the population has no access to education and other assets including radio, TV, print media, computers and connectivity to the internet. Yet the latter are the communication channels commonly used to drive the ICTs in the education sector. To provide sustainable access to ICT infrastructure at higher levels of education, some institutions in Africa have placed additional ICT fees per student. This has become a common practice in all Kenyan universities. Other countries have adopted use of “old” or “recycled” ICTs. For example, the Computer Aid International¹⁴ specializes in sourcing and distributing professionally refurbished computers for re-use in education and health in Africa and other developing countries (Ferrell & Shafika (2007:36). There are other low-cost computing pilot projects – including One Laptop Per Child (OLPC) and NEPAD e-Schools – that countries are experimenting with in several African countries.¹⁵

The fifth challenge is that of low budgetary priority placed on the development of the ICT particularly by the African states. For example, according to Shrum et al. (2007:249):

Dwindling government and donor funding to national research institutions means that top management must prioritize and limit funding to those areas perceived to have a potential to produce immediate and demonstrable results. Internet connectivity is rarely perceived as such.

¹⁴ For details you can visit its website: www.computeraid.org

¹⁵ For the OLPC you can visit its website: www.laptop.org or www.olpc.com and for NEPAD e-Schools you can visit its website: www.eafricacommission.org

The last hurdle in the diffusion process is the characteristics of both the potential adopters and the education system. To what extent do potential adopters appreciate the modern technologies? Paradoxically, there is some evidence that ICTs are not strongly appreciated in Africa as sometimes assumed. According to Shrum et al (2007:248):

Among the many reasons for low use of Internet by educational and research institutions in Sub-Saharan Africa is inadequate appreciation of the true power and usefulness of this tool. ... Out of 48 scientists [studied at Katumani research centre], only two had direct access to Internet connectivity in their offices. The rest were either uninterested or could not afford it.

If this finding reflects the true reality in Africa, there is need to lobby and demonstrate the potentials of ICTs particularly in higher education. Most important it is imperative to challenge the popular view among some top managers of education institutions in LDCs that ICTs including the Internet is “a part-time hobby rather than an essential tool for day-to-day performance” (Shrum et al, 2007:250).

These challenges explain why the ICT penetration rate in Africa’s education sector has been remarkably low. This creates a situation where many schools and colleges cannot access the ICTs. Accordingly, learners and trainers in African educational institutions are yet to reap optimal benefits that accrue from ICT adoption. Table 4 presents data that highlight the low penetration rate of computers in selected African countries.

Table 4: Computer penetration Ratios of schools in selected African countries

<i>Country</i>	<i># of schools</i>	<i># of schools with computers</i>	<i>% of schools with computers</i>
<i>Egypt</i>	<i>26,000</i>	<i>26,000</i>	<i>100</i>
<i>Ghana</i>	<i>32,000</i>	<i>800</i>	<i>2.5</i>
<i>Mozambique</i>	<i>7,000</i>	<i>80</i>	<i>1.1</i>
<i>Namibia</i>	<i>1,519</i>	<i>350</i>	<i>22.2</i>
<i>South Africa</i>	<i>25,582</i>	<i>6,651</i>	<i>22.6</i>

Source: Ferrell & Shafika (2007:20)

It is apparent that except for Egypt; which had computers in all its schools (a penetration rate of 100%), the rest of the countries have exceedingly low penetration rate. This is typical in Sub-Saharan countries where few schools have access to computers. Overall, to improve the general performance of the education sector, the identified challenges should be tackled at every stage of the diffusion process. This will require combined efforts of the African states, donors, private sector as well as civil society organizations.

Application of ICTs to improve learning and teaching in Africa's education sector

The use of ICTs in Africa's education sector can boost both the learning and teaching activities. By adopting ICTs, schools, colleges and universities can benefit as follows:

1. Increasing access to useful instructional teaching materials:

In many African countries, teachers/instructors find it difficult to obtain adequate instructional materials at all levels – primary, secondary, tertiary and university. Indeed, in most African countries, there is an acute shortage of updated instructional materials. This problem is manifested through lack of libraries at some levels (e.g., primary and secondary) and the existence of poorly equipped libraries at higher levels. It is unfortunate that in many countries, even university libraries lack effective information management systems and updated reading materials. This problem frustrates both the instructors and learners at all levels.

How can this problem be addressed? By adopting ICT – such as the Internet – teachers/instructors, researchers and university lecturers can access and share as equal partners the existing information in the global networks.¹⁶ On the other hand, once connected to the Internet, learners at all levels could navigate in the information superhighway in search for more information beyond their local libraries and national boundaries. Through Internet connections, schools and colleges can dramatically widen their access to teaching and learning materials.

¹⁶ See <http://ictinafrica.com/sector/education.htm> that observes that “ICTs have the potential to increase access to education, improve teaching and learning and improve the efficiency of educational management.”

2. Enhancement of distance education.

There are many gaps in Africa's education sector that include inadequate physical facilities (e.g., schools), equipment and personnel. In many countries, the available schools cannot accommodate all the prospective pupils and as a result, classes are overcrowded while many prospective learners are locked out of the education system (Republic of Kenya, 2006:54). In addition, there is a perpetual shortage of teachers at all levels. For example, in many African countries, the few public universities can only take a small fraction (of around 5% with excellent scores) of those who complete high school. Unfortunately, a large number of those who still meet the minimum university requirements are not admitted due to lack of adequate facilities (PUIB, 2006:23). Accordingly, many deserving students (with a high "thirst" for higher education) are locked out of the universities and other tertiary colleges. How can such deserving groups be assisted through the adoption of the ICTs?

Through the application of ICTs, Africa can introduce and/or strengthen the strategy of Distance Education. In fact, provision of distance education in Africa is considered as a realistic way of reaching out a large number of people who have no opportunity of accessing education through the existing traditional channels. The fact of the matter is that the existing physical facilities and personnel (teachers, instructors and lecturers) in Africa cannot match the overwhelming demand for education in Africa. Distance education, therefore has a high potential in Africa. The promise of distance education in Africa is well documented by Darkwa and Mazibuko (2000: 3) who assert that:

Distance education could be used to make it possible for African secondary school graduates, only a fraction of whom can be accommodated in African tertiary institutions, to enroll directly, and without leaving their homes, in online colleges and universities on the continent and around the world.

Further, these authors highlight the advantages of distance education over the traditional education system that include:

- a) Virtual access to faculty in higher institutions around the world.
- b) Introduction of new interactive pedagogical techniques (e.g., more hands-on learning opportunities, independent research, less reliance on rote memorization).
- c) The creation of virtual institutions and linkages where resources could be shared by people and organization in physically unconnected places.

The strategy of distance education as a medium of offering education in Africa has been tried on a limited scale but with notable success. In citing an exemplary case of distance education in Africa, Darkwa and Mazibuko (2000:5) observe that:

The most ambitious distance education initiative on the continent to date is the African Virtual University (AVU) project. This is the first satellite-based attempt to harness the power on information technologies to deliver university education ... Baranshamaje in Darkwa and Mazibuko (2000:5) adds: The AVU project will deliver instructional programs, strengthen the capacity in African partner institutions, implement a network of infrastructure, and implement a digital library program.¹⁷

As illustrated by the successful AVU project, through the adoption of ICTs, schools and universities in Africa can drastically expand their student-catchments areas by removing geographical barriers of access. However, much as distance education sounds promising in Africa, it has many (technological) challenges. First, the high cost implications that should be addressed. In Africa, the costs of access to the Computer-Mediated communication networks are highly exaggerated by the high cost of telephones. The second obstacle is the low rate of connectivity to the Internet in Africa. This hindrance is well captured by Marcelle in Darkwa and Mazibuko (2000:6) who explain that:

Even though Africa has 12% of the world's population, it includes only 2% of the global telephone network with over half the lines in cities. Telephone density is less than two lines per 1,000 inhabitants, compared with 48 per 1,000 in Asia and 280 per 1,000 in America, 314 per 1,000 in Europe, and 520 per 1,000 in high income countries.

In support of the observations that Africa's telecommunication is severely underdeveloped, Table 5 presents data on communication connectivity. An attempt is made to compare Sub-Saharan Africa with selected regions of the world.

¹⁷ According to (Ferrell & Shafika, 2007:35), "... the AVU is an innovative education institution based in Nairobi, Kenya, that services 57 learning centres in 27 African countries. The AVU works with universities based in Africa and other countries such as US and Australia to provide academic programmes and short courses through open and distance e-learning." See AVU website for more: <http://web.archive.org/web/20060426202907/www.avu.org> for more.

Table 5: Comparison of Africa's connectivity to Telecommunication with selected regions of the world

<i>Regions</i>	<i>Number per 100 population connected to telephone by 2001</i>	<i>Number per 100 population who use Internet by 2001</i>
<i>Sub-Saharan Africa</i>	4	1
<i>South Asia</i>	4	1
<i>East Asia and Pacific</i>	23	4
<i>Industrialized Countries</i>	117	37
<i>Developing Countries</i>	16	3
<i>World</i>	32	8

Source: UNICEF (2004)

Data in Table 5 shows that Sub-Saharan Africa and South Asia had the lowest connectivity to telephone and had the lowest Internet users by 2001. More specifically, it is saddening to note that by 2001, only a mere 4% and 1% of the population in Sub-Saharan Africa was connected to phone and used Internet respectively. This was the same situation in South Asia. The data help to capture the problem of digital divide in the world. It is worth noting that while only 1 person in 100 used Internet in Sub-Saharan Africa and Asia, the corresponding figure for the industrialized countries was 37. Indeed, more than one-third of people in the industrialized countries are Internet users. These figures help to reveal Africa's major technological challenges – including low connectivity to the ICTs -- that must be addressed to improve the performance of its education sector.

As documented earlier, the major challenges include a) lack of trained manpower (professionals) to support the implementation of distance education; b) absence of supportive policies to enhance implementation of distance education; c) a general shortage of the requisite ICTs infrastructure and d) general ignorance on the potentials of distance education among educators and policy makers. These challenges must first be addressed to pave way for a successful implementation of distance education in Africa.

3. Improvement of quality.

Through the adoption of ICTs, African teachers, instructors and lecturers would enhance their access to valuable instructional materials. Access and use of such materials would help to improve the quality of teaching. Teachers, instructors and lecturers would be more empowered to deliver quality education. Furthermore, as documented by an electronic source:

ICTs can be used for teacher professional development through the use of distance education. As many countries in Africa struggle with large number of under-qualified teachers, ICTs could be leveraged to provide these teachers with distance education courses that will not require them to leave the classroom and/or to support on-going In Service (INSET) teacher development programs.

In the same way, by accessing various sources of information, learners would obtain more information to supplement what they learn in class. Again this would improve the quality of education offered.

4. Strengthening interactions among teachers and students.

Effective learning and teaching are boosted by the interactions between teachers and students. Through the use of ICTs, education institutions can facilitate the interactions of teachers and students.. For example, through the formation of discussion groups, using the email system, students are able to engage in class discussions effectively without meeting. In addition, using the same system, teachers can effectively interact with a class without actually meeting. This way, adoption of ICT can strengthen interactions among teachers and students thereby enhancing effective teaching and learning in schools and colleges.

5. Making learning and teaching lively and effective

By introducing modern teaching technologies, for example, use of Power Point rather than “chalk and talk,” instructors are able to improve the learning moods of the class. Indeed, well-trained instructors are more lively using modern teaching technologies and effective. On the other hand, students are always more attentive to follow a lesson delivered through the use of modern ICTs – that basically emphasizes both visual and audio aids. The use of ICTs thus replaces the traditional “dry lecture method” adopted by many instructors in Africa especially at secondary and university levels.

6. Other ways of improving education sector through application of ICTs.

There are ways of improving the teaching and learning in Africa that include improving efficiency of education institutions through the use of ICTs. Where schools, have installed computers, their efficiency in processing information (e.g., students' grades) has improved. Further, use of ICTw has strengthened collaboration of scholars and researcher especially at the university level. As confirmed by Shrum et. al. (1992), the use of the Internet by researchers in developing countries (like India and Kenya), enhance collaboration. Practically, through the Internet, researchers are able to share their findings with their peers within and outside their country.

Summary and conclusion

Through the use of selected indicators, this paper has first shown the state of technological development in Africa. In addition, by using education statistics, this paper has described the poor performance of the education sector in Sub-Saharan Africa and South Asia. To help improve the performance of the sector, the suggests that ICTs could be used to address some of the salient challenges. In particular, the paper demonstrates the critical rôle of ICTs in improving the education sector in Africa. The latter could help improve teaching and learning in schools and colleges. For example, application of ICTs would enhance access to the much-needed information by both teachers and learners. In addition, the use of ICTs would enable many more people who have no chance of ever joining a classroom to be.

This paper also recognizes the many challenges that should be addressed to facilitate the use of ICTs in schools, colleges and universities. For example, given that many schools in Africa are not connected to telephones and electricity, it would be difficult to adopt ICTs. The educational institutions that have access to electricity are also hampered by the frequent power failures (disruptions) in Africa. In general, Africa has the lowest connectivity to both telephone and Internet. These are challenges that must be addressed to pave way for the adoption of ICTs in the education sector. At a global level, there is need to tackle the problem of digital divide.

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