Methodology for Value Chain Analysis in ICT Industry Frameworks for the Study of Africa

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Methodology for Value Chain Analysis in ICT Industry

Frameworks for the Study of Africa

By

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1.0 Introduction

The world is experiencing a new industrial and technological revolution which is bringing about a significant, fast and extensive transformation of society and industry. The result of this revolution is that there is now a rapid increase in the processes of production and the transmission of goods and services produced. The ICT revolution is also encouraging new goods and services, changing the nature and organization of work, replacing materials, resources, energy and land with information and knowledge as the principal factors of production. Furthermore, the ICT is blurring the former differences between manufacturing and services sectors, between work, education and leisure activities and between male and female work roles. The ICT systems are pervading virtually all forms of human endeavor: work, education, leisure, communication, production, distribution and marketing. It is also changing the scale and content of information networks, the interdependence of organizations and how people live, work, shop, learn, communicate and play.

Information and communications technology (ICT) refers to technologies that pertain to human communication processes and the information they handle. Information and communication technology (ICT) includes telecommunications equipment, computing hardware and software, office machinery, electronic goods and components used to store, process, and communicate information. It is the new science of collecting, storing, processing and transmitting of information. It refers more particularly today to how computers store, process and transmit information through, for example, satellite, telephone lines, teletext and cable. It is the convergence of information, computing, and telecommunications. The ICT sector is a gamut of industries and services activities – Internet service provision, telecommunications equipment and services, information technology (IT) equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services and other related information and communication activities. These technological components which used to be accounted as separate activities have converged to characterize all aspects of ICTs. It can be conceptualized as an innovation system whose components interact to produce or deter innovative information and communication

activities. Alternatively it can be seen as a value chain in which the product is either a good, such as a computer or software product, or information communication services.

Computers are one of the three major aspects of ICT; the others are information and telecommunications. The two main components of computers are hardware (the physical pieces of equipment) and software (the instructions used to control the tasks of the product). The enormous progress made by computers is largely responsible for the new information and communication technology revolution.

Whereas the role of ICT in the transforming of society is acknowledged, what has not been explored adequately is the impact of ICTs on economic development. Efforts to relate ICT to economic development are lowest in Africa. The current project is designed to contribute to filling this gap. Given the varied nature of the potential uses and impacts of ICT, this paper lays out a framework for analysing various ICT value chains in Africa by focusing on ICT Producing and Consuming Activities. The framework will guide the investigation by African researchers at the national levels.

The paper is divided into five parts. Following this introduction, Part 2 introduces analytical framework in the value chain methodology and Part 3 provides background on the status of various segments of ICT chain in Africa. Part 4 discusses the current ICT infrastructure in Africa, Part 5 addresses research methodology and the data needs, while Part 6 draws conclusions.

2.0 Analytical Frameworks for ICT Producing and Using Activities

The paper uses two analytical frameworks for understanding ICT producing and consuming activities; the national systems of innovation and the value chain methodology. In the following sections, we discuss each of these approaches and examine how the two complement each other.

2.1 National System of Innovation

The concept of system of innovation is a shorthand for the network of interorganisational linkages that apparently successful countries have built up as support system for economic production. In this sense it has been explicitly recognized that economic creativity is actually about the quality of "technology linkages" and "knowledge flows" amongst and often between economic agents. Where the interactions are dynamic and progressive agents take great innovative strides. Conversely where systemic components are compartmentalized and isolated from each other, the result is often that relevant agent bodies are not all productive. In extreme cases they have ceased to provide any innovative output at all. Put another way the key property of a system of innovation is therefore not so much its component parts or notes, but rather how it performs as a dynamic whole.

According to the national system of innovation (NSI) approach, the most fundamental resource in the modern economy is knowledge and therefore it follows that the most important process is learning recognizing that learning is predominantly an interactive process. The NSI approach looks at the innovation system as a crucial subsystem of an economy or society. NSI approach to development is essentially evolutionary associated with three main features (AERC, 2006:5):

- dynamic and process views,
- uncertainty and
- learning.

The dynamics and process views are reflected in the characterization of interactions (especially the centrality of firms), networks and linkages among agents of innovation and

between them and the environmental factors (internal and external). NSI is a set of interrelated institutions the core being those which generate, diffuse and adapt new technological knowledge. These institutions may be firms, R&D institutes, universities or government agencies. They may also be rules and regulations, norms and practices, values (much like business systems). Institutions mark boundaries which have an influence on uncertainty and influence the intensity and direction of learning. Learning is the key dynamic mechanism for knowledge accumulation, innovation and growth. Innovation is central to the learning process.

From the point of view of the firm, innovation includes all those processes by which firms master and practice product designs and manufacturing processes that are new to them, if not to the nation or even to the universe (Nelson and Rosenberg, 1993). The national systems of innovation (NSI) approach defines the nation as the appropriate level of analysis in the sense that concern is on the behaviour of actors not necessarily at the forefront of world's technology but on the factors influencing national technological capabilities. National systems are postulated to differ in respect of the structure of the production system and the institutional set-up hence the national idiosyncrasies. These may include internal organization of firms, inter-firm relationships, the role of the public sector, institutional arrangements in respect of specific sectors such as the financial sectors and R&D activity.

In spite of the strong national characteristics that these institutions have today, successful systems are increasingly distinguished by their openness and their links to regional and global networks and collaboration arrangements.

In its ultimate analysis, an economy's ability to harness a new ICT technology for development in a sustained manner depends to a great extent on the national system of innovation. NSI is an interactive system of existing institutions, private (both local and foreign) and public, universities and government agencies aiming at the generation and diffusion of technology (Freeman 1987, Nelson 1993, Lundvall 1992). The interaction among them may be technical, commercial, legal social and financial as much as the goal of interaction may be development, protection, financing or regulation of new S&T (Neosi et al 1993).

The dynamics of ICT technological and institutional change unfold at many different levels, and on different time scales. Individual ICT technologies change relatively rapidly, whilst technological systems tend to change relatively slowly. Innovation is non-linear, as systems typically show increasing returns to adoption, so that small changes in initial conditions can result in radically different outcomes. Innovation processes are uncertain because neither future technological and market opportunities nor policy and regulatory regimes can be accurately predicted.

Systems approaches recognize that any actor-individual, firm or government – has limited ability to gather and process information for decision making – so-called "bounded rationality" (Simon, 1955, 1959; Foxon, 2006). Because the future is uncertain and firms lack perfect knowledge, what they know and how they learn becomes central to understanding the innovation process. Finally, innovation systems approaches emphasize the importance of institutional factors in influencing the rate and direction of ICT innovation. These range from habits of thought and action to policy and regulatory frameworks (North, 1990; Hodgson, 1988).

In its ultimate analysis, an economy's ability to harness the new ICT technology for development in a sustained manner depends to a great extent on the national system of innovation. NSI is an interactive system of existing institutions, private (both local and foreign) and public, universities and government agencies aiming at the generation and diffusion of technology (Freeman 1987, Nelson 1993, Lundvall 1992). The interaction among them may be technical, commercial, legal social and financial as much as the goal of interaction may be development, protection, financing or regulation of new S&T (Neosi et al 1993). Promoting the use and production of IT and also the creation of the information infrastructure, human capital and an innovation system calls for targeted policies which *interalia* include those relating to trade and investment.

2.2 The Value Chain Methodology

A value chain is the sequence of production, or value adding activities leading to and supporting end users of a particular product. It is, in other words, the chain of activities required to bring a product from its conception to its final consumption. Overlapping names and concepts have been given to this sequence of activities (McCormick and Schmitz, 2001). For example, value chains have been compared to the *filiére* approach in economics, which involves an assessment of the various stages of physical transformation and their interconnectedness in the journey of a commodity from raw materials to the consumer (Barnes 2000; Kaplinsky and Morris, 2001). The term 'global commodity chains' was extensively used in economic literature in the early 1990s, while the business community often refers to 'supply chains' (Gereffi and Korzeniewicz, 1994). We prefer and will use 'value chain' for a number of reasons. Chief among these is that the term highlights the value addition that takes place at every stage of the chain. Recognition of this chain of value addition encourages the investigation of the distribution of that value among the various actors and promotes a search for upgrading strategies, which will be discussed further later in this chapter.

Value chains have a geographic dimension. They may be national, international, or global, depending on location of the various processes comprising them. In a national chain, all processes, from design to distribution, take place within national boundaries. In many chains, the processes spill over beyond national borders and become regional, international, or even global. In global value chains, the different processes of design, supply, production, etc, take place in different parts of the world. While international value chains operate in more than one country, global value chains operate in two or more regional blocs. Value chains at the scale of supranational regions operate at the level of trade blocs (Gereffi et al., (2001). The geographic dimension is important to developing countries because they want to know which links of the chain are within their borders, how profitable these existing links are, and what potential exists for bringing in additional links.

The value chain provides an important construct that facilitates the understanding of the distribution of returns from the different activities of the chain (Kaplinsky and Morris, 2001). By breaking a chain into its constituent parts of design, supply, production, and distribution, one can better understand its structure and functioning and perhaps more importantly, assess its scope for systemic competitiveness. Value chain analysis, therefore, is an effective means of conceptualizing the forms that functional integration takes in the production process, because it shifts the focus from production alone to the varied set of activities that make up the chain.

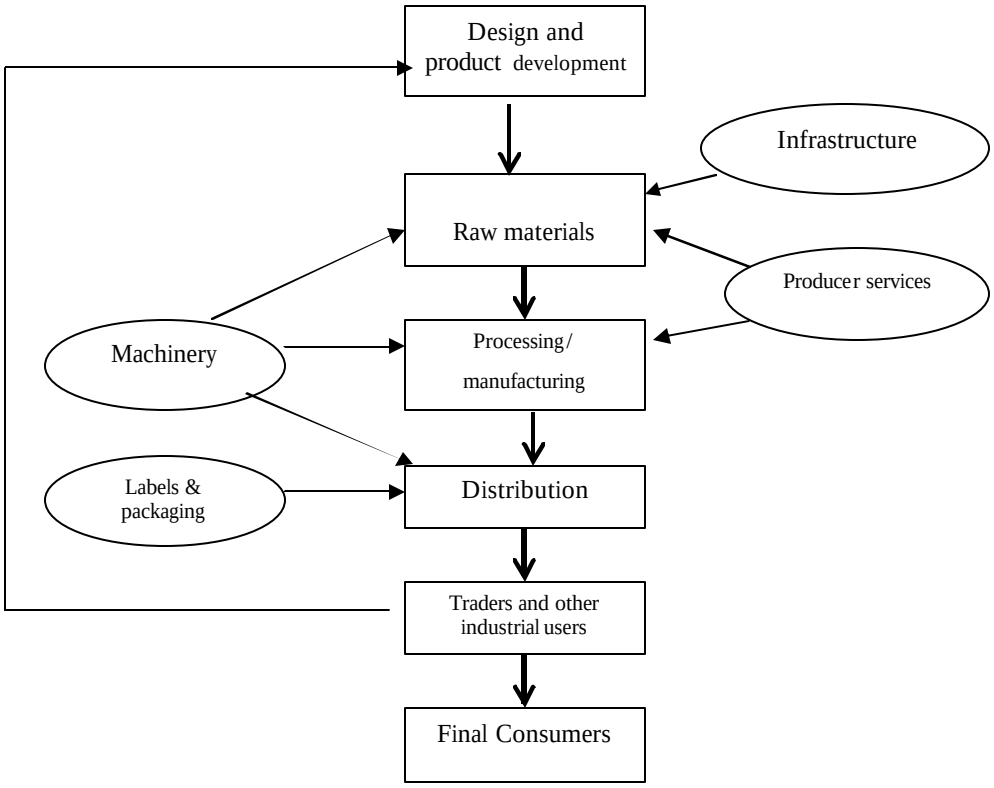
Value chain analysis also highlights the issues of chain coordination or governance. The pattern of direct and indirect control in a value chain is called its governance (McCormick and Schmitz, 2001). Chains vary in the degree of overall control that is exerted, in the location of control within the chain, and in how much of it is concentrated on a single firm (Gereffi et al, 2001). Overall control can be almost non-existent, with interactions being mainly driven by market forces, or a chain can be strongly or weakly directed by one or more of its actors. The concept of governance is most meaningful in the latter case. In these cases some firms directly or indirectly influence the organisation of the chain's production, logistics, and marketing systems. Through the governance structures that they create, these firms can take decisions that have consequences for others' access to markets and the range of activities that they are able to undertake. The influence can extend from defining the products to specifying the processes and standards to be used in production.

Governance is sometimes exercised directly through the control of key resources and decisions about entry and exit and monitoring of suppliers. Governance may also be exercised in more subtle ways, such as providing technical support to enable producers to achieve the required performance. The parameters defining what is to be done at any time are product definition, how it is to be produced (production process), when it is to be produced and how much is to be produced (Humphrey and Schmitz, 2001). The way a chain is governed may determine such competitive factors as market access, fast track to acquisition of production capabilities, distribution of gains and to funnel technology assistance.

Gereffi (1994, 2001) is credited with identifying two main types of value chains: buyer-driven and producer-driven. In the buyer-driven value chains, the buyer at the apex of the chain plays the critical governing role. Labour-intensive industries common in least industrialized countries are often buyer-driven. Examples include garments, processed fruits, and horticultural products (Gereffi et al., 2001, Dolan and Tewari, 2001). In the producer-driven chains, producers with critical technology play the main role of coordinating the various links and take the responsibility of checking the efficiency of their suppliers and customers. Producer driven chains often have significant foreign direct investment, and are more often capital and technology intensive industries (Gereffi, 2001).

A visual representation of the different stages and the connections between chain actors has been mapped in Figure 1. Chain maps can be basic flow charts or fairly complex diagrams showing a chain's varied interactions. The central core of the chain, represented by a series of rectangles connected by arrows, shows the material flows from product design to raw materials, processing, distribution, and ultimately, final consumers. To the right and left of the diagram are ovals that stand for other inputs into the chain. These include machinery supply, labels and packaging, and services such as infrastructure and various producer

Figure 1: A Simple Value Chain



Source: Adapted from UNIDO 2003

services. The diagram also suggests the existence of information feedback from the purchasers of the product into its (re-)design and development.

The mapping highlights the sometimes forgotten fact that production is only one of several value adding activities. Value chain analysis and the actual mapping that accompanies it identify the various activities performed in partial links in the chain at different stages of the process, the transformation of inputs into outputs, and the support services. This distinction is important since it draws attention away from an exclusive focus on services.

2.3 The Challenge of Information and Communication Technology Leapfrogging on the Value Chain in Africa

Much of the world has followed an incremental path of ICT technological advancement. For example, telephone lines were used for dial up Internet access and then cable lines were utilized for high-speed access. African countries simply have not had the resources to make investments along the incremental stages. This has left many African countries in a state of antiquated technology resources. On the other hand, because of "the lack of investment in legacy systems, hardware and software, they can be in a good position to 'leapfrog' over some of the incremental steps and to select a new position on the technology curve" (Fleming, 2003, p.8; Ensley, 2005).

Technological leapfrogging offers an opportunity for developing countries to catch up with modern ICT resources. Steinmueller defines leapfrogging as "bypassing stages in capacity building or investment through which countries were previously required to pass during the process of economic development" (Steinmueller, 2001, p.2; Ensley, 2005). In practical terms, leapfrogging is "bypassing some of the processes of accumulation of human capabilities and fixed investment in order to narrow the gaps in productivity and output that separate industrialized and developing countries" (Steinmueller, 2001, p.2; Ensley, 2005). Several characteristics about current technologies make it easier for developing countries to introduce ICT resources into their regions. Hardware is less expensive and easier to install. The "potential for leapfrogging seems even brighter owing to the emergence of Internet technologies" (Steinmueller, 2001, p.2). Internet technologies support the global flow of information and the establishment of distance-free personal and organizational relations. With modern Internet and ICT resources, there is hope that developing countries can enhance their economies and improve their inhabitants' quality of life.

Rapid advances in ICT present the late-industrializing (such as African) nations opportunities for rapidly catching-up with the more advanced nations through rapid diffusion in the use of new ICT (Kagami and Tsuji 2000). Late-comers may be able to exploit new ICT more efficiently than the advanced countries for two reasons:

- First, they may be able to learn from the experience of the advanced countries without having to pay the cost of initial learning and experimentation (the "fast follower" advantage);
- Second, they may be able to leapfrog into the latest generation of technologies, thus avoiding the legacy problems of having too much asset-specific investments sunk into earlier generations of obsolete technologies (the "leapfrogging" advantage). The more "disruptive" the new technological advances, the greater the new "attacker's advantage" can be in exploiting new technologies versus the incumbents (Foster, 1986).

It argued that such opportunities for growth and catching-up, however, may be outweighed by considerable threats arising from their late-comer position:

- First, technological learning may require a long cumulative process of human capital development through incremental learning by doing. Consequently, new technologies cannot be diffused at a faster pace in the late-industrializing countries than in the advanced countries because of the human capital bottleneck.
- Second, efficient adoption of new ICT may pre-suppose the existence of business infrastructure not only in the form of 'hard' physical capital (computers, network infrastructure, etc.), but also 'soft' social capital (relatively efficient factor and product markets, well-functioning financial and regulatory institutions, etc.). Thus, while it is possible for new individual firms to overtake established industry leaders by being faster and more nimble in exploiting new, disruptive technological innovation, it is more difficult for an entire nation to leapfrog other nations technologically.
- Third, the late-comer countries may lack the financial resources to invest in new technologies as aggressively as the advanced nations, with the result that the latter will reap greater productivity and innovation benefits from new technology than the former (Jalava and Pohjola, 2001).
- Finally, given that advanced countries are able to adopt and apply new ICT faster than the later-industrializing nations, they may be able to overcome their factor cost

disadvantage compared to the late-industrializing countries, thus giving them the ability to re-capture much of the ICT manufacturing that might migrate to the developing countries (Wong, 2001).

The question of whether existing inequalities in economic well-being across nations may be accentuated or attenuated by ICT revolution ultimately rests on how these opportunities and threats are actually realized in practice. Will the rapid market growth and technological disruption opportunities created by the revolution generate sufficient "digital dividends" to African Countries? Or will the weight of cumulative advantages enable more advanced countries to better exploit the new technologies, leading to an increasing 'digital divide' between the more advanced and African Countries?

2.4 Mapping the Value Chain in ICT Industry

The ICTs can be disaggregated into ICT producing activities and ICT using activities. It is important to address both with a view to establishing their significance and draw policy implications on each of the two categories (AERC, 2006). In general, the chain in each of the above activities might consist of several components. Each of the components within the ICT industry has a value chain associated with it. We shall look at each one of them in detail to understand what each one offers to different parts of society.

2.4.1 Applying Value Chain Approach to ICT Producing Activities

ICT equipment producing industries can be categorized into ICT producing manufacturing activities which include manufacturing, assembly, software production and ICT producing service activities such as various forms of business processing, e.g. data entry, accounting, transcription, web design and hosting etc (see figure 2).

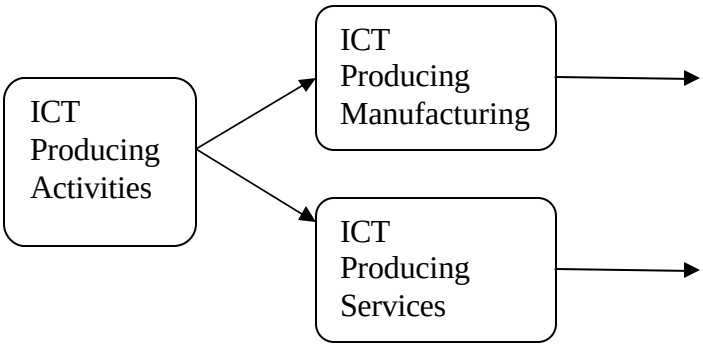


Fig 2: ICT Producing Activity Chains

The ICT Manufacturing Chain

ICT producing manufacturing produces *hardware* and *software* products intended to fulfill the function of information processing and communication or must use electronic processing to detect, measure or record physical phenomena or control of physical process. ICT hardware can be disaggregated into telecommunications equipment and computer hardware manufacture and assembly. The latter covers manufacture and assembly of computers (branded or unbranded/clones) and include clusters that are emerging in activities associated with repair of computers. Telecommunications hardware comprises the manufacture and assembly and repair of telecommunications related equipment such as cell phones and others.

At the top of this chain lies design and research, see figure 3. .These are the Labs where cutting edge research takes place to come up with new product design and development. At the next level in this chain are the manufacturers. They are the ones who actually manufacture the chips and integrated circuits that go into each of the components. The devices include all the switches, routers and other telecom/computer equipment that forms the hardware component of the IT industry.

At the lowest level of the ICT value chain are assemblers. They are the players who just assemble different components (completely knocked down kits - CKDs) and then sell the

assembled product. The assembled product could be personal computer, printer or any other device. Usually multinational organizations have a presence across the value chain. They enter different markets and depending on the ease of doing business and availability of skilled resources set up an assembling unit, a manufacturing plant or a research Lab.

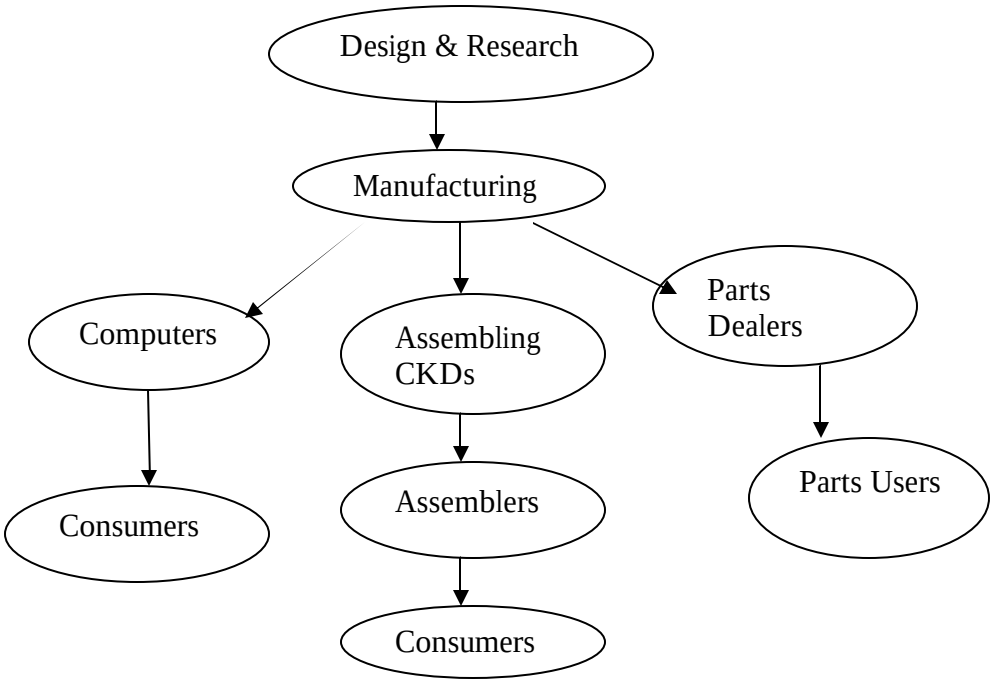


Figure 3: Value Chain for ICT Producing Activities

Characterizing the ICT Producing Activities

Keywords in today's ICT manufacturing sector are: increased competitive pressures, short product life cycles, complicated production chains, high level of outsourcing, globalised production networks, end-to-end solutions, flexibility, 'global footprint', cost reductions, and low cost countries. The ICT producing industry is the most globalised industry after the garment industry. A normal computer now contains components manufactured and assembled all over the world: semiconductor chips made in New Mexico or Scotland or Malaysia, a disk drive made in the Philippines, Singapore or Thailand, a CRT (cathode ray tube) monitor made in Japan, circuit boards made in China, and assembled in Mexico or Costa Rica (Schipper and Haan, 2005). As a consequence countries are competing on wages, advantages and incentives to attract foreign investments. Prices of ICT devices are in

continuous decline, and profit margins for manufacturing are thin. This is one of the reasons for the continuing shift to low-cost countries, and is used as an excuse for putting pressure on the wages of the ICT-workers.

The highly complicated producing chain and the pressure to cut costs pose a challenge to the sector. It requires involvement at different levels of the supply chain, both from Original Equipment Manufacturers (OEMs), Electronics Manufacturing Services companies (EMS) and Original Design Manufacturing companies (ODMs).

The electronics industry, and information technology in particular, is actually a trendsetter in creating globalised production networks. The key developments in the restructuring process in the assembly of IT hardware are:

- Vertical specialisation;
- Vertical disintegration of the value chain by brand name firms, also called the Original Equipment Manufacturers (OEMs), towards 'Fabless' manufacturing (in which firms do have minimal or no manufacturing capabilities of their own);
- Vertical reintegration by Contract Manufacturers, by acquiring manufacturing assets of the OEMs;
- The rise of the Contract Manufacturers: the EMS and ODM companies;
- Global production networks.
- The centralisation of manufacturing/supply chain management.

Vertical specialization: In this system, the leaders in the ICT sector try to achieve market-control by focusing on the design of key products in highly specialized market segments. Their aim is to create new product markets through the development of new technologies and their commercialisation. The vertically integrated electronics manufacturers have traditionally managed products all the way from design and development through manufacturing and distribution. Companies such as IBM and Digital Equipment designed and produced the key components of their computer systems in their own facilities, including computer chips and operating software. But with the emergence of specialized technology companies such as Intel and Microsoft, the production system of the computer

industry became increasingly modular: Computers, servers and internet-routers are assembled from standard components such as chips, disk-drives, modems and displays, and assembled and configured in various ways into products for different competitors (Schipper and Haan, 2005).

Vertical disintegration: As leaders in the industry focus on achieving market control by product innovation they lose their interest in the "small" profit margins of manufacturing. Product innovation is increasingly separated from manufacturing. For companies such as IBM, Cisco, and Sun Microsystems, manufacturing was no longer where they added value. They got paid instead for understanding customer needs, design and distribution. This increases the pressure to get the less-profitable manufacturing assets off the balance sheet. Some companies have ended up with minimal or no manufacturing capacities of their own, these companies are called 'fabless' companies. The first OEMs outsourced their low-margin operations to Contract Manufacturers in the mid-1980s. Thus, together with the vertical specialization, we see at the same time vertical disintegration of the computer supply chain (Schipper and Haan, 2005).

Following the development of vertical specialisation and vertical disintegration, a new model of outsourced manufacturing emerged: Contract Manufacturing (CM). There are two major types of Contract Manufacturers in the electronics sector: EMS companies and ODM companies. The Electronics Manufacturing Services companies (EMS) are also known as Contract Electronics Manufacturing companies (CEM), a slightly different name for the same group of companies. ODM stands for Original Design Manufacturing companies who also hold the intellectual property for the products.

The current level of outsourcing

The level of outsourcing in the ICT producing manufacturing and services sectors is very high and is still increasing: the dynamics of the ICT sector have been driving the industry to increase its outsourcing to the EMS and ODM industry. OEMs outsourced 50% of the manufacturing of notebooks in 2002, over 80% in 2004, and the estimate is 85% for 2005.

While the EMS and ODM industry manufacture virtually 100% of the motherboards for desktop PCs, it only assembled 67% of the final desktop computers. Some OEMs still consider final assembly to be an important interface with the customer, so this is carried out internally by the branded OEMs. These OEMs use Contract Manufacturers for the large scale manufacturing of printed circuit boards or pre-assembled product kits (also called the 'bare bones'). The overall ratio of manufacturing outsourced against manufacturing in-house in 2004 was 73% - 27% (Schipper and Haan, 2005).

Global production networks

Through their continuing acquisitions, CMs are striving to build a global footprint, strategically positioning itself in every major regional market, and offering synchronised worldwide manufacturing that provides ICT OEM companies with a model that minimises their manufacturing and material costs with advantages for the logistics because of the presence near the market. The strategy is to build 'Super Sites' in low-cost regions with access to local resources and suppliers, and 'High-competency Centers' that specialise in high-tech services for infrastructure products. The strategy of the major OEMs is to centralize their relationships with CMs; some have started to create special accounts for their relationships with CMs, resulting in the selection of a small number of preferred CMs for their global operations. Recently some OEMs have taken back part of their outsourced supply chain management (the purchasing of components) to counterbalance the bargaining power of the CMs. CMs on their part are also centralizing their supply chain management. Purchasing decisions are shifted away from individual plants to a company-wide organization (Schipper and Haan, 2005).

ICT Producing Services

Also important in ICT producing are Content Providers/Software Developers. These consist of the software part of the IT industry. This relates to software development and content generation. Based on level of skills required it can be classified as: IT enabled Services; Content Management/ Software Development; and Tech Consulting. The content

providers are also seen as ICT producing services since they are meant to enable the function of information processing and communication by electronic means.

2.4.2 The Value Chain in the ICT Consuming activities

Uses of ICT are diverse ranging from e-commerce, enterprise management, e-services etc. They comprise telecom/IT services that can be provided to individuals, academic and corporate organizations and forms an important component of the telecom infrastructure. Based on technological complexity the value chain comprises: Value added Services; Voice – Cellular; Data – ISP; Voice – Basic, NLD, ILD; Voice Services – Fixed line basic, national long distance and international long distance.

ICT Using/Consumption Activities:

- Service providers
- Application Developers/ Content providers
- Intermediaries
- Sector Specific users, government, private firms etc

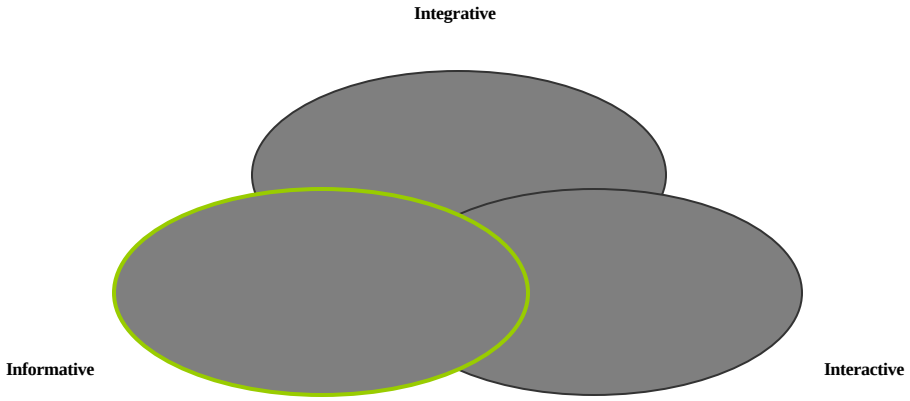
The other users are Application Domains which consist of all the areas/domains/industries. They cover the gamut of sectors both social and business, which have been impacted by the infrastructure created by the Information and Communication technologies. The internet has metamorphosed over the years from being a mere channel for disseminating information to being a powerful integrative force binding disparate functional applications thus allowing the economy to work in near real time.

There are different ways in which the ICT has been put to use. These are seen to be integrative, interactive and informative (see Figure 4).

Informative is the most basic form in which the ICT is used by society. For example internet is just another medium for disseminating information like the print media or television. However the difference lies in the cost at which the information is disseminated, the

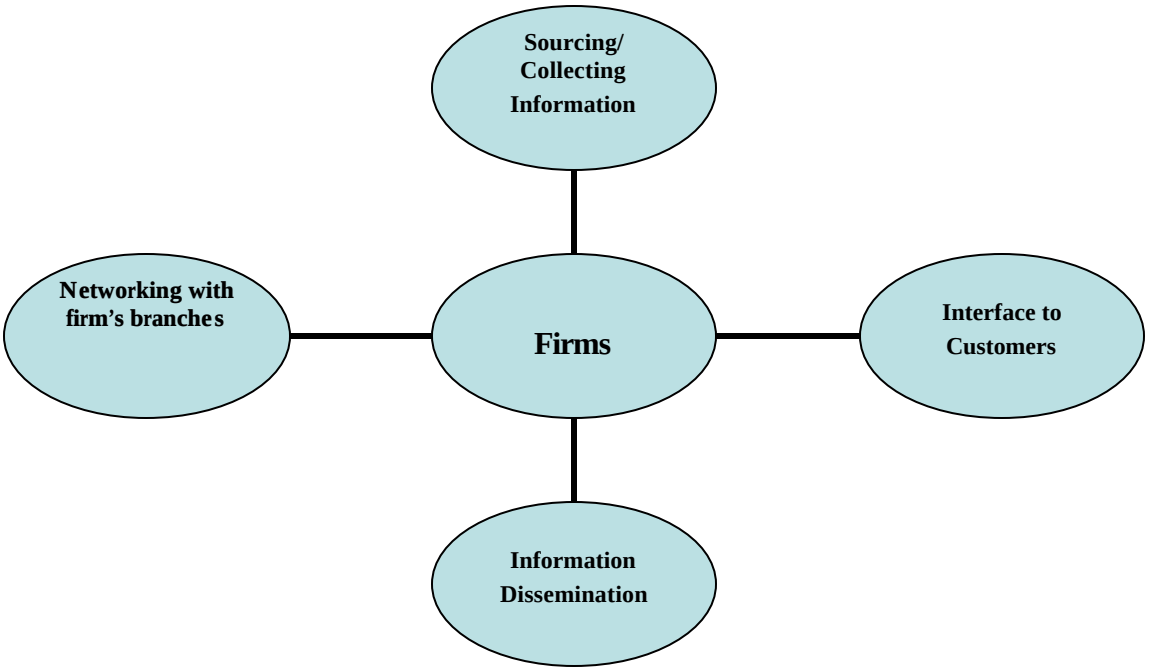
richness of the information and the number of people that information can reach. These features of the Internet make it an appealing platform around which cheap solutions to complex social and economic problems are built (Sudhanshu, 2002).

Figure 4: ICT Consuming Activities



The ICT use is also Interactive. This implies using the ICT as a medium for two-way communication of information. In this mode not only does the internet act as a medium for disseminating information but also as a medium for collecting information. The medium becomes more transactional in nature. This requires more skill and technical expertise especially in the software development and content management domain (Sudhanshu, 2002). Organizations today are using the ICT (i.e. internet) to bind diverse application and present one common interface to the customer. The Internet in this form is being used by business organizations to offer better services to their customers at reduced cost taking into account the preferences and desires of each and every customer. It is this form of exploitation of the Internet, which has given rise to the oxymoron 'mass customization'.

Figure 5: Interactive use of ICT



Each of the above interactive components in the ICT using activities can be analysed separately as a value chain. For example, we can examine the flow information dissemination chain from the source to its application below. There are several components in this chain, each of which is likely to be affected by a host of factors:

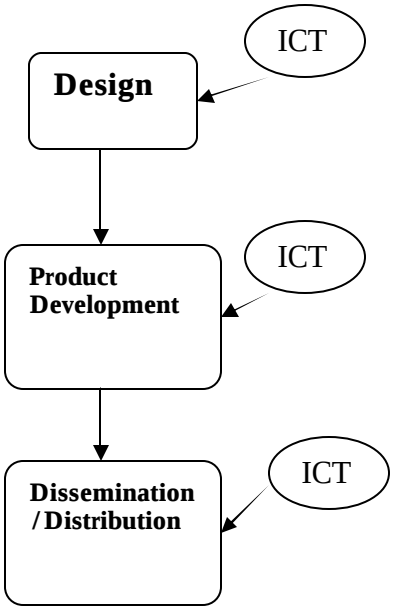


Figure 6: Value Chain in the ICT Services Flows

Sectoral Applications Initiatives

Although ICTs are cross-cutting to many uses in different sectors, a few sectoral applications are gaining attention in Africa in recent years based on countries priorities. These include education, health, business and trade and governance. Education and capacity building: The agenda for ICT and education in Africa can be strengthened through E-education initiatives, such as the African Learning Network[1] that supports school networks (e.g. SchoolNet), university networks (e.g. VarsityNet), networks of research institutes (e.g. African Knowledge Network Forum - AKNF[2]) and networks for marginalised people (e.g. Out of School Youth Network - OosyNet) (Bounemra and Soltane, 2002).

The utilisation of ICTs for improving government services in Africa is gaining momentum. Recently, ECA launched an electronic dialogue on e-governance[3] that aimed at providing insights into trends in e-governance programmes on the continent. African governments of countries should try to explore possibilities of using the net to provide better services to society. In countries with low penetration, this could start by simply posting more and more information on the net. This would lead to more transparency in the functioning of government; improve the awareness levels of people creating a more mature society. Moving forward attempts should be made to create databases of people and use them for better governance. Some of the benefits from such databases could be:

- Come up with better statistics about different segments of society on different variables such as education health, income etc and so be able to frame policies accordingly. One example could be structuring subsidies to target specific segments of society.
- Improve Law and Order by keeping criminal records accessible to all in real time
- Faster issuance of government related documents such as Acts, application forms for various services, and tax return forms.

[1] http://www.uneca.org/adf99/adf99education&youth.htm
[2] http://www.uneca.org/aknf/
[3] http://www.bellanet.org/lyris/helper/index.cfm?fuseaction=Visit&listname=aisi-l

2.5 Complementarities between Value Chain Approach with Innovation Systems Approach

Value chain analysis incorporates both vertical and horizontal relations between different sectors, underlining the necessity to approach the concept of competitiveness not solely on the basis of a single economic sector, but more broadly focusing on whole set of relations this sector has with other economic domains. These interrelations determine the position and competitiveness of an entire cluster. The idea of a value chain becomes useful for analytical and policy purposes, once we include three further features:

- First, the activities are often carried out in different parts of the world, hence the global value chain;
- Second, some activities add more value and more lucrative than others (the policy-makers' concern is to help local enterprises to move into the lucrative activities);
- Third, some actors in the chain have power over the others.

On the other hand, Systems are characterized by networks of production of strongly interdependent firms linked to each other in a value adding production chain. According to systems logic, interaction between different units departs more and more from the vertical structure, with horizontal relations gaining ever-increasing importance. Thus, the approach can complement the value chain analysis by:

- Analysing economic competitiveness as its scope is not limited to isolated intra ICT-industry relations alone, but also pays attention to relations with other sectors.

- Analysing innovation possibilities, as innovation is typically generated in a system of comprehensive networks. Frequently, these networks have far-reaching access to a number of actors across different sectors. Systems approach, by identifying the support connections helps to establish sources for action without identifying priorities.

3.0 The Status of Various Segments of the ICT Value Chain in Africa

In this section, we re-examine the status of different components of the ICT Producing activities and Consuming services in Africa.

3.1 ICT Producing Activities

3.1.1 ICT Producing Manufacturing

Africa's ICT manufacturing is still at infancy. Telecoms and computer markets are relatively small, and indeed ICT manufacturers in the developing world tend to be found in Asia or in "offshore platforms" like Mexico. Africa has small-scale assembly operations but their product tends to go to regional markets. Manufacturing requires large amounts of "brainpower" and skills in depth which is mostly lacking or less organized in Africa.

A few firms have led the way in the local production of what can be regarded as locally branded computers in Africa. An example is Sahara (India and South Africa), The Zinox Technologies Ltd. (jointly owned by *Stan Tech*, Nigeria, *Mustek*, South Africa, and *Alhema*, France) which has the WHQL certificate for its range of products – desktops, notebooks, servers –branded in October 2000. The Zinox Computers assembly plant, located in Lagos, has at present a daily operational capacity of 200 to 350 computers. The firm's computers have a number of components and parts – power circuits, casing, keyboard , and packaging –fabricated abroad to the company's design. Following the launch of Zinox, other efforts such as the United Information Technologies (UNITEC), Omatek Computers and Beta Computers have entered the Nigerian market with different products (Oyelaran-Oyeyinka, 2006).

3.1.2 ICT Producing Services

Africa has slightly more capacity in this area. There are a small number of regional companies producing original branded software: Soft (Ghana), Software Technologies (Kenya) and Pastel (South Africa). And there is even the occasional software contractor:

Zimbabwe's Cyberplex Africa does 80% of its business outside of its country base. The cost advantage alone should make this possible. Its programme work for Deloitte in the USA cost them US$10,000 against the US$90,000 it would have cost them in North America. Buying local and selling in dollars is a strategy that seems to work.

R & D, and Software Development

Software development (and R & D) needs low-cost, high-quality engineers. Even somewhere as large as South Africa that produces hundreds of thousands of graduates only has 3000 in maths and science subjects. In many of Africa's mid-scale countries, the pool of software engineers numbers in the hundreds and inevitably a proportion have outdated skills. In its competitor countries, people with these skills number in the thousands and many have current or near current skills. With the small exception of South Africa, sub-Saharan Africa has no R & D capacity. Zimbabwe's SIRDC has ambitious plans but these are in the future. There are little or no project management skills and no developed business culture to provide an easy common ground for international partners or buyers. Knowledge of English - the business lingua franca - is very variable. For example, Tanzania's decision to make Swahili its main language means that its ICT community will probably be less proficient at accumulating the knowledge it requires in a second language.

Business Process Outsourcing (BPO)

BPO is the lowest end of the "value-chain" and ranges from simple data input to transcription (voice to text), and specialized services. Africa has barely entered the market. Ghana and Kenya have several examples. There are plans to set up a company in Uganda to do offshore accountancy processing. Africa's competitive edge would be to target the banks and insurance companies of the developed world who are looking to cut "back-room" costs. Other specializations include medical transcriptions and legal transcription. Higher level services require higher skills.

3.2 ICT Consuming Activities in Africa

The use of Information and Communication Technologies (ICTs) has grown relatively rapidly in most urban areas in Africa. The ICT consuming landscape in Africa has changed dramatically over the last few years and within the continent there are many pockets of significant developments (Jensen, 2002):

- One of the early and still most important impacts has been in the use of email to reduce the cost, and to increase the speed and duration of international communications. This has allowed many people and organisations to improve management, obtain resources and generally achieve much better communications with their family, friends, colleagues and partners around the world or in neighbouring countries.

- In 2005, Africa had the highest growth rates in terms of numbers of Internet users, since many countries start from very low levels, but it has the lowest penetration rate after Oceania. South Africa, Egypt and Nigeria account for approximately 14 per cent of African users. South Africa and Egypt have above average penetration rates in Africa (UNCTAD, 2006). At the global level, Africa has very high growth rates (66 per cent), but many African countries start from rather low levels. The highest growth in the number of Internet users has been in Eritrea, Sudan, Morocco, Congo, Libya, Lesotho and Nigeria. Egypt, with 3.9 million users, has caught up with South Africa and is now the country with the second largest number of Internet users in Africa (UNCTAD, 2006).

Africa is catching up in telephone use, but one fourth of subscribers are in South Africa. The top four countries (South Africa, Morocco, Nigeria and Egypt) account for 57 per cent of all subscribers in the region. Very high subscriber growth rates can be observed in many countries, such as Algeria, Nigeria, Ghana and Sudan, to name the larger ones (UNCTAD, 2006). The number of mobile phone subscribers in Africa increased from 15 million in 2000 to over 80 million in 2004, an increase of 433 per cent (UNCTAD, 2006). Mobile phones are the only ICT in which developing countries have surpassed developed countries in terms of

users. Among African countries, South Africa, Nigeria, Egypt and Morocco continue to be the leaders in terms of the region's number of subscribers. In Africa, mobile phones have proved so successful that in many cases they have replaced fixed lines. An important consideration here, is that a single mobile phone is frequently shared by several people, particularly in poor, rural communities, and people at all income levels are able to access mobile services either through owning a phone or using someone else's (UNCTAD, 2006).

Despite progress in ICT consumption in Africa, Sub-Saharan Africa, along with South Asia remain at the bottom of the list of developing regions in Internet usage (see Table 1):

Table 1: Internet, Mobile Subscribers and Penetration by Region, 2006

	Mobile Subscribers	% Change 2004-2005	Mobile Penetration	% Change 2004-2005	Internet Users	% Change 2004-2005	Internet Penetration	% Change 2004-2005
World	2,171,179,091	23.5	33.6	22.0	1,020,614,866	19.5	15.6	18.1
Developed Economies	809,906,208	9.5	83	8.9	531,289,219	10.7	54.4	10.1
Asia Developed	102,545,000	3.9	76.1	3.7	89,173,852	32.4	66.1	32.1
Europe	463,582,325	9.7	96.1	9.4	205,412,718	7.4	42.5	7.0
North America	221,828,884	11.6	66.3	10.6	219,758,649	6.7	65.7	5.7
Oceania Developed	21,950,000	12.7	90.8	11.5	16,944,000	10.4	70.1	9.2
Developing Economies	1,174,964,724	31.3	22.8	29.5	441,132,301	30.6	8.5	28.8
Africa	134,941,820	67.4	14.1	63.9	35,389,128	52.5	3.6	49.3
Asia Developing	799,936,437	25.2	22.1	23.7	316,233,484	26.4	8.7	24.9
Latin America and the Caribbean	239,588,382	37.0	41.8	35.2	89,135,132	39.3	15.5	37.5
Oceania Developing	498,085	58.8	4.6	56.2	374,557	12.1	3.5	10.3
South-East Europe and CIS	186,308,159	49.6	56.8	49.9	48,193,346	32.1	14.6	32.5

Source: UNCTAD calculations based on the ITU World Telecommunication Database, 2006. Note: Mobile, Internet Users – persons; Mobile, Internet penetration – per 100 persons.

Furthermore, the success in ICT Consumption remains skewed in many parts of Africa as:

- The divide between urban and rural areas is even greater. Most of the services and users are concentrated in the towns, while the majority of Africans are scattered in small communities spread-out across the vast rural areas. Very limited diffusion of the telecommunication networks into rural areas (often over 75 percent of the country's telephone lines are concentrated in the capital city) and irregular or non-existent electricity supplies are a common feature and a major barrier to use of ICTs, especially outside the major towns.

- Most tax regimes still treat computers and cell phones as luxury items, which makes these almost exclusively imported items all the more expensive, and even less obtainable by the majority. Although there have been notable efforts in some countries to reduce duties on computers, however communications equipment and peripherals are still often charged at higher rates.

- Although there are a few notable official general government web sites, such as those of Angola, Egypt, Gabon, Lesotho, Mauritius, Morocco, Mozambique, Senegal, South Africa, Togo, Tunisia, and Zambia, there is as yet little discernible government use of the Internet for existing administrative purposes. Web presence is higher in some sectors, particularly those involved in tourism and foreign investment, and these often have more mature sites that are aimed at developing an international market presence, however these are of little interest for most potential users.

Especially in Africa, the number of broadband subscribers in most countries is extremely small, and penetration rates are less than 1 per cent even in countries that are more advanced in ICT, such as South Africa, Mauritius, Egypt and Tunisia (UNCTAD, 2006).

Computers are still by far the most important gateway to the internet even though the internet is increasingly being accessed through a variety of devices. Computers are indispensable for the development of the information economy and in particular for the application of ICT in e-business processes. An in-depth presentation of the presence of computers in developing countries is limited by the available data. Estimates about the number of PCs in countries are usually based on shipments (i.e. computers sold) or, if this information is not available, imports, coupled with a realistic replacement rate.[2] The latter

obviously differs among countries, with many developing countries having significantly lower rates. The number of PCs by country is shown in annex I, while table 1.6 shows the penetration of PCs by region and level of country development (UNCTAD, 2006).

Some African countries have very few computers; for example, Malawi reported 15,800 computers for 2003. Similarly, computer penetration rates are lowest for Africa (1.4 per cent), compared with 66.8 per cent for North America (UNCTAD, 2006).

Second-Hand Systems

Second-hand branded systems, most especially notebooks, have become increasingly popular due to their relatively low cost and reasonable period of good service. The importance of second-hand computers (although currently being blamed as a form of e-waste dumping by the developed countries) is an important starting point for a large number of entrepreneurs who import these systems to be serviced and sold in Africa. The business is sustained largely due to the comparatively low cost of such systems which are sought by those who either cannot afford new systems and do not necessarily look for the latest brand in the market.

3.3 Environmental and Health issues in Wireless Technology

As wireless technologies become available in Africa, we need to consider a number of pertinent issues:

- The very countries enjoying new benefits from the rapid spread of low cost cell phones are the same ones with few or unenforced laws and regulations related to the environment.
- A recent report from INFORM, *Waste in the Wireless World: The Challenges of Cell Phones,* calls attention to the hazardous materials used in the phones and batteries including arsenic, antimony, beryllium, cadmium, and lead.
- The health of consumers is affected both by the applications of wireless technology and by the devices' impact on the body. And proliferation of the devices in hospital environments can result in interactions and interference.

- The increase in use of different devices that make use of radio transmitters has resulted in interference problems. In some hospitals in Scandinavia, cell phones are banned because they have caused ventilators, defibrillators, and dialysis machines to fail. Other studies have shown these failures to be very rare.
- Studies of the effects of wireless devices on humans can cause genetic damage in human blood.

Africa needs to come to terms with the above problem before it suffers the effects of environmental degradation as the dangerous materials leach into soil and water. Nevertheless, there are positive aspects that need consolidation:

- It is suggested that telecommunications can help empower rural people to voice their concerns and defend their interests. Many individuals and groups are exploring how electronic mail and other computer mediated communications can help empower those concerned with social justice, environmental preservation and other causes.

- Clearly though, cell phones are popular in Africa because of the predominance of oral cultures and the relatively low literacy rate. People simply want to talk with friends and relatives; cell phones in villages have cut down on travel time for users who had previously gone to regional towns in order to make a call.
- Most media such as radio, television and newspapers have been developed for one-way broadcasts of information. In contrast to the hierarchical patterns of broadcast technologies and exclusive private networks, decentralized networks of communication through the public telephone network have strengthened civil society.
- Telephones provide interactive two-way communications. Telephones can help empower people to talk back, to ask questions, make deals and maintain networks of social relationships.
- The implications for Africa and non-democracies is more serious. Cellular phones are a challenge to authoritarian governments whose means of survival is the suppression of information in order to subdue the population.

3.4 The Current ICT Infrastructure and Regulatory Challenges in Africa

Production and use of ICT, however, stands on the pillars of information infrastructure, human capital, and an innovative system. The central pillar is an appropriate policy regime which *interalia* include those relating to trade and investment that not only promotes the production and use but also facilitates the creation of needed human capital base, information infrastructure and innovation system. The availability and quality of basic ICT-related infrastructure are very important for determining the location of globalised services activities.

Economy-wide framework conditions are important factors in decisions about where to locate production activities. These include the cost and ease of setting up a business, and the procedures for enforcing contracts. Most African countries have a large catch-up potential, so their competitiveness, which also resides in other inputs, such as relatively lower costs for the factors of production (land, capital and labour), different time zones, pool of skilled labour, language skills, etc. need to increase substantially. In addition to economic indicators, factors such as the social and political context are also important and are equally wanting.

The quantity and quality of infrastructure and their prices vary greatly across African countries. Some countries have large absolute stocks of infrastructure, which is one indication of national capacity for supplying ICT-enabled offshored services (OECD, 2006b). Overall the stock of ICT-related infrastructure in Africa suggests there is still a long way to go before it can match developed countries in terms of the intensity and quality of infrastructure. The ICT sector is one of the sectors more amenable to private sector participation. Although Private Sector participation has increased, the depth of this is limited.

There are several reasons for the low level of ICT technology in Africa (Butcher, 2003:68): Major constraints and challenges for the development of the ICTs in Africa also include:

- Weak telecommunications infrastructure to support the rapid development of ICT in the continent.

- Restrictive institutional structures which are ill adapted to facilitate these developments to meet the huge demand for ICT services.
- Inadequate regulatory systems and frameworks to guide the development of the sector and rapid diffusion of ICTs.
- Weak and non-existent regional links to help create economies of scale and drive cost of capital equipment down.
- The general low level of economic activity often makes technology unaffordable.
- Many African countries still have irregular or non-existent electricity supplies, which makes ICT use problematic.
- Lack of related infrastructures (electricity, etc.). Rail, road, and air transport is limited and this infrastructure is needed to implement and support ICT infrastructure, as well as the increased social and economic activity that this technology should stimulate.
- Many tax regimes define computers and cellular phones as luxury items, which adds to the price of these goods especially as the vast majority must be imported, and
- Lack of human Resources Capacity to support roll out, design and exploitation of ICT's. Lack of skills together with the problem of brain drain also makes widespread adoption of new technology difficult.
- Concentration of such investments in the more profitable areas of the economy.
- Poor local capital markets to facilitate the mobilization of funds to support these developments.
- Poor commitments and leadership within African countries to drive this evolution.
- The perception of Africa as a high risk continent with weak governance structure and systems.

Although a number of African countries have embarked on (regulatory) reforms, the effectiveness of this is still hampered by:

- Low capacity of regulatory authorities,
- Poor institutional authorities,
- Disparate institutional/regulatory frameworks across the continent and within the different regions.

In the short-term, ICT Infrastructure deployment and rollout are targeted at sub-regional connectivity and inter-connectivity projects and initiatives directed at building and rolling-out the physical telecommunications and communication network.

The general business climate for increased investment in Africa, acutely needed for the ICT sector, has suffered from the well-known problems of small markets divided by arbitrary borders, non-transparent and time-consuming procedures, limited opportunities (due largely to the historic pattern of monopolies and high levels of state control), scarce local capital, currency instability, exchange controls and inflation.

By 2003, sixteen (16) African countries had ICT policies, while twenty one (21) were in the process of preparing an ICT policy. However, 16 countries had not yet begun the process of developing an ICT policy (ITU, 2004). The ITU also identifies promising trends in competition and the regulatory environment for African telecommunication markets. Since 1994, 41 African countries have opened their mobile markets up to competition, with more than one mobile operator. Forty countries have now established independent regulators, setting the foundations for further expansion in telecoms services. However, generic policy recommendations of greater competition and independent regulation are usually specific to each market and must be tailored to their individual needs and characteristics.

Perhaps the most interesting developments in African telecoms are the innovative programmes and new institutional mechanisms being tried out to provide wider access to more affordable ICTs and to find practical ways of bridging gaps in access to telecommunications. In actual fact, ICT policy-making is not that new; policy making has been around since the introduction of computers to Africa. Most recently African countries were engaged in formulation of either their telecom or broad-based ICT policies. According to the Economic Commission for Africa, by 2004, half of African countries completed their e-strategies in an effort to enhance social welfare and economic development. Another quarter of African nations (about 14 countries) were in the process of developing their ICT strategies. The rest have yet to start the process.

While there are a variety of efforts underway to restructure national telecom operations and

build better national and international infrastructure, many of these lack a cohesive approach built on a clear understanding of the dynamics and impact of the fast paced and constantly changing environment communications technologies. Models of infrastructure provision are likely to be quite different to those employed in developed countries because of the generally low income levels, limited formal business activity and the much greater importance of the rural population, where up to 80 percent of the people may live outside urban areas. In addressing the low-income factor, innovative models may be necessary which focus on shared infrastructure, public access facilities and the use of intermediaries to interact with the public who may not have functional literacy, let alone be computer literate.

African countries face severe constraints in their ability to develop needed human capital base, hence the role of appropriate investment policies that attract investment for human capital formation cannot be over emphasized.

Regulatory problems anticipated in taxing ICTs given the growth of the mobile phone industry.

When the so called information revolution started, communication infrastructure was largely state owned and communication was regarded as a partly public good and a natural monopoly because of network externalities and high sunk costs. As content flows globally, taxation of the uptake from the mobile content has become a real challenge for many African Countries. One area of growing concern for both regulators and policy makers is how to deal with technologies like Voice over Internet Protocol (VoIP), which challenge existing business models.

Developments in mobile handset technology and use of mobile devices by consumers have made the mobile commerce market more consumer-oriented, more global in scope and more device-dependent. As a result, consumers can reap the benefits of their handsets or other mobile devices at any time, anywhere. However, mobile commerce also raises some serious consumer policy and regulatory issues such as the limited information available on screens and the security of payments made via mobile devices.

4.0 Towards a Methodology for Value Chain Analysis of ICT in Africa

There are several challenges in using value chain analysis. First, traditional production and consumption systems are not designed for classifying costs by value activities. Furthermore, some activities may have very complex value chains, a fact that makes the analysis difficult. Value chain analysis is an important tool for strategic management, and when competition is intense, companies must manage activities and costs strategically, or they will lose their competitive advantage. Value chain analysis can be used for determining at what point costs can be reduced or value added in the organization's value chain. Critical steps in the ICT value chain approach in Africa entail having the appropriate research questions, mapping the different ICT chains i.e. ICT producing and consuming activities, and finally analysing the segments (or sub-value chains and systems).

4.1 Framing the Research Questions

4.1.1 ICT Producing Activities

- Given our earlier discussion of the poor performance of ICT manufacturing and services producing activities in Africa, it is pertinent to consider in the analysis:
  - What is the extent of production and trade in ICT products and services i.e. hardware, software?
  - What are the bottlenecks to production of these activities i.e. infrastructure and regulatory frameworks.
  - What are the possible interventions to address these constraints?
  - What are the possible outcomes of these developments?

Box 1: Important Steps in Value Chain Methodology

- Identifying the activity producing or using sector
- Identify the particular product and market that define the chain.
- Formulate research questions
- Mapping the Value Chain
  - Mapping a value chain entails making a visual representation of its different stages and the connections between chain actors.
- Value Chain Analysis-identify
  - Who governs the chain?
  - What is the geographical spread of the chain?
  - What issues affect each segment
  - What issues affect the linkages in the chain

4.1.2 ICT Consuming Activities

There are two steps in analyzing the ICT Consuming activities; Step 1: Map basic chain i.e. if ICT is to be used in the production of wildlife safaris for business travellers, first you need to map the safari value chain. Step 2: Indicate where and how ICT will be used in this chain. Internet searches and surveys of travel agencies at the design stage; links into reservation systems, weather forecasting, mobile phone networks, and satellite maps at the production stage; and web sites, Internet advertising, and use of e-mail distribution lists at distribution stage.

Firms and individuals use Information and Communication Technology as weapon to respond to competitive threats, or to seek new opportunities by offering new services. Firms will use ICT for activities ranging from automating existing practices to changing business models. They will use ICT, for example, to:

- Reduce the costs of information exchange,
- Collect data to better understand their customers' behaviour,
- Offer new products or services,
- Improve their performance

Rapid advances in ICT have increased the tradability of many service activities and created new kinds of tradable services. In particular, "knowledge work" such as data entry and information processing services and research and consultancy services can be easily carried out via the Internet and e-mail, and through tele- and video-conferencing.

The development of global value chains offers new opportunities to SMEs by enabling them to expand their business opportunities across borders, although reaching international markets is often a difficult step for SMEs. The increased opportunities for SMEs come along with important challenges in terms of management, finance and the ability to upgrade and protect in-house technology. Suppliers can often be given more responsibility in the value chain to undertake more and more complex tasks.

Basic thematic questions for ICT consuming activities that might be asked are:

- Has ICT broken barriers to knowledge, information? How has ICT eliminated information or knowledge gaps in production? Through what channels has this been achieved? i.e. Internet, telephony and how is this linked to activities in different sectors i.e. agriculture, tourism?
- Has ICT broken barriers to participation? How has ICT promoted participation i.e. in different sectors, by gender etc? Through what channels has this been achieved? i.e. Internet, telephony and how is this linked to activities in different sectors?
- Has ICT broken barriers to economic opportunity? Has it enhanced Trade, business activities and interaction?
- How has ICT catapulted economic activities? Through what channels has this been achieved? i.e. Internet, telephony and how is this linked to activities in different sectors? What are possible impacts?

For example, in the different segments of the ICT consumption, the relevant criteria are to map out are:

  - Service quality
  - Price of services
  - Time from order to delivery
  - Punctual delivery of services
  - Flexibility
  - Innovative design.

Value chain analysis should the researcher to find out where the bottlenecks are:

- Which part of the chain functions (informative, interactive) holds up progress to service delivery? i.e. infrastructural factors, business environment, attitudes of consumers? Which is contributing to costs escalation i.e. is it some government policy?
- Which bottlenecks deserve priority attention of government? Which can be expected to be resolved by the private sector and which require public-private partnership? Where can the donor agencies help?

4.2 Mapping the Chain and Analysing the Segments

The value chain perspective ensures that this action plan does not stop with domestic linkages. It highlights the importance of facilitating linkages with the global economy. This includes improvements in infrastructure, customs and visa procedures, which enable enterprises to move goods and people quickly in out of the country. Mapping the relevant value chain helps these departments to identify where there are weak links. Knock-on effects up and down the chain become more apparent, complex interdependencies can be visualised and communicated more easily. Thus, the value chain approach provides a framework for sector-specific action. Understanding the centrality of relationships helps to identify leverage points and ways to intervene. The general point to be made here is that grasping the big picture is important, not just for the researchers, entrepreneurs, but also for the policy-makers. Should they help local enterprises to find a niche in global value chains coordinated by outside enterprises? Or should they provide support for local enterprises so that they can produce and market their own product overseas?

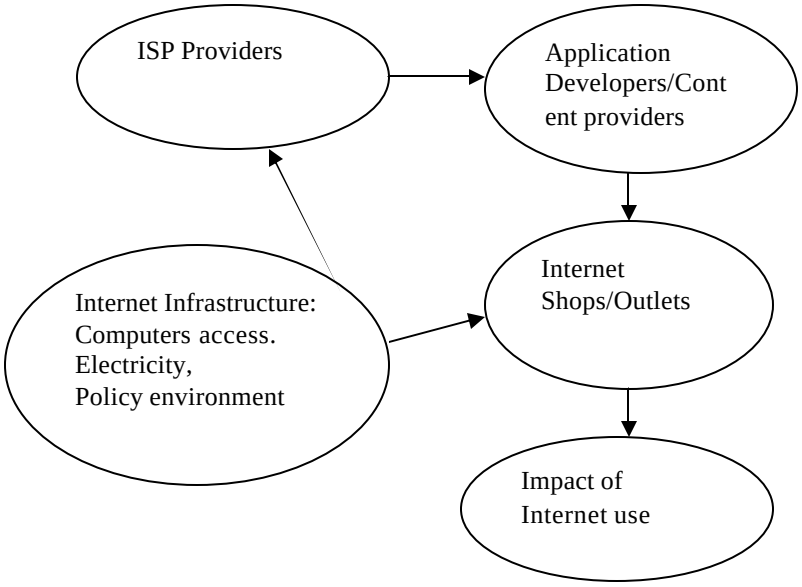
The main general point is that the value chain approach, by tracing the connections from the buyers to the producers helps to establish priorities for action. It can also be used for drawing national and foreign support agencies into a common strategy.

4.2.1 ICT Producing Activities

A map indicating the different stages of the ICT producing value chain has been discussed in section 2.4. The basic structure of the chain in Fig 3 suggests 3 components that include design, raw materials, processing, and assembling. Since ICT production has not taken of in Africa, issues pertinent to ICT analysis might focus on the analysis of economic and infrastructural causes of this. What essential components are missing in Africa? These may be issues of skilled manpower, investment climate, market size etc critical to the process.

4.2.2 ICT Consuming Activities

Again the discussion of the map for ICT consuming activities is provided in section 2.4 with illustration of the map in figure 4.



Range of Services in ICT consumption chain

Many use the Internet mainly for communication and information purposes. However, business transactions via the Internet (or e-commerce) is on the rise.

Business to Consumer (B2C) -- online consumerism: B2C e-commerce occurs when a company sells its goods or services to the consumer over the Internet.

Business to Business (B2B) e-commerce -- online transactions among companies and Government related e-transactions: B2B e-commerce involves companies using the Internet for making transactions with suppliers and services providers. This kind of transactions used to take place using electronic data interchange (EDI) over proprietary network before migrating to the Web. They usually involve standard commodity trading such as steel, sourcing activities or supply chain management.

Internet Service Providers (ISPs): Not all licensees operate an active business and the ISP market is dominated by a few major players. Broadband access technologies such as Asymmetric Digital Subscriber Line (ADSL), Fibre To The Building (FTTB), Local Multipoint Distribution Service (LMDS), Asynchronous Transfer Mode (ATM) and cable modem are becoming more popular.

Internet Content Providers (ICPs) and Portal Sites: In a broad sense, all Web sites are ICPs. The success of a commercial ICP lies very much on whether its content is interesting enough to attract high hit rates (eyeballs), which would then be translated into revenue by getting online advertisement. Moreover, some commercial ICPs also facilitate online transactions (usually of B2C type) to generate revenue.

Some ICPs specialise in one single topic and provide one-stop information search services. This kind of portal sites (including vertical portals) is a natural development in managing infinite information on the Internet.

Application Services Providers (ASPs: ASPs deliver and manage applications and computer services from remote data centres to multiple users via the Internet or a private network. In other words, ASPs assist the companies to outsource its IT functions so as to concentrate their resources on their core business.

Most higher value-added service activities require a high level of educational attainment within the labour force. Thus, the ability to generate these activities requires time, significant inputs of public funds, and a social and cultural framework that supports the development of these kinds of skills. Lower value added service activities are often strong complements to higher value added service activities. The retail service clerks are often required for the generation of value added from product design engineers.

4.3 Challenges of Data Requirements

One important area of our research concerns how to measure the ICT. This is a challenge, but there are others. Many African countries have no reliable industrial statistics of any kind. Many African firms are unwilling to give data to researchers. How should the researcher proceed in such situations to estimate value addition at firm level?

In February 2006, the UNCTAD organized the WSIS Thematic Meeting on Measuring the Information Society. The meeting produced a core list of internationally comparable ICT indicators on Internet use, infrastructure and access (see Annex Table 3). These indicators were agreed on by the national statistical offices of developing countries. The agreed indicators on infrastructure cover such factors as mobile phone tariffs, international Internet bandwidth per inhabitant and community Internet access. Where individuals and households use the Internet, and what activities they undertake - such as acquiring information, communicating, purchasing or ordering goods and services, learning, dealing with public authorities and engaging in leisure activities - are also monitored. For businesses, the indicators cover areas like buying and selling over the Internet. The challenge is still on capacity-building and training activities, and on creating regional and international databases on ICT indicators.

The list of core indicators provides useful guidance for countries wishing to start collecting ICT indicators, and constitutes the basis for developing internationally comparable statistics on the information society. There is plenty of scope for further developing the core list, which can be amended or expanded with new policy-relevant statistical indicators as experience is gained. This work has continued throughout 2005 and will be presented at the WSIS Tunis parallel event organized by the Partnership (UNCTAD, 2005).

Equally important is the data on NIS which would be complementary to value chain analysis. Some statistical offices have started compiling figures on ICT use by enterprises and on e-business, but much remains to be done to bring out systems information. In many countries where ICT services are a growing economic sector, data on international trade in those services do not even exist. New initiatives should be supported to collect ICT data and increase their consistency and comparability. This will not only make the statistician´s task

easier, it will help economists monitor the digital divide between developed and developing countries.

Currently, very little internationally comparable data are available on the ICT sector in developing countries. Similarly, comparable data on international trade in ICT services suffer from a lack of an internationally agreed upon definition of ICT trade in services. By contrast, data on international trade in goods are collected at national borders by most countries and compiled in the UN Comtrade database (UNCTAD, 2006).

4.4 Selection of Countries for the Pilot ICT Study

It is proposed as shown in Table 2 that the study be carried out in five regions in Africa (Anglophone West Africa, Francophone West Africa, East Africa, Central Africa and Southern Africa). In each region at least two leading countries in terms of depth and history of ICTs have been selected for in-depth study. This will permit the envisaged analysis of the impact of ICT on economic development at the sectoral and macro levels (AERC, 2006:16).

Table 2: Countries Proposed for Pilot Study

		Internet Penetration Ratio, 2005
Anglophone Western Africa	Nigeria	3.8
	Ghana	1.8
Francophone West Africa	Benin	5.0
	Senegal	4.6
Eastern Africa	Sudan	7.7
	Kenya	3.2
	Uganda	1.7
Central Africa	Gabon	4.8
	Cameroon	1.5
Southern Africa	Zimbabwe	7.7
	South Africa	10.8

4.5 Drawing Conclusions

A great deal of empirical research is needed to gain a clear picture of the role of ICT in development in Africa. The ICT manufacturing has not yet taken off in Africa and empirical analysis needs to focus on the factors (infrastructural and regulatory) that may be responsible for this state of affairs. On ICT consuming and ICT producing services, an increasing volume of research and case studies on estimating the impact of ICTs on social and economic development, including firm productivity, national GDP growth, trade, labour markets and income inequality, can be undertaken. Some studies exist, but most appear to be fairly narrow since the ICT sector is still new and undergoing evolution. The short experiences do not yet provide the sort of overview required for the development of improved national policies for development.

Value chain analysis would be very effective in tracing product flows, showing the value adding stages, identifying key actors and the relationships with other actors in the chain. Value chain studies in which detailed value added analysis on ICT producing, consuming and services would be invaluable, especially if these studies also incorporate data on national and/or local innovation systems. The methodological approach presented in this paper suggest approaches that tailored to the specific ICT producing and/or ICT using activities. Qualitative and quantitative methodologies should be combined as far as possible. Surveys can be used to collect quantitative data, but such surveys will have to be very carefully designed and implemented to ensure that the information collected is of the highest quality. Case studies of workers, enterprises, and even sectors can be carried out using a variety of methods to gather in-depth information. Finally, policies need to be assessed for their effectiveness, not only in achieving particular ICT goals, but also in ensuring that desired impacts can be achieved in the specific sectors.

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Annex Table 1:

Country	2005 Internet Users	2005 Internet Penetration	Mobile Phone Subscribers 2005	Mobile Penetration 2005	Broadband Subscribers 2005
Africa					
ALGERIA	1920000	5.8	13661000	41.6	195000
ANGOLA	176000	1.1	1094115	6.9	
BENIN	425000	5.0	75063	1.0	196
BOTSWANA	80000	3.4	823070	46.6	
BURKINA FASO	64600	0.5	572200	4.3	260
BURUNDI	40000	0.5	153000	2.0	
CAMEROON	250000	1.5	2259000	13.8	
CAPE VERDE	25000	4.9	81721	16.1	937
CENTRAL	11000	0.3	77000		
CHAD	40000	0.4	210000	2.2	
COMOROS	20000	2.5	16065	2.0	4
CONGO	50000	1.3	490000	12.3	
COTE D'IVOIRE	200000	1.1	2190000	12.1	
D.R CONGO	140625	0.2	2746000	0.9	1500
DJIBOUTI	10000	1.3	53000		42
EGYPT	5000000	6.8	13629602	18.4	113526
E. GUINEA	7000	1.4	96900	19.3	
ERITREA	70000	1.6	40438	0.9	
ETHIOPIA	164000	0.2	236000		
GABON	67000	4.8	649807	47.0	1515
GAMBIA	65000		247478	16.3	71
GHANA	401310	1.8	1765000	8.0	1904
GUINEA		0.5	189000	2.4	
GUINEA-BISSAU	31000	2.0	67000	5.0	
KENYA	1111000	3.2	4611970	13.5	
LESOTHO	60000		245052	13.7	45
LIBERIA			160000	4.9	
LIBYAN ARAB	400000		410000		
MADAGASCAR	100000	0.5	504660	2.7	
MALAWI	52500	0.4	429305	3.3	404
MALI	60000	0.4	869576	7.7	
MAURITANIA	20000	0.7	745615	24.3	164
MAURITIUS	300000		713300	57.3	
MOROCCO	4600000	14.1	12392805	39.4	249138
MOZAMBIQUE	300000		1220000	6.2	
NAMIBIA	150000		495000	24.4	
NIGER	29000	0.2	299899	2.1	212
NIGERIA	5000000	3.8	18600000	14.1	500
REUNION	220000	28	1500691		
RWANDA	50000		290000	3.2	0.6
SAO TOME &	40000		12000	7.6	
SENEGAL	540000	4.6	1730106	14.8	18396
SEYCHELLES	21000	26.0	57003		575
SIERRA LEONE	20000		329000		
SOMALIA	90000	1.1	500000	4.2	
SOUTH AFRICA	5100000	10.8	31000000	65.4	165290
SUDAN	2800000	7.7	1986000	5.5	1800
SWAZILAND	52000		200000	19.4	
TANZANIA	460000		2500000		
TOGO	300000	4.9	443635	7.2	
TUNISIA	953770	9.4	5680726	56.3	16491
UGANDA	500000	1.7	1525125	5.3	
ZAMBIA	320000		735000	6.3	250
ZIMBABWE	1000000	7.7	699000	5.9	10185

Source: UNCTAD (2006).

Table 1.24

Country grouping by Infodensity levels

Group A	Infodensity 2003	Group B	Infodensity 2003	Group C	Infodensity 2003	Group D	Infodensity 2003	Group E	Infodensity 2003
Denmark	246	Slovenia=	166	Bulgaria=	112	Samoa	82	Kenya=	34=
Sweden	242	Czech Republic=	160	Brazil=	111	Ukraine	82	Djibouti=	32=
Netherlands	238=	Estonia	160	Mexico=	99=	Belarus=	76=	Lesotho	32=
Finland	238=	Hungary	159=	Russian Federation	95=	Kazakhstan=	70=	Tajikistan=	32=
Norway	234=	Spain	156=	Turkey	95=	Paraguay	69=	Côte d'Ivoire=	32=
Switzerland=	219=	Portugal	155=	Trinidad & Tobago	94=	Georgia=	67=	Lao People's Dem. Rep.=	31=
United States	212	Italy	151=	Romania	92=	Bolivia=	67=	Sudan	28
United Kingdom=	210	Malta	150=	Malaysia	91=	Fiji=	67=	Zambia	27=
Belgium=	208	Slovakia=	142	Dominican Rep.	90=	Philippines	66	Cameroon	27=
Austria	203=	Greece=	141	Mauritius	89=	Botswana=	64	Pakistan	26
Canada	201	Latvia=	136=	Serbia & Montenegro	87=	Namibia	63=	Mauritania	26
Iceland	200	Poland	135=	South Africa=	87=	Guyana=	63=	Senegal	26
Australia	197=	Cyprus	133=	Lebanon	86	Ecuador	61	Ghana=	25=
Luxembourg=	194=	Lithuania	133=	Kuwait=	85=	Guatemala=	59=	Benin=	25=
Ireland	190=	Qatar	132=	Belize=	84	Armenia	56=	Congo	24
Germany=	186	Uruguay	126	Panama	83=	Oman	55=	Uganda	24
Hong Kong (China)=	185=	Argentina	124	Costa Rica	82	Albania	54=	Rwanda	24
France	181	Brunei Darussalam=	121	Thailand	82	Kyrgyzstan=	53=	Cambodia	23=
Singapore	180	Chile	119=	Colombia	80	Mongolia	52=	United Republic of Tanzania=	23=
Israel	178=	Croatia	117=	Rep. of Moldova=	79=	Swaziland=	51=	Yemen	23=
New Zealand	177=	United Arab Emirates	108	Jamaica=	79=	Nicaragua	51=	Mozambique=	23=
Japan=	177=	Macao (China)=	105=	Venezuela=	74=	Indonesia	48	Madagascar	21
Rep. of Korea=	171=	Bahamas=	103=	Peru	71=	Iran	47=	Papua New Guinea=	21
		Bahrain=	98=	Jordan=	69=	Gabon=	47=	Nigeria	21
		Barbados=	96=	Saudi Arabia	67=	Tunisia	47=	Bangladesh=	21
				El Salvador=	64	Sri Lanka	45=	Haiti	20
				China	62	Egypt	44	Nepal	20
						Honduras	42	Malawi	18
						Morocco	41	Guinea=	17=
						Zimbabwe	39=	Mali	15=
						Libyan Arab Jamahiriya=	39=	Myanmar	15=
						Algeria	36=	Burkina Faso=	14
						Cuba	35=	Angola	12
						Syrian Arab Republic	35=	Liberia	11
						Gambia=	35=	Central African Rep.=	11
						India	34=	Chad	11
						Viet Nam	31=	Dem. Rep. of the Congo =	10
						Togo	29=	Ethiopia	10
								Eritrea	10
								Niger	8

Source: UNCTAD and Orbicom (2005)=

Annex Table 3: List of Core ICT Indicators

No.	Indicators
	Basic infrastructure and access
1.	Main telephone lines per 100 inhabitants
2.	Mobile cellular subscribers per 100 inhabitants
3.	Radio per 100 inhabitants
4.	Television sets per 100 inhabitants
5.	Number of PCs per 100 inhabitants
6.	Number of Internet subscribers per 100 inhabitants
7.	International Internet bandwidth per inhabitant
8.	Broadband Internet subscribers per 100 inhabitants
9.	Internet access tariff (20 hours per month) as a percentage of per capita income
10.	Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)
11.	Percentage of population with access to PIACs by type of PIAC (governmental/private)
12.	Percentage of population covered by mobile telephony
	ICT sector
13.	Percentage of total workforce involved in ICT sector (by gender)
14.	ICT imports and exports as percentage of total imports and exports
15.	Value added in the ICT sector (as a percentage of total value added)
	Households
16.	Percentage of households with radio
17.	Percentage of households with a television
18.	Percentage of households with a telephone (Fixed only, mobile only, fixed and mobile)
19.	Percentage of households with a personal computer
20.	Percentage of households with Internet access (from the home)
	Individuals (by age, gender, including the disable)
21.	Percentage of population that use a computer
22.	Percentage of population with access to the Internet (by type of access, purpose, location of use)
	Business
23.	Percentage of businesses with computers
24.	Percentage of businesses with Internet access
25.	Percentage of businesses with a website
26.	Percentage of employees using PCs
27.	Percentage of employees using the Internet
28.	Percentage of businesses receiving orders over Internet
29.	Percentage of businesses placing orders over Internet
30.	Percentage of businesses with an intranet

31.	Value of orders received over the Internet (as a percentage of total value of orders)
	Education
32.	Percentage of primary and secondary schools having Internet access for students for study purposes
33.	Percentage of students enrolled in tertiary education having Internet access for students for study purposes
34.	Enrolled Student to PC ratio (in primary, secondary schools and tertiary education)

35.	Percentage of students enrolled in tertiary education in an ICT field or an ICT- dominated field (of the total number of students) (by gender)
36.	Percentage of ICT-qualified teachers in primary and secondary schools (of the total number of teachers)
37.	Percentage of tertiary education institutions with e-learning courses (of the total number of tertiary education institutions)
38.	For what purpose do students/teachers use computers/Internet (% for E-mail, research, employment opportunities, application software, etc.)
	Government
39.	Ratio of availability of PCs to number of staff
40.	Percentage of government offices with Internet access
41.	Percentage of government offices and agencies with a website
42.	Percentage of government employees with Internet access from the office
43.	% of government workers that use ICTs
44.	Purpose of use: (%) for e-mail, research, database work, geomatics, application software, etc
	Agriculture
45.	% of agricultural population and extension workers involved in the exploitation and deployment of ICTs to the sector
46.	Typology of usage of ICTs in the agricultural sector (% in R&D, business, weather, prices, etc..)
47.	Number of Local web-sites and data bases with agricultural information and content
	Health
48.	% of health institutions using ICTs (by type of health institution: private clinic, government, university hospital, pharmacy etc…)
49.	Geographic distribution of health institutions with computers, telephone and Internet connectivity
50.	% of health professionals that use ICTs for medical purposes
51.	Purpose of usage and % in tele-medicine, e-mail, research (health information, continuing medical education or distance learning, health promotion (including health information systems), database, Software applications, etc
52.	% of local web-sites and data bases with medical information
	Supplementary Indicators
53.	Total Resident Population
54.	Total number of households
55.	Percentage of households with electricity

56.	Total number of sub-regional and regional backbones and Exchange Points to which the country has access
	ICT investment and expenditures
57.	% of ICT investments and expenditures (% vis a vis GDP and vis a vis general Government expenditures)
	Content issues and local languages
58.	% of software developed in local language
59.	% of websites developed in local languages
	Security issues
60.	% of networks and websites which are attacked, and nature of attacks
	National Information and Communication Infrastructure (NICI) Plans and legislation
61.	Esistence of national or sectoral ICT policies and strategies and their implementation status
62.	Existence of national ICT legislations and regulatory frameworks and their effective implementation.