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African Information Society Initiative, Technology Transfer and the Evolution of Digital Information and Knowledge Management Systems in Africa

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Abstract

The paper presented the effect of technology transfer on the African continent's quest to develop an information society using the AISI framework developed in 1996. The analysis made in this paper was however, developed relying on the theoretical framework available in the literature on Africa's efforts and achievements in her quest to become an information society. The paper supports the fact that for Africa to be able to achieve its information society initiative objectives that it most take technology transfer issues very seriously. Some remarkable achievements made by some African countries were also outlined in this paper.

Keywords: Information Society, African Information Society Initiative, technology transfer, Digital Information Management Systems, Digital Knowledge Management Systems

Introduction

During the 22nd Economic Commission for Africa (ECA) Conference of Ministers in 1995, African Ministers of Social and Economic Development Planning came to the conclusion that the primary way to salvage Africa's socio-political and economic misfortune was to launch her into the Global Information Superhighway (GIS) (Amoako, 1996 and AISI Brochure, 1996). This was as a result of their submission that launching Africa into the GIS will guarantee the continent's speedy transformation across centuries of development attained by developed countries. This launch presumably, will enable Africa to have access to technologies required for rapid socio-cultural, industrial and economic transformation. Hence, a high level working group of IT experts was commissioned to deve! p a documented framework tagged the African Information Society Initiative (AISI) which spelt out how African countries would attain the information society status by the year 2010.

The AISI Brochure (1996) spells out four major development goals to be met by the African information society agenda:

1. improvement of quality of life
2. economic integration of the region
3. improved trade and other linkages with global community
4. utilization of information technologies

These goals however, are to be achieved based on four components of the AISI framework: institutional, human resources, information resources/infostructure and technological resources. In other word, AISI would require African countries to build, at country and regional levels,

institutional framework that will eliminate financial, technological, regulatory and business environment obstacles which have impeded Africa's development. Equally, the human resources framework demands that Africa must build and maintain a qualitative workforce that would be able to develop, import and adapt new technologies that are required for proactive and innovative production breakthrough. Africa must also develop digital Information and Knowledge Management Systems (IKMS) where information and knowledge resources would be made available and accessible. These requirements however, would be hinged on the use of information and communication technologies (ICTs) at all levels.

Amoako (1996) indicates that by the year 2010 AISI would have led to an African information society where:

- everybody, students, villages, government offices and business can access information through computers and telecommunications.
- Information and decision support systems are used to support decision making in all major sectors of each nation's economy.
- Access is available throughout the region to international, regional and national "information highways."
- A vibrant private sector which would exhibit strong leadership in growing information based economies.
- African information resources are accessible globally reflecting content on tourism, trade, education, culture, energy, health, transport and natural resource management.
- Information and knowledge empower all sectors of society.

This means that by 2010:

1. African countries would have procured and built ICT infrastructure which are required to deploy and use Internet based IKMS.
2. African countries would have built Internet based IKMS where information and knowledge can be readily accessed
3. Everybody in Africa would have been able to create and use digital information resources, irrespective of their levels of education and their socio-cultural and economic involvements.
4. Africans would have attained skills and knowledge required to cost effectively acquire, process, use and transfer information and knowledge in digital environments.

This paper therefore, assessed the effects of technology transfer on the emergence of IKMS that are required to meet AISI goals. This is because it was considered proper to assume that technology transfer from societies and regions that have perfected or at the verge of perfecting their information society initiatives would improve the possibility of developing appropriate IKMS to support the AISI framework. Tiamiyu and Aina (2008) and Heokman and Javorcik (2006) have already pointed out that activities that generate and perfect technologies is more undertaken in high income countries.

The segments covered in the paper are:

- What is Technology Transfer?
- The Relevance of Technology Transfer to the Evolution of IKMS in Africa
- Practical Cases of Technology Transfer in African Countries
- Conclusion

What is Technology Transfer?

The difficulty involved in defining the term 'technology' which is believed to have evolved from the term 'technique' has led to the postulation of various kinds of definitions for the term.

Definitions by Peter Drucker and John Kenneth Galbraith cited by Okongwu (2007) presented technology "as not just about tools, machines or artifacts...[it] deals with how man works" and "the systematic application of scientific and other organized knowledge to practical tasks (p. 8)," while Nwoko (1991) defined technology as "the methodical utilization of natural resources and forces on the basis of the knowledge of nature, in order to take care of man's needs (p.23)." Okongwu (2007) was of the opinion that "technology is more than subduing or controlling environment, it has become a means or tool for achieving certain advantages such as transmuting the nature of things...thereby achieving enhanced value by so doing generating surplus (value-added surplus) (p. 8)." Technology therefore, is knowledge, mental ability and know-how. It determines the performances of factors of production, that is, the quality of entrepreneur and labour, the value of capital and how well land and natural resources are put to use.

As a result, the concept of technology transfer has transformed rapidly with the evolution of the information society. Scholars have used technology transfer and knowledge transfer interchangeably, with good examples being Rodriguez, *et al.* (2008); and Heokman and Jovorcik (2006) who wrote that the "acquisition and diffusion of ***knowledge or technology*** are of great importance for economic development, as the adoption of new techniques, machines, and production processes is key determinant of productivity growth (pg 1) (Bold and italic are for emphasis)." Hence, in the context of this paper technology transfer represents knowledge transfer. Accordingly, Chandra and Kolavalli (2006) posited that the need for countries or industries lagging behind to catch up with their peers has led to high rate of technology transfer in recent times.

Okongwu (2007) defined technology transfer as, "the flow of applicable knowledge, skills, capability, expertise, equipment or facility for the manufacture, construction, management, processing or production of a device, product, system or services from one location, sector or activity to another, within a specific time frame." He noted that there are three kinds of technology transfer:

1. transfer from one sector of an economy to another, e.g. 'spin off' or 'spill over' such as from military to civilian economy (the Internet for example)
2. transfer from one geographical location (country, community or company) to another.
3. transfer from laboratory (R&D result, patent, etc.) to the market (industry spin outs)

Bruun (1980) revealed that technology can be transferred through literature, exchange of workers and through institutional contract. Chandra and Kolavalli (2006) opined that technology can be transferred internally though Foreign Direct Investment (FDI) and externally through licenses, contracts, and sales of equipment or know-how. Technology can also be transferred passively, that is, without formal and pre-arranged actions. This particularly happens with movement of people, resources, labour and information across firm, local or international boundaries and can be explained in terms of imports, mobility of labour and FDI (Ferranti, *et al.* 2003 and Chandra and Kolavalli, 2006). It is very important that technology transfer should be pre-arranged, monitored and assessed against set goals (Okongwu, 2007).

However, technology transfer is determined by both internal and external factors. Internal factors are those factors that interplay within the society or industry that wants to acquire a technology, while external factors are those factors that influence a society and industry country that wants to give out or transfer technology. These factors include:

1. cost of technology (external)
2. terms of transfer (external)
3. technological capability of recipient country (internal)
4. political and cultural environment (internal)
5. technology support structure (internal)

6. technology transfer framework/programme (internal)
7. market size (internal) (Okongwu, 2007, p. 16).

The extent of IKMS technology available to African countries therefore, is a function of the seven factors listed above. Interestingly, five of the seven factors are classified as internal factors, that is, factors inherent in African societies. This is to say that Africa's proposal to create jobs, provide better and reliable healthcare systems, information society compliant education and research sector, improve her culture, trade, commerce and tourism, ensure food security and avert man made crises and natural disaster by deploying an African wide IKMS primarily depends on factors inherent within African countries.

Azubuike (2007) also pointed out that research has established four preconditions of knowledge economy: reliable economic and institutional regime, educated and skilled population, dynamic information infrastructure and efficient innovative system of firms, research centres, universities and organizations capable of tapping into the stock of global knowledge. This means that African countries are required to play more role than those societies where the various IKMS technologies required to support the deployment of IKMS for AISI are domiciled. When one considers technological capabilities of African countries, especially in relationship with the quality of education and R&D activities, human resources capacity, and the political and cultural environment available there, one would conclude that attaining the AISI dream of building and using IKMS to reach Africa's development goals requires more internal efforts than looking outside of the African continent (Sanni, 2003, Barry, *et al.*, 2008, Pehrson, *et al.* 2008, Pinto, *et al.* 2008 and Hanafizadeh, *et al.*, 2009).

The Relevance of Technology Transfer to the Evolution of IKMS in Africa

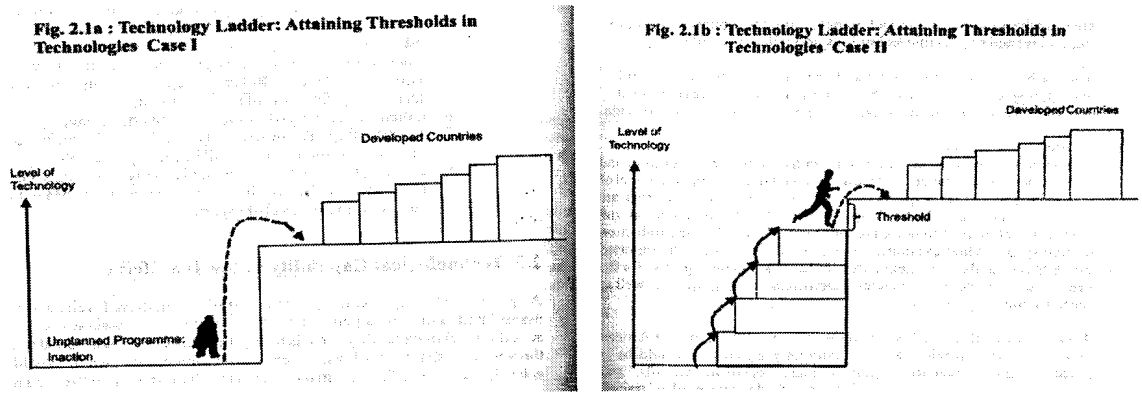
The fields of social and management sciences have been involved with research and discourses on technology transfer for decades. In the recent past, the field of library and information science has also started paying more attention to technology transfer, especially with the evolution and expansion of knowledge management studies across the globe. The array of literature that has been produced by these academic fields has convergence and divergence on issues relating to the role technology and its transfer can play in the level of development attained by societies around the world. One thing however, that is common to all of them is that they emphasize that the differences in technology reflects the operations of modern economic forces (Ferranti, *et al*, 2003, Chandra, 2006, Rodriguez, *et al.*, 2008).

It has been articulated earlier in this paper that a well planned technology transfer programme is more desirable than an unplanned technology transfer programme. Okongwu (2007) pointed to this when he noted that the transferee's, (the recipient of a technology) ability to absorb and adapt a given technology go a long way to determine the extent of impact the technology would have on the transferee. Fergerberg (1994) postulated that technology expansion and transfer from one setting to another is difficult and costly. Chandra and Kolavalli (2006) wrote that "The differences in the economic performance of countries that have access to the same set of technologies and similar levels of investment in physical and human capital suggest that technological learning is important in its own right and requires policy attention." The importance of this is that a well planned IKMS technology transfer programme will allow African countries to know what they really require to reach set goal of deploying IKMS to meet the AISI objectives. It is suffice to say that a well planned technology transfer programme can present avenues for a valuable socio-political, cultural and economic evaluation. This may be valuable to understanding the kind of IKMS Africans require to meet the AISI goals and objectives.

A well planned IKMS technology transfer programme may afford African countries the following benefits:

1. self assessment of development opportunities available to them through various socio-political, cultural and economic activities. Examples can be drawn from an assessment of education and training opportunities available to teach information literacy, information systems design and deployment and how to harness IKMS technology transfer opportunities available through importation of goods and services including academic literature, from other countries and regions of the world.
2. provision of information on African countries' positions along various IKMS technology thresholds, that is, their current needs and capability in terms of ability to design and deploy IKMS. This is very fundamental to the choice of IKMS technology from the array of IKMS technology available globally.
3. attainment of a qualitative and quantitative assessment of work force abilities, skills, mentality and knowledge in relationship with the deployment, use and maintenance of IKMS.
4. allows African countries to carryout assessment that gives them the opportunity to know what is required of Africans, literate and non-literate, to use information and knowledge as vital resources for taking informed decisions in all aspects of their lives as stated in the AISI framework.
5. allows African countries assess their political, cultural and business environments and their science and technology expenditure and infrastructure. This is important as it will allow them to know how well they are doing and what is required to improve their performances with regard to the laid down impact factors on the development goals in the AISI framework.

Having outlined these benefits, it becomes pertinent to note that a significant part of Africa's quest to develop a reliable and appropriate IKMS along the AISI framework may be solved by a thorough and objective evaluation of local needs, available local resources (man, machines, and materials), available technology in other societies of the world, cost of getting this technology, required political support and local socio-cultural, political and economic environment. The figures below explain this.



Okongwu, 2007 Technology Ladder (Used with permission)

An institutional framework which has incorporated technology transfer programme at countries and regional levels can serve as reliable tool for this kind of assessment. The AISI objective to have an African information society where IKMS would be made readily available can depend on a technology transfer programme that is deliberately mounted. This may help reveal threshold characteristics as shown in Figs. 2.1a and 2.1b above. Fig 2.1a reveals the consequences of

unplanned programmes which mostly results into inaction. This may have resulted from issues concerning intellectual property rights, copyright, patent right and technology transfer policies that have been laid down by international laws and laws inherent in the transferor's country (Babafemi, 2007, Gallagher, 2007 and Manton, 2006).

Practical Cases of Technology Transfer in African Countries

The cases of technology transfer in African countries have always been dictated by external or what could be best termed global changes and rising international competitions. This often posed challenges that require government and industry to reposition along the line of the four components of AISI: Institutional, human resources, infostructure and information technology. For instance, Kiggundu (2006) commented on technology adaptation that revamped the fishery industry in Uganda thus:

> A number of factors and relationships were critical to the transformation of Uganda's fisheries industry-notably joint efforts across firms, action by the public sector, the involvement of quasi-public, private, and international standard setting bodies; and the requirement of global buyers (p. 308).

He noted that critical factors like skills, mentality, mental ability, knowledge management infrastructure -creation, storage and dissemination-, education and training, institutional capacity, etc., were all revisited and upgraded to support the adaptation of new fishery technology in Uganda. In the first instance, Ugandan government had to provide political support by overhauling public offices in charge of legislations affecting fisheries, thereafter, the government also funded or sought for funding to improve institutional capacities, especially laboratories, fishery research institutions and empowering universities to mount academic programmes in fisheries. This was done to develop and empower institutions that were considered as knowledge infrastructures and the capacity of people involved in the fisheries production in Uganda. This was considered important because of the need to create IKMS where information can be shared and knowledge accessed for management decisions.

In the case of Kenyan floriculture industry, Whitaker and Kolavalli (2006) noted that socio-political, economic and technological environment played vital role in the adaptation of new technologies that placed Kenya at the top of the table of floral product exporters to Europe. This was expressed thus:

> ...the need to respond to changing preferences of sophisticated consumers in Western Markets, and the need to maintain an edge over competing production centers that attract global capital flows require producing countries to have efficient institutions, appropriate policies, and adequate infrastructures... (p. 337).

Four wares were recognized as vital to the floral industry and these were particularly managed by the Kenyan floral industry with background support from the Kenyan government:

1. hardware: structures and equipment designed to modify the environment or control the climate during the production, processing, and transport of flowers.
2. plant-ware: genetic materials that embody attributes desired in market and that are suitable for local production. Knowledge and processes required for the production of these input are not included.
3. nature-ware: materials and knowledge systems necessary to minimize environmental damage from the production of ornamentals, such hydroponics, which can potentially reduce water usage; chemicals that have lower residues; or knowledge systems, such as integrated pest management, which reduces the use of chemical pesticides.

4. software: knowledge systems that are essential for making the best use of material technologies and managerial capabilities. Greenhouse management is an example (Whitaker and Kolavalli, 2006).

These wares were harnessed and used to overhaul floral production, harvesting, processing, and transportation to markets (mostly foreign markets). IKMS played very vital role in making Kenya understand its own environment, external environment (including current prospective markets and competitors), changes in floral technology, what technology to adapt and how to adapt such technologies through technology deepening.

However, Nigeria's involvement in AISI and her implementation of its principles were hampered by the framework's timing. The reason being that Nigeria was at the peak of military dictatorship at the time AISI was launched in 1996. The military regime in power during this period also deliberately shut Nigeria out of information society initiative as it was aware that information democratization would liberate Nigerians. Aiyepeku (1997) reported how Nigeria was deliberately left out of the AISI initiative and the various effects of this on Nigeria's future development. However, immediately after the military regime handed power over to a civilian democratic regime in 1999, actions were taken to repair the battered image of the country in international circles. After tackling her international image problem Nigerian government took the following decisive steps:

1. deregulation of regulated corporations,
2. revamping of the educational sector-introduction of a nine year-based universal basic education, solidifying government legislation supporting the establishment of private universities, increased funding and remuneration for teachers at all levels of education in Nigeria, etc.-,
3. improvement of local communication infrastructure, e.g. Nigerian Postal Agency (NIPOST),
4. deregulation of the telecommunication sector,
5. provision of platform to support Internet connectivity,
6. improved press freedom and
7. government commitment to good governance (NEPAD, 2008 and APRM, 2008)

Olatokun (2006) also reported Nigerian government's effort in initiating Information and Communication Technology policy to regulate the growth in the use of ICTs in the country. Consequently, Nigerian currently has over 50 million subscribers who have access to, and use Global System Mobile (GMS) communication and also ranks second in the league of top ten Internet users in Africa with over 10 million Internet users (Internet Stat, 2009). The Research4Life also reported that Nigeria is among developing countries whose research output have grown tremendously in the last six years (Parker, 2009). Apart from this, higher institutions and other corporations in Nigeria are automating their operations (Adeleke and Olorunsola, 2007, Oduwole, 2005 and Ehikhamenor, 2003). So also, public examinations bodies like the Joint Admission Matriculation Board (JAMB), West African Examination Council (WAEC) and Nigerian Examination Council (NECO) now have automated registration system and Internet portals which mandate their candidates to use Internet based registration system. The introduction of the Nigerian Virtual Library, coordinated by National Universities Commission is also another commitment toward using IKMS.

There have also been African-wide achievements that have been recorded over the years as a result of African countries' resolution to comply with the AISI initiative. Part of this is the evolution of digital libraries in Africa which has been reported by Mutula and Ojedokun (2008).

Some of the digital library projects that have been accomplished include the Index of South African Periodicals (ISAP) and the African Association of Universities Database of African Theses and Dissertation (DATAB), African Journal Online (AJOL) to mention but a few. Coupled with this, Amoussougbo and Opoku-Mensa (2005) recorded efforts made to increase African academia's role in the development of the African information society. Part of the effort made so far include the launch of African Learning Network (ALN), which was to facilitate academic networks and the use of new learning and teaching technologies among African academics. Another area of achievement is the development of Spatial Data Infrastructure (SDI) to manage geoinformation. Ezigbalike (2005) reported ECA effort from 1972 when it helped to establish the Regional Centre for the Training in Aerospace in Nigeria and in Kenya in 1975, to its present efforts meant to develop Africa's capacity to use SDI to measure poverty in line with the dictate of the AISI framework.

Furthermore, Etta and Parvyn-Wamahiu (2003) highlighted the use of telecentres for the dissemination of social, survival and business (including agriculture and health) information in five African countries-Mali, Mozambique, Uganda, South Africa, and Senegal. The use of telecentres become imperative as a result of the need to reach, as requested by the AISI framework, the rural poor and those that have been marginalized by the urban-skewed information technology penetration in Africa. Services rendered in telecentres in Africa include telephony, facsimile, Internet access, and email. Others include scanning, text processing, printing, and photocopying. These services help the rural settlers to carryout various functions that deal directly with their existence and sustenance.

Conclusion

Even though there are catalogues of practical cases of the implementation of AISI framework by African countries, we can only say that the AISI framework, whose timing expires in 2010, has minimal effect on the African economy. Africa still remains a very poor continent, in fact the poorest continent in the globe. Between 1996 when the initiative was launched and now, African countries cannot be said to have become an information society. Africa ranks the least in the league of Internet penetration among the continents with 5.6 % penetration as against North America's 74.4 % penetration. African also constitute only 3.4 % of Internet users globally. This places her (using population density advantage) only over Middle East and Oceania/Australia in the world Internet use Table (Internet World Stats, 2009). In fact, Africa's contribution to the growth of world knowledge, especially as measured by the Internet, is still very minimal.

Does this now mean that the AISI initiative has not paid off? Considering the statistics on Internet usage growth between 2000 and 2008, it will be expedient to say that the AISI initiative has paid off. Africa's Internet users' growth was put at 1100 %, a growth rate that is second to Middle East's 1296.2 % growth rate in eight years. The AISI initiative has helped Africa to reposition in major sectors, primary among which are telecommunication and education. Growth in knowledge production through publications in reputable and international journals has also been recorded in recent times. The challenges that Africa currently face is the need to properly harness her resources towards developing, importing and using available technologies judiciously for sustainable growth and development. This warrants the inclusion of technology transfer protocols and policies into its development plans. Africa's growth in every sector should be checked against technology development and movement across sectors and boundaries. This means that technology transfer should be given a substantial institutional power in order to be able to harness its benefit in expanding the implications of AISI in the present and future. This paper concludes that AISI has worked well for Africa and that it should be extended for another fifteen years, with special concentration on adopting technology transfer policies capable of

harnessing Africa's human, natural and artificial resources as this is capable of lifting Africa's socio-political, cultural and economic burdens within a shorter timeframe.

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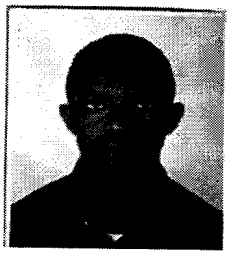

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