

Prospects for sub-saharan Africa to grow in an era dominated by knowledge and information technology

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ABSTRACT

The thesis of this article is that *knowledge and the information technology revolution are responsible for the rapid economic growth experienced by some economies today. This is demonstrated through a simple example of how the knowledge economy, the natural resource-based economy, and the industrial economy relate to each other. Because of the potential for the knowledge that is fuelling rapid growth in knowledge economies to become public goods, the World Trade Organisation (WTO) is being used as the arbiter and store of patent rights over knowledge. As the store of patent rights, membership of the WTO can become a way of sharing in this knowledge and also integrating into world trade and economy.*

Because of the existence of knowledge gap, Sub-Saharan African (SSA) countries are not benefiting from the information technology revolution. Their economies continue to stay mostly in the primary sector, where even to maintain the type of quality that WTO demands may not be easy. This knowledge gap affects the competitive position of SSA in international trade. All is not lost though. There is room for leap-frogging in knowledge. International organisations like the World Bank, United Nations Development Programme, World Health Organisation, etc., are playing a very important role in disseminating new knowledge and technology to encourage leap-frogging. SSA countries need to exploit this opportunity to narrow the knowledge gap and to make it possible for their economies to grow rapidly so that they can become part of the global economy. How this is done will depend on the policies that each country pursues.

Key words: knowledge economy, information technology, leap-frogging.

RÉSUMÉ

Le présent article soutient l'argument selon lequel la connaissance et la révolution des technologies de l'information et de la communication constituent de nos jours le fondement de l'évolution rapide des économies. La démonstration en est faite à travers une illustration simple de la relation entre l'économie des savoirs, l'économie des matières premières et l'économie industrielle.

En raison du potentiel de connaissance qui favorise la croissance rapide des savoirs, qui deviennent de ce fait des biens publics, l'Organisation mondiale du commerce (OMC) est devenue un organisme d'arbitrage et de propriété intellectuelle. A cet égard, l'adhésion à l'OMC pourrait être un moyen d'échanger les savoirs et de faire partie intégrante du commerce et de l'économie à l'échelle mondiale.

Du fait des disparités en matière de connaissance, les pays d'Afrique subsaharienne ne bénéficient pas des retombées de la révolution des technologies de l'information et de la communication. Leurs économies se limitent essentiellement au secteur primaire et il leur est difficile de satisfaire aux normes de qualité exigées par l'OMC. Ces disparités affectent négativement la compétitivité de l'Afrique subsaharienne dans le cadre du commerce international. Cependant, tout n'est pas perdu.

Des possibilités de réduction rapide de "l'écart de connaissance" existent grâce à l'action des organisations telles que la Banque mondiale, le Programme des Nations Unies pour le développement, l'Organisation mondiale de la santé, etc., qui jouent un rôle important dans la dissémination de nouvelles connaissances et la vulgarisation des nouvelles technologies. L'Afrique au sud du Sahara gagnerait à exploiter l'opportunité ainsi offerte de réduire "l'écart de connaissance" afin de faciliter la croissance rapide de son économie et assurer son intégration au sein de l'économie mondiale. La réalisation de cet objectif dépendra, cependant, de la politique mise en oeuvre par chaque pays.

Mots clés: économie de savoirs, révolution de l'information et de la communication.

Introduction

The increasing dominance of the use of knowledge and information technology in some economies is turning them into knowledge economies. These emerging knowledge economies are supported by the global infrastructure for telecommunications, data exchange, media and entertainment, the knowledge industries, the publishing industries, the computer hardware and software industries, the new financial systems that are supporting online transactions, the emerging global legal infrastructure based on the World Trade Organisation (WTO), and the agreements in information technology, telecommunications and financial services, and the biotechnology and genetic engineering industries (Verzola, 1997).

These economies, with their growing global coverage, are changing societies, and consequently, development patterns. As an economic phenomenon, globalisation is manifested in a shift from a world of distinct national economies to a global economy in which production is internationalised and financial capital flows freely and instantly between countries. Multinational Enterprises wield vast economic power, while anonymous institutional investors influence currency rates, the availability and price on international capital, and interest rates. And the framework of rules within which economic activity takes place is increasingly defined in the international framework of the WTO, the International Monetary Fund (IMF), the World Bank, the Organisation for Economic Co-operation and Development (OECD), and the summits of the Group of Seven (G7) most developed nations. The powers of states and bureaucrats are thus being transferred to these organizations and the multinational enterprises. The relationships between nations are being altered, and new development paths are being created. This paper examines the implications of these changing relationships on the prospects of Sub-Saharan Africa in this global economy. The paper discusses the changing economic patterns and relationships and the role of the World Trade Organisation (WTO) in upholding these patterns and relationships.

The main objective of this paper then, is to demonstrate that if Sub-Saharan Africa does not narrow the knowledge gap, the prospects for rapid economic growth and integration into the world economy under the present changing conditions will be difficult.

Three economic sectors give rise to three worlds

The changing trends globalising the world are being driven by dramatic improvements in telecommunications, exponential increases in computing power coupled with lower costs, and the development of electronic communications and information networks such as the Internet. With these changing trends, three major sectors can be identified in every economy: natural resources

(agriculture), industry, and knowledge.

The natural resources sector is the sector that can be labeled the sector of living goods and related services. Here, work is with the production and consumption of living matter. This is a very special sector. It can also be referred to as the ecology sector. It is basically a life – support sector.

The industrial sector is the sector of non-living, material goods. This sector requires the most in terms of energy and raw materials, as it involves the extraction of raw materials from nature, and the transformation of dead matter through human labor and machine power into finished products.

The knowledge sector is the sector of non-material goods. The goods of this sector have very high knowledge and information content. Frequently, they are practically pure information, like the software on diskettes. This is already the dominant sector in the United States of America, and to a lesser extent in Europe and other highly advanced countries. Workers in this sector require a good deal of formal education and the ability to acquire and to apply theoretical and analytical knowledge (Drucker, p.8). They require a different approach to work and a different mindset. They also require a habit of continuous learning.

These three sectors give rise to three types of economies, and thus to three worlds. Natural resource-based economies continue to have their natural resource sector as their dominant sector. Most of the labour is employed in this sector¹. Industrial economies have the industrial sector as the dominant sector, and the knowledge economies have knowledge as the dominant sector (Table 1). Almost 90% of information owned today through patents and copyrights are in the possession of the knowledge economies. The labour force in the industrial economy is dominated by the blue-collar worker, while the knowledge economy is dominated by the knowledge worker.

The interplay between these three types of economies comprises the dynamics of the world economy today. It is an interplay that is marked by a mix of competition and cooperation, exploitation and dependence. It is an interplay that shows the changing trend in comparative advantage. The world economy is increasingly being dominated by knowledge economies, and the major economic debates today reflect the conflict between the interests of emerging knowledge economies on the one hand, and the newly industrialized as well as the natural-resource based economies on the other hand (Oyejide, 2002; Oyejide and Njinkeu, 2002). Of course, secondary conflicts continue to exist between industrial econo-

Table 1. Characterisation of the the types of World Economies

TYPE OF ECONOMY			
PARAMETRE/ CHARACTERISTIC	NATURAL RESOURCES	INDUSTRIAL	INFORMATION/ KN OWLEDGE
MAIN ECON. SECTOR (GDP > 60%)	MOSTLY AGRICULTURE	INDUSTRY (MANUFACTURING)	KN OWLEDGE (SERVICES)
CAPITAL ASSET	LAND	CAPITAL	KNOWLEDGE
TYPE OF ECONOMY	MIXED	MIXED	FREE MARKET
SOCIETY	RURAL	CITIES/URBAN	NON-LOCATION SPECIFIC
STRATEGIC RESOURCE	LAND	CAPITAL	KNOWLEDGE
MAJOR EXPORTS	AGRIC. GOODS	INDUSTRIAL GOODS	KNOWLEDGE (INFORMATION)
DRIVING FORCE	LAND & LABOUR		KNOWLEDGE
MANAGEMENT	AUTHORITATIVE, HIERARCHICAL, BUREAUCRATIC	LABOUR AUTHORITATIVE HIERARCHICAL, BUREAUCRATIC, UNIONIZED	PARTICIPATIVE, DEMOCRATIC, HORIZONTAL, EFFICIENT
SOURCE OF POWER	LAND IN THE HANDS OF A FEW	CAPITAL IN THE HANDS OF A FEW	KNOWLEDGE IN THE HANDS OF MANY
WORKFORCE	UNSKILLED/ SKILLED	SKILLED	EDUCATED TELECOMMUTE

Source: Author

mies and agricultural economies, as they have existed in the 19th century and the first half of the 20th century.

Trade among the three worlds: winners and losers

To appreciate the plight of predominantly natural resource-based economies like those of Sub-Saharan African countries, let us look at the nature of trade between natural resource-based, industrial and knowledge economies. Consider the following typical products: cocoa or coffee, a stereo system, and computer software. As a hypothetical, but realistic example, assume a situation where one has US\$500.00² to spend on either of the products because they are tradable with each other.

Let us consider three representative countries that produce these goods, Cameroon, Taiwan and the United States. Cameroon produces and sells cocoa and coffee. At US\$2.00 per kilogramme of cocoa, Cameroon needs to produce 250 kilogrammes of cocoa to earn the US\$500.00. Taiwan is an industrial country that manu-

factures stereo systems. We assume Taiwan can produce one stereo system that costs US\$500.00. The United States is a knowledge economy, and produces software. Assume that a programmer writes an X programme and sells one copy for US\$500.00. In short, a knowledge economy like the United States can trade one copy of its programme X for 250 kilogrammes of cocoa from Cameroon, or for a stereo system from Taiwan. Now, suppose another US\$500.00 is available to buy any of the goods. With a diskette, it may take a couple of minutes for the American to copy programme X that will be sold for the US\$500.00. Assuming no fault with the diskette, the quality of the second copy of programme X will be as good as the first one. For the Cameroonian, it will be necessary to take a farming year, and hope that the weather conditions will be the same, and also that the inputs will be applied in exactly the same way, which may not be possible, to produce cocoa of the same quantity and quality. For the Taiwanese, it may take a day to produce another stereo set, if the raw materials and machines are in place.

This simple example gives an idea of difficulties in ex-

change, and why some economies will grow faster than others. A knowledge economy can produce, with minimum of input in labour and raw material, exchange value that natural resource-based and even industrial countries must produce at considerable inputs of labour and raw materials. Another way of saying this is that knowledge economies are in a position to realize huge margins of profits when trading with other economies; therefore, they are also in a position to extract huge amounts of wealth from their trading partners.

In short, an information economy like the United States can come to Sub-Sahara Africa, and trade one copy of its WordPerfect for 200 pounds of cocoa or coffee, or for one of Taiwan's color television sets.

Characterization of Knowledge Economies

In knowledge economies, information technology is no longer a business resource, but the business environment. Knowledge is a critical asset, just as labour and capital in the agricultural and industrial economies respectively. Knowledge is however, a public good: there is no marginal cost to an additional person using the knowledge. Because it is possible for people to use it without paying for it, governments must provide incentives for creating knowledge by the private sector through patents, copyrights, and other intellectual protection rights. Today there is a need to integrate knowledge into countries' strategies for development. According to Peter Drucker (1994), "The productivity of knowledge has become the key to productivity, competitive strength, and economic achievement. Knowledge has become the primary industry, the industry that supplies the economy with the essential and central resources for production." Alfred Marshall has stated that "while nature shows a tendency to diminishing returns, man, shows a tendency to increasing returns, ... knowledge is our most powerful engine of production, it subdues nature, and satisfies our wants" (Naisbitt, 1984). The role of knowledge in development is no longer questionable. Knowledge is inextricably tied to growth and development. In knowledge economies, the strategic resource is information as opposed to capital in the industrial economies. Industries in knowledge economies are brain-intensive instead of capital-intensive. Knowledge is mass-produced, and this is the driving force of the economy.

A growing phenomenon in knowledge economies is that many workers telecommute, with flexible working hours. Some characteristics of the workforce are: continuous training and retraining, participative management, horizontal communication between workers and management, and changing the work place organization through balancing of high technology with recreation-type activities. Workers know value is not increased through

labour, but by knowledge, thus replacing Marx's Labour Theory of Value.

Emerging new relationships

What we are witnessing is the emergence of a new type of relationship between a natural resource-based economy and a knowledge-based economy, where the former provides cheap raw materials and a market for highly profitable information products. Indeed, this new type of relationship can even exist between a knowledge economy and an industrial economy, where the industrial economy serves as a market for expensive information products and a source of relatively cheaper and lower-margin industrial products.

This new type of relationship will exploit natural resource-based economies even more as their genetic resources are now considered a "heritage of mankind" and therefore practically free.

GATT/WTO provides the legal infrastructure for the world dominance of the emerging knowledge economies by protecting their monopolies over information on the one hand, and prying open new information sources (biodiversity, the professions) and markets (telecommunications, media, and services), on the other hand. An elaborate legal structure, based on the concept of intellectual property rights, which are essentially monopoly rights, have been developed by WTO. The monopoly concepts of intellectual property rights, which include patents and copyrights, are the main form of ownership in the knowledge economies³. Together with the infrastructure for distributing information goods (the information superhighways), knowledge economies use the WTO, as a legal infrastructure for protecting these rights. The special role that the Internet will play in this scheme is as the global infrastructure for the distribution of the information goods, which knowledge economies will be selling to the rest of the world.

World Trade, WTO, and the Global Knowledge Economy

For nations to develop, they need to participate in world trade. Participating in world trade means consuming goods and services produced more efficiently in parts of the world that have a comparative advantage, and selling to the world goods and services in which you have a comparative advantage, to allow you pay for what you consume, but cannot produce. Millions of goods and services are produced and sold in the international markets. In this market, both the customers and producers are to a large extent very well informed and/or educated about their expectations. If the lack of knowledge and/or uncertainty faced by a consumer can create inefficiencies and even break the market at a national level it is easy to understand the importance of

the need to clearly determine and define a way of providing quality goods in the world market.

In the international market, quality must be taken for granted. In this environment, every player promises to assure quality and to provide information that each party is keeping his/her own promise. Failure to keep these promises will result in market failures. The question this raises is compliance to and enforcement of established quality management assurance standards. In real life, non-compliance situations will always arise, and to avoid disputes between affected parties, the need for a neutral arbitrator then becomes crucial. This is where the World Trade Organisation comes in: it struggles with these issues on a daily basis. Since its establishment in 1948, the GATT/WTO talks have evolved through establishing agreements on trade and tariffs to publication of the ISO-9000 series of international quality management standards. These standards specify in detail the procedures for ensuring quality at all stages of production. For WTO certification, firms need to document their processes. The ISO-9000 certification standards are normally based on national standards, which specify that the production process meets certain standards. These are then adopted by the International Standards Organisation (ISO), which is a guarantee that goods produced under these processes are of a certain quality. These standards apply to the whole production process and not to specific products, and are designed to signal quality in the international market. The result is that most international buyers now insist that their regular suppliers obtain the ISO-9000 certification seal of approval.

The above discussion is very important to SSA because of the nature of the product the sub-region produces and sells in the world market. As the simple example above indicated, the difference between the natural resource-based economy and the knowledge economy is not only the time it takes to produce the product, but also the quality. While knowledge goods, stored as information on a diskette would maintain the same quality,

and last for a long time, coffee or cocoa or bananas, would neither maintain the same quality, nor last over long periods of time.

As of 1997, there were 132 members of the WTO, up from 23 members since its creation in 1948 (Economist, May 16-22, 1998). This is out of 211 economies in the world. The above scenario definitely points to the fact that quality management assurance (QMA) is no longer a national concern but a global concern. What the Sub-Saharan African countries have been trying to do is negotiate to trade under concessionary conditions (see Oyejide, 2002 and Oyejide and Njinkeu, 2002). This can only be considered a temporary measure to allow SSA countries enter the knowledge economy, as reliance on natural resources can not sustain growth under the present changing comparative advantage situations.

The implications of the knowledge economy on quality management assurance are more evident when we examine the role SSA countries play or must play when they join the World Trade Organization. World trade in general provides an excellent forum for SSA countries to gain access or at least awareness of new technologies and knowledge used in packaging the goods in the market. This occurs through communications between buyers and suppliers. As the world market becomes more and more knowledge driven, the opportunities for SSA countries to acquire knowledge is increased (Table 2).

World trade also exposes SSA countries to international benchmarks for quality. To supply in the world market means competition with the best performers in the market. To gain and maintain a market share requires the establishment and maintenance of good standards, measurements, tests, and quality assurance systems, which will be mandated by competition as well as international quality and regulatory standards.

In the case where SSA countries have to buy in the world market, they would also have to invest in order to build a knowledge base needed to understand the technology that

Table 2. Goods in International Trade By Level of Technology

Technological Intensity	% Total, 1976	% Total, 1996
High Technology Goods	11	22
Medium Technology	22	32
Low Technology Goods	21	18
Other Primary Goods	34	13
Resource Based Goods	11	11
Others	1	4

Note: High technology goods alone doubled their share of global trade while the share of primary goods dropped to less than 25%

Source: World Bank, World Development Report, 1998.

is embedded in the products that they use. Even if SSA countries are not members of the WTO, they are compelled by the nature of their products to sell to developed or knowledge economies. Since these countries are members of WTO, their national quality standards form the basis of ISO-9000 standards. In order to maintain their WTO certification, SSA countries would need to guarantee the quality of their products that are inputs for the developed economies.

Sub-Sahara Africa (SSA): Constraints

a) Environment

The systems of government, and to a certain degree, the way SSA economies operate, are closely tied to their colonial past. The public sector tends to be the dominant sector in the economy. Most of the governments try to use the rational meritocracy as organizing principle of public sector management. Meritocracy should lead to economic and political liberalization, a necessary condition for quality management assurance in the public sector (Wescott, 1998). Unfortunately, the rational hierarchical meritocratic model has failed in many African countries. Governments are not able to carry out basic functions of formulating policies, delivering services, and maintaining the infrastructure. Promoting the model has led to perverse effects on incentives, encouraging "rent-seeking," "free-loading," and other unintended outcomes. The reason is that many African civil services have competing goals as task performance/service delivery on the one hand, and political incorporation on the other hand. The central feature of such bureaucracies is group solidarity, subordination of specialized, expert knowledge to bureaucratic control, lack of transparency in application of rules, high tolerance of misdemeanor and ineptitude, and general laxity in the administration of the career service. These features influence negatively, the ability of these economies to produce goods that meet WTO required standards.

b) The Knowledge Gap and the Struggle for Development

The system of government notwithstanding, the knowledge gap between developing and developed countries has been identified as the major cause of the growing development differences by most policy and development analysts (World Bank, 1999, Drucker, 1994). The understanding of how and what creates knowledge gaps is crucial in determining appropriate development strategies. It is important to understand that living in a global economy, the world economy conditions many aspects of economic performance. The global economy may provide opportunities for long term growth, but it also generates volatility and exposure to shocks in the short run, especially in financial markets. Developing coun-

tries must learn from the experiences of the present knowledge economies, especially economies with a success record in closing the knowledge gap like Korea (World Bank, 1999). We can try to capture the knowledge gap situation in the formulation below.

Reduction in Knowledge Gap (RKG) = α TK(Technical Knowledge) + β IF (Information Failure)

$$RKG = \alpha TK + \beta IF$$

Where α is positive and β is negative

The rate at which information failures (IF) are reduced depend on how fast technical knowledge is captured.

α = f(culture, knowledge base, education, governance, institutions, etc.)

β = f(technology, social institutions, governance, etc)

Because technology is forever changing, there will always be information failure. The technical knowledge is also constantly changing, making it difficult for the gap to be completely closed. The pertinent issue is to narrow the gap and not necessarily to reduce it completely.

SSA economies are dominated by the primary sector, both in terms of the contribution to GDP, and in employment. The exports of these countries are mostly primary products, an indicator of the limited knowledge in production. However, as part of the global economy, these countries are obliged to make efforts to leap-frog from the natural resource-based economies into the knowledge economy at least in certain sectors or aspects of the economy (Kwankam and Ningo, 1996). The stumbling block is the knowledge gap. Today, the colonial administrative structures left intact, and its subsequent colonial mentality and mindset amongst most of the administrators, creates an environment where the people who are the principal consumers are not vested with the right to dictate or choose the quality of their goods and services. This environment is characterised by the lack of an impartial judiciary to enforce judgements; the lack of respect for human rights; inadequate systems for providing quality challenging education to support new technology and define local technology; and the lack of national quality certification programmes to ensure quality management assurance to meet WTO standards.

Communications

Available information technology and computer systems provide the necessary channels for SSA to access and adopt all the knowledge it may determine necessary. In addition, the existence and effectiveness of international organizations such as the World Trade Organisation (WTO), International Monetary Fund (IMF), World Bank, United Nations Development Programme (UNDP), World Health Organisation (WHO), etc., further facilitate the process to access this knowledge. These organizations will, and do, continuously signal techno-

logical innovations to member states on a real time basis.

Information failures have plagued SSA country efforts in the acquisition and adoption of knowledge. The probability that a root cause analysis will identify the poor performance of "knowledge gatekeepers" in these economies as the major cause of these failures is very high. The success of any government policy for the acquisition of knowledge, external or not, is dependent on the creation and maintenance of an effective "knowledge gatekeepers networks" within the economy. The knowledge gatekeeper's network must be planned, organized and charged with the responsibility to facilitate and ensure communications between international knowledge gatekeepers and the local knowledge gatekeepers. A second and equally important responsibility will be to capitalize on the local communication's traditions of the SSA countries to ensure dissemination of appropriate knowledge to the targeted population (farmers, doctors, craftsmen, etc.).

It is noteworthy to observe that SSA countries have abused this concept in the past by burying these roles in the hands of bureaucrats in some government ministries who receive information, store it, and may be sometimes, disseminate it at the wrong time, and without any value added to it. Sometimes they do not just pass on the information. SSA countries will reap momentous benefits in productivity, and greatly improve performance, by capitalizing on the available communication opportunities and the proper use of their knowledge gatekeepers. Public support for technology transfer provides incentives to search for the best technology, invest in training, to adapt and upgrade their designs.

Conclusions

This paper has discussed how the knowledge economy, the natural resource-based economy, and the industrial economy relate to each other. The paper has demonstrated that knowledge and information technology is at the base of the rapid transformation of economies. Because of the potential for the knowledge that is fuelling rapid growth in knowledge economies to become public goods, the WTO is being used as the arbiter and store of patent rights over knowledge. As the store of patent rights, membership of the WTO becomes a source of assuring quality and integrating into world trade. Because of the knowledge gap, SSA countries are not benefiting from the information technology revolution. Their economies continue to stay in the primary sector, where even to maintain the type of quality that WTO demands may not be easy. All is not lost though. There is room for leapfrogging in knowledge. International organisations like the World Bank, UNDP, USAID, WHO, etc., are playing a very important role in disseminating

new knowledge and technology to encourage leapfrogging. SSA countries need to exploit this opportunity to narrow the knowledge gap and to make it possible for their economies to grow rapidly. How this is done will depend on the policies that each country pursues.

¹ In Cameroon, for example, nearly 70 percent of the labour force is in this sector.

² This is approximately 350,000 francs CFA, Cameroon currency

³ This has been a main source of conflict between South Africa and Drug Companies in Knowledge Economies over the manufacture of drugs for treating HIV/AIDS.

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