

**INFORMATION INFRASTRUCTURE DEVELOPMENT  
IN  
SUB-SAHARAN AFRICA**

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## **Abstract**

Since the post-war period researchers have been pointing to a shift towards a new techno-economic paradigm. Whilst the macroeconomic impact of this powerful wave of technology has yet to be determined, it is sensed intuitively as being more important than generally suspected and to have major multiplier effects on national development. The convergence of information technology and modern communications has raised renewed hopes for enhancing national development in developing countries. At the same time, there are legitimate fears of increased marginalisation for those countries that fail to keep pace in the technological race.

Grappling with the complexity involved in constructing an infrastructure that can improve their ability to achieve development objectives, and may lay the foundations for their future competitive advantage, few Sub-Saharan African countries have constructed a coordinated policy response to the complexities involved in creating an effective information infrastructure. Economically and politically fragile, and with only the promise of technological potentialities, the vast majority of African policy-makers are adopting a cautious approach. In the face of such a policy vacuum external actors such as multilateral development agencies, have taken it upon themselves to design, implement and fund initiatives with the idea of information infrastructure at their core. Such initiatives, whilst bringing much needed infrastructure to the region, are often short-termist in outlook and do not necessarily dovetail with local development objectives. If less developed countries and regions are to implement telecommunication networks and information services that will serve their interests, they must prioritise objectives that rest firmly in their particular economic, political, cultural and social context.

Within a broad, multi-dimensional research schema, the research examines the main actors in the field of information infrastructure development in Africa. These are identified as development agencies, indigenous government and the foreign private sector. By articulating the respective roles of these actors and their spheres of influence, the research provides a coherent understanding of information infrastructure

development activities within Sub-Saharan Africa. The research outlines a policy framework, which at both the conceptual and practical levels, argues that government plays the critical role in articulating national strategies for the coordination of disparate actors and scarce resources. The main contribution of the research is a practical policy framework that pinpoints priority areas for information infrastructure development within the Sub-Saharan Africa region.

*...The African must realise that he must fight unceasingly for his own emancipation; for  
without this he is doomed to remain the prey of rival imperialisms.*

**Jomo Kenyatta, 1967**

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## **List of Frequent Abbreviations**

<b>ADB</b>	African Development Bank
<b>AISI</b>	African Information Society Initiative
<b>ARIN</b>	American Registry for Internet Numbers
<b>CABECA</b>	Capacity Building in Electronic Communications for Development in Africa
<b>CTA</b>	Constructive Technology Assessment
<b>DRMAS</b>	Digital radio multi-access system
<b>EPLF</b>	Eritrean People's Liberation Front
<b>ESTC</b>	Ethiopian Science and Technology Commission
<b>ETA</b>	Ethiopian Telecommunications Authority
<b>ETC</b>	Ethiopian Telecommunications Corporation
<b>FLAG</b>	Fibre optic Link around the Globe
<b>FMOC</b>	Nigerian Federal Ministry of Communications
<b>GATS</b>	General Agreement on Trade and Services
<b>GDP</b>	Gross domestic product
<b>GEO</b>	Geosynchronous earth orbiting satellite
<b>GIIC</b>	Global Information Infrastructure Commission
<b>GIS</b>	Geographical Information Systems
<b>GMPCS</b>	Global Mobile Personal Communications
<b>IBRD</b>	International Bank of Reconstruction and Development
<b>ICTs</b>	Information and communication technologies
<b>IDRC</b>	International Development Research Centre
<b>IIA</b>	Internet Initiative for Africa
<b>IITF</b>	Information Infrastructure Task Force
<b>INTELSAT</b>	International Telecommunication Satellite Organisation
<b>IP</b>	Internet Protocol
<b>ISP</b>	Internet Service Provider
<b>IT</b>	Information technology
<b>ITU</b>	International Telecommunications Union
<b>KBS</b>	Kilobytes per second
<b>LAN</b>	Local area network
<b>LEO</b>	Low earth orbiting satellite

<b>MEO</b>	Medium earth orbiting satellite
<b>MIT</b>	Massachusetts Institute of Technology
<b>NCC</b>	Nigerian Communications Commission
<b>NCIC</b>	Ethiopian National Computer and Information Centre
<b>NGOs</b>	Non government organisations
<b>NII</b>	National information infrastructure
<b>NITEL</b>	Nigerian Telecommunications Plc
<b>OAU</b>	Organisation of African Unity
<b>OECD</b>	Organisation for Economic Cooperation and Development
<b>PADIS</b>	Pan-African development information system
<b>PSTN</b>	Public Switched Telecommunications Network
<b>PANAFTEL</b>	Pan African Telecommunications Network
<b>PATU</b>	Pan African Telecommunications Union
<b>PICTA</b>	Partnership for ICTs in Africa
<b>POTS</b>	Plain old telecommunications systems
<b>RASCOM</b>	Regional African Satellite Communication System
<b>RBA</b>	United Nations Development Programme's Regional Bureau for Africa
<b>SDNP</b>	Sustainable Development Network Programme
<b>TEP</b>	Techno-economic paradigm
<b>UN</b>	United Nations
<b>UNCTAD</b>	United Nations Commission for Trade and Development
<b>UNDP</b>	United Nations Development Programme
<b>UNECA</b>	United Nations Economic Commission for Africa
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organisation
<b>USAID</b>	United States Agency for International Development
<b>VANs</b>	Value-added networks
<b>VSAT</b>	Very small aperture terminal
<b>WTO</b>	World Trade Organisation

# CHAPTER 1

## 1.1 Introduction

The increasingly ubiquitous nature of information and communications technologies has two concurrent and complementary impacts on developing countries. First, they open up opportunities to accelerate social and economic development. Second, they create a pressing policy and investment agenda both to capitalise on the new opportunities and to avoid the deterioration of international competitiveness. The pressing reform and investment agenda dictated by the rise in the importance of information and communication technologies, aims to move countries into a different kind of economy where information is a key factor of production, and firms compete globally on the basis of knowledge, networking and adaptability. This research asserts that the creation of an information infrastructure represents a key investment for Sub-Saharan African countries. At the same time, it acknowledges the complexity involved in creating this novel infrastructural construct. This chapter begins with a delineation of the key terms of the research, provides an introduction to the literature on information and communication technologies (ICTs) and their impact on society, and a more specific critique of the literature on ICTs and developing countries. Finally, the research methodology and contributions of the research are presented.

## 1.2 Research objectives

Specifically, the research seeks to fulfil the following objectives:

- **To evaluate the state of national information infrastructures in Sub-Saharan Africa**

Wilson (1996b) et al. have set out to dispel the myth that the developing world is hopelessly behind in terms of information and communication services. Meaningful – albeit still unevenly distributed – information infrastructure development is under way in Sub-Saharan Africa. But whilst development agencies, the foreign private sector and African entrepreneurs are energetically pursuing opportunities in the continent's emerging information infrastructure markets, they are impeded by what Wilson labels a

"Berlin Wall" of regulation and monopoly (Wilson, 1996b, p. 4). This dissertation will investigate the state of information infrastructure in the region by looking at two of the most important elements: telecommunications and information technology development.

- **To evaluate the construction of information infrastructure in Sub-Saharan Africa, in terms of the respective roles of multilateral development agencies and the foreign private sector**

The research concentrates on two of the most significant external actors in the construction of information infrastructure in the Sub-Saharan Africa region: multilateral development agencies and the foreign private sector. The research asserts that what ultimately is determinant is not communication or other technologies per se, but rather the social and economic forces in command of the conceptualisation, design, development and application of those technologies.

- **To construct a framework for designing information infrastructure policies**

Given the lack of homogeneity in the developing world there is no single "one size fits all" solution. Each government has its own immediate focus and priorities in developing appropriate information infrastructure policies. While acknowledging that individual nations are at differing stages in this process, the research contends that there are general principles and guidelines that should be followed by policy-makers in order to achieve the best policy mix. The research presents the case for an integrated public policy approach to the implications arising from the wider use of information and communication technologies. The overarching theme and guiding concept of information infrastructure is provided, alongside an analysis of these technologies in supporting development.

### **1.3 Justification of the research**

Given its multidisciplinary nature it is only recently that anything resembling a body of work on the subject of information and communication technologies (ICTs) has begun to form. Attempts to create a cogent body of work have been hampered by two main factors. Firstly, the sheer rate of growth of technology has militated against a consolidation of accumulated data. Secondly, the issues surrounding ICTs straddle the whole social science spectrum. Despite these obstacles researchers are attempting to find appropriate responses to the myriad questions posed. The literature that is available has tended to emanate from the United States and Europe and hence neglects issues that may be more relevant to developing countries.

These works represent the first efforts to analyse these initiatives with the distance that time brings, and are a welcome addition to the debate. Yet, few authors have attempted to judge the merits of one approach over another and there has been very little substantive work on developing countries, let alone Sub-Saharan Africa. Odedra (1990a) concludes that there is little in the way of established theoretical or empirical material to provide guidelines for research on information infrastructure and developing countries. The academic research that has been conducted has focused on issues of technology transfer and diffusion, information systems capabilities and information technology policy (Bhatnagar and Anderson, 1990; Odedra, 1990a; Kluzer, 1993; Grant, 1996 and Harindranath, 1997). At the same time, as of 1998, there had yet to be a single, clearly defined explicit policy statement on national information infrastructure by any Sub-Saharan African country, except South Africa. Given the growing importance of information infrastructure, this research attempts to provide much needed research in this field.

It is essential to begin with a definition of the units of analysis in order to delineate the field of enquiry. The research is primarily concerned with information infrastructure in Sub-Saharan African countries. The research uses the term information infrastructure both to indicate a new range of goods and services and a foundational technology which is having, and will have, an increasingly profound effect on the processes of production and delivery of all other industries and services. The scope for such an infrastructure itself is new, emerging only within the last two decades as a result of the

convergence of a number of inter-related advances in the areas of micro-electronics, fibre optics, software engineering, communications, laser and information technology (Freeman, 1995).

The term "infrastructure", though normally seen in the physical sense as a public good with considerable economies of scale, is equally amenable to the concept of strategic information and communication technologies. Talero (1996) points out that certain information systems in an economy, such as an air transport control system, should be properly viewed as part of an infrastructure: fostering economic activity, enjoying economies of scale and benefiting non-users. But whereas physical infrastructure is easily identifiable, the constituent parts of an information infrastructure are more difficult to pinpoint. Intuitively these strategic information systems are those that are seen to facilitate a raft of concerns, ranging from supporting and generating private profits, to public service delivery (Drake, 1995).

In the light of these two aspects, any viable definition must take into account both the national and infrastructural considerations. Thus, information infrastructure is, for the purposes of this research, defined as the telecommunication networks and strategic information systems that can be utilised for national development. As Talero (1996) points out, this definition accommodates the developmental concerns of developing countries and denotes something both existent and novel that underpins current and emerging forms of economic activity.

As befits the growing importance of information infrastructure, myriad definitions abound as to what this generic term can encompass. Hamelink (1997), for example, sees information infrastructure from a technological standpoint as composed of information and communication technologies that can be classified according to five functions:

- **Capture:** such as remote-sensing satellites, radar systems, video storage systems and optical character recognition devices.
- **Transport:** such as coaxial cable, fibre optic cable, microwave links, communication satellites, cellular mobile radio, facsimile machines, telex and modems.

- **Storage:** such as memory chips, magnetic film, tape, laser emulsion and microfilm.
- **Process:** such as integrated circuits, computer software and peripheral equipment.
- **Retrieval:** such as on-line databases, television, radio.

Heeks defines information and communication technologies as the 'electronic means of capturing, processing, storing, and communicating information' (Heeks, 1999, p. 3). He goes further to argue that there are other technologies within an information system, including:

- Intermediate technologies, such as radio, television and traditional telecommunications;
- Literate technologies, represented by written formats such as books and newspapers; and
- Organic technologies, based solely on the human body such as the brain and sound waves.

This research takes a different approach and argues for a definition that assesses its potentiality for society rather than technological specifications. With this in mind information infrastructure and the technologies that comprise it are seen as having an impact in four main ways. Firstly, as an end product in itself, information and communication technologies such as computer hardware and software represent a source of income for those who produce, maintain and sell them; a potentially important contributor to gross national product. Secondly, information and communication technologies can be seen as a production technology. As a means of production they have revolutionised the manufacture of products such as cars, and are now widely diffused throughout almost every sector in industrialised countries; allowing more efficient and productive use of resources. Thirdly, as a conduit for information, technologies such as the telephone and electronic mail represent a vital element in the transfer of information. Finally, information technology can provide a means of processing information. The utilisation of software such as decision support systems and computer-aided design can facilitate the transformation of information into knowledge.



The context in which the research is located is Sub-Saharan Africa. We use the term Sub-Saharan Africa to denote a region that has a population of approximately 600 million and spans three main linguistic zones – Anglophone, Francophone and Lusophone.<sup>1</sup> It is comprised of forty-eight independent states that, on the whole, emerged from a long period of colonial administration only in the late 1950s and 1960s. Of the world's thirty-four least developed countries, twenty-six are to be found in this region. This region is thus unique in its high concentration of poor countries, with disparities in culture and language but with similarly parlous states of capabilities in information and communication technologies, and macroeconomic weakness. Throughout the dissertation the term Africa is employed. This is not to denote all the countries on the African continent but rather refers to those countries within the Sub-Saharan Africa region.

#### **1.4 Review of the literature**

The rapid expansion of the Internet and the profound transformations of the media and telecommunications markets have raised the visibility of information and communication technologies to such an extent that they and their impact on society remain one of the key polemic issues at the end of the 1990s. The literature surrounding these issues has developed organically over time with distinct stages of development. Borrowing a term from economics there would appear to be a definite conceptual product life cycle. The first phase in this cycle has been the identification of a phenomenon that is both technical and speculative in orientation. Actors whose brief it is to explain the features and implications of a new trend or shift dominate this phase. The area of concern is defined in broad brush strokes, given the uncertainty over the longevity of the phenomenon. A typical example of the work at this stage of development is Arthur C. Clarke's paper, "Extra-Terrestrial Relays; Can Rocket Stations Give Worldwide Coverage?" (Clarke, 1945).

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<sup>1</sup> However the level of ethnic diversity in the region is staggering. In Nigeria alone, for example, there are over 250 identified ethnicities (Garba, 1995).

Clarke postulates the possibility of space stations giving worldwide communication coverage by the end of the century. Allied with these early speculative essays were arguments that we are witnessing a shift towards a post-industrial techno-economic paradigm began to gather force in the immediate aftermath of the Second World War. Vannevar Bush (1945) was perhaps the first in a stream of authors heralding the advent of what Marshall McLuhan (1964) was to call the "global village". These exploratory articles were followed in quick succession by, amongst others, Hayek's (1945), "The Use of Knowledge in Society" and Tadeo Umesao's (1984) concept of *johoka shakai* or informationalised society. These were amongst the first to point to revolutionary changes in the uses of information and its potential socio-economic impact.

In the wake of these earlier speculative essays, there has been a rush, in both the popular and academic media, to place these rapid changes in a societal context<sup>2</sup>; the goal being to relate the increasing sophistication of technology and planning to the emergence of a new society. Daniel Bell's (1973) concept of the post-industrial society for example, suggests that, unlike Rostow's (1953) stages of growth thesis in which economic growth is the axial principle, in a post-industrial society the key principle is the acquisition and codification of theoretical knowledge. Thus, power resides in the possession and with the possessors of that knowledge (Bell, 1973, pp. 18 – 20). Despite the differing labels, there is a consensus that, of all the changes taking place in our time, none have more profound ramifications than the new ways in which we communicate with one another. There are no historical precedents to guide us through this momentous change and it is difficult to predict what it may bring about.

Whether or not one is inclined to wholeheartedly commit oneself to such proselytising, the past two decades have seen a profound shift towards a era in which information technology and telecommunications are assuming greater and greater importance. Whilst critics of this view have suggested that such changes are illusory, research by Machlup (1962) and Porat (1977) is often cited as empirical corroboration of the phenomenon. By disaggregating US employment data, Porat's research argued that agriculture and manufacturing were on the decline and that the "information economy"

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<sup>2</sup> For example Dahrendorf's (1975) "post-capitalist" theory and Amitai Etzioni's (1973) "post-modern" theory, are examples of the attempts by writers to capture the Zeitgeist (Dizard, 1982).

had arrived. Focusing on the activities that workers performed rather than on their explicit job titles, he was able to argue that, by 1980, 'more people in the United States were engaged in information work than any other kind of work. Indeed about 48 per cent of the US population was engaged in one form or another of information work' (Porat, 1977, p. 57). Though both Machlup and Porat's studies have been described as crude and prone to unsupported generalisation (Dizard, 1982), the literature points to a permanent shift in the structure of the global economy, and it is one whose ramifications are difficult to predict. Given this seemingly irrevocable trend the locus of debate has shifted to more fundamental and less technical concerns.

The focus of these concerns is more on the implications of these profound changes as their effects become more evident and earlier predictions seem to be more than ephemeral. Seeing the problem from a different angle, theorists and the media have seized on the idea of technology as a potential panacea for, and the cause of a raft of present and future societal problems. They have in their sights an altogether larger beast and their writings are characterised by the utopian, hyperbolic and apocalyptic, as more attention is given to institutional, political and distributional issues. Analysts recognise that technological change, as Ellul (1964) has pointed out, is far from neutral, creating winners and losers. The spectre that haunts this utopian vision is the fear that these changes will support existing power structures, weakening further the technologically dispossessed (Castells, 1997b).

There are two perspectives underlying much of the recent debate in this phase. On one axis we have an impact perspective, concerned with the speed and the extent of change and its impact on society. At one extreme the negative position suggests that "continuism" is likely with a "more of the same" view which argues for the limited role of ICT-related change. Schiller (1984) argues, for example, that the primary beneficiary of these changes will be corporate capitalism, with no change in the underlying superstructures of society. Commentators predict increased polarisation with negative connotations and the term "info haves and have-nots" is placed on the international agenda. Concerns grow that if citizens are not able to have access to the new telematics infrastructures and services, existing patterns of inequality will simply be reinforced; leading to an information aristocracy rather than a digital democracy (Burstein and Kline, 1995). In this perspective there is a more reasoned realisation that any benefits

are unlikely to accrue equitably. Theorists such as Manuel Castells (1997b) point to the negative consequences that lie in wait for countries that fail to upgrade their information infrastructures.

At the other extreme, optimists such as Toffler (1970) and Gilder (1997) point to the benefits that these radical changes will bring. In this perspective the emerging global information society is characterised by positive features: there will be more effective health care, better education, more information and diversity of culture. New digital technologies are seen to create more choice for people in education, shopping, entertainment, news media and travel. This positive and transformist perspective stresses that the information society is fundamentally new and that it has an all-pervasive revolutionary quality. Gilder (1997), for example, asserts that new information technologies will undermine the monopolies, hierarchies, pyramids, and power grids of established information society. In a similar vein Carter (1995) looks at the strategic importance of exploiting the opportunities offered by ICTs to support economic regeneration. Within this perspective ICTs are envisioned as being the conduit for a variety of services that will empower citizens.

On the other axis we have an agency perspective which reflects debates between the extremes of technological and social determinists. Technological determinists see the information society as being driven by technological advances<sup>3</sup>, asserting that technological change drives economic growth, leads to profound structural adjustments, and institutional changes. Allied to this is a belief in the transformative capacity of technology. Writers such as Freeman (1995), among others, assert that it is technological breakthroughs that drive a cyclical process of creative destruction, with new technologies inducing novel, more productive investments, but at the same time destroying the economic feasibility of earlier ones. This leads to a fundamental change from the prevailing economic model of an industrial paradigm to a new techno-economic paradigm (TEP) based on a cluster of innovations in information and communication technologies (Perez, 1983; Soete, 1985; Freeman, 1994a).

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<sup>3</sup> See, among others, Hiltz and Turoff (1978); Toffler (1980); Beniger (1986) and Zuboff (1988).

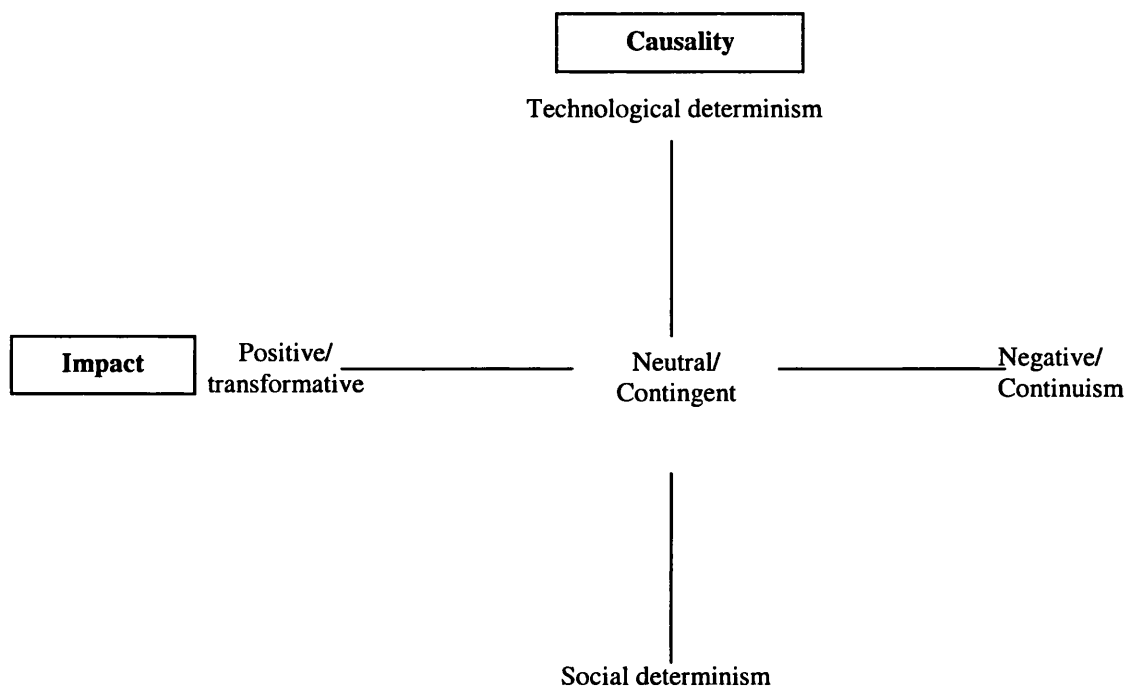
The gravest problem with the technological determinist perspective is that it ignores the role of human agency. Determinists believe that technological choices and the changes arising as a result of them, originate in a socio-economic vacuum. However, they fail to see the specific interests that generate them. Guided by this perspective, policy-makers find it very difficult to accept that technological innovations do not, in and of themselves, create the institutional arrangements within which they function. They fail to see that whether the potential of technologies will be realised in positive rather than negative ways, depends much more on their institutional organisation than on the features of their technical performance (Callon, 1987).

If the technological environment is accepted as given, then options for decision-makers are limited to reactive policies and programmes, 'designed to cope with, or adapt to, the consequences of technical change, rather than anticipating (and so influencing) these consequences' (Edge, 1995, p.26). Unless they understand what problems the major stakeholders want to see resolved, and what technical systems they select, policy-makers cannot anticipate the consequences of these systems and thus make a concerted attempt to influence their use in socially beneficial ways. At the other extreme of the agency dimension are those who argue for the critical importance of social determinism. According to this perspective every stage in the design and implementation of a technology involves conscious choices which are determined by human agency. These choices shape the direction or usage of technological outcomes with differing implications for a society as a whole and particular groups within it (Williams, 1982).

Figure 1 overleaf, shows the breadth of the debate between technological and social determinists. In this impact-causality matrix, each continuum has a midpoint of, respectively, neutrality about impacts and contingency about the causes of those impacts. Characteristic of speculative debate, differences between positions are not likely to be easily resolved as they remain captives of their value system (Miles, 1989). Yet, there appears to be a consensual point of access to all the different perspectives: that these technologies are not neutral and will have an impact, be it positive or negative. This conceptual schema is useful in that it provides a framework for some of the more common perspectives. Such a framework necessarily simplifies a complex reality, but it can be used to understand differing positions on technology and

development. Moreover, the broad brushstrokes of the conceptual schema show how little substantive work has been conducted on the implications of information and communication technologies for industrialised countries, not to mention developing countries.

**Figure 1: The Impact-Causality matrix**



In order to provide an insightful analysis we must place these fundamental changes firmly in the context of developing countries and more specifically Sub-Saharan Africa. This analysis begins with the historical treatment of communications in development theory, the disillusionment that arose from this treatment, the current revival in support of technology and economic development and the criticisms it attracts. It then identifies four aspects of the current debate: the technological, the economical, the critical and the public policy perspective.

**1.5 Information and communication technologies and development theory**

In the context of Sub-Saharan Africa, the debate on the impact of information and communication technologies has been less vociferous and detailed, and emerged at a later stage than the debate in industrialised countries. It can be traced back to the post-

war development theory literature that emerged as the majority of newly-independent developing countries embarked on ambitious plans for national development. Rostow's (1953) "stages theory of economic growth", for example, encapsulated the economic thinking at the time. Growth and development were considered synonymous, and a simple "iron law" of economic growth held that, so long as the amount of savings and investment results in a rate of growth of output that is greater than the increase in rate of population growth, cumulative economic growth would take place (Heilbroner, 1963, p. 86). Rostow even went so far as to prescribe a precise formula that would take countries through a set of stages to, ultimately, that of high consumption. Needless to say few, if any countries were able to meet these demands. Rostow's stages model was the ultimate attempt on the part of post-war economic planners to devise something like a development-vending machine: 'you put in the money, press the button, and get growth' (Brookfield, 1975, p. 39).

Analysts of all ideological persuasions are increasingly agreed that the basic construct sought by theorists from as early as the 1940s, the 'typical underdeveloped country', simply does not exist (Todaro, 1997). Belatedly, theorists and practitioners are emphasising that individual circumstances – economic, social and political – vary, and that the appropriate path of economic and political development cannot be determined *a priori*, but only in the context of these specific conditions. At best, one can seek to theorise in terms of groups of countries with similar conditions and key characteristics. In the wake of the failure of earlier development models there has been a growing realisation that development is more multidimensional than economics could comprehend, and more cumulative than simplified models can capture (Streeten, 1980). Subsequently there has been an increase in the readiness to acknowledge the contribution made by different analytical perspectives.

One such perspective was that of development communications. The role that the availability of information and the operations of the mass media in particular should play in economic development has been the subject of considerable debate. Lerner's (1958) "The Passing of Traditional Society" epitomises the strongly prescriptive approach. Asserting that the communication of information about the thinking, practices and achievements of the developed world to a receptive minority of potential opinion-formers in the developing nations, would set in train a self-perpetuating

virtuous cycle of literacy, technical innovation, economic growth, urbanisation and industrialisation. In the mid-1960s, it was argued that mass media – the press, radio and later television – could act as an agent of development. Development communications, the intersection of the communications and the economic and social sciences, represented an important component of the stages of growth model prevalent at the time. The central ideas behind the model were that:

- development is essentially the maximising of goods and services available to a given society and is quantifiable;
- the developing world is distinguished from the developed world by the lack of these goods and services;
- one of the main constraints to the developing world increasing its stock of goods and services is the consciousness of its people. Trapped within their own experiences they have a lack of knowledge of what is available to them. By increasing awareness of the gains made in other countries, perceptions would be altered. As a result, there would be a shift from a subsistence-based society to a capitalist economy; and
- the most effective method of achieving this change in beliefs was the application of technology-based communications, principally radio and, in time, television. Literacy is not necessary; images are created that promote "psychic mobility", and messages concerning health, education, farming methods, and more, are delivered (Dordick, 1993, p. 22).

Despite the lack of empirical evidence, this development model held considerable sway in the early 1960s, as the majority of developing countries invested heavily in constructing broadcast media infrastructures. The United Nations Educational, Scientific and Cultural Organisation (UNESCO), for example, recommended that developing countries achieve a minimum of media availability: 10 newspapers per 100 people, five radio receivers per 100 persons, two cinema seats per 100 persons, two television sets per 100 people (UNESCO, 1964). Yet these well-intentioned interventions were deeply flawed. By and large, policy-makers in the developing countries were concerned with the availability of technological products, rather than with the more complex problems associated with their political, economic and cultural integration. Thus little or no attention was given to meeting the infrastructural



requirements for a productive assimilation of imported science and technology in the recipient countries. The process of technology choice also tended to be undemocratic. Very seldom was there a comprehensive analysis of needs and alternative choices to meet those needs, nor was there usually any public consultation on alternatives (Connors, 1993). Most policy-making was characterised by an emphasis more on operational choices (procurement and deployment) than on the strategic:

Rarely did the countries at each stage of the decision-making process raise basic questions such as: Does the country have the technology? Can it develop the technology? Can it adapt imported technology? How long will it take? What resources will be needed? What are the trade-offs between importing technology now and waiting to develop it at home? Why not import now, but plan in such a fashion that there will be no more repetitive imports in the future? (UNCTAD, 1985, p. 162).

When, in the course of the 1960s, the volume of transferred technology increased considerably, many recipient countries became aware of a number of issues: the transfer usually consisted of end-products rather than of technology per se, much of the transfer took place as intra-firm movements, and the conditions under which the transfer took place were often disadvantageous for them. Moreover, much of the technology was inappropriate, obsolete, over-priced, or all of these combined (Odedra, 1990b). The development communications model which had seemingly justified expenditure on communications appeared to have failed to achieve any of its objectives. Much of what was on offer, even in the more specifically educational and advisory programmes, did not target those most in need. The potential opinion-formers, on whom the 1950s model depended, tended to be unrepresentative of the majority of the population. Those who were most likely to seek out and learn what was available were invariably relatively well-educated, urban residents with little contact with the illiterate, uneducated subsistence farmers who were the real target. As Connors argues 'it was little wonder, then, that the one transistor radio in the Third World village, which could act as a conduit for valuable practical advice, has often been permanently tuned to a popular music channel' (Connors, 1993, p. 20).

Lerner had suggested that the dissemination of images or accounts of the prosperous West would give rise to 'a revolution of rising expectations' (Lerner, 1958, p. 24). In reality the reverse was the case as frustrations rose and nations could not satisfy consumer wants (Woods, 1993). Due to the lack of indigenous expertise in broadcasting, the cost of original programming was high, and programmes were imported from the United States and Europe. These messages were being transmitted by people who had little or no understanding of the conditions that prevailed in the recipient states, presenting messages that were alien to indigenous cultures and often promoted the desire for inappropriate consumer goods. By serving to increase the unequal distribution of power and wealth by raising both the aspirations and the productivity of the more privileged information-consuming segments of society it has accentuated the competitive disadvantage of the have-nots (Bourgault, 1995; Cruise O'Brien, 1983; Woods, 1993).

During the 1970s, the increasing introduction of more sophisticated information and communication technologies often had unforeseen negative secondary effects, such as serious balance of payments problems arising from their capital intensity (Clippinger, 1976). The primary beneficiaries of such new technologies as satellite communications were, more often than not, the companies that were responsible for the provision of the equipment, the banks who were providing the funding, and the local administrative élite who used the new technology (Hamelink, 1997). It was felt that developing countries were unfairly prejudiced, specifically by the bias of western-centric news agencies, and more generally by the lopsided flow of transborder data (Williams, 1982).

In response to what was seen as the increasing bias of information flows emanating from industrialised nations a raft of information initiatives were launched by development agencies in the late 1970s and early 1980s. At the 1980 UNESCO General Conference, the International Programme for the Development of Communication was initiated with the unanimous support of all member states. Shortly thereafter, the International Telecommunications Union (ITU) Plenipotentiary Conference of 1982 established an independent commission to study the problems of worldwide telecommunications development. The UNESCO MacBride Commission report of 1980 reflected more accurately the fears of developing nations. The report called for a "new world information and communications order" which would reflect more

accurately the particular problems of the developing nations, guarantee the rights of citizens to communicate, and take action to right the acknowledged imbalances in the ways in which international communication was run. In 1985, the ITU's Maitland Commission produced a report entitled "The Missing Link", recommending more investment in telecommunications in developing countries and more resources for training and transfer of technology. Among its principal conclusions were the following:

...it was urgent to grant higher priority to investment in telecommunications; the effectiveness of existing systems had to be improved; the scarcity of foreign exchange in developing countries required new methods of financing; and the ITU itself should play a more effective role in ICT development. The Maitland Commission concluded not only that ICTs are critical to economic development, but also that they unleash forces transforming education, enriching national cultures and reinforcing social cohesion (Report of the Maitland Commission, 1985, p. 13).

In the 1980s, Third World leaders came to share the expectation within industrial nations that innovations in telecommunications and computer technologies could markedly improve industrial performance and increase economic productivity. Furthermore, there was a common belief that ICTs could, in fact, enable developing economies to leapfrog over industrialisation into a post-industrial society. In the spirit of what Sussman (1991) has labelled "re-modernisation – the empire strikes back", information and communication technologies have replaced radio and television, and have been hailed as embodying revolutionary potentiality in the struggle for economic development. With this hope, developing countries began to launch policies and programmes to acquire a share in international satellite communications and transborder data flow networks. Behind this flurry of activity has been a strong fear of being left behind and cut off from the emerging global digital highway. The general belief seems to be that, without adequate access to the global information infrastructure, developing countries cannot hope to be economically competitive (Cogburn and Adeya, 1999).

Whether these new technologies, and the access to information they bring, can act as a catalyst for development is a moot point. With sporadic and ineffective communications infrastructures, endemic poverty, poor health and illiteracy, the widespread utilisation of these "revolutionary" technologies remains a pipe dream for all but a tiny elite. Policy-makers in developing countries are thus confronted by a difficult conundrum. They are being advised to nurture the development of highly sophisticated, world-class channels capable of carrying the digitised content that will increasingly become the norm for trade and commerce. At the same time, they must address the needs of the vast majority of their populations who have low per capita incomes and are rurally based.

Given the multidisciplinary nature of the topic at hand, there is no unified body of literature on information and communication technologies and developing countries. The four dimensions outlined below represent important compass points in the debate on the impact of ICTs in developing countries. They should not be seen as mutually exclusive, rather they complement and add to the efficacy of a critical analysis of the current debate.

## **1.6 The dimensions of information infrastructure**

### **(a) The technological dimension**

In the technological dimension the emphasis is placed on discussing the relative merits of competing technologies in technical terms. The Internet and the applications needed to access it and the telecommunications systems linking them up, have all been widely reported upon (Wilson, 1996a; UNDP, 1998b; Solomon, 1995; Jensen, 1996). Here the focus is on the design, distribution and the uses of the hardware and the software systems. In this area little substantive work has been carried out though Kahin and Wilson (1997), within the Harvard Infrastructure Project and at MIT, undertook a major study analysing information and telecommunications technical systems in 1997. The Canadian International Development Research Centre (IDRC) and the United Nations Economic Commission for Africa (UNECA), have produced some of the more

comprehensive and up-to-date work in the field of technological developments in Sub-Saharan Africa.<sup>4</sup>

The brief of writers with this technical bent appears to be to explain the most advanced cutting-edge features of new technologies to other like-minded experts. Much is made of competing methods of content delivery such as fibre optic technology, low earth-orbiting satellites and radio technologies. The Internet here looms large as the most tangible aspect of the information revolution and indeed it is taken as a proxy of the level of sophistication of a nation's information infrastructure. As a result much is made of the lack of network capacity in developing countries. Maps showing the geographic representation of Internet coverage are provided as damning evidence of the developing world falling further and further behind (Goodman, 1994). The technological solution is cast as a "broadband network". The purest vision being an integrated, all-fibre, all digital, two-way, high-speed network over one "super-pipe". Which would allow for the transmission of an entire spectrum of communication applications from "plain old telephone services" (POTS) to video-on-demand interactive services. Proponents within this dimension are technologically determinist, viewing technology as a neutral prime mover.

#### **(b) The economic dimension**

The economic dimension concentrates on the dynamics of technological change. Technology is seen as central to economic development and as the most obvious cause of the cumulative wealth of industrialised nations (Freeman, 1994a; Chesnais, 1986). Proponents argue that information and communication technologies enable a multitude of activities to be done in different, cheaper and more efficient ways and thus represent a new factor of production (Perry, 1995). This factor of production is seen as a chronic disturber of the comparative advantage that lies at the centre of the emergence of a new techno-economic paradigm (Chesnais, 1986). Citing the influential economists, Schumpeter and Kondratieff, the assertion is that technology has provided the principle source of change for firms, regions and nations alike. A further assertion is that

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<sup>4</sup> See in particular Menou (1993) and Jensen (1996).

technological change drives economic growth through a process of creative destruction, with new technologies inducing novel, more productive investments, but at the same time destroying the economic feasibility of earlier ones. However, these changes do not lend themselves easily to economic analysis (Ayers, 1990; Foray and Freeman, 1993; Rosenberg, Landau and Mowery, 1992).

The diffuse benefits and the sheer unpredictability of technological change make it difficult to ascertain the economic benefits to be gained from ICTs. Nor can we seek solace in economic history. The telecommunications industry is one of the few major global industries that has undergone an almost complete transformation, from one based on electromechanical technology, to one based on microelectronics (Akwule, 1992; Cowhey, 1995). In other rapidly growing areas such as information technology we have few previous industrial counterparts sufficiently similar to make a comparison. Despite this high level of unpredictability economic theorists have attempted to locate these phenomena within a theoretical framework. One such attempt concerns technical progress and how countries develop technologically over time.

Though not formally accepted as an alternative to neo-classical theory, the neo-Schumpeterian or neo-technology approach attempts to offer a benchmark for studying a wide range of issues concerning technological progress. In the spirit of Kuhn, Dosi (1984) introduces the notion of technological paradigms to describe the prevailing body of technological knowledge. Within this school of thought the market acts to reward firms and countries who keep abreast of technological innovation whilst penalising those that fall behind. At the commercial level the market thereby acts as an economic environment, selecting certain innovations and rejecting others. Diffusion theory represents an extension of this microeconomic analysis to the country level. It represents an attempt to explain the determinants, pace and trajectory of the adoption of technological innovations, and how transitions to major technological paradigms has led to historical changes in the economic rankings of countries.

Dosi, Pavitt and Soete (1990) extend diffusion analysis to show how technology may give rise to historical shifts in the relative economic positions of nations. Like firms, leading nations will attempt to maintain economic advantage through the exploitation of technological opportunity. Thus, the very existence of gaps will act as a technology pump from leading to lagging countries. Some elements of technological and scientific

knowledge will be transferred free, via conduits such as multinational organisations (Dosi, Pavitt and Soete, 1990).

The second strand in the economic approach sees information and communications technologies as a valorisation of public communication. It promotes the development of new technology in the hopes of creating a demand in the marketplace that will yield economic and social benefits. The keys to this approach are positive externalities, as demand acts as a multiplier feeding on itself and stimulating even greater production. The major hypothesis is that information and communication technologies are seen as underpinning a host of economic activities. This is supported not just by unbridled optimism, but by a host of studies in the field of economics. Economic studies and lessons of the last 15 years are seen to provide substantial evidence at the microeconomic and macroeconomic levels that telecommunications investment yields direct and measurable economic benefits contention (Cronin, et al., 1991, Hyun and Lent, 1999, Runge, 1985). Bell (1973) has asserted that one of the prerequisites of participating in the information economy is that there must be an extensive communications infrastructure. It follows from this that the basic building block of the information infrastructure is the telephone service and the high-speed telecommunications backbone linking it internationally. Hudson's (1984) study, "When Telephones Reach the Village", shows strong evidence of a positive correlation between the telephone and economic development in developing countries. Despite the contestability of the flow of causality, the consensus is that an efficient telecommunications infrastructure is a necessary but not sufficient condition for economic development (Hardy, 1980; Saunders et al , 1984).

Whilst the studies cited above appear to point to an economic justification for putting in place advanced information infrastructures, there are a few important caveats. Hardy (1980), for example, fails to specify in precisely what ways telecommunications supports economic growth; rather it appears to be tacit assumption, an intuitive given in his research. This problem bestrides the concept of information infrastructure: how to effectively measure the potential impact of this recent convergence of technologies. At the micro level, there is still a distinct lack of understanding as to where and when – much less why – information technology can be applied to foster economic growth. The measurement of productivity linked to technology growth continues to be problematic

(Solow, 1988; Castells, 1997a) two of the major econometric studies in this field have arrived at differing conclusions (Cronin et al, 1991; Capello, 1994).

Despite these caveats, these technologically determinist theories have been embraced wholeheartedly by some development practitioners in development agencies. They point to the success of the newly industrialising countries as evidence that this phenomenon has the potential for widespread application in the developing world. Consequently, despite the lack of any substantive work on their appropriateness to particular developing regions, new technology is seen as a panacea. The leitmotif of the literature is of developing countries "leapfrogging" stages of technological development. For example, Knight and Boostrom (1995) assert that, 'countries which are able to seize the opportunities these technologies present will be able to leapfrog into the future even though they lack a developed communications infrastructure today'. They even go so far as to suggest a lack of infrastructure may be a benefit in disguise: 'In fact countries with little existing communications infrastructure, with less need to deal with vested interests in old technologies, can proceed directly to the use of wireless technologies and fibre' (Knight and Boostrom, 1995, pp. 34 – 36).

Yet such sweeping assertions are not embedded within the social context of access to these technologies. Although data on usage is at present limited in the context of Sub-Saharan Africa, even on a worldwide scale they do not indicate that anything more than a small percentage of the world's population is on-line, and that the majority of these come from affluent countries and have professional backgrounds (ITU, 1997a). One can draw parallels with the spectacular failure of the application of development theory to practical problems over the last three decades. The lessons from this failure have evidently not been learnt, and the developing world is hardly well served by policies based on rarefied economic theories, which often show such a blatant disregard for the resource-scarce realities of developing countries.

### **(c) The critical dimension**

A critical perspective on information and communication technologies takes a political economy approach. Historically, the principal incentives for the development of ICTs after the Second World War have come from military interests, and therefore many of



the innovations in electronic data processing and telecommunication technology described above have been, to a large extent, stimulated by the needs of military operations (Hamelink, 1997). At the same time, large corporations also found important uses for electronic networking. Commercial transmissions through electronic networks commenced during the 1960s and 1970s, facilitating airline reservations, international banking and credit control. The upgrading of telecommunication technologies and their integration with electronic data processing was thus largely promoted by an international military/industrial complex that needed fast, reliable and inexpensive technologies for their information handling and were willing to make exceedingly large investments (Hamelink, 1997).

The high development costs of the majority of information technologies has meant that its economic viability is geared towards high-volume production and the exploitation of a mass market (Hamelink, 1997). In the component industry the industrial structure is highly concentrated and transnational. This phenomenon is increasing as large multinational firms attempt to reap the advantages of economies of scale by the utilisation of vertical integration. As result of the increasing concentration and importance of ICTs to global terms of trade, concern has been voiced about the implications for developing countries. Critics such as Rada (1980) contend that the readjustment policies of industrialised countries, together with their development and control of information technology, is simply reinforcing the present division of labour through substantial increases in productivity and concentration of information-intensive sectors in them. Furthermore, he argues that the developed economies control an increasingly all-pervasive technology that has changed both their industrial and service sectors, and in turn reinforced their major advantage in science and technology. As a result the theory of comparative advantage, the assumption that developing countries would industrialise on the basis of labour-intensive industries, has been effectively undermined by the convergence of information and communication technologies. If there is no longer any need for labour, asks Kaplinsky and Cooper, (1989) where does the comparative advantage for developing countries lie?

The effort to increase automation has led to greater integration between manufacturers and electronic/information technology firms (Rada, 1980, p. 50) This phenomenon has been matched by a similar concentration in information storage and retrieval. As

Woods points out, this concentration is associated with the development of fluid international networks that are not constricted by national boundaries. (Woods, 1993, p. 131). The economic, political and cultural ramifications of these data flows are of immediate and growing concern to those countries which are seen as being dependent vis-à-vis the industrialised world.

Proponents of the critical dimension also argue that the creation of an information infrastructure requires a massive mobilisation of funds and a sustained commitment to investment. As the production of the necessary technology is restricted to a small number of developed countries the development of information infrastructure will be inevitably funded via recourse to foreign currency. Yet given the worsening macroeconomic climate prevalent in the majority of Sub-Saharan African countries, exacerbated by worsening terms of trade in primary commodities, and continued indebtedness, access to foreign exchange is limited. Greater public expenditure in advanced communications systems has usually first increased indebtedness, especially foreign indebtedness. Secondly, it has helped to produce a redistribution of spending away from crucial areas such as education, health and other utilities. Thirdly it has benefited relatively small sections of the population (Sussman, 1997).

Those within the critical dimension assert that developments in information and communications technologies, as well as the growth of transborder data flows, impact negatively on the development efforts of developing countries. One of the dominant metaphors of regional development is the core-periphery dichotomy (Friedman, 1966; Santos, 1979; Strassoldo, 1981). According to this perspective the world is now divided into three broad types of regional economy: those with a highly technological environment; those with a significant proportion of skilled personnel but lacking a diversified and modern industrial structure; and those with reserves of unskilled labour which are either surplus to farming and rural occupations or redundant to declining industries (Hamilton and Linge, 1983, p. 24). These tally directly with the core, semi-core and periphery structure. The world systems perspective sees the core-periphery structure as dynamic rather than static. The world systems view also maintains that core and periphery are not areas, regions or states, but spaces where core or peripheral processes dominate. In simple terms, core processes consist of relations that incorporate relatively high wages, advanced technology and a diversified production mix, whereas

periphery processes involve low wages, more rudimentary technology and a simple production mix (Taylor, 1989, p. 17).

Economically, the core is a set of regions where complexity, technology and control are the norm, and where linkages to other nodes and the global system are common. The situation in developing countries is considerably more complex than the model is able to capture (Lo, Salih and Douglass, 1981). Nonetheless the concept of dualism captures effectively the interrelationships – and lack of relationship – between different groups in the economy. Dependency theorists, such as Escobar (1995) and Hamelink (1983) argue that, as users of the end products of the technology, developing countries are not in a position either to establish technological control or to engage in competitive research and development.

In the cultural dependency model, ideological-cultural relations of domination and dependence are expressed in the control of the production and distribution of culture and ideology by the metropolitan capitalist countries, and more specifically their transnational corporations. Metropolitan centres such as the United States, Britain, France, Germany and increasingly Japan, have "world" languages, and largely control the flow of news and information to dependent societies. They exercise a largely unchannelled dominance in scientific and technological research and development, and produce the basic technical means of media and cultural production throughout most of the dependent world. This extremely asymmetrical flow of information between the advanced capitalist countries and those in the developing world is seen as not simply a commercial exchange, but rather a process whereby the latter are dominated by the communications ideologies of the major capitalist countries (Boyd-Barrett, 1977).

In addition the reliance on highly concentrated databanks and information technology hardware means that decisions in crucial areas of economic development and public policy will be made in accordance with criteria established in the major corporations of the capitalist world. Metropolitan cultural-ideological domination both reinforces and is part of capitalist economic domination. It helps ensure that subordinate classes remain locked into a capitalist hegemony, which they cannot challenge fundamentally since their consciousness is profoundly conditioned by metropolitan-derived ideologies and values. The domination is such that dependent ruling classes stay within and help

maintain this hegemony, reproducing the old colonial patterns of dependency and domination (Rada, 1980; Kaplinsky and Cooper, 1989; Hamelink, 1983; Mattelart, 1980).

The principle problem with these arguments is that they assume that an ideological superstructure can be created and reproduced elsewhere. Further that this superstructure can somehow be imposed without being a part of the internal dialectic of change and social and cultural reproduction. There can be little argument that there is a substantial inequality in terms of mass media and cultural production between developed and less developed countries. There is also a substantial inequality between countries in their ability to utilise information and communication technologies. Nor can issue be taken with the contention that information flows are often unidirectional. However, the existence of such inequalities provides us with little insight into the way in which international capitalist ideologies affect the process of development. In spite of these flaws the cultural dependency approach is useful in that it demonstrates that domination does not simply depend on repressive methods but can also contains a sophisticated ideological component (Sarti, 1981). While dependency perspectives still provide the framework for much of the theorising and analysis of international flows of information in the third world, they have been increasingly challenged and modified. The focus is now on questions of internal social structure, on what happens to these information and communication technologies in the specific context of different national societies.

More recent criticism has stemmed from the utility value of the technologies themselves. The sceptics are on the whole dismissive of the transformative power of information and communication technologies. For them the hyperbole surrounding these technologies is akin to that which surrounded information technology in the 1970s. Information technology then was trumpeted as a valuable tool for development practitioners and as an opportunity to foster economic development. However, despite heavy investments the returns were far from dramatic (Solow, 1988). In the light of the convergence of information and communication technologies critics see history repeating itself. For them, advocates of the "revolutionary potential" school of thought are akin to ardent salesman, peddling "silicon snake oil" (Stoll, 1995; Noll, 1996). Connors (1993) argues, for example, that much has been made of the potential for these technologies in education, with little basis on reality. The education system in Sub-

Saharan Africa is already in a state of acute disarray and neglect, and computers will add to that, being expensive, prone to obsolescence, and needing salaried personnel to look after them.

Those in this critical dimension sense intuitively that information and communication technologies, unless effectively planned, will only serve to further widen the gap between elites and the poor. For example, it has been pointed out that free trade has historically been advocated most ardently by the countries that stand to gain the most from market liberalisation (Estabrooks, 1988); this thesis can be extended to the development of information infrastructure in Sub-Saharan Africa. Such ideas err on such critical issues as the sources of comparative advantage in a dynamic world, the benefits of integration and the nature of international competition. These issues, of crucial importance, have been almost universally ignored in the mainstream literature. The critical dimension counterbalances this and highlights the importance of asking critical questions in the final analysis.

Given the continued failure of the application of orthodox development theory, concern shifted in the 1980s away from the grand reconstruction of society to meeting the basic needs of people (Todaro, 1998). The feeling has been that development theory has forgotten its fundamental goal: to improve the economic and social lot of the masses. The emphasis should, thus, be placed on the elimination of absolute poverty as well as economic growth. Thus the recommended path was based not on a heavy concentration on modern sector development, but on a more evenly diffused, broad-based development to which the 'traditional' sector would make a substantial contribution and appropriate technology would be utilised. Allied to this was the importance of self-help and isolation from the industrialised economy. Furthermore, foreign aid and assistance were seen as detrimental drugs that countries must be weaned from (Garba, 1995). This view was essentially anti-technology and a nostalgic harkening back to simpler times in the past, proposing a disengagement from the world economy (Schumacher, 1993). Evidently this was impractical. Senghas' (1983) criticism of this approach sums it up best:

What choices do the Third World countries have? Hardly any, for a variety of reasons. Firstly, the dominant elites of most Third World countries whether elected or not, civilian or military, are the principle local beneficiaries of this relationship [with the highly industrialised countries]. They are vulnerable to all manner of blandishments that accompany high-power sales drives. Secondly it will be foolhardy and impracticable to opt out of the worldwide network of satellites, computers and digitalised telephones. No country can stay away from these networks and yet remain within the mainstream of world commerce. The alternative is to be forced out of office or to increase repression. Proposals for de-linking and self-reliance are mostly conceptual fantasies that have little relevance to the realities on the ground (Senghas, 1983, p. 22).

#### **(d) The public policy dimension**

The fourth dimension to the debate on information and communication technologies concerns public policy. Underpinning much of the literature surrounding these technologies is an indication that technological accumulation is by no means a passive, mechanistic process, but a painstaking, costly and deliberate effort on the part of successful firms, governments and nations. It follows from this that the future development of an effective information infrastructure is determined by the complex interaction of the oft-competing forces of technological progress, economics and public policy. With no clear choice of technology government policy plays a major role in the both the speed of technology uptake and the choice of technology. Public policy may significantly alter the private and public costs and benefits associated with any given technological alternative; therefore it becomes a critical factor in the equation.

In light of this much of the recent debate regarding information and communication technologies clusters around issues of public policy. Dutton (1997) identifies four contending viewpoints within the sphere of information and communication technologies and public policy: public interest guardians, information society sceptics, information industry deregulators, and information society enthusiasts. For the enthusiasts the "visible hand" is much in evidence with public policy playing a pivotal role in the promotion of information and communication technologies (see for example Bangemann Group, 1994; Mackintosh, 1992). Guardians also recognise the importance

of a guiding hand but are more concerned with how information and communication technologies pose a threat to the public interest. A particular concern is the distribution of these opportunities (Blumler et al., 1992; Mansell, 1993). The sceptics are on the whole dismissive of what they see as the "fool's gold" of information and communication technologies. For them the hyperbole which abounds is driven by those most likely to benefit from greater diffusion of these technologies; the result of supply-push rather than demand-pull (Stoll, 1995; Noll 1996). Deregulators are also enthusiasts, but see the emerging information infrastructure as being market driven and being hindered by red tape. They are ardent supporters of the free market and advocate the total deregulation of all industries concerned (Noam, 1994).

Most of the responses to the policy conundrums created by information and communication technologies have been *ad hoc* and incoherent in nature. The first comprehensive attempt to analyse the impact of the convergence of technologies was the Nora-Minc (1980) study, commissioned by the French government in 1980. The report identified the challenges arising from information technology for France. These new challenges were seen as being the onset of the "l'informatization de la societe", or the computerisation of society, which could result in 'changes for the better or for the worse', depending upon the actions of French national planners (Nora-Minc, 1980, p. 112). "Telematique", the convergence of information and communication technologies was seen by the authors as increasing productivity, but causing short-term unemployment. Fostering the decentralisation of administrative structures and promoting the competitiveness of small and medium-sized enterprises, thereby moderating power relations (Nora and Minc, 1980).

They predicted that with knowledge as an engine of growth, there would be significant social and economic changes, comparable to those that took place when agriculture was replaced by manufacturing. The report then noted that in contrast to these likely outcomes, French traditions 'favour centralisation and administrative proliferation, hierarchy rigidity in big business' (Nora and Minc, 1980, p. 6). However, where Nora and Minc differed radically from previous commentators was their emphasis on a proactive government response in the light of these challenges. They concluded that if France 'does not respond effectively to the serious new challenges she faces, her internal tensions will deprive her of the ability to control her fate' (Nora and Minc,

1980, p. 254). The report calls for the creation of deliberate policy vis-à-vis telematics, arguing that the technology can only 'facilitate the coming of a new society, but it cannot construct it on its initiative' (Nora and Minc, 1980, p. 6).

Baran (1957) and Farber (1964) were amongst the earliest of writers to focus on the technical and political dilemmas confronting the policy-makers who must struggle to create effective responses to the technological changes they face. They argue convincingly that the impact of information and communication technologies has been underestimated and that the interim period will be a period of inevitable discomfort to those nations that are least prepared. Seen from this standpoint, academics and practitioners are trying to clarify the relationship between information and communication technologies and development. Their ultimate goal is to provide novel frameworks through which to understand how this convergence in technologies can make a sustainable contribution to economic development. One such framework is the concept of a national and infrastructural approach to information and communication technologies. An emergent and relatively novel policy construct, it represents an attempt by researchers to create order out of policy chaos.

### **1.7 National information infrastructure policy**

At this early stage of its evolution it is unsurprising to find that national information infrastructure (NII) is an oft-cited but rarely described concept. However, there is general consensus amongst writers that it is underpinned by two fundamental constructs. Firstly, that it is pitched at the national level and secondly that it is infrastructural in outlook. Critics of this view contend that the effects of globalisation confine the national level solely to the margins of economic policy (Drucker, 1970). Yet, however transnational the phenomena may appear, national policy-makers and leaders must first calculate the consequences at the local level. For example, most telecommunications companies, no matter how international, will serve national markets. Moreover regulatory structures will be put in place to control the indigenous market rather than the global market. It would thus seem that the most relevant questions being asked by economic actors are still being pitched at the national level. This is not to diminish the importance of taking into account the impact of



globalisation, but rather to insist that the starting point must be the national political economy (Lamberton, 1994).

It would appear that there is a rich seam of work in the field of public policy design from which policy-makers can draw inspiration. Mintzberg (1983), for example, describes the internal structure and the immediate organisational environment for large policy organisations. Hahm and Plein (1995), in their analysis of the role of the Presidency in technological development in Korea, show the importance of a high level champion of the cause. Odedra (1990a) emphasises the importance for developing countries of an explicit information technology (IT) policy rather than the reliance upon an allocatively inefficient trial and error approach. Corey (1995) compares information technology policies in South-East Asian countries and finds that success is a function of vision by highest-level national leadership, modern IT infrastructure and education, trained personnel and human resources development strategies. Lindberg (1977) in his comparative work on national energy policies, concludes from comparing several cases by discussing, 'the great difficulty that governments have experienced in coordinating the contradictory roles thrust upon them in the course of the evolution of the energy problem'. National policy-making is characterised by 'fragmented and incoherent policy-making' within the government, and contention with competing groups and a powerful 'industrial technocracy' beyond it (Lindberg, 1977, p. 335).

Adopting the concept of information infrastructure, researchers, frequently under the aegis of development agencies, have attempted to articulate policy frameworks. Institutions such as InfoDev, created by the World Bank in 1996, have become a prodigious source of analysis on information infrastructure issues. Under its aegis for example, Talero and Gaudette (1996) have both produced papers on possible scenarios for the construction of national information infrastructures in developing countries. Independent scholars have also carried out solid comparative work as can be seen from *Telecommunications Policy* and other specialist journals. Yet at the academic level Drake et al. (1995) have pointed out the significance of the paucity of international telecommunications and information studies in the leading political science and policy journals. With the exception of Cowey and Krasner, few leading scholars have done substantive work in this field. The majority of output still emanates from professional journals and the development agencies such as the World Bank and United Nations.

Moreover the literature that is available on information infrastructures has tended to emanate from the United States and Europe and hence neglects issues that are more relevant to developing countries. Much of this research takes it as a given that countries have an embedded IT and communications facility. With these assumptions firmly in place the key issues are generally seen to be the impact on employment, common regulatory standards, market development and new applications, and the role of the private sector (Bangemann Group, 1994, Cowhey, 1995). The latter, the relative roles of the public/private sector and how this affects the construction of an information infrastructure has attracted significant comment. Researchers such as Cowey (1995) have attempted to explain the different approaches taken to information infrastructure by comparing different industrial structures. The assertion is that the protectionist, top-down approach evident in Europe is a result of the domination of large, often state-owned companies, whereas the information infrastructure in the U.S. is seen as being more dynamic; a reflection of the large number of small start-up firms and a wider variety of firm size (Talero, 1996).

In terms of the relative roles of the sectors vis-à-vis the development of the information infrastructure, the consensus appears that the private sector is an engine of growth whilst the public sector is seen as the regulator and arbiter of free trade. The most comprehensive report to date on the European Union's (EU) approach to building information infrastructure echoes these views. Produced by the EU's Bangemann commission, it asserts that the main task of government is to 'safeguard competitive forces...so that demand-pull can finance growth' (Bangemann Group, 1994, p. 221). Yet such an argument whilst viable for the industrialised nations fails to address the practical concerns of developing countries. In reality these regions without a developed pre-existent infrastructure require significant guiding by the "visible hand". Singapore's "intelligent island" proposals show that even in an island state with a relatively developed communications infrastructure, in-depth planning is necessary to bring an information infrastructure to effective fruition (Blanning et al., 1997).

Few countries, developed or developing, have produced a strategy that transcends the telecommunications sector to address computer hardware/software systems, publishing, the Internet, and other segments of the ICT spectrum. This is hardly surprising given

the complexity and the variety of issues clustered around the concept of an information infrastructure. Furthermore, given the lack of heterogeneity of the developing world there is no single "one size fits all" solution. As Han and Walsham state, 'to imitate existing national strategies can only lead to major weaknesses in any systems' (Han and Walsham, 1993, p. 24). Thus, each government has its own immediate focus and priorities in developing appropriate policies. While acknowledging that individual nations are at differing stages in this process, the public policy dimension contends that there are general principles and guidelines that should be followed by policy-makers in order to achieve the best policy mix.

With different rationales and different strategies, countries have made efforts to address the challenges thrown up by the convergence of information and communication technologies in a concerted manner. The earliest examples of which were Singapore's vision of an "intelligent island" in 1992 and the Clinton/Gore vision of a U.S. "National Information Infrastructure". These efforts appeared to reach critical mass in 1994, inspiring the concept of a Global Information Infrastructure and subsequent G-7 conferences on what became known as the Global Information Society. In an attempt to investigate this phenomenon researchers, have attempted to investigate the raft of recent initiatives in the pursuit of a national information infrastructure.

Kahin and Wilson (1997) investigate efforts to define a broad but coherent set of national policies to advance the development of information infrastructures. The motivation for most initiatives are found to be innovation, economic growth, and competitive advantage. Information infrastructure is seen as having positive externalities which it is hoped will cascade rather than ripple through the national economy. Wilson (1996a) points out that national initiatives typically involve a three-prong approach. Firstly, a grand vision is formulated; this is designed to conceptualise the plan and to give the nation an easily digestible concept to grasp. The epithet "2000" is normally added to the title of the vision, to convey the feeling of the dawning of a new era. Singapore's Vision 2000 is a recent example of this. The next stage involves marshalling appropriate policies or policy frameworks. Wilson (1996a) points out that this may mean recasting existing policies to account for changes in technology. Finally, strategies for implementation are outlined which invariably cover specific policies. These may encompass new regulatory frameworks, tax incentives, deregulation and

promotional rhetoric. He points out that these policies often require continued monitoring given the volatile nature of technological shifts.

A report by the OECD (1996) takes a similar approach to Wilson and details the approaches taken by member states. These recent approaches can be characterised by two factors. Firstly, an extremely broad vision that appears to encompass not only telecommunications, but also information technology, content and a myriad of applications. Secondly, the emphasis is placed on the private sector, which is expected to be the catalyst that spurs the organic growth of the information infrastructure. While a useful compendium in itself, methodological concerns are non-existent, with little effort to aid in the process of constructing national baselines for comparison. While useful as a summary of shared concerns and evolving developed country position, the report does not provide much guidance for researchers, prioritise which aspects should be singled out, or suggest causal relations amongst the factors.

Both these works represent a first effort to analyse these initiatives with the distance that time brings, and are welcome additions to the debate. Unfortunately they represent a collection of descriptive accounts of public policies in this area. No attempt is made to judge the merit of one approach over another and the case studies are almost entirely confined to the industrialised countries and South-East Asia. In fairness to Kahin and Wilson (1997) and their contributors there has been very little substantive work on national information infrastructure in developing countries let alone Sub-Saharan Africa. Indeed, as of 1998, there had yet to be clearly defined explicit policy statement on information infrastructure plans by any Sub-Saharan African country, excluding South Africa. Yet frequent reports rank this region at the bottom of information infrastructure indices (UNESCO, 1997; Connors, 1993; Dordick, 1993).

However, these indices continue to be empirically problematic. The rigorous measurement of an environment in terms of the access to information that it affords its inhabitants is a formidable task. Data on the wide range of variables which determine the intensity and quality of indigenous information infrastructure are difficult to collate on a genuinely comparable basis (Dordick, 1993). The nature of the phenomenon being measured ironically contributes to the difficulty, in so far as in information-intensive environments the breadth and sheer volume of data is too great to be conducive to

consistent measurement. Conversely in information-poor environments, there is simply a dearth of reliable empirical evidence. Despite this, there are some relevant measures available on a global scale, which permit comparative analysis. According to statistics from the ITU et al. the situation in Sub-Saharan Africa is in marked contrast to many Asian and Latin American countries, who are already making haste and actively competing for information investment dollars and trade. These developing regions are becoming increasingly aware of the clear relationship between local communications infrastructure and encouraging foreign direct investment.

Singapore was the first country to articulate a national information infrastructure, publishing plans for the creation of an "intelligent island", where a fibre optic communications network would support a large variety of advanced information services. Korea likewise plans the completion of its own infrastructure for 2015, whilst construction of Malaysia's high-speed super corridor continues apace (Kim, 1999). Thailand's IT 2000 Policy represents similar efforts to create regional hubs in South-East Asia for financial services, manufacturing, commerce, transport, tourism and human resources training. The Chinese government was laying new telecommunications lines in 1997 at the rate of 14.5 million a year, and other countries are seeking alliances and partnerships with western companies to help meet the cost of boosting capacity (ITU, 1998b).

There are signs of change, though, in Sub-Saharan Africa with many governments embarking on telecommunications reform in order to improve local capabilities. However, the main focus of efforts to reduce the digital disparity have emanated from international development agency organised initiatives. As a result the majority of initiatives in pursuit of information infrastructure are being designed, implemented and funded by the international development agencies. For example, the African Information Society Initiative, founded at the African Regional Symposium on Telematics for Development organised in Addis Ababa in April 1995 by UNECA, is an attempt to overcome these traditional problems and ensure Africa can participate in the "Global Information Society". Its partners include the International Telecommunications Union (ITU), UNESCO, and IDRC. By 2010 this initiative foresees an information society for Africa in which:

Every man and woman, schoolchild, village, government office, and business can access information through computers and telecommunications; information systems are used to support decision-making in all the major sectors of each nation's economy; access is available throughout the region to international, regional and national "information highways"; a vibrant private sector exhibits strong leadership in growing information-based economies; African information resources are accessible globally, reflecting content on tourism, trade, education, culture, energy, health, transport and natural-resource management; and information and knowledge empower all sectors of society (Cogburn, 1996, p. 32).

Yet new technologies have the potential to further widen existing gaps between the elite and the poor within African countries (Castells, 1997b). While some sectors are adopting information and communication technologies, for the most part they are overwhelmingly used by the wealthier and predominantly urban elites (Wilson, 1996b). Moreover, in the face of technological uncertainty few Sub-Saharan African countries have constructed policy strategies to ensure that the benefits of these technologies accrue equitably. Economically and politically fragile, and with the merits of information and communication technologies still unproved and only the promise of potentialities, most are adopting a wait-and-see attitude.

The majority of developing countries are increasingly trying to attract foreign direct investment. At the same time, as information and communication technologies become increasingly central to the competitiveness of corporations, the quality of the local information infrastructure is looming larger and larger in the locational decision of firms (Keen and Kanbur, 1991). A 1997 survey of European business decision-makers found that 43 per cent of companies regarded the quality of telecommunications to be 'an absolutely essential' factor in considering where to locate their businesses abroad (ITU, 1997b). Most studies have suggested a reciprocal relationship over a period of time between telecommunications and economic development (Hardy, 1980). Yet the precise nature of the relationship between infrastructure quality and economic development is extremely complex and fraught with difficulties for policy-makers. What is evident is that efficient infrastructures are not sufficient in themselves to guarantee economic development. Human capital is critical throughout the process of

technological change. In all settings, the skills of the people – for accepting and interpreting information, for improving and enhancing technology, and for generating new technology – ultimately determine what organisations and nations can accomplish (Cassiolato, 1997; Madon, 1994; Odedra-Straub et al., 1995; Grant, 1996). An educated, skilled population has far more opportunities for change, innovation and new endeavours than one where lives are trapped in a routine of poverty.

Much of the literature takes a utopian vision of the transformative power of information and communication technologies, and thus calls for public intervention to ensure the effective adoption of these technological tools. Winner (1993), for example, calls for the establishment of political ergonomics, a discipline that would develop ideas to facilitate the specification of a suitable fit between a society and its instruments. In reality infrastructures are by their very nature evolutionary and emergent. They are the combined outcome of many major and myriad minor decisions all concurring to shape their appearance and functionality. Even if this were not the case, the sheer complexity of many large technological systems is such that rational design would still result in sub-optimal performance. One must also acknowledge that the technology *per se* is not a panacea. Yet in a limited way, the explosion of information and communication technologies may offer us a new path of thought and action. This has opened up a whole range of activities and new solutions from which conventional thinking, old traditions and the limits of previous technology and thinking have excluded us until now. To paraphrase Albert Einstein, the thinking that has brought us to our present stage cannot carry us beyond it. Taking this on board we would do well to heed the words of Hayek in his classic essay, "The Use of Knowledge in Society" (1945), 'that knowledge does not exist in concentrated or integrated form, but as dispersed bits of incomplete and contradictory information from which knowledge has to be gleaned' (Hayek, 1945, p. 526).

## 1.8 Summary

This chapter has presented a critical review of the literature surrounding the convergence of information and communications technologies and its impact on society. It has presented an impact/causality model that highlights the breath of opinion on this topic and the speculative nature of the debate. Placing this analysis in the

context of developing countries it has argued that there are four dimensions that must be taken into account to gain an understanding of the current issues. Contending that the shift towards a knowledge-based economy has important implications for all countries – especially those in developing regions – an argument has been made for the importance of an integrated approach to information infrastructure development and public policy in this area. Additionally the chapter has sought to analyse the more recent literature on the information infrastructure concept, and how national policy-makers are resolving the problems practically.

The arrival of information and communication technologies has brought with it extraordinary changes which are not well understood. This is a time of uncertainty, but the major danger is that problems are seen as merely technical with consequential neglect of the human, social, and economic aspects. In response to this uncertainty, much of the literature is frankly unhelpful. The utopian envisages a better world, but says little or nothing about how to get there, often supplying nothing but literary hot air, which serves to keep technology-based hopes alive. The dystopian, on the other hand, sees only the reinforcement of existing power relations. Evidently the likely outcome lies somewhere between both extremes. The main purpose of the research is to provide policy-makers in Sub-Saharan Africa with analytical perspectives that create a better match between technological potential and the achievement of development objectives.

## **1.9 Research methodology**

Within the discipline of information systems there has been an increasing use of interpretive research methods, ranging from phenomenology to methods of language interpretation (Lee, 1991, p. 342). Klein and Myers (1996) argue that this shift arises from a number of reasons. It reflects a desire to move away from strictly technological approaches that neglect managerial and organisational issues. Researchers are seeking to investigate the grey areas of human interaction with information systems that strictly positivist approaches fail to tackle (Mumford et al. 1985; Orlikowski, et al., 1991; Lee et al., 1995). Klein and Myers assert that, through interpretive research the 'researcher can study problems in the richness of their real-life setting as contrasted with the artificial context of research laboratory studies' (Klein and Myers, 1996, p. 2).



Interpretive approaches give the researcher greater scope to address issues of influence and impact and to ask questions such as why and how particular technological trajectories are created.

Moreover, many have pointed to the amenability of interpretive research to investigating new and emergent phenomena. Kodoma, for example, argues that:

Although established frameworks are the most appropriate for analysing past technologies, when a new paradigm of technology is emerging, there might be a serious discrepancy between the subject of study and the methodology used for the study. We have to create a new conceptual framework for a new paradigm (Kodoma, 1995, p. 15)

Klein and Myers (1996) go further by asserting that an interpretive research methodology is 'often the only way to glean knowledge in a scholarly way in an area which is new or not accessible to quantitative research at all' (Klein and Myers, 1996, p. 2). It is this last assertion, the lack of accurate and relevant quantitative measures, in tandem with the desire to study the complexities of information infrastructure development in Sub-Saharan Africa that underpins the methodological approach of this thesis. The concept of information infrastructure in Sub-Saharan Africa is as an emergent phenomenon that suffers from a distinct lack of accepted common frameworks, approaches and methodologies to guide the practical employment of public policy. Straddling a number of diverse disciplines ranging from political economy to information systems, few researchers have attempted to take a holistic approach to the issues at hand. The research seeks to describe and understand the context in which information infrastructure is developed in the Sub-Saharan African region.

This thesis takes a primarily qualitative approach to investigating the issue of information infrastructure development in Sub-Saharan Africa. It was felt that the variety of actors and the lack of accurate quantitative data in this area precluded a strictly quantitative approach. Nor would a quantitative approach provide the necessary descriptive detail for interpretative research (Miles and Huberman, 1994). In order to capture and interpret the key issues the thesis employs multiple research techniques to

arrive at the critical elements that interact to constitute efforts to create national information infrastructure in Sub-Saharan Africa. The primary methodological tools employed are an analysis of quantitative data and the descriptive case study method. According to Yin (1994) the case study method is appropriate in situations where there are a large number of variables. Case study research excels at bringing to us an understanding of a complex issue or object, and can extend experience or add strength to what is already known through previous research. Yin defines the case study research method as 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used' (Yin, 1994, p. 23).

The often volatile nature of technological change coupled with the richness of the Sub-Saharan Africa region necessitates a research approach that is broad enough to highlight the key actors and stakeholders within their context and narrow enough to achieve the research objectives. Towards this aim there are three principles that underpin this research. Firstly, that it is problem-oriented, focusing on specific large-scale systems namely information infrastructure and its development in Sub-Saharan Africa. Secondly, the research emphasises the development of general principles as well as analytical approaches that can be used in the design of large-scale systems. Finally the research is policy-oriented, concentrating on the development of improved procedures for governmental decision-making. It tries to point out failings in current policies due to flawed normative models or conflicts with cultural values, and then to identify and propose alternative policies.

Yin (1994) identified six primary sources of evidence for case study research. Not all sources are essential in every case study, but the importance of multiple sources of data to the reliability of the study is well established (Stake, 1995; Yin, 1994). The six sources identified by Yin (1994) are:

- documentation;
- archival records;
- interviews;
- direct observation;

- participant observation; and
- physical artefacts.

No single source has a complete advantage over the others; rather, they may be complementary and can be used in tandem. Thus a case study should use as many sources as are relevant to the study. With its use of multiple data collection methods and analytical techniques, it can provide researchers with opportunities to triangulate data in order to strengthen the research findings and conclusions. Triangulation increases the reliability of the data and the process of gathering it (Jick, 1979). In the context of data collection, triangulation serves to corroborate the data gathered from other sources. The research aims to explore these issues at the following levels:

- **An analysis of the present levels of information infrastructure in Sub-Saharan Africa**

The initial period of research concentrates on a regional analysis of the existing and projected level of the sophistication of infrastructure in Sub-Saharan African countries. Given the inherent definitional issues with delineating elements of an information infrastructure the thesis isolates two key segments – the telecommunications and information technology sectors – as proxy variables. The methodology chosen for this element of the research is an analysis of secondary, and, where available, primary data. Sources of data include United Nations agencies, national statistics and market research reports. The purpose of this element of the research is to get an overall picture of the development of information infrastructure in terms of these two proxy variables. This survey reveals the extent of current developments and the actors undertaking them.

Critics of this approach have questioned the validity of "counting telephones" in developing regions; however, it is the contention of this thesis that such methodological devices can establish benchmarks that facilitate regional and international comparisons (Mansell and Wehn, 1998). This positivist approach represents a sense-making exercise in order to quantify the extent of information infrastructure development in the region. There is an explicit acknowledgement as to the shortcomings of existing data, and given the time frame of the research and the impracticalities of region-wide data

collection, it was adjudged that secondary data sources were sufficient to provide a suitably accurate overview. Quantitative data collection and analysis are also critical to the formulation of public policy. Without an indication of information infrastructure densities and the like, policy-makers are hampered in their efforts to prioritise the use of scarce resources.

- **An examination of the respective roles of development agencies and the foreign private sector in information infrastructure development in Sub-Saharan Africa**

The development of information infrastructure in Africa continues apace despite government inaction. International development organisations are increasingly placing more emphasis on plugging the so-called communications gap, whilst multinational initiatives are multiplying as corporations see healthy profits in protected markets. In terms of the role of the development agencies, an evaluation research approach is undertaken. Suchman (1967) defines this approach as 'the determination of the results attained by some activity designed to accomplish some valued goal or objective' (Suchman, 1967, p. 85) This approach is appropriate because it evaluates broadly aimed projects through the use of aggregated secondary data. It also has advantages with regard to flexibility on measurement issues, data sources, data collection procedures (aggregate, observational, and interviewing data are of relevance in this instance), cost and expertise (Hoole, 1976).

To assess the role of development agencies a two-pronged approach is taken. In order to get an overall picture of the extent of development agency activity in this area content analysis is conducted on 273 development agency initiative abstracts, taken from the Partnership for ICTs in Africa (PICTA) donor's database. This database is publicly available on the World Wide Web, and allows authorised agencies to update their information and communication technology-related activities via the Internet. The hosts of the database estimate that the database covers 90 per cent of development agency activities in the field of information infrastructure construction in Sub-Saharan Africa. This was considered to be an appropriate sample from which to draw conclusions. Abstracts from all these projects based in and around Sub-Saharan Africa

were then analysed using the NUD\*IST content analysis software, which allows the identification of common themes in texts.<sup>5</sup> These themes were then assessed quantitatively and interpreted accordingly.

Content analysis is just one of several research techniques which may be used to conduct textual analyses (Babbie, 1995; Silverman, 1993). The other techniques tend to involve an in-depth analysis of particular texts by examining their underlying meanings through a detailed scrutiny of their construction and structure and the relationships between different words within each text (semiotics). Another common approach is examining the behaviour of people interacting with texts and reacting to them (ethnography and linguistic ethnomethodology) (Unerman, 1999). Krippendorff (1980) characterises content analysis as a research technique for use in analysing a wide variety of communications and structures it in such a way as to enable further investigation. It therefore seems a particularly appropriate research method for undertaking a quantitative analysis of the project abstracts of ICT-related projects. The research method behind content analysis typically:

...involves establishing categories and then counting the number of instances when those categories are used in a particular item of text. . . [It] pays particular attention to the issue of *reliability* of its measures – ensuring that different researchers use them in the same way – and to the *validity* of its findings – through precise counts of word use (Silverman, 1993, p. 59, emphasis in original).

A key assumption is that either the number of times an item is disclosed, or the amount of space devoted to a particular disclosure, signifies the importance of the item being disclosed (Deegan and Rankin, 1996; Krippendorff, 1980). The technique enables further analysis on unstructured documents by providing well-defined and consistent measurement categories which can be used to compare the content of each document analysed. The approach of this thesis was to employ a strictly quantitative approach to content analysis rather than more in-depth investigations which would have explored

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<sup>5</sup> NUD\*IST (Non-numerical Unstructured Data by Indexing, Searching and Theorizing) is a software package for the management and qualitative analysis of non-numerical unstructured data. It provides facilities for managing, exploring and searching the text of documents.

the social context and construction of the communication within the text (Unerman, 1999). The objective being to quantify and categorise the number of ICT-related projects being funded by development agencies.

The first stage involved in designing a content analysis project is to decide upon the units of analysis to use for both observation and recording of data. Krippendorff (1980) identifies four types of units of analysis used in every content analysis study as being: sampling, recording, context and enumeration units. Sampling units represent definable instances of communication which are independent from each other. In the case of this research, the most clearly definable sampling units were the project abstracts of development agency ICT-related projects. These were chosen because they represented a succinct introduction to the project (on average less than 300 words) and allowed clear categorisation.

This quantitative analysis of the sample of development project abstracts provides important information on the direction of development assistance flows, and how one of the key groups of actors is influencing information infrastructure development in the region. This quantitative exercise was consolidated in Chapter Six by a descriptive case study of one particular project. Given the wide range of project areas and different institutional agenda, there was an acknowledgement that one case study would be unlikely to exemplify the role of development assistance in information infrastructure development in Sub-Saharan Africa. Thus the goal of case study selection was not to investigate a "typical" development agency ICT-related project. Rather, the case study was designed to illustrate the problems that were deemed typical to development projects in this area. The selection of the case study was based on a number of criteria.

Firstly, it was imperative that the project was information infrastructure-related. A significant proportion of sample projects within the PICTA database were focussed on awareness raising activities such as workshops and conferences, and it was felt that these, concentrating mainly on sensitisation, were too narrowly focused. Moreover the case study was designed to encompass technological as well as design and conceptualisation issues. The second set of important criteria was that the project under investigation had to be based in the Sub-Saharan Africa region and had clearly stated predefined objectives to be achieved within a fixed duration. The third criterion was

that, given the disproportionate influence of the major development agencies such as the United Nations and the World Bank, the selected project had to have been designed and funded by a major development agency. A final important selection criterion was the level of access to project-specific documentation afforded to the researcher. Given that the important decisions regarding the design of development projects take place prior to project implementation (Taylor, 2000), it was critical that the researcher had access to project documents and internal data.

Evaluations of development projects are often carried out either by project designers or by external researchers. Both of these traditional approaches to project evaluation have evident flaws. Unfortunately, the scope for 'moral hazard' within evaluations conducted by project coordinators is wide (Dow, 1989). They may not provide accurate and honest appraisals of project outcomes as their objectivity may be fatally compromised. At the same time external evaluators suffer from two main deficiencies: their distance from the project itself and their reliance on project coordinators who are unlikely to want to provide unflattering data. It was thus hoped that by participating in the project, the researcher could get a unique insight that normally eluded external researchers.

After consultations with various agencies, the researcher took advantage of previous work experience with the United Nations Development Programme (UNDP) to select a case study of a project that satisfied all the above criteria. The project selected was designed, conceptualised and funded by the UNDP's Regional Bureau for Africa (RBA), based in New York. In response to the UN Secretary-General's Special Initiative for Africa, RBA had decided to implement a programme to increase Internet connectivity in Sub-Saharan Africa. To that end they had designed an "Internet Initiative for Africa". Having previously worked in the regional bureau for Africa as an economic consultant, both the project coordinator and leader assented to my participation on the project, specifically on a mission to assess a proposal the bureau had received from the Ethiopian Telecommunications Corporation (ETC) to improve their fledgling Internet provision service.

Within this unit of analysis two elements of investigation are conducted. Firstly, the overall design of the Internet Initiative for Africa is examined. Secondly an evaluation of the Ethiopian Internet Initiative for Africa project is conducted. The research was

conducted over two extended periods of time. Over a three week period in New York and then during a three week period in Addis Ababa, Ethiopia. The case study was based on interviews with project leaders in New York and Addis Ababa. The first period, based in New York, involved an analysis of the secondary literature of the project and meetings with the project leader and policy advisor. Within-case analysis was employed to familiarise the author with the conceptual basis underpinning the project and also the rationale. The researcher studied the project's written documentation in order to get a sound understanding of the project itself.

The second phase of the case study represented an assessment of the initiative, based on the author's experience as a participant in an evaluation mission to Addis Ababa, Ethiopia. Analysis at this level allowed the gathering of multiple sources of data, namely: in-depth semi-structured interviews, observational data collection firstly as an observer and secondly as a participant, and secondary data collection. It was decided to use semi-structured interviews, as recommended by Yin (1994), to expand the depth of data gathering, and to increase the number of sources of information. The interview protocol was free form and followed the recommendations of Yin (1994).

Firstly, informal meetings were conducted with the local staff of the UNDP country office of Ethiopia to ascertain the key sectors of Internet users in Ethiopia. These were identified as:

- non-governmental organisations;
- academia;
- private sector; and
- international organisations.

A minimum of two organisations were then selected from each category as being a representative sample of that sector. Interviewees were then selected based on their knowledge of Internet issues and also their usage of electronic networking. Where possible, interviewees were responsible for information systems and communications decision-making in their respective organisations. In order to sensitise interviewees to the project under investigation, a copy of the Initiative project document was delivered prior to the commencement of the interviews. Over a period of three weeks, 21 semi-



structured interviews were conducted with the following groups in order to ascertain their opinions on the Internet Initiative in Ethiopia:

- private sector information technology vendors;
- senior staff at the United Nations Economic Commission for Africa;
- senior staff at the National Computer and Information Centre;
- head of the Ethio-Internet Centre (ETC's Internet Centre);
- members of the Chamber of Commerce;
- officials of the local UNDP office;
- Addis Ababa University officials and senior staff; and
- several NGOs.

There were a number of qualifying criteria for selection. Firstly, that interviewees had used or attempted to use the Internet. Secondly that interviewees were involved in the procurement of information and communication technology equipment for their organisations. These conditions were designed to ensure that interviewees could provide real insight into both the problems of using and procuring ICT products, and would be capable of providing informed opinion on external efforts to improve both these aspects. Semi-structured interviews were chosen as the data collection technique of choice because of the need to get feedback on specific topic areas, whilst at the same time giving interviewees room to be informative. The semi-structured interview themes are listed in Appendix D, along with a list of all those interviewed and their organisations. The case study was not designed to test an hypothesis, but rather was designed to illustrate issues arising from ICT-related development projects in Sub-Saharan Africa (Bouma and Atkinson, 1995). The primary unit of analysis is the United Nations Development Programme / Regional Bureau for Africa Internet Initiative. The case study itself was not designed to test the achievement of project objectives, but to question certain assumptions of the project designers and to illustrate some of the traditional issues concerning ICT-related donor-assisted initiatives raised in the literature.

To further assess actors involved in information infrastructure development in the Sub-Saharan Africa region Chapter Five explores the role of the foreign private sector. Again, this group of actors is playing a varied role in the region, ranging from the provision of telecommunications services to the production of information technology products. To focus the research it was decided to investigate the role of emerging forms of telecommunications provision in and around the continent. To this end satellite and submarine cable projects were used as proxy variables for the role of the foreign private sector in the infrastructure development efforts of African countries. Primary and secondary sources were used to arrive at a comprehensive list of all the major satellite and cable projects being conducted that affect the Sub-Saharan Africa region. These initiatives were then assessed in terms of their contribution to the indigenous infrastructure and their value-added. Criteria include such variables as geographic coverage, cost of service, and intended market. To illustrate the potential impact of these innovations in telecommunications and data transport, two countries, Nigeria and Ethiopia, were selected to illustrate the demographic and economic issues that will dictate the appropriateness of new connectivity options for African policy-makers.

- **An assessment of the role of indigenous efforts to construct information infrastructure**

Two national case studies, Nigeria and Ethiopia, are presented to assess indigenous information infrastructure creation. Based on primary and secondary data, the role of national policy-making is analysed in terms of relevant public policies and public pronouncements concerned with information and communication technologies. Variables such as telecommunications reform, fiscal policy and education policy are evaluated, as well as the role of domestic industries. Each case study employs quantitative data to analyse the two proxy variables of the telecommunications and information technology sectors.

### 1.9.1 Assumptions and limitations

Throughout the research proxy variables, namely the telecommunications and information technology and Internet sectors, are used to demonstrate key developments in information infrastructure creation. However, given the paucity of data and inaccuracy of metric methodologies these variables remain difficult to isolate empirically. The research relies heavily on secondary data sources; however, the rapid pace of technological change often meant that aspects of the information infrastructure within a particular country, such as Internet connectivity changed significantly over a six month period. However, given that overall the level of information infrastructure components within Sub-Saharan Africa remains relatively and absolutely underdeveloped, the secondary data sources were capable of conveying a suitably accurate overview of the sector.

With regards to the choice of case study methodology, critics assert that the study of a small number of cases can offer no grounds for establishing reliability or generality of findings. Others feel that the intense exposure to study of the case biases the findings. Some dismiss case study research as useful only as an exploratory tool (Lee, 1989). Despite these valid criticisms, researchers continue to use the case study research method with success in carefully planned and crafted studies of real-life situations, issues, and problems (Grant, 1996; Odedra, 1990a; Kluzer, 1993; Kamel, 1994). For the purposes of this research the case study method was deemed appropriate and consistent with the exploratory nature of the area of enquiry. The national case studies of Ethiopia and Nigeria were designed to be descriptive case studies at the macro level. This macro level approach, based on analyses of secondary data, precluded a much more detailed investigation of both countries. Nonetheless, the case studies achieved the objectives of identifying the main local and external actors, the constraints to infrastructure development and the role of public policy. Such a description deeply enriches the understanding of causality and how information infrastructure development in the region is being affected by the context in which it is constructed.

The case study of the Internet Initiative for Africa project in Ethiopia raised a different set of methodological issues, namely the potential bias of the researcher as an active participant. Though the evaluation of a project is traditionally conducted with *ex post*

investigations the compartmentalised nature of the Internet Initiative for Africa project in Ethiopia permits an assessment of that particular part of the initiative (Rebian, 1996). Moreover, interviews were carried out once the project objectives had been agreed upon. It was thus unlikely that there would be any fundamental change to the project design.

### **1.9.2 Contributions of the research**

Whilst this research does not seek to provide explicit policy solutions, it does provide a conceptual framework that will guide African policy-makers and point to areas of consideration. Specifically the dissertation provides:

- A critical analysis of the literature on ICTs and its impact on Sub-Saharan Africa.
- A conceptual framework which justifies the importance of information infrastructure for Sub-Saharan African countries.
- An analysis of the current sophistication of information infrastructure in Sub-Saharan Africa. This will allow an assessment of the key areas of strength and weakness that national polities should focus on.
- A critical examination of the respective roles played in the construction of infrastructure by development agencies, the foreign private sector, and national governments.
- Finally, the research suggests a framework for the development of national information infrastructure policy. This framework aids both in assessing current infrastructure, and designing public policy that is appropriate to the indigenous environment.

### **1.10 Structure and outline of the research**

The thesis is divided into nine chapters. Following this chapter's introduction to the literature, Chapter Two presents theoretical justifications for the utility value of information and communication technologies in meeting the developmental challenges

facing Sub-Saharan Africa. It also points to the importance of human agency in shaping technological trajectories, utilising constructive technology assessment theory to underpin a belief in the role of public policy.

Chapter Three articulates a conceptual framework which provides policy-planners with an empowering analytical perspective from which to view information infrastructure development. This national information infrastructure framework is a multidimensional conceptual construct that recognises the existence of a multiplicity of actors with varying and often divergent interests, and justifies the role of the state as coordinator, constructor and regulator.

Chapter Four presents a survey of the state of information infrastructure in Sub-Saharan Africa in terms of two key elements: telecommunications and Internet development. The empirical evidence, whilst incomplete, does reveal statistical homogeneity in the Sub-Saharan Africa region in terms of the paucity of information infrastructure. An analysis is made of the state of both these sectors. The chapter then seeks to identify the various actors partaking in the development of information infrastructure in the region, assessing their roles and motives.

Chapter Five examines new telecommunications connectivity options emerging on the continent and asks how they can contribute not only to improved telecommunications, but also to the broader development of information infrastructure in Sub-Saharan Africa. It presents a framework to analyse the relative merits and disadvantages of these technological systems in relation to national criteria.

Chapter Six looks at the critical role that development agencies have played in the development of information infrastructure in Sub-Saharan Africa. It argues that whilst their efforts have brought much needed expertise and physical infrastructure, there are legitimate concerns as to the effectiveness of externally designed initiatives. Firstly, an introduction is provided to the history of development assistance to African countries in the field of information and communication technologies. Secondly, a sample survey of projects is conducted to determine the main areas in which development assistance is being applied in ICT-related activities, and the rationale

behind these activities. Finally a case study of the United Nations Development Programme's Internet Initiative for Africa is carried out.

Both Chapters Seven and Eight represent analyses of the information infrastructure in, respectively, Nigeria and Ethiopia in terms of the conceptual framework outlined in Chapter Three. Following this framework, the twin pillars of information infrastructure – the telecommunications network and the information technology industry – are examined in-depth. Specifically it sets out to review existing capabilities, identify the actors engaged and/or determining information infrastructure development. Providing assessments of short-term needs, and pointing to the creation of strategies to achieve longer-term objectives.

Chapters Nine provides policy recommendations on how to solve problems common to the Sub-Saharan Africa region, and specific to Ethiopia and Nigeria. Chapter Ten represents a summary and discussion of the research findings and the implications for public policy. It draws conclusions from the research undertaken and presents a case for the utility value of the national information infrastructure framework. Finally, suggestions for future research are provided.

## CHAPTER 2

### The Justification for Information Infrastructure

#### 2.1 Introduction

The review of the literature in Chapter One revealed widespread speculation and little in the way of substantive research into the issue of information infrastructure in industrialised and developing countries. The theoretical analysis presented in this chapter seeks to avoid the conceptual flaws inherent in causal and technologically determinist models, by arguing the case for a more limited, utilitarian role for information and communication technologies. The research does not seek to reify information and communication technologies as *deus ex machina*. Nor at any stage does the research attempt to argue that the construction of an information infrastructure can lead to economic development. Rather, it seeks to justify expenditure on information infrastructure for the facilitation of the achievement of national objectives. These new technologies are seen as facilitating and enabling national capabilities and a raft of concerns ranging from supporting and generating economic activity to public service delivery, providing, for example:

- information for policy formulation and implementation;
- better data for financial control of the public sector;
- improved decision support systems;
- access to information for the rural population;
- links for researchers and professionals to research findings;
- information for more effective natural resource management; and
- improved access to timely and relevant information on international markets.

A utilitarian approach argues that there is clear justification for the use of information and communication technologies in developing countries. The emphasis is placed firmly on practical as opposed to theoretical propositions, as answers are sought to such concerns as the relationship between investing in technology and the benefits which might arise. The justification for the positive role that these technologies can play in facilitating national development emanates from a number of important strands in

social science research. Firstly, the emergent literature on the "economics of information", which argues that decision-makers in developing countries are poorly served by inadequate information infrastructures that undermine their short and long-term competitiveness (Abidi, 1991). Secondly, studies attesting to the economic importance of infrastructure, in particular telecommunications. Thirdly the economic importance of new technologies for long-term economic growth, as exemplified by the neo-Schumpeterian school of thought. Finally, the research introduces constructive technology assessment theory as a justification for public policy in information infrastructure construction.

## **2.2 The economics of information**

Stigler famously remarked that, [information] occupies a slum dwelling in the town of economics' (Stigler, 1968, p. 71). Since then there has been increasing interest in the "economics of information". Theoretical treatises proliferate on the previously neglected implications of informational asymmetries for the functioning of markets, competitive or otherwise. This recent work has been in addition to that associated with the extant literature on game theory, bargaining, and negotiation, in which information and misinformation play crucial roles.

The main information "problems" seen to affect developing countries can be grouped as follows:

- uncertainty about the future (incomplete information);
- inherent uncertainties and deficiencies or asymmetries in information about the present; and
- informational deficiencies or asymmetries about the present which are "unnecessary" in the sense that it is possible, at a price, to remove or reduce them by "searching" and/or "advertising".

While everyone suffers from uncertainty about the future, it is not the case that everyone suffers equally, since people have differing access to information sources and varying capacities to process them. Policy-makers in developing countries, however,



may not have access to even to such rudimentary guides as information on current prices, let alone other market conditions or opinions. In volatile commodity, financial and foreign exchange markets, for example, the effects of even slight delays in the receipt of information may have serious consequences.

The new economics of information focuses on cases of imperfect information in which prices serve not only to clear markets but also to convey signals as to quality. Hillier (1997) points out that uncertainty over the quality of goods and services may be "inherent" in that further search efforts may give little insight into the characteristics of the good or service. This informational problem may directly impede developing countries' entry into international trade. The quality of their products may be regarded as uncertain and, surprisingly, the lower their prices the greater buyer resistance may be. Imperfect information is also said to generate lender resistance to developing countries financial instruments in global credit markets. Boafo (1990) highlights that the 'herd mentality' of private banks' lending to particular developing countries suggests highly imperfect information and reliance on the behaviour of other participants in the market.

Of even greater significance for developing countries is the dearth of information surrounding purchasing decisions. Governments and the private sector in developing countries face major informational problems as buyers. For them, the informational situation is often analogous to Akerlof's<sup>6</sup> (1984) seminal analysis of the market for "lemons". His analysis showed that those who sell high-quality products are reluctant to sell in the open world market at some kind of average price, which includes that for low-quality products. However, the poorest and least informed tend to seek out bargains on the "used car market" of the world; and they, like used car buyers are frequently exploited. The low-quality goods drive out the high-quality ones on the open markets. Not only then are there direct costs to the cheated purchasers from quality misrepresentation by sellers but, more importantly, there are social costs derived from the driving out of some legitimate businesses from the market. As Spence (1974) points

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<sup>6</sup> The seller of superior goods *knows* that his good are superior and will not be adequately compensated in an open market in which "lemons" are also to be found, and which the inevitably ill-informed are unable to tell the difference. The cautious (or informed) buyer is willing to pay a higher price for better quality goods. There are some signs – firms' reputations, branding – to guide the ill informed; but these typically involve oligopolistic rent which wise poorer buyers can ill afford (Akerlof, 1984).

out that, 'clearly the traditional presumption of *caveat emptor* has no basis within welfare economics, when information is costly' (Spence, 1974, p. 35).

Examples of the dangers arising from the provision of misleading or incomplete information, in environments within which there are a few checks or balances, abound in developing countries. A dramatic example is the introduction of widespread access to television in Samoa in the mid-1970s. Frequent advertisements for the medicinal product Pepto-Bismol led to enormous quantities being consumed 'in a society where no incidence of intestinal or digestive ailments had previously been visible' (James and Lister, 1980, pp. 83 – 4). Examples such as these point to the intuitive conclusion that consumers in developing countries are more likely to form their predilections on the basis of misinformation.

Moreover information plays a critical role in the development process. The ability to identify, implement, and evaluate development strategies is inextricably connected to the effective collection, utilisation and dissemination of information (Kelly, 1998). These informational deficiencies are endemic in Sub-Saharan Africa; most countries have trouble acquiring, retrieving, processing and disseminating information of various types. This "information poverty" exists at every level of society and impairs public and private decision-making. In the South, where raw information is lacking, as well as the means to convert it into knowledge, information poverty takes many forms and can have serious consequences (Ansu-Kyeremeh, 1996). For example, local business opportunities are curtailed by serious lack of knowledge about local and international markets, concerning changed patterns of demand, or new products, technologies and methods of production. Researchers, scientists, and skilled workers are isolated from current developments in their professions. Lack of timely information means, in turn, low productivity and poor-quality research, and valuable time wasted hunting for information and repeating research already done. Moreover, developing countries face obstacles that seriously handicap policy-makers: inadequate knowledge of natural resources, and unreliable socio-economic data, as well as poor information on national accounts, debt, balance of payments, market prices, extent of poverty, and impact of poverty alleviation, health and education programs (Abul Naga, 1994).

This leads to fundamental weaknesses in public policy planning. Lack of information also reduces bargaining power in bilateral and multilateral negotiations (Levine and Lippman, 1995). For example, major companies armed with remote-sensing satellite information about commodities such as oil, minerals or crops may know more about a developing country's resources than the country itself. Jequier and Dedijer (1987) discuss this issue with reference to the example of Guyana which in 1976 extended the limits of its territorial waters to the now customary 200 miles; thus extending the area under its sovereignty by 50 per cent. However, though it was likely that this additional territory contained oil, the country had not a single oil industry engineer. Thus, without foreign intelligence the country would have been unable to exploit its natural reserves. Similar weaknesses may be felt in borrowing on international capital markets, dealing with multinationals, or influencing decisions by multilateral organisations like the World Bank or the International Monetary Fund.

Another illustration is the need for intelligence on multinational corporations. These corporations often comprise a disproportionately high level of economic activity in developing countries (UNCTAD, 1995). However, despite their prevalence and their importance to a country's balance of payments, policy-makers often know very little about their activities (Jequier and Dedijer, 1987; Klein, 1988). Thus developing countries often find that they are negotiating from a position of considerable informational weakness. These multinationals, which often have turnovers larger than the GDP of many developing countries, have access to and often produce the latest market intelligence (Cruise O'Brien, 1983). The surprise withdrawal of IBM from India in the wake of new indigenisation decrees in the late 1970s, for example, has been widely attributed to India's lack of information with regards to the two companies. Failure to develop information infrastructures in developing countries may not only mean the perpetuation of the inefficiencies and inequities of present international exchange but also their worsening, as a result of internationally unbalanced technological change in the foreseeable future.

There is evidently a clear need for the development of better systems of market information for use by developing countries, particularly those in Sub-Saharan Africa, which are characterised by the poverty of their information infrastructure. To acquire information through arm's-length purchase is to face the difficulties of quality

assessment, rapid obsolescence, inappropriate packaging, other's market power and probable high cost (Abul Naga, 1994). The long-term solution to the issues raised above points firmly to the development of indigenous information systems (Madon, 1992; Kamel, 1994). Scale economies in the collection, processing, storage and transmission of information have always been at the centre of discussions about informational capacity on the part of economic and political actors (Spence, 1974). As Klein points out, 'whether information is to be made or bought, the difficulties of appropriating the product, the gains to be realised through its diffusion, and the potential for scale economies and positive externalities, all suggest the potential productivity of governmental rather than decentralised private activity in this sector' (Klein, 1980: 278). This would seem to point to the economic value of the public information infrastructure provision.

There is also a desperate need for more informed decision-making in developing countries. For example, rural communities would benefit greatly from mechanisms that furnish them with the information they need to manage their environment and resources more efficiently. As Brodnig and Mayer-Schönberger (1999) argue 'accurate and reliable information is a key ingredient, if not precondition for sustainable development' (Brodnig and Mayer-Schönberger, 1999, p. 1). For example, the ability of policy-makers to manage their natural resources can be vastly improved by deploying technological innovations such as geographical information systems (GIS).<sup>7</sup> These allow the collection of accurate and comprehensive spatial data in such information-intensive areas as disaster prevention and resource management. Brodnig and Mayer-Schönberger (1999) highlight the fact that in many developing countries maps and other geographical products from the colonial era are still in use as informational benchmarks.

From a governmental point of view, information infrastructure is increasingly being seen as critical to effective public administration. Bhatnagar (1999) and others have pointed out that technological innovations in information systems such as electronic document management, and inter- and intranets can lead to innovative administrative

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<sup>7</sup> A Geographical Information System (GIS) can be defined as a computer-based system used to capture, store, edit, analyse and display geographically referenced data (Poole, 1995).

information systems which can enhance policy formulation, improve the quality of public service delivery and make planning more effective. Moreover decision support systems can aid policy-makers in the effective deployment of public policy.<sup>8</sup>

### **2.3 The economic value of public infrastructure**

There have been numerous economic studies on the general role of public infrastructure in economic growth. Much of the literature seeks to capture infrastructure's direct and indirect externality effects by observing the relationship between public capital expenditure (as a proxy for increases in the stock of infrastructure), and some growth in aggregate output or productivity. For example, a survey of 179 manufacturing establishments in Nigeria documented the costs of unreliable infrastructure and the costs of consequential investment in alternative sources. The study found that due to the unreliability of electricity supply, 92 per cent of firms owned electricity generators. In fact private infrastructure provision constituted 15 per cent of total machinery and equipment costs (Lee, 1996). Moreover, the survey found the burden fell disproportionately on small firms. If small firms are unable to realise the benefits of efficient generation of infrastructure services, either because the services are non-existent or provided so unreliably, they will be forced to seek higher cost alternatives which may have unfavourable impacts on profits and levels of productivity. In their totality these costs result in an under-utilisation of existing productive capacity and production inefficiency. These estimates, however, fail to reflect a more important feature of infrastructural deficiency; namely dynamic long-term costs.

Aschauer (1989) and Canning (1999) has conducted studies on U.S. infrastructure, and Reitveld (1989) has surveyed studies of infrastructural impact in Europe. The consensus emerging from these studies is a positive correlation, but for numerous reasons, their conclusions are far from robust. For example, even when efforts are made to identify the direction of causality, the results are often inconclusive because of other econometric factors (Lee, 1996). In addition the variables chosen are often too

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<sup>8</sup> See Kamel (1994) who investigates the role of Egypt's Information and Decision Support Centres (IDSC) in supporting the policy-making capabilities of local governors.

aggregated to allow meaningful policy recommendations, and little attention is paid to the efficient utilisation of the infrastructure under examination. An infrastructure's linkages to an economy are multiple and complex, because it affects production and consumption directly, creates many positive and negative externalities, and involves large flows of expenditure. Nowhere is this truer than in the telecommunications sector.

In light of the increasing integration of the global economy and the simultaneous economic opening up of many developing countries, telecommunications is now recognised as a fundamental requisite of any national or large-scale growth project in the developing world. As one of the few industries that cuts across and integrates social and economic activities, telecommunications holds a strategic position in the building of a dynamic and flexible national economy. The sector is central to the national and international flows of capital and commerce (Kiplagat and Werner, 1994; Labelle, 1995; Saunders et al., 1994). This is especially true in light of the merger of communications technologies and information technology that has radically transformed the role of communications technologies in the productive system.

It follows from this that the basic building block of the information infrastructure is the telephone service and the high-speed telecommunications backbone linking it internationally. A more persuasive justification for a prioritisation of information infrastructure expenditure looks at the relationship between telecommunications infrastructure and economic activity in various sectors. In this context telecommunications are widely considered to be a strategic investment that is the key to maintaining and developing competitive advantage at the level of the nation, region, and the firm. Countries and firms that lack access to modern systems of telecommunications cannot effectively participate in the global economy (Wellenius and Stern, 1994).

Acknowledging that the diffuse benefits and the sheer unpredictability of technological change make it difficult to ascertain the economic benefits to be gained from information and communication technologies, there has been substantial increase in research on the influence of information and communications on economic growth. One major hypothesis is that information and communication technologies are seen as underpinning a host of economic activities. This is supported not just by unbridled

optimism, but also by a host of studies in the field of economics that seem to justify this contention (Edirisuriya, 1995; Runge, 1985; Macdonald and Madden, 1998). These economic studies and lessons of the last 15 years are seen to provide substantial evidence at the microeconomic and macroeconomic levels that information infrastructure, and specifically telecommunications, investment yields direct and measurable economic benefits.

Mostly designed to support the planning and design process in developing countries, the underlying objective of these studies has been to justify quantitatively the economic value of telecommunications investment (Saunders et al., 1994). The economic rationale underlying these studies is that telecommunications infrastructure may be viewed as an input to a productive process, a 'factor of production' like petroleum or electricity (Saunders et al., 1994, p. 73). In their review of the literature Saunders et al. (1994) point out that one can group the economic benefits to be derived from telecommunications under four categories: market information for buying and selling, transport efficiency, regional development and coordination of international activity. They also assert that telecommunications can amongst other things:

- substitute cost-effectively for mail usage and personal travel;
- potentially increase productivity through better management in both the private and public sectors;
- remove some of the physical constraints on organisational communication in various sectors of the economy; and
- improve the efficiency of markets, allowing economic agents greater scope in responding to changes in information.

They conclude that telecommunications still appears to command a lower order of priority in many developing countries than is justified in economic terms. Communication and mass media researchers have also echoed these sentiments. Pool (1977), for example, has asserted that 'it would seem clear that international telecommunications is of great importance to the developing world. It can bring deficient information facilities at a leap up to the best, or its lack can lead to slipping further and further behind' (Pool, 1977, p. 56).

These claims are corroborated by empirical studies on the relation between economic growth and the diffusion of information and communication technologies in which the supply and demand of telecommunications has been linked to the level of economic development of a country (Jipp, 1962; Hardy, 1980; Sauders et al., 1994). Hudson (1984) asserts that there strong evidence of a positive correlation between the telephone and economic development. Hardy (1984) investigates the telephone's role as a contributory agent in economic development. Concluding that there is a positive correlation, in that telecommunications plays a crucially supportive role in economic activity. Similarly, the diffusion of information technology has been related to the development of the non-agricultural sector of the economy (Stoneman, 1976; Ayers, 1990; Bhagavan, 1997; Freeman, 1995).

Consequently, information and communication technologies are seen as representing a set of generic technologies with the potential for stimulating substantial economic growth and productivity because they are all-pervasive in their implications for industrial and economic development. As result, some researchers have made a strong case for the value of investment in these technologies as an enabler of economic development; based on ideas of information technology enhancing worker productivity and increasing the returns on other capital goods. Looking specifically at the value of information technology investments, a number of researchers argue that information technology-led development may result in or anticipate economic growth. Kraemer and Dedrick (1996), for example, in a study of information technology investment in 12 Asia-Pacific countries, found a strong correlation between information technology investment and productivity in national economies. However, they themselves admit that it does not provide 'conclusive evidence of a causal relationship'<sup>9</sup> (Kraemer and Dedrick, 1996, p. 330).

Whilst the studies cited above appear to point to a clear economic justification for putting advanced information and communications infrastructures in place, there are a few important caveats. Hardy (1980), for example, fails to specify in precisely what ways telecommunications supports economic growth; rather it appears to be a tacit assumption, an intuitive given in his research. This problem bestrides the concept of

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<sup>9</sup> See Brynjolfsson and Hitt (1993).



information infrastructure: how to effectively measure the potential impact of this recent convergence of technologies. Yet at the micro level, there is still a distinct lack of understanding as to where and when – much less why – information technology can be applied to foster economic and employment growth. The measurement of productivity linked to technology growth continues to be problematic and researchers have yet to come up with a conclusive answer to the so-called 'Solow Paradox' – computers everywhere, but little in the way of productivity gains.<sup>10</sup> This research does not seek an answer to this question, nor are any suggested, but it does echo the conclusions of Kenney (1995) who argues that, '...electronic switching and advanced telecommunications are the core of the emerging information technology. A country's ability to benefit from new information systems, through domestic and international computer networks, data communications, fax and media, for example, depend heavily on the modernity of its telecommunications network' (Kenney, 1995, p.38).

## **2.4 Neo-Schumpeterian theory**

The multiplier and network characteristics of information and communication technologies have led many to ascribe special qualities to them. Hamelink (1986) argues convincingly that they do not just represent another technology, but rather the command and control system for all other technologies. Consequently, the control of this technology is a vital component in the distribution and execution of social power. Differential access to information and communication technologies determines the capacity to collect, process and use information: a conclusive factor in decision-making (Kamel, 1994). Moreover information and communication technologies are increasingly becoming a foundational technology: more and more they represent the indispensable infrastructure for a whole range of industrial production processes.

Proponents of this opinion argue that information and communication technologies enable a multitude of activities to be done in different, cheaper and more efficient ways

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<sup>10</sup> Daniel Sichel (1998) provides an excellent analysis of the key issues. In brief, he argues that recent developments in information technology are a continuation of past trends and that caution is necessary before a nation can hope to count on a large boost to productivity growth.

and, thus, represent a new factor of production (Perez, 1983). This factor of production is seen as a chronic disturber of comparative advantage that lies at the centre of the emergence of a new techno-economic paradigm (Dosi, 1984). The impact of information and communication technology arises from three of its characteristics. Firstly, it is an enabling technology: it can be applied in a wide range of different circumstances and can itself contribute to further technological change. Secondly, the capacity of the technology has been increasing at an exponential rate for over two decades and shows no signs of abating. Finally, and most importantly, the cost of technology has fallen rapidly over the same period of time, and again seems likely to continue to do so.

Citing the influential works of Schumpeter (1939) and Kondratieff<sup>11</sup>, the assertion is that technology has provided the principle source of change for firms, regions and nations alike. Technological change is seen as driving economic growth through a cyclical process of "creative destruction", with new technologies inducing novel, more productive investments, but at the same time destroying the economic feasibility of earlier ones. Freeman argues that the global economy is now at the critical, and painful, juncture between the fourth and fifth cycles. Further, that the change from an industrial model, based on a specific techno-economic paradigm (TEP) to another invariably implies profound structural adjustments, and institutional changes:

Changes of TEP are based on combinations of radical product, process and organisational innovations. They occur relatively seldom (perhaps twice a century) but when they do occur they necessitate changes in the institutional and social framework if their potential is to be fully exploited.

(Freeman, 1987, p. 67)

According to TEP theory the current paradigm is easily identifiable and gives rise to Kondratieff-type cycles. Freeman and Perez describe the former TEP in the following manner:

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<sup>11</sup> The theory of long waves, though often credited to Kondratiev, actually has a rich lineage, with economists such as Pareto, Parvus and van Geldern all having commented extensively on the secular movements of long time series of price data, identifying such long waves (Brundenius, 1995; Mager, 1987). The renewed interest in long cycles in economic development is primarily associated with Schumpeter and the neo-Schumpeterians such as Freeman, Soete, Perez and van Duijn).

The technological paradigm which predominated in the post-war boom was one based on low-cost oil and energy-intensive materials (especially petrochemicals and synthetics), and was led by giant oil, chemical, automobile, and other mass durable goods producers. Its ideal type of productive organisation at the plant level was the continuous flow of assembly line, turning out massive quantities of identical units. The ideal type of firm was the corporation with a separate and complex hierarchical managerial and administrative structure, including in-house research and development and operating in oligopolistic markets in which advertising and marketing activities played a major role. It required large numbers of middle-range skills in both the blue and white-collar areas, leading to a characteristic pattern of occupations and income distribution...This paradigm required a vast infrastructural network of motorways, service stations, airports, oil and petrol distribution systems, which was promoted by public investment on a large scale already in the 1930s, but more massively in the post-war period (Freeman and Perez, 1988, p. 60).

Freeman argues that information and communication technologies have the capability 'to act as the basis of a technological revolution in countries aiming to catch up the world's industrial leaders' (Freeman, 1996, p. 218). But there is an explicit acknowledgement that realistically 'catch-up' applies only to a small band of developing countries that are increasingly leaving the rest behind. Fagerberg (1994) argues that while "catch-up" growth is possible, it can only be realised by countries that have a sufficiently strong social capability in investment, education and research and development. Perez (1983) and Soete (1985) point out that there is no way in which an indigenous enterprise can overcome the huge disadvantage in comparative unit costs if basic infrastructure and skilled human capital are absent, as is the case in most developing countries. More importantly the existence of a local science and technology infrastructure, and research and development efforts by local firms, are prerequisites for the efficient use of these new technologies (Antonelli, 1986; Appleton and Teal, 1999; Bezanson, 1997). The fact that the technology innovation and diffusion processes are dynamically intertwined has important implications for technological mastery in developing countries. Public policy must, therefore, be aimed at creating a climate that is conducive to national innovation.

For the purposes of the conceptual framework, the work of the neo-Schumpeterians provides an insightful explanatory framework in which to view the fundamental changes that the global economy is undergoing. It places these radical changes in a historical framework and makes a persuasive argument for the value of information infrastructure. Neo-Schumpeterian theory makes it clear that technology is no exogenous "mantra from heaven" (Dosi et al., 1988), rather, that technological change is an inherently endogenous process: technologies are conceived, developed and diffused by way of a long and costly process that is mediated by economic and social considerations.

This section has made a case for the importance of information infrastructure for developing countries. By citing economic theory and studies, it has argued that countries are disadvantaged by uncertainty arising from an informational deficiency that can be alleviated by the use of information and communication technologies. Secondly, with reference to research on the value of public infrastructure in general, and telecommunications in particular, it has shown a clear-cut justification for constructing or upgrading information infrastructure. Finally, the conceptual framework has utilised neo-Schumpeterian theory to place the current fundamental technological changes in an historical context, and show the far-reaching implications for public policy. However, like the proverbial curate's egg, the theory of long waves and new technoeconomic paradigms is good in parts and bad in others.<sup>12</sup> Neo-Schumpeterian theory offers theoretical titillation to developing countries seeking more substantial insights, based on praxis, on how to harness the potentiality of information and communication technologies. Whilst the above section has provided a theoretical justification for the importance of a well-developed information infrastructure, there are evidently some compelling challenges that Sub-Saharan Africa faces in an era characterised by the ubiquity of information and communication technologies.

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<sup>12</sup> Firstly, these changes do not lend themselves easily to economic analysis (Ayers 1990; Foray and Freeman 1993; Rosenberg, Landau and Mowery 1992). Rosenberg and Frischtak, (1984) along with others have questioned the very existence of long-wave cycles.

## 2.5 Challenges to development in Sub-Saharan Africa

### (a) Increased competition and commodity substitution

Traditional domestic markets are becoming more exposed to competition enabled by new technological capabilities. With many Sub-Saharan African countries dependent on donor assistance and foreign direct investment, the increase in the number of competing countries which may be more attractive locations due to better information infrastructures, poses a serious threat to wealth creation.<sup>13</sup> Advances in biotechnology and material science are leading to synthetic substitutes for the primary products on which the majority of Sub-Saharan African countries are dependent (Coates and Mahaffie, 1997). Prices for products such as vanilla, sugar, cocoa and palm oil have declined steadily over the last decade as Western firms have undertaken genetic research to develop outright synthetic substitutes or varieties that can be produced in their laboratories or in non-traditional environments (Wright and McManus, 1991). The concern, therefore, should be how African farmers and firms can take advantage of global opportunities and develop the necessary skills to compete. Similarly, optical fibre could virtually eliminate copper from trunk systems in the future telecommunications market. As the region that produces the majority of the world's copper, African countries will find a shrinking demand for their product. This reduction in the economic viability of traditional commodity markets may also have an impact on rural-urban migration. The rise in the application of new technologies, new production systems, and the organisation of international trade reduces the need for traditional agricultural farming. As a result there is a growing exodus from rural to urban areas. Rural people are destined to be painfully absorbed into the informal economy of already overcrowded urban centres (ADB, 1998; Castells, 1997b).

Technological innovation is also leading to efficiency improvements in the use of raw materials. The result is a long-term trend of dematerialisation in industrial production

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<sup>13</sup> A survey of 55 US corporations with investments in Africa found that the telecommunications infrastructure was ranked as the fifth most important factor in considering undertaking direct investment in Africa. Yahaya, L. (1996) *Foreign Direct Investment in Nigeria*, M.Sc. Dissertation, University of Manchester.

(Quah, 1999). This declining material intensity in production represents a new barrier to Africa's full participation in the world economy, as most African countries are exporters of primary commodities and raw materials. Complicating the situation are the challenges of globalisation and the ever-changing context of development. In the current era of globalisation and international trade agreements, African policy-makers are finding it harder to utilise public policy to protect fragile sectors and nurture infant industries. Public policy space has been severely limited, as African countries must comply with new rules. Unlike the tiger economies of East Asia in the 1970s and 1980s, African countries cannot implement strategic trade policy, which promotes export while protecting domestic firms from intense foreign competition in the local market. Africa must today comply with trade regimes which it did not participate in designing and does not have the capacity to comply with.

#### (b) The international intellectual property rights regime

Allied to this is the race to lay claim to knowledge, particularly in biotechnology, which has been accelerated by the privatisation of research and development, market liberalisation and the tightening of intellectual property rights legislation. The 1999 UNDP human development report asserts that: 'In defining research agenda, money talks louder than need – cosmetic drugs and slow-ripening tomatoes come higher on the list than a vaccine against malaria or drought-resistant crops for marginal lands', argues the report (UNDP, 1999, p. 6). It goes on further to assert that:

tighter control of innovation in the hands of multinational corporations ignores the needs of millions. From new drugs to better seeds for food crops, the best of new technologies are designed and priced for those who can pay. For poor people, technological progress remains far out of reach (UNDP, 1999, p. 6).

There are thus legitimate calls for a review of the intellectual property rights agreement under the World Trade Organisation. Despite the increasing importance of intellectual property rights, current international agreements on intellectual property were negotiated before most governments and people understood the social and economic implications of patents (Brush, 1996). As a result the intellectual property rights regime has developed with little input from many of the developing countries, which are now

feeling its impact. According to the UNDP report current patent laws pay little attention to the knowledge of indigenous people, and on what can be owned: 'The result: a silent theft of centuries of knowledge from developing to developed countries' (UNDP, 1999, p. 6).

International intellectual property legislation and control over the networks through which information flows are becoming the key sources of power in the information economy; neither of which African countries control. Multinational corporations are increasingly exploiting Africa for its untapped knowledge and reselling it back to the continent (Brush, 1996) A recent case saw US grain corporations attempting to establish "Basmati" rice as their own trademark (Kundnani, 1998). One of Africa's continuing problems is that it does not know what it does not know. Ignorance over the continent's natural resource endowments combined with the increasing sophistication of such technologies as remote sensing mean that better-informed players are patenting Africa's resources and profiting from Africa's ignorance. The global intellectual property rights regime is at the behest of such corporations and only serves to undermine the efforts of developing countries to safeguard their heritage.

### (c) Unemployment

The impact of the information economy on employment is still unclear. Some economists, such as Schumpeter and Kondratieff<sup>14</sup>, argue that any impact on employment is dependent on the nature of the jobs created, and the extent to which jobs are replaced. Information and communication technologies and electronic commerce can create new employment opportunities in a number of areas in developing countries. Service industries, such as airlines and insurance, that involve labour-intensive tasks are taking advantage of the fact that modern telecommunications networks allow them to locate these activities in lower wage regions. However, employment generation is predicated on Africa's need to create a comparative advantage in cheap skilled labour.

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<sup>14</sup> Soete, L. and ter Weel, B (1999) Schumpeter and the knowledge-based economy: on technology and competition policy, Maastricht: MERIT.

Another related issue of importance is the effect of these technologies on labour and capital productivity. As the labour displacement caused by such technologies is in fact a de-skilling at the level of the labour process, labour shortage acquires an entirely different dimension in developing countries (Cassiolato, 1997). This de-skilling arises in tandem with an increasingly desperate need for highly-skilled personnel. Thus, in order to maximise value added from these technologies, a fundamental reappraisal of capabilities is required. This calls for an increase in expenditure on human resources; precisely the opposite of what is happening in the majority of developing countries (ADB, 1998). The basic characteristics of these technologies, as outlined above, all point to an indelible fact. To use them effectively requires skills and capabilities that far exceed those received from the simple importation of sophisticated technology (Odedra, 1990a, Grant, 1996). Gaining access may be a first step, but it only leads to static efficiencies; but what is necessary are dynamic gains. These will only arise through a long interactive process of learning-by-doing, where the user-producer relation plays a crucial role.

Even if this is achieved, regions and firms are increasingly attracting talent from around the world, while leaving aside a significant fraction of their own population whose educational level and cultural/technical skills do not fit the requirements of the new production system. Silicon Valley in San Francisco, the most advanced information technology producing region in the world, is a case in point. It is widely acknowledged that this concentration of cutting-edge firms has only been able to maintain the pace of innovation by the annual recruitment of thousands of engineers and scientists from India, China, Taiwan, Singapore, Korea, Israel, Russia and Western Europe (Saxenian, 1994).

Africa is likely to suffer from a severe brain drain that stems from inadequate national universities (Appleton and Teal, 1998). India, for example, whose Institutes of Technology (IIT) are regarded as a developing world success story, continues to see one in five information technology graduates leave the country to pursue further study in the United States or England with few returning (Appleton and Teal, 1998). Such is the global demand for skilled labour that, at a 1999 training session in Holland,



Microsoft representatives reportedly hired bodyguards to fend off other recruiters.<sup>15</sup> Increasingly the poorest parts of the world may find that they are less and less relevant to the functioning of a global information economy, if their only asset is the cheapness of their labour in an era in which there is a demand for cheap *and* skilled labour (Castells, 1997b). To leverage Africa's comparative advantage in labour there is an urgent need to upgrade the skill sets of its workers. At the same time, in order to benefit from such lucrative industries as outsourcing, the existence of world class information infrastructures is critical (Heeks, 1999a).

(d) Social disruption and a loss of government control

The Industrial Revolution brought great economic and social benefit, but it also brought about massive dislocations of people, increased industrial pollution, unhealthy child labour and unsafe work environments (Crafts, 1979). Societies were often slow in responding to these negative side effects. Similarly, the increasing use of information and communication technologies may bring potential invasions of privacy, easier access by children to pornographic and violent and hate materials, more sophisticated and far-reaching criminal activity and a host of other as-yet-unknown problems. In addition, as global integration increases, governments are seeing a reduction in the scope of their powers. Governments who hope to raise financial capital on the international markets or from institutions know that there is a heavy price to pay. They must conform to a narrow set of criteria that are adjudged to increase the likelihood of healthy returns for international investors. Thus countries are discouraged from investing in social programmes as these are seen as being inflationary (Harris, 1998). Privatisation of state assets is often a prerequisite and a tight monetary and fiscal stance is seen as essential.

Unfortunately these neoliberal economic principles are often discordant with the achievement of national development objectives and the straightjacket of international finance criteria reduces the economic manoeuvrability of the developmental state. For those developing countries that stray from the mantra of neoliberalism the punishment can be swift and devastating. The 1998 East Asian financial crisis was the direct result

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<sup>15</sup> "Global demand for IT professionals reaches crisis point", *Predicasts*, 15 January 1999.

of a collapse of confidence by overseas investors in the underlying fundamentals of the region's component economies. In Thailand, for example, US\$ 8 billion was withdrawn from the financial markets in just five hours, as investors responded to perceived structural weaknesses in the Thai economy (Harris, 1998).

Moreover, commentators on the information economy have failed to ask who is best placed to reap the trumpeted benefits. Whilst African countries struggle to upgrade their communications infrastructures, the best placed are invariably those multinational corporations who can invest in high-cost research and who have access to global distribution channels (Kundnani, 1998). The structure of the information economy enhances the position of those at the cutting edge of the application of ICTs. Thus, those who stand to gain the most from the integration of global markets are economic agents, such as multinational corporations, who are finding it is easier to coordinate their cross-border activities (Sussman, 1997). This has serious implications for government control over their economic behaviour. African governments may find it increasingly difficult to monitor the financial affairs of cross-border economic agents and their impact on domestic economies. In addition government fiscal controls are becoming increasingly challenged by the development of electronic commerce and new service industries (Braim, 1998).

#### (e) Exponential Loss

According to the traditional model of international trade, comparative advantages between countries arise from differences in resources rather than differences in production functions. Yet within the information economy technological differences are a major engine of trade (Krugman, 1995). Moreover any such technological advantages will tend to cumulate rather than lessen over time, as comparative advantages in technology become self-reinforcing. Those who do not participate will suffer punitive costs. For example, people with Internet access now enjoy better consumer product-pricing opportunities than those without access. They also enjoy greater access to information. Moreover, those without access to the Internet are finding themselves penalised. Nations whose economic players don't have access to computer networks and the Internet will suffer as well. The value of not participating will be calculated at an exponential loss.

This concept of exponential loss is based on Metcalfe's law<sup>16</sup>, which is a consideration of the utility value of networks. The law states that the usefulness, or utility, of a network equals the square of the number of users. Until a critical mass of users is reached, a change in technology only affects the technology. If we take the telephone as an illustration, Metcalfe argues that one phone has no utility value, a few phones have limited value, but when telecommunications diffusion is ubiquitous a telephone becomes almost a necessity. The essence of Metcalfe's Law is that new technologies are valuable only if many people use them. A more recent example is the Internet, which exhibits Metcalfian "exponentiality" because the technology has bypassed critical mass. The concept of exponential loss represents the obverse of Metcalfe's law, and attempts to explain how countries are affected negatively by not being connected to global networks. The obverse abstract relationship can be constructed by saying the degree of exponential loss is equal to the benefits of being connected plus the dynamic costs of not being connected, divided by a time period and given an exponential value. Thus, the value of the network can be expressed as  $n^2$ . The dynamic cost of not being connected can be expressed as the cost ( $c$ ). This relationship takes place over time ( $t$ ). Therefore given these variables the relationship can be expressed as:

$$L = \left( \frac{n^2 + c}{\partial t} \right)^n$$

Where  $n^2$  is the value derived from being connected and  $c$  is the cost of not being connected in terms of worsening terms of trade, for example, and  $\partial t$  is equal to the time period. Also where the benefits of being connected to the network or  $n$  is a function of the number of users  $n_u$  multiplied by the marginal utility value added of each additional user. So that:

$$\int (n_u \times i)$$

As with every abstract theory *ceteris paribus*, or "all other things being equal", applies: namely that the benefits for developing country and industrialised country users are obviously different. The benefits for a developing country from being online are at the

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<sup>16</sup> Robert Metcalfe founded 3Com Corporation and designed the Ethernet protocol for computer networks.

same time greater and lesser than that of an industrialised country. For example, electronic mail may be more useful to an African than a European because of the unreliability of substitute communication mechanisms (assuming of course a reliable, fast and cheap connection). At the same time, the number of people that someone in Sub-Saharan Africa can e-mail are far fewer, and the available local content much less, hence the benefits of the network may be less pronounced. Also the exponential opportunity cost of exclusion may well be greater in technologically advanced countries where Internet access/skill are becoming prerequisites in certain areas.

The potential benefits of the Internet to Sub-Saharan African countries, for example, will be dependent entirely on the efficacy of the telecommunications network: how many telephones there are, how easily they can be interconnected and their reliability. How quickly a new application reaches critical mass is determined by how much it costs new users to get access to the network, since buyers will weigh this cost against the utility value of the technology at the time of purchase. The lower the initial price, the more quickly critical mass is reached. The exponential nature of information infrastructure growth has clear policy implications for Africa. Without concerted efforts to widen access to these technologies and to create an environment conducive to their growth the technological gap seems set to widen further.

#### (f) The changing public policy environment

Ndulu (1997) points out the changing global environment has irrevocably altered the model for policy-making in Africa. For example, he points to the slow but ineluctable transition from a *dirigiste* style of macroeconomic management to a more *laissez-faire* approach. This calls for more information on the behaviour of various market entities and a sounder knowledge of the efficacy of the variety of policy instruments in inducing the desired response from a wide range of actors. Consequently, over the last decade the demands for more informed and precise policy-making have increased significantly in Sub-Saharan Africa. Whether these challenges to national development in Africa come to the fore is contingent upon the ability of African policy-makers to critically examine the state of Africa's information infrastructure and economy and construct an effective policy response. Despite the weakness of the state in the majority

of African countries in the area of ICTs it must not be lulled into unrealistic expectations of the benefits that can accrue from the information economy.

## **2.6 The role of public policy**

The common strand underpinning all the above justifications for information infrastructure is that the effective utilisation of information and communication technologies throughout the economic system is not just a matter of making incremental improvements, or of extending existing capacity in a few new industries. Explicitly, it involves a major upheaval in all sectors of the economy and changes in the skill profile and capital stock (Freeman, 1996, p. 134). Freeman's work and the theories of technological change and economic growth all point to the same conclusion. The process of technological accumulation is by no means a passive, mechanistic process, but a painstaking, costly and deliberate effort on the part of successful firms, governments and nations. The main problem in such periods of paradigm change is the adaptation of the economy to change. It is here that the type of structural and institutional inertia identified by Perez (1983) is acute, and that new national policies and new regulatory regimes play a central role in overcoming it (Freeman, 1995). The ability of government and actors to constructively shape and assess technology is at the heart of a conceptual framework which makes a compelling case for the role of public policy planning in the area of information infrastructure development.

Economic history is littered with prescriptions and exhortation as to the merits of economic liberalism: the intersection of market forces, unfettered exchange rates and integration into the global economy. The underlying assumption, that the market does indeed know best, can be traced to Ricardian economics. However, as Penrose (1990) asserts, it 'neither appeals to history nor experience demonstrate its truth in a dynamic world. Where did government not play, in collaboration with local businesses and other elites, a very powerful role?' (Penrose, 1990, pp. 238 – 230) In reality few countries achieved economic success by rigidly applying Adam Smith's tenets of economic liberalism: relying on the "invisible hand", abandoning subsidies and being freely open to imports and foreign investment. The role of integration as an aspect of economic liberalism also requires careful examination. The reality is that imports and technology

may flow in with investment without achieving lasting, effective technology transfer. The juxtaposition between the ideal and the reality arises from a long chain of assumptions from which the case for economic liberalism precariously hangs.

Even in an era of downsized governments and hollow states, some functions remain important for governments to perform. The general case for government intervention in technology-related issues may be divided into three broad arguments:

1. The first set of arguments is founded on the assertion that an unfettered market mechanism is unlikely to result in the optimal resource allocation of technological activities (Cooper, 1980). In developing countries the following issues must be addressed:

- That monopolies or oligopolies exist within certain parts of the communication industry. The strong oligopoly in the production of information technology has serious implications for developing countries. It generally means that importers of embodied technologies are in an asymmetric position vis-à-vis developed nations.
- Inappropriate choice of technology may be made due to a lack of information regarding alternatives, and weak negotiating structures with suppliers of technology, which may result in unduly expensive technology transfer.
- Pressures of comparative advantage in trade may reinforce the reliance on labour-intensive production of a narrow range of basic products. Rather, considerable advantage may accrue from looking to the production of innovative products and diversifying the industrial base. As this is unlikely to happen spontaneously, the need for careful and planned manipulation of resources is clearly necessary.
- There are public good aspects to information infrastructure that will not be undertaken by the market. The market does not cater for public goods, and social welfare is increased when government intervenes to fund non-commercial expenditure such as education and resource management.
- The planning horizon of individual firms is often shorter than is socially desirable. As a result short-term planning could prevent society as a whole from planning for long-term structural shifts in the nature and input requirements of technologies currently at the development or introductory stages.

2. A second argument rests on the political economy of developing countries, the need for technology appropriate to the locale as opposed to western-oriented modes of production.
3. The third argument relates to the fear that benign neglect in a world increasingly dependent on technology, and the access to information which it brings, has serious long-term consequences for terms of trade.

Echoing these justifications for the role of public policy in the sphere of information and communication technologies are the difficulties inherent in technology transfer. One has to bear in mind the intrinsic limits of technology transfer. Despite the simple neo-classical view of technologies as simple commodities, recent research continues to suggest otherwise. Dosi, Pavitt and Soete (1990) assert that firm specific technologies are much less mobile and leaky than 'information' and equipment embodied techniques of production, thus technology innovations tend to be firm specific. They conclude that in order to fully maximise the utility value of new technologies, developing countries need to develop the capacity to produce and use them locally.<sup>17</sup>

Further empirical evidence points to the fact that the rate of technology diffusion across countries is influenced by the systemic, strong cumulative effects of "interrelatedness". The argument is that late-adopting countries, with smaller amounts of the innovative capital goods that embody the new technologies, have lower rates of diffusion (Antonelli, 1986). The reasons offered include the paucity of relevant and timely information and skills for information-based technologies, and a lack of a critical level of interrelatedness with other complementary technologies. As Kaplinsky and Cooper highlight, 'unless all, or most of the "electronic jigsaw" is in place, the systemic advantages of information and communication technologies are difficult to capture' (Kaplinsky and Cooper, 1989, pp. 7 – 8). This obviously poses obstacles for longer-run systemic competitiveness.

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<sup>17</sup> Research by McKendrick (1988), amongst others, shows how the inefficient introduction of automation in the Indonesian banking system was caused by an excessive reliance on foreign vendors of hardware who supplied neither maintenance nor the software needed for the system to function properly. This contrasted with the successful introduction automation in Brazilian banks, which jointly developed their automation systems with local suppliers who were also owned by the main banks.

Odedra (1990b) argues that very little information technology transfer is actually taking place in Sub-Saharan Africa. The five major channels of transfer: acquisition of equipment, technical assistance, education and training, direct foreign investment and licensing are not effective. She lists a number of key factors, which greatly facilitate the technology transfer process. Firstly, a widespread awareness of the value of information for development. Secondly, a level of indigenous organisational capacity for supporting the transfer process should be in place. Thirdly, a range of infrastructure improvements necessary to support the system and the services based upon them should be in place; an explicit justification for the role of public policy. Countries in Sub-Saharan Africa lack the financial resources, industrial infrastructural base, research and development capacity and requisite national institutions for formulating and implementing technology policies, all of which are the prerequisites for effective technology transfer. Nor has the region generated indigenous institutional capacity to assess whether incoming technologies are appropriate.

If the putative goal of countries in Sub-Saharan Africa is to attempt industrial "catch-up" and ape the success of their faster-growing developing counterparts, the implications are clear. Developing countries can no longer rely on low-cost labour; greater emphasis will have to be given to technological acquisition and improved quality. Highly skilled personnel are required to absorb, adopt and apply the imported technologies and industrial organisations. In addition, a well-trained workforce is required to assimilate and diffuse the new technologies and work systems.

Harindranath (1997), in his PhD thesis on India's information technology industry and public policy, points out the key role that government has played in liberalising key sectors. However, he asserts that India's policy in this area has had both positive and negative impacts on the local information technology industry. He argues that the early success of the Indian IT industry owes a great deal to the relative absence of government controls. But that government continues to restrict the growth of the sector through financial and administrative controls and bottlenecks in these sectors. For example, in a newspaper article surveying India's IT industry, Dewang Mehta, the president of the National Association of Software and Service Companies (Nasscom) points out that his organisation appealed to the Indian government for the provision of



high-speed data telecommunications links in 1991. However, such calls for assistance were ignored as [the government] reckoned [Nasscom] were smaller on the economic scale than plastic-bucket manufacturers'.<sup>18</sup> With hindsight such neglect has not stopped the Indian IT industry growing to a valuation of \$5.7 billion in 2000, with annual IT revenues forecast to reach \$87 billion by 2008, contributing 35 per cent of India's total exports and providing employment for 2.2 million people.<sup>19</sup> However, earlier government provision of suitable infrastructure may have allowed the industry to grow even faster.

It is clear that in such regions government should act as a facilitator by creating the necessary infrastructural support for the growth of knowledge-based industries. The Indian government now has ambitious plans to diffuse information infrastructure throughout the country, including plans to provide 86, 000 villages with video and Internet facilities linked to educational centres. In a survey of Sub-Saharan Africa, Harindranath (1997) goes on to assert that it is not just that African countries lack effective national strategies for information infrastructure development, but that most countries continue to take a decidedly negative stance towards this sector. Allied to these issues are legitimate concerns over the role of development agencies in encouraging the use of ICTs that have tended to benefit affluent urban residential users over their rural counterparts. Sussman (1991) argues that this has led to the neglect of other telecommunications services that are primarily used by the rural and urban labouring classes. What is needed is an understanding of the ramifications of fundamental technical change that doesn't take the technological imperative for granted.

## **2.7 A theoretical justification for the role of public policy**

The idea of a technologically determined information revolution, with serious social implications, has been a consistently recursive topic both in the academic and popular press. Many authors have pointed to similar junctures in history when new technologies have been imbued with revolutionary potential (Flichy, 1995). Yet the successive

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<sup>18</sup> Knipe, M. (2000) "Lonely cabbies spearhead the IT revolution", *The Times*, 9 March 2000, p. 19.

<sup>19</sup> *Ibid.*

failure of these technologies in no way appears to have diminished the appetite for technological determinism. This popular thesis argues that technology follows an inner logic and proceeds down an unstoppable path, and that society is at the behest of a technological imperative (Edge, 1995). In this universe, technology is king and all that is necessary is to assess its impact.

However, as Williams (1982) and Edge (1995) point out, the false assumption is that these technologies are effective and reliable vehicles for achieving organisational change. This overlooks the often protracted difficulties in their implementation and frequent failures to deliver predicted and desired outcomes. As Mackay (1995) points out, what is striking about the notion of technological determinism is neither its theoretical validity nor its explanatory utility, but rather that it is 'the single most influential theory of the relationship between technology and society' (Mackay, 1995, p. 4).

Despite the popularity of technological determinism, it leaves unanswered the fundamental question 'what is shaping the technological changes that are having these "effects"?' (Mackay, 1995). In response, a body of work straddling disciplines as diverse as economics, sociology and politics has begun to emerge that challenges the prevailing technological determinist orthodoxy and attempts to answer this question. These studies are underpinned by a shared desire to open the "black box" of technology, and explain why technologies develop and diffuse as they do. Specifically the aim is to debunk the two popular strands of technological determinism: namely that the nature of technologies and the direction of change are immutably unproblematic; and that technology has necessary and determinate "impacts" upon economic life and society as a whole.

In response to the prevailing technological determinist orthodoxy, some theorists have argued the need to widen the scope of enquiry to more than monitoring the social adjustments necessitated by new technologies. Though from varied academic disciplines the unifying theme is that technologies are not neutral, that they do not follow a predetermined, linear path. Williams (1982), for example, describes the development of communications technologies as contingent on structural and historical forces. He argues that actors deliberately choose to invest in a particular technology for

their purposes. Further, that groups of actors that have power will choose to develop those technologies that enhance that power. He goes on to argue that every stage in the design and implementation of a technology involves conscious choices. The criteria on which these actual choices are made depend on social as well as the purely technical issues. These choices 'shape the content of artefacts and the direction (or trajectory) of innovation programmes, resulting in many potential technological outcomes with differing implications for a society as a whole and particular groups within it' (Williams, 1982).

A review of the emergent literature on the shaping of technological change reveals a multitude of factors that influence the development and diffusion of technologies<sup>20</sup>, ranging from geographical and resource concerns to the role of cultural and political factors. However, studies have tended to focus on one or more of these rather than looking at the broad picture. A more thorough approach takes the starting point as the particular social context within which technical change takes place, rather than a particular technological field. The social processes, the actors involved and their respective interests and goals are identified, and attempts made to trace their influence on evolving technologies (Mackay, 1995). What is needed, therefore, is an examination of the dynamic interaction between social forces that affect technological development and technological innovations that affect social relations. More specifically, an acknowledgement that the manner in which society shapes technology is dependent on the objectives of actors involved in the development and diffusion of that technology (Daey Ouwens et al., 1987; Rip and Van den Belt, 1988; Bijker and Law, 1992).

Whilst researchers have attempted to look beyond narrow technological questions, public policy still remains firmly rooted in a technocentric world. As a result the emphasis of research and policy has traditionally focussed on attempts to understand and predict the likely consequences of evolving technologies; so that those that are considered socially undesirable can be avoided or ameliorated. This conception of the technological given has restricted the approach of public policy to technology, to two

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<sup>20</sup>Mackay (1995) lists at least nine types of social influence on technological change: geographical, environmental and resource factors; scientific advance; pre-existing technology; market processes; industrial relations; organisational structures; state institutions and the international system of states; gender divisions; and cultural factors.

dimensions: promotion and control (Johnston and Gummett, 1979; Coombs, Saviotti and Walsh, 1992). Promotion activities concentrate on the mismatch between existing levels of technology in a country and its technological needs. The control arena looks at the externalities that arise, or could arise from technological implementation, which are deemed to be socially undesirable. The policy regimes that have evolved from these two basic approaches have generally been aimed at a fairly aggregate level. They have tended to focus on distributional issues, externalities and various perceived instances of market failure (Coombs et al., 1992).

In the control dimension policy emphasis has been placed on pragmatic responses to particular types of problem, arising from technologies, which are deemed to be socially undesirable. Prominent examples include environmental pollution, and product safety. In an attempt to reduce the negative externalities arising from these undesirable technologies, public policy has sought to penalise them, by resorting to fiscal as well as statutory measures. In the promotion dimension government intervention has sought to push favourable technologies via, amongst other measures, research and development funding and subsidisation. Both forms of technology forcing, promotion and control policies rely on perceptions of what is socially desirable or undesirable (Bijker and Law, 1992).

However, such an approach to public policy is flawed in a number of respects. An assessment of technological merits gives no indication of the interests of those deciding what is socially desirable. Moreover, this policy approach is essentially reactive, and fails to ask questions about the design, development and diffusion of the technology itself. Collingridge (1980) argues that traditional assessment of technology faces two fundamental problems. Firstly, an information problem: impacts cannot easily be predicted until the technology is extensively developed and widely diffused. Secondly, a power issue: once a technology is entrenched change is difficult and subject to significant inertia, and that technological flexibility is a solution to the problem. This essentially reactive approach traditionally focused on post hoc economic evaluations of the benefits of technologies already designed and developed. In the 1970s technology assessment research in the U.S. and Europe focused on the direct and derived consequences of technology. The overarching goal was to establish a more informed basis for public policy decision-making on the introduction of new technologies. The

decision-making processes related to technology 'were considered to be rational, sequential, and containing separate decisions; during the process, the results of technology assessment were often ascribed a decisive role' (Smits and Leyten, 1988, p. 18).

A more proactive, and therefore more effective, approach has emerged recently in the guise of constructive technology assessment. Constructive technology assessment (CTA) may be defined as a field of research which, in an anticipatory way, analyses technical innovations, calculates their consequences for the environment and for society, checks the expected results with regard to relevant values, and makes recommendations based on these studies to the responsible decision-makers. Emerging in the Netherlands in the early 1980s, it began as a broadening of traditional technology assessment to acknowledge the role of actors in the design and development of new technology (Rip et al., 1995). As *constructive* technology assessment it is designed not to prevent all innovations, but to select out of the abundance of feasible innovations, the actually desirable ones and to slow down technical development wherever it could become dangerous (Ropohl, 1983, p. 84). Technology assessment policies thus 'focus on problems of dealing with and adjusting to change. It involves in the first instance abandonment of the traditional normative goal of trying to define an optimum and the institutional structure that will achieve it, and an acceptance of the more modest objectives of identifying problems and possible improvements' (Nelson and Winter, 1982, p. 394).

The underlying assumption of CTA is that technological change stems from within the economic and social system and is not merely an adjustment to transformations brought about by causes outside that system (Bijker and Law, 1992). The goal is to develop technologies with desired positive impacts and with few (or at least manageable) negative impacts. An intentional strategy to do so would integrate the anticipation of technological impacts with the articulation and promotion of technology development itself. Thus, CTA emerges as an instrument of government policy aimed at improving the societal integration of technology and influencing the use and further development of technology. CTA intuitively bestrides two dimensions: the analytical and the normative. The analytical dimension, as outlined below, involves an assessment of the actors and interests intimately bound up in the design, development and diffusion of

technology. A key task in this dimension is the identification of the positional identities of actors, how they intervene and their relative roles in the development of the technological system (Staudenmaier, 1985, pp. 198 – 99).

Callon (1987) proposes a number of hypotheses that emerge from this viewpoint:

- Technological development results from a large number of decisions made by numerous actors.
- Technological options can never be reduced to their strictly technical dimension. Hence the design of technological options is a matter of political debate.
- Technological options bring about irreversible situations, resulting from the gradual disappearance of the margins of choice: as time goes on, choices are inexorably predetermined by decisions taken earlier. Unlike some decisions which always remain possible to revise, those that are materialised in technical commitments lead to durable imbalances and the consequent discarding of options which, with hindsight, might have been thought preferable to those actually taken.

Correspondingly these hypotheses raise a number of fundamental questions:

'(a) How do we identify the actors who take part in the process of design and adoption of technologies? In what ways do they intervene? (b) How do we explain the disappearance of alternative technological options (or of what is called technological variety)? (c) How can we account for the appearance of irreversible (or lock-in) situations?' (Callon, 1987, p. 308).

It is the answers to questions such as these that must be placed at the heart of information infrastructure planning. The policy planning process is comprised of a broad constituency of actors that form an intricate web of interaction between interest groups and organisations. These interactions underpin the shaping of new technological trajectories; what Russell and Williams have labelled 'the general characteristics of a society's technological ensemble' (Russell and Williams, 1988: 11). Dahl's (1967) interest groups approach concurs and asserts that domestic policy formulation arises out of the interaction between key interest group coalitions. The predominance of this approach in the US is based on the fact that in American

institutions, interest group coalitions – and not the state – are the central actors in policy formulation (Richardson, 1999). In developing countries, and especially in Sub-Saharan Africa, where the state is predominant, less attention has been paid to interest groups. Developing countries experience a continual reconfiguration and transformation of the political landscape, obfuscating the causal correlation between coalition preferences and policy outcomes. Yet although this makes actor identification problematic, the difficulty varies according to the scope of the subject under inquiry. With the relative absence of government and the clear roles of international organisations, non-governmental organisations and the foreign private sector it is possible to identify the actors and coalitions within Sub-Saharan Africa.

The second dimension of CTA is normative in nature and is especially applicable to the countries of Sub-Saharan Africa. This dimension seeks to ensure that new technologies dovetail with existing and future goals of social development. From this vantage point information and communication technologies should not be conceived as the starting-point for planning design, but rather as a means to an end, to achieving specific goals, in the most appropriate, culturally adapted and efficient way. In light of this dimension, information infrastructure planning adopts primarily a socio-economic view. Characteristically, it treats information infrastructure as a resource capable of being allocated, conserved and re-distributed like other elements of national infrastructure. Moreover, the concept of planning for information infrastructure is intimately bound up with the concept of development. However, the concept of development remains nebulous and hard to pin down. Rather than proposing a definition of development it is sufficient to say that a constructive technology assessment views information infrastructure planning in light of the social environment and according to national objectives. It is designed to see what specific prescriptions, amongst which technology is included, can best advance these social goals (Hancock, 1981).

In Sub-Saharan Africa, the normative perspective will invariably revolve around some pre-established objectives of "development policy", varying according to each country's needs and aspirations. There is, however, a consensus that certain developmental objectives are desirable (UNDP, 1998b):

- reducing dependence on other countries and fostering self-reliance;
- equitable income distribution, which may include an emphasis on provision for "basic needs";
- increasing per capita income;
- diversifying the industrial base;
- environmental sustainability;
- increasing employment; and
- encouraging foreign investment.

Other important issues in the normative dimension may include:

- urban vs. rural considerations;
- labour vs. capital intensive approaches;
- long range vs. short-termism;
- centrally planned vs. decentralised planning; and
- national vs. local projects.

One immediate problem with these policy aims is that they not all entirely compatible. For example, emphasising basic needs provision may retard income growth. Encouraging inward foreign investment seems likely to increase "dependence". Furthermore if we add the commonly cited aims of technology policy further contradictions appear:

- improving the efficiency of technology transfer;
- improving the efficiency of technology operation;
- broadening and strengthening the industrial base; and
- developing indigenous technology capability.

Bearing in mind the immediate contradictions in some aspects of these normative goals, it is to be expected that further application of policies designed to improve the utilisation of technologies may exacerbate these conflicts. Evidently constructive technology assessment of information and communication technologies will require management of these policy conflicts. Given the diversity of circumstances in which



different Sub-Saharan countries pursue their normative objectives, and given that even within individual countries, different sectors may have different requirements and priorities, it is clear that no one approach can simultaneously satisfy all requirements, in all sectors, in all countries. Each country or region will want to utilise the new technological and service opportunities to meet its particular priorities and needs, these objectives represent an illustration of the normative perspective which underpins constructive technology assessment. This is qualified by the analytical perspective of constructive technology assessment which recognises that realisation of these normative goals is contingent upon the capacity of the recipient economy to understand fully the complex characteristics of the technologies that flow in (Bhagavan, 1997; Odedra-Straub et al., 1995). Taking a government perspective, Rip, Misa and Schot (1995) argue that CTA offers three strategies:

- to support the development of desirable technologies;
- to regulate or "punish" undesirable technologies; and
- to influence transformations of technology that occur anyway.

Ideally all governments, especially those in Sub-Saharan Africa, would pursue the last strategy. Indeed, much of the emphasis in constructive technology assessment theory is placed on steering the development of technology from the outset. However, given the asymmetries in information and research and development capabilities between developing countries and industrialised nations this proves, at least in the short-term, unrealistic. In Sub-Saharan Africa the public policy response, in both dimensions of the control and promotion of information and communication technologies, has been weak, and more often than not counterproductive. They lack the requisite skills and, more importantly, information to conduct a thorough assessment of information and communication technologies and how to plan for information infrastructure. Yet the future social impact of information and communication technologies is uncertain. Since there are no valid scientific instruments to predict future social impact, it is necessary to make social choices about the future under conditions of uncertainty.

These uncertainties do not justify a "do-nothing" policy. Each country has a clear priority: to create an information society and an information economy that reflects its culture and needs. Developing countries should enhance the national capacity to learn,

identify areas where policy is appropriate, take appropriate action and take an active part in developing national information infrastructures. Quite simply there *are* options for developing countries in Sub-Saharan Africa. They are in a position to steer the development of information and communication technologies to suit their needs. Long-term goals should be to:

- direct the application of new technologies to promote local, regional, and national networks;
- create indigenous capacity in these new industries; and
- direct attention to cutting-edge technologies.

But before these can be achieved the interim priority must be to conduct a thorough analysis of existing levels of information infrastructure, pinpoint weaknesses and develop expertise in technology assessment. Though CTA is still in its theoretical adolescence it offers much in support of the role of public policy in shaping technological trajectories. As a school within the broader theory of social shaping, it furnishes decision-makers with analytical perspectives that can help to create a better match between technological potential and preferred sustainable futures. However, the paradigm of CTA is still under construction: analysis of cases, designing of experiments and policies, and development of specific tools have yet to be done. Within this research constructive technology assessment represents the final piece in a conceptual jigsaw that has justified the importance of information infrastructure and offered an empowering framework within which to view the role of public policy.

The arguments presented in the preceding sections suggest that a number of issues need to be addressed by policy-makers in Sub-Saharan Africa and the international community as a whole. As Freeman (1995) has highlighted, it is evident from the growing inequalities of the global economic system that countries cannot be left simply to fend for themselves. There must be an acknowledgement that countries do not begin in this prospective technological revolution from the same starting-line. The choice of technology is neither a reflection of technical necessities nor the culmination of an evolutionary struggle for competitive survival which unfolds independently of the influence of politics and society (Daey Ouwens et al., 1987). On the contrary, the diverse new forms of technology and organisations are shaped by strategic decisions

about potential markets and the historically-contingent balance of political power within societies. At these critical junctures, when technologies and institutional structures are in a state of flux, a combination of structural economic forces and political concerns will determine the future direction and shape of technological progress for many decades. As Haq (1988) highlights, a technology:

...may appear extremely attractive and tempting as a symbol of modernity, but it calls for serious examination as to whether it is appropriate, easy to maintain, efficient, cost-effective, compatible with the general level of technology and, most important, whether it is likely to help achieve the fundamental socio-economic goals of less developed countries (Haq, 1988, p. 147).

## 2.8 Summary

By recourse to theories of information economics and the role of infrastructure for national development this chapter has made the case for the importance of information infrastructure in Sub-Saharan Africa. It has avoided the simplistic polarisation of information and communication technology effects as being either benign or deleterious, but argued that it is contingent on human agency. Information and communication technologies and the infrastructural conduit through which they flow are seen less as "revolutionary" artefacts, than effective mechanisms for improving and supporting the capacity of policy-makers and economic agents in Sub-Saharan Africa. This utilitarian approach to information and communication technologies reminds us that these tools are only intermediary devices designed to facilitate the delivery or understanding of information. Finally, the chapter has presented arguments against technological determinism, which point to how actors shape technology and how governments can constructively assess and influence national technology trajectories.

In the absence of a thorough analysis of the impact of these technologies, and indigenous input into the implementation process, this state of affairs may continue with far-reaching ramifications. Long-term strategies must be formulated that make it more difficult to embark on what Mody et al. (1993) refers to as *ad hoc* purchases, *ad hoc* proposals, and the acceptance of Trojan horses as gifts. Having outlined the

theoretical contribution of constructive technology assessment, and the broader school of social shaping theory, the question arises as to how developing countries can utilise these analytical perspectives to facilitate the achievement of social goals through the use of information and communication technologies. The first goal must be to recognise the inherent complexity involved in the information infrastructure planning process. The creation or upgrading of information infrastructure involves an in-depth understanding of the cultural, economic, technological and social dimensions particular to each locale. Therefore a contextual analysis is necessary to better understand the politics, practices, and impact of changes as they are experienced by various nations.

## **CHAPTER 3**

### **National Information Infrastructure: A Conceptual Framework**

#### **3.1 Introduction**

This chapter constructs a conceptual framework, based on the arguments presented in Chapter Two, of the importance and utility value of information infrastructure for Sub-Saharan African countries. There is an explicit understanding that the development of an information infrastructure is a uniquely complex and dynamic task, involving the coordination of a portfolio of internally and externally-driven factors, actors and projects. This research argues the need for a systematic approach to the development of information infrastructure in Sub-Saharan Africa. It reviews the complex interactions between actors and the multi-faceted nature of constructing national scale information infrastructure policies in an increasingly globalised world.

The framework for information infrastructure proposed in this chapter is not designed to provide a detailed operational plan, but rather to provide an analytical perspective that facilitates effective policy-making. At the same time, it is argued that though information infrastructure policy will be dictated by country-specific issues, there are certain commonalities across Sub-Saharan Africa which allow the articulation of a generalised policy framework. The conceptual framework outlined below serves as an analytical device that facilitates an understanding of the interaction between a range of actors, issues, motivations and mechanisms. As with all new technology systems, an information infrastructure portends both significant potential benefits and serious potential problems. Some investments may result in positive economic and social returns, others may result in enormous waste. Within the conceptual framework of this research, the likely outcome is predicated on the efficacy of public policy.

This research defines information infrastructure policy as comprising the set of all public laws, regulations, and policies that affect the development and use of information and communication technologies and the creation, use, storage, and communication of information. This broad definition focuses on the institutional policies that determine the kind of information infrastructure that is created and how

the information that flows through this infrastructure is disseminated. This definition is necessarily broad and inclusive. The conceptual framework does not seek to focus on the narrow and broad definitional debates surrounding the terms "information" and "policy". Rather, it uses the term information infrastructure policy in the more traditionally employed context of public policy. Arguing for the need for a multilevel and multidimensional framework within which the role of government and public policy is paramount.

### **3.2 Information policy theory**

Ironically, at a time when the availability of timely and relevant information is increasingly becoming acknowledged as critical to national development (Madon, 1994; Kamel, 1994) there is a conspicuous absence of academic investigation in this area. There is little in the way of research on information policy in Africa; the library and information systems field aside. There is a distinct lack of accepted common frameworks, approaches and methodologies to guide the practical deployment of information policy. The available literature continues to be exploratory rather than definitive, and serves to map out the territory (Rowlands, 1996). This mapping out is hampered by the theoretical pluralism of the field. Problems abound particularly in relation to definitional constructs and the need to appropriate the right models in order to aid in the sense-making process.

If one deconstructs the concept of information policy into its two key elements: information and policy, a review of the literature reflects the theoretical pluralism evident in the field (Machlup and Mansfield, 1983; Liebenau and Backhouse, 1990). Nor is the term "policy" easily dealt with, Hogwood and Gunn (1984), for example, differentiate 10 clear definitions of the term. As Rowlands argues 'there are at least as many definitions of the term "information policy" as there are writers on the subject' (Rowlands, 1996, p. 27). Hernon and Relyea, point out that 'although the literature often refers to information policy in the singular, there is no all-encompassing policy – rather, information policies tend to address specific issues and, at times, to be fragmented, overlapping and contradictory' (Hernon and Relyea, 1989, p. 71). Within

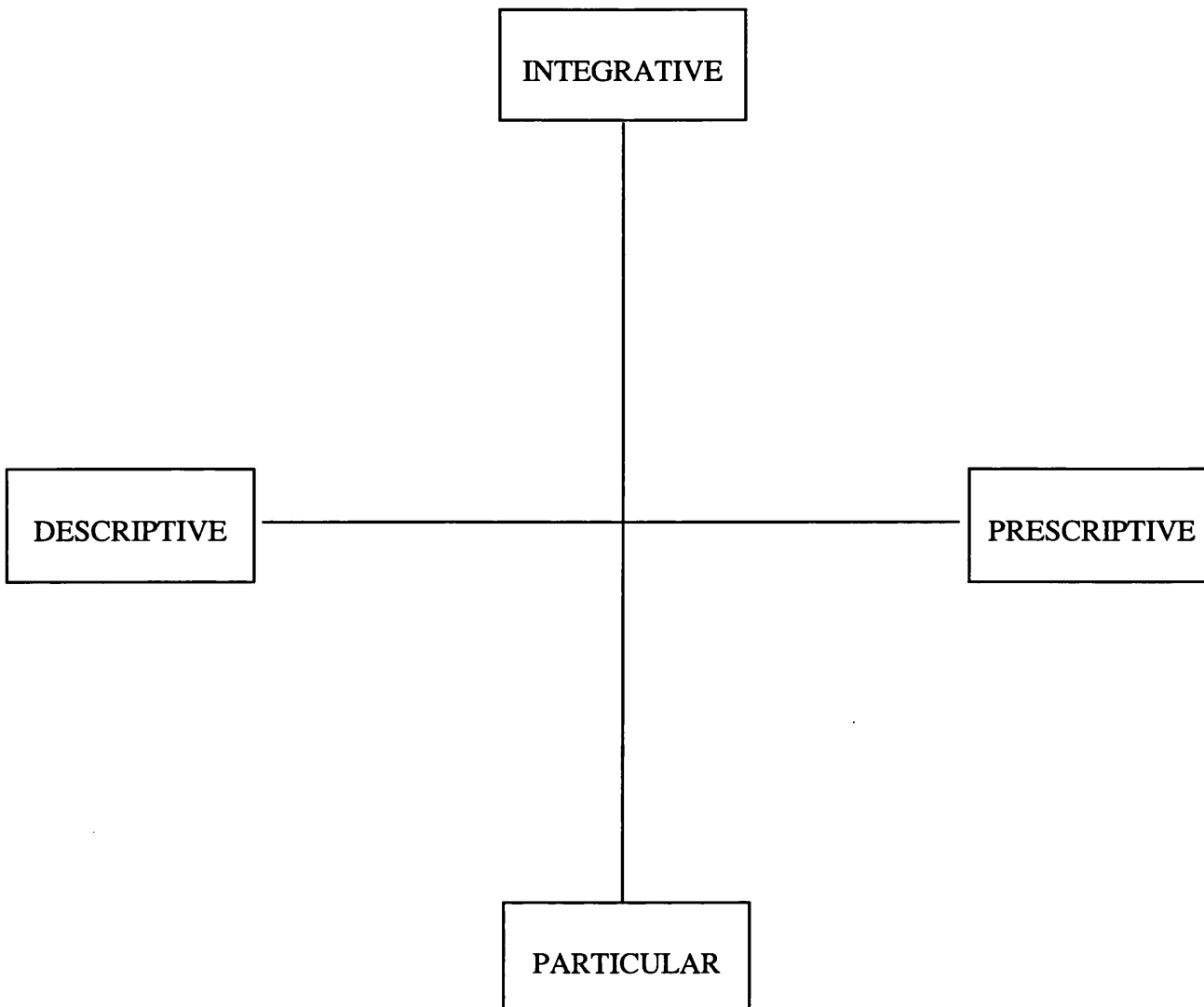
the conceptual framework of this thesis, policy is defined as purposeful action in the pursuit of predefined objectives.

The *leitmotiv* of information policy research appears to be complexity (Rowlands, 1996; Malley, 1988; Wilson, 1996a). There is also an explicit acknowledgement, that given this complexity and the breadth of information infrastructure policy, there is no ideal catch-all policy (Han and Walsham, 1993; Talero, 1996, Mansell and Wehn, 1998). Rather, information policy, and by extension information infrastructure policy, represents a compromise between competing interests; comprising an enduring conflict among or between objectives, customs, plans, activities and stakeholders. Though the lack of an academic treatment of information policy is bemoaned above, there do exist, in the social science literature, a number of models and frameworks for investigating public policy. Rowlands (1996) provides an incisive matrix based on the work of Trauth (1986) which locates the majority of contemporary research on information policy in one of four quadrants.

In Figure 2 overleaf, an information policy matrix is presented in which the vertical axis indicates the scope of the research whilst the horizontal axis indicates the intent of individual policy studies. According to Trauth (1986), research that falls into the "descriptive studies" region characteristically describe policies or highlight issues that require policy. Prescriptive policy studies, on the other hand, make a normative judgement as to what the content of policy should be. They 'explicitly set out to make recommendations and to have an influence on the formulation of policy'. (Rowlands, 1996, p. 37).

In the matrix, the horizontal axis represents not only the breadth of the inquiry at hand but also the degree to which the research incorporates elements from different disciplines. Trauth (1986) argues that the scope of the literature on the policy formulation process veers between research that can be characterised either by being integrative or particular studies of the policy process. "Integrative" policy studies take a broader approach and are commonly multidisciplinary in outlook, while particular approaches tend to focus only on one area, public policy, and remain within a single academic discipline.

**Figure 2: Information Policy Matrix**



Adapted from Trauth (1986)

Trauth (1986) came to the conclusion that what is urgently needed is more practical research into the policy formulation process. Research that is located in the upper right hand of the matrix, and that is both prescriptive and integrative and that focuses on the immediate needs of policy-makers. This is the approach of this research. It does not seek to create frameworks and methodologies for understanding information policy and how it comes to be; rather, the explicit intention of this research is normative: to create a framework that provides recommendations for what national information infrastructure policy should be in Sub-Saharan Africa. In this respect the research is inclined more towards the practical rather than the theoretical. It seeks to answer a

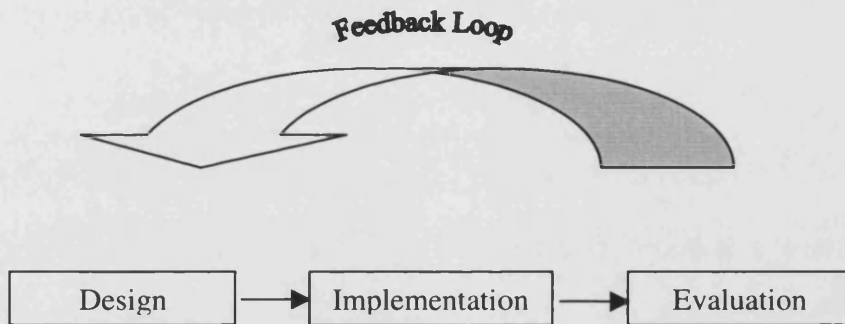


specific set of questions, by creating a practical policy construct that pinpoints priority areas for information infrastructure construction in Sub-Saharan Africa.

By conceptualising policy as a process rather than an event or occurrence we can better understand and influence the process of policy creation. Lasswell (1977) asserts that the policy formulation process lies along a continuum, as show in Figure 3, that can be divided into three sequential phases:

- Design
- Implementation
- Evaluation

**Figure 3: The Policy Formulation Continuum**



As we move from left to right the issue gains recognition as an area for public action and an agenda is set. At this stage various actors conspire to shape the appearance of the problem and ultimately determine the agenda and policy approach. The final stage of the design stage is the creation of specific policies which actors assume will lead to a desired outcome. The policy formulation process then shifts to the implementation phase, with an assignment of roles and responsibilities and actual policy implementation. Next, the process moves into the evaluation phase, wherein the policy or group of policies are monitored during their duration and evaluated at their culmination. However, such a continuum applies to static *ad hoc* policy-making. What is lacking from the above conceptualisation of the policy process is the all-important feedback loop. This has traditionally been the problem with policy-making in Sub-Saharan Africa: the discontinuity of public policy.

Since Lasswell's (1977) "simplified stages" model of policy development there have been various theoretical reinterpretations of how policy is formulated. One such approach argues that policy development is based initially on the achievement of an ideal state. In this approach policy-making occurs in a vacuum, unaffected and unsullied by everyday realities, conducted by rational actors. Policy options are selected almost scientifically, based on cost-benefit analysis, and are arrived at by a rational decision based on the information at hand. Writers such as Trauth (1986) and Lindblom (1959) assert that firstly ideals are articulated, and then policies sought to rationally achieve them. This theoretical model is simplistic and reductionist in a number of ways. Firstly, actors rarely see their behaviour as irrational; thus rationality is often a subjective concept. Secondly, in reality the policy process is a far less "rational" and murkier process based far more on compromise and conflict resolution than the achievement of ideal states (Mintzberg, 1983). Nevertheless, the rational actor model offers much theoretically to analyses of policy-making by what it purposely neglects.

Another important approach is the bureaucratic imperative model. This approach argues that at the outset of policy formulation the rational actor approach is often in evidence. That is to say that policy-makers begin with the best intentions and highest ideals of how their policy will achieve a particular objective. However, these objectives must be channelled through the prism of bureaucratic structures, which inevitably distort the final policy product. Burger, for example, argues that:

Any policy that is to be implemented by a bureaucracy must be transformed in such a way that whatever the intent of the policy-makers about the implementation of the policy, the bureaucratic rules of the implementing organisation will be more powerful (Burger, 1993, p. 19).

Within this perspective policy-makers are more prone to short-term "fire-fighting" rather than the systematic achievement of long-term goals. Public policy tends to be reactive rather than pre-emptory; a response to the emergence of new technologies and that tends to be technology-driven.

Given the inherent complexities of trying to macro-manage competing interests, policy-makers often operate on a pragmatic basis and adopt a flexible and conservative stance. Rowlands (1996) sums up this approach as the 'art of the possible'; ends become subservient to the means available. As a result, the policy process is characterised by cautious incrementalism. It contrasts significantly with the rational actor approach in that ideals are subverted by the reality of the sub-optimality of public bureaucracies. Despite their contrasting perspectives both the rational actor and bureaucratic imperative models assume an underlying linearity in policy-making. In spite of the locus of power, the policy process is marked by its journey through a series of stages. A third interpretation challenges this assumption.

The "garbage can" model is adapted from an idea proposed by Cohen, March and Olsen (1972) and further developed by Kingdon (1984) who argues that policy-making is, '... a primeval soup [in which] ideas float around, confront one another and combine. The soup changes in a process of natural selection, survival, demise and recombination' (Kingdon, 1984, p. 87). In the garbage can approach, policy-making is characterised first and foremost by chaos and dynamism. Unlike the rational actor approach, which tunes out the background noise, the environment in which policy is formulated is the key to understanding policy outcomes. A generalised view is that the environment is constructed on shifting sands, comprised of mobile and fluid strategic alliances amongst concerned parties and government. Each actor or group of actors pursues their own agenda and the policy output is representative of their respective spheres of influence and lobbying strength. Kingdon (1984) identifies three sets of characteristics that fuel the non-linearity in the policy-making process:

- problematic preferences in the early stages of the policy-making process make it difficult for the individual participants to grasp what their preferences are, these may have to be "discovered" as the process unfolds and as more information becomes available;
- unclear technological trajectories ensure that individual participants in the policy-making process may not necessarily fully understand the needs and goals of the organisations they represent; and

- fluid participation in the composition of the participants in any large scale decision-making process may change over time. Dominant actors may lose their power and weaker players may move ahead.

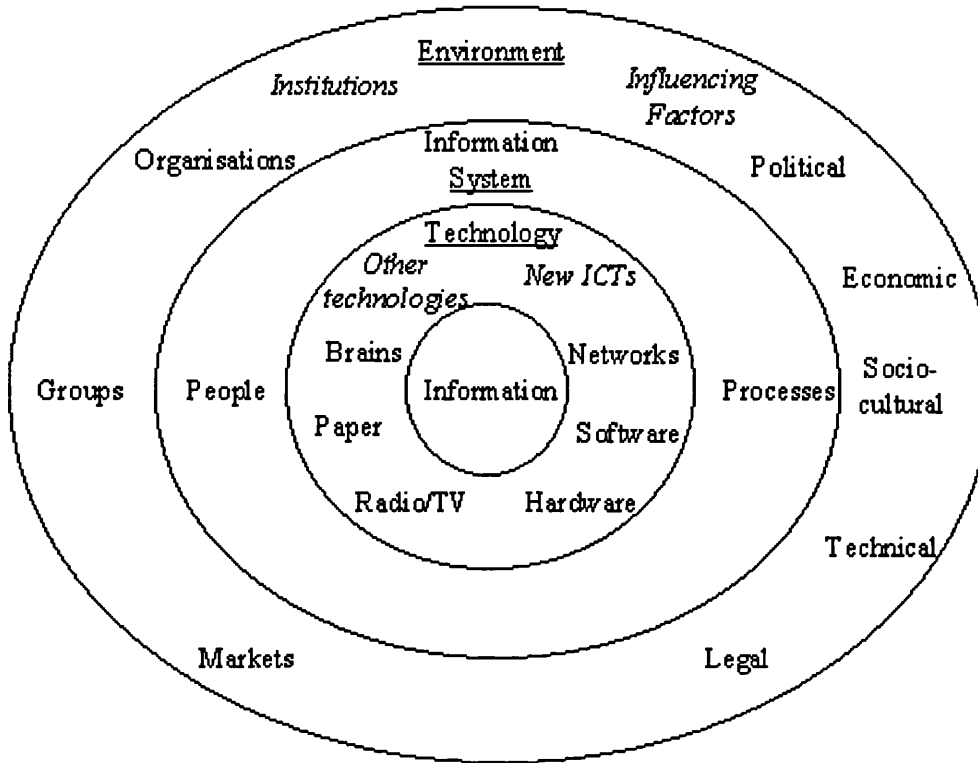
Thus according to Kingdon et al. this model sees policy-making as an asymmetric process typified by bargaining amongst actors. This model is actor-centric rather than process-centric, with networks of actors emerging and acting strategically as "policy entrepreneurs", taking advantage of temporary windows of opportunity (Rowlands, 1996)

### **3.3 Implications for information infrastructure planning in Sub-Saharan Africa**

Having outlined the theoretical concepts surrounding information policy, the question arises as to the implications for national information infrastructure policy formulation in Sub-Saharan Africa. Information infrastructure planning remains very much an emergent phenomenon in both industrialised and developing countries. However, many of the principles underlying policy planning in this area have developed from communications planning. Mowlana (1990) defines communications planning as 'systematic, institutionalised principles, norms, and behaviour that are designed through legal and regulatory procedures and/or perceived through historical understanding to guide formation, distribution, and control of the system in both its human and technological dimensions' (Mowlana, 1990, p. 16). This definition complements constructive technology assessment theory because it points to an analytical framework that acknowledges the role of policy-planners in shaping the development and diffusion of technology (Bijker, et al., 1987).

Conceptually there are two distinct elements within an information infrastructure: information and the technological conduit through which it passes. According to Heeks (1999b) an information infrastructure is also composed of two further elements: processes of purposeful activity and people to undertake those processes. This research asserts that information infrastructure can only be understood and manipulated in the context in which it operates (Madon, 1993; Odedra, 1993). It exists within an environment of institutions (organisations, groups, markets) and of influencing factors

(political, economic, socio-cultural, technical and legal). Grant (1996), for example, highlights the significance of 'macro-contextual and organisational factors on information systems capability building' (Grant, 1996, p. 4). Heeks presents this milieu as in Figure 4.



**Figure 4: A Systemic View of Information Infrastructure**

Source: adapted from Heeks, 1999b

From this diagram it can be seen that an information infrastructure sits within an environment or system comprised of institutions and influencing factors. This systemic approach seeks to take a holistic view of information infrastructure development (Kelly, 1998). Heeks omits to mention that national information infrastructure development is also influenced by international and regional factors. These cross-cutting layers affect every aspect of information infrastructure planning and must be taken into consideration at all times. The information infrastructure itself is comprised of a number of layers beginning with human resources and processes. Next by the technologies, both traditional and modern, that act as conduits for the ultimate purpose of an information infrastructure: the information it provides.

This multidimensional model shows the complexity inherent in coordinating the creation of an infrastructure that is contingent on so many different actors and processes. Given this complexity the best approach to clearly articulating a strategy for information infrastructure construction is to take a sequential approach: beginning with the national planning process and culminating with international considerations. Whilst there is an explicit acknowledgement of the importance of the crosscutting nature of international and regional concerns. To preserve conceptual clarity the approach of this chapter is to take each level in turn.

### **3.4 Information infrastructure planning at the national level**

The first stage in the information infrastructure planning process must be a conceptual understanding of the problems at hand. There is no such thing as a standard outline for an information infrastructure strategy, and given the number and diversity of the countries in Sub-Saharan Africa, there is no single "one size fits all" solution. As Han and Walsham state, 'to imitate existing national strategies can only lead to major weaknesses in any systems' (Han and Walsham, 1993, p. 34). Rather, the creation and direction of public policy is affected by cultural ideologies (Porat, 1977, Hofstede, 1991; Fallows, 1996). The alignment of cultural norms and technology policy may play a significant role in shaping information infrastructure policy. This is especially true in Sub-Saharan Africa where cultural norms are deeply embedded.

Obijifor (1998) asserts that information and communication technologies in Africa can be categorised in terms of urban and rural forms. The urban kind of communication corresponds most closely with those found in industrialised countries, namely modern communication delivery mechanisms such as the telephone and mass media. However, for the vast majority of Africans the traditional information and communication channels are the norm. Examples of rural communication tools include tribal drums and community leaders, the marketplace, religious establishments and drinking spots. Ugboajah (1985) asserts these traditional sources of, and delivery mechanisms for information in Sub-Saharan Africa are widely used because they are considered to be authentic and reliable and because they allow face-to-face interaction and opportunities for immediate feedback.

Taking this viewpoint on board writers have argued that the "African conception" of communication is different from mainstream western perceptions (Obijiofor, 1998, 1998; Grant, 1996; Ugboajah, 1985). However, this is only true to an extent. What should be taken from discussions about the "African" conception of communication is not its special character, but rather that in the absence of a modern, pervasive and reliable communications systems, rural inhabitants will continue to rely on tried and tested methods of information gathering. The African conception of communication is no different from that of western societies in that Africans prefer to get their information from trusted sources or failing that "the horse's mouth" (Ugboajah, 1985).

The traditional mechanisms for the communication of information in rural areas are limited in their effectiveness and should be supplanted by a gradual introduction of more modern information and communication technologies. However, traditional information and communication delivery mechanisms must be respected and if an information infrastructure is to be truly national, then they must be used as a means of informing the rural population of the need to "upgrade". Ugboajah (1985), in an analysis of rural communication in Nigeria, cogently substantiates this point by pointing out that traditional rural information communication mechanisms occupy an important position in the diffusion of messages within the belief systems of the rural audience. Further, that these traditional mechanisms are:

...respected and revered [and are] perceived as authoritative and credible...it is important that [their] role in the communication of rural change be recognised by those in charge of reaching the village audiences by more 'modern' means (Ugboajah, 1985, p. 16).

The implications of this are that national culture and demographics are critical factors in information infrastructure development. In an incisive paper on the role of national culture in information infrastructure planning, Garfield and Watson (1998), utilising a cultural classification model developed by Hofstede (1991), argue that Sub-Saharan African societies can be classified as hierarchical and high power distance societies. The Sub-Saharan African organisational framework is seen as "familial". In this organisational mode information infrastructure development is the result of supply push rather than demand pull, with government sponsoring the development of a network or

heavily regulating its competition and use. In such societies, where there is an unequal distribution of power resources, Garfield and Watson (1998) argue that policy-makers within this organisational model will design the information infrastructure playing field and applications that serve national objectives. Whilst there is an explicit acknowledgement that each country's cultural and demographic composition will impact on the information infrastructure planning process, it is possible to identify some generalisable planning guidelines.

### **3.4.1 Planning principles**

There are principles that should be common to all information infrastructure planning exercises. Hancock (1992) asserts that the key principles are that:

1. Planning should be contextualised: at whatever level it is pitched, it should attempt to treat a coherent spectrum of social, cultural, technical and economic concerns.
2. Information and communication technologies should not be perceived as the starting point, but rather as a means of achieving specific goals, in the most appropriate, culturally adapted and cost effective way available.
3. The information infrastructure planning process should be democratic and broadly representative.
4. The process should systematically include within its parameters the needs of users, and ensure their representation to the maximum extent possible within the planning environment.
5. Planning should have a sound conceptual base, drawing on external or traditional models only after analysing their appropriateness and relevance to the planning environment.
6. Planning can only be undertaken effectively if it places emphasis upon access to the best research and information base available in a given environment.
7. Information infrastructure planning should be organised as an evolutionary process, capable of learning from its own practice and application.
8. Evaluation and monitoring are integral to all stages of the planning and implementation process.
9. Information infrastructure planning should avoid prematurely closing off strategic options.



There are also fundamental premises underlying the methodology for the formulation, implementation and operation of a national information policy. Such national policies are required to ensure:

- the harmonious implementation and operation of information resources, services and systems (e.g. timely access to relevant information for varying needs of users) throughout the society;
- coordination and compatibility of the overall national information system and better complementarity and compatibility between the various legislations concerning the provision of information; and
- more effective participation in regional and international information systems and services.

From a review of the literature (Talero, 1996; Wilson, 1996a; Ohojah, 1995; Odedra-Straub et al., 1995; Odedra, 1993) it is also possible to identify six components that are desirable for information infrastructure planning in Sub-Saharan Africa:

1. A portfolio of investment projects to develop and put in place the information infrastructure. Intuitively, this portfolio would consist of projects to expand the telecommunications network and projects to deploy the strategic information systems that the country needs for its developmental priorities.
2. A set of policy and legal reforms to create an environment conducive to information infrastructure growth. Examples include public information policies that protect investment, intellectual property, and individual privacy.
3. A strategy for development of human resource capabilities in information and communication technologies, through appropriate education and training policies and institutions.
4. An agreement on responsibilities for implementation, financing, regulation and participation.
5. The need for information infrastructure institution-building.
6. The importance of fostering a local ICT culture.

Having identified the premises and the key components underlying the information infrastructure planning process, the next task is to delineate the necessary stages in the

planning process. These stages are by no means static but rather should serve as general steps through which policy-makers should pass in order to optimise their understanding of the issues at hand. The mercurial nature of technological change necessitates policy dynamism and the application of a certain degree of "fuzzy logic"<sup>21</sup> to some policy aspects while maintaining some policy rigidity:

- (a) A review of existing facilities and services in the information infrastructure.
- (b) Identification and analysis of current actors and activities in the information infrastructure.
- (c) Needs assessment: An analysis of present and future needs in the various sectors of information infrastructure.
- (d) Strategy formulation.
- (e) Assignment of roles and responsibilities.
- (f) Evaluation, reappraisal and research.

There must also be an explicit recognition that information infrastructure planning does not take place within the national vacuum, but rather it takes place within and is affected by a regional and international context.

#### **(a) Review of existing capabilities**

Both the review of existing facilities and identification of actors and activities within the current information infrastructure are closely linked stages and collectively can be seen as part of the crucial sense-making process. The first stage necessitates, as it were, a stock-taking exercise of the current condition of the information infrastructure. Evidently the information infrastructure in developing countries places the emphasis on more traditional methods of information delivery and retrieval. However, as stated earlier, this research concentrates on information and communication technologies. Thus the elements of the information infrastructure that policy-planners should focus on are those listed below. From a review of the literature (Melody, 1996; Kahin and Wilson, 1997) it is possible to identify a consensus on the foundations of an information infrastructure based on information and communication technologies:

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<sup>21</sup> See Kosko, B. (1993) *Fuzzy Thinking: The New Science of Fuzzy Logic*, New York: Hyperion.

- Telecommunications
- Information Technology
- Content
- Applications
- Human resources
- Regulatory and legislative framework

This stock-taking exercise will involve: (a) a review of existing capabilities in all the above areas and (b) the activities of identified actors in the areas above. The importance of these preliminary exercises cannot be overstated. It is the foundation on which all other decisions will be built. Designed to create an information infrastructure profile, this exercise requires detailed information on each of the above categories. For the telecommunications network, for example, necessary information will include, *inter alia*, traditional measures of network capacity such as teledensity, as well as more dynamic measures which capture the growth of wireless communications. The assessment of public policy towards these components of information infrastructure is also of crucial importance.

#### **(b) Examination of actors and activities**

This is primarily envisaged as involving an examination of the actors identified and their current influence on the development and diffusion of information and communication technologies. This framework is first of all designed to indicate a universe of actors, and their spheres of influence. Following the analytical perspective of constructive technology assessment the identification of actors is crucial to the development of effective public planning. A preliminary list of the main actors in information and communication technologies development in Sub-Saharan Africa is listed below. This list is in no way exhaustive and should be taken only as indicative of the reality:

- National government
- Domestic and international non-governmental organisations (NGOs)
- International development agencies

- The domestic private sector
- The foreign private sector
- Regional bodies
- Professional associations
- Technology institutions

Analysis would involve looking at, for example:

- **National government:** The current public policy regime in the fields of information and communication technology: an assessment of its merits or flaws. Obvious examples would include policy pronouncements, the regulatory regime, education policies, and fiscal measures.
- **International development agencies:** Identification of development assistance for information infrastructure development, the various agencies involved, objectives of projects and levels of assistance, assessments of appropriateness and sustainability.
- **The domestic private sector:** Level of indigenous capacity in the main areas of information infrastructure, and their utilisation of information and communication technologies.
- **The foreign private sector:** multinational firms and their penetration of the domestic market, supply arrangements, and influence on domestic consumption and production.

Again, the above list is only indicative of the type of analysis that should be conducted. Each country and region will doubtless have different actor configurations, and it goes without saying that any analysis must be firmly rooted in the local context. Table 1 overleaf represents a generic framework that provides a summary checklist for the consideration of policy planners. The rows identify the major actors in each sector of the information infrastructure, the resources required, the regulatory and promotional areas on which public policy should focus, the primary product and services outputs, and finally the sectoral strengths, weaknesses, opportunities and threats that public policy should address. The columns signify the key activities in information infrastructure. The supply of equipment, telecommunications network development, the

applications and value-added services run over that network, and finally the users of the envisaged services.

**Table 1: A systemic view for identifying information infrastructure development priorities in Sub-Saharan Africa**

<b>Markets/ Activities</b>	<b>Equipment Supply</b>	<b>Network Development</b>	<b>Content/ Value Added Services</b>	<b>Demand for Applications</b>
<b>Actors</b>	Telecoms / IT Media Electronics	Government / PTO Development agencies Foreign private sector	National Regional Global	Private Sector Government Households
<b>Resources Requirements</b>	Technology Capital Skills	Capital Skills Management Interoperability	Skills Marketing Management	Integration Skills Capital
<b>Policy/ Regulation</b>	Domestic capacity/ import/export Education	PTO reform/ Coordination of Foreign Aid	Access IPR Standards	Sectoral reform Skill change Transition policies
<b>Products/ Services</b>	Transmission/ Switching Terminals Software	Public Services Leased capacity Designer networks	Databases Internet Multimedia	Networks Specialised content Network management
<b>Strengths/ Weaknesses/ Opportunities/ Threats</b>	By product line By technology development By skill base	Network coverage Productivity	Local content Access Skills	Leading and lagging sectors Development goals

*Source: Adapted from Melody, (1996)*

This framework affords policy planners a holistic overview of the key components and requirements of information infrastructure development. Being actor-centred it is compatible with constructive technology assessment, and provides an effective framework within which to view a host of activities. Having identified the actors and their influencing roles, policy-planners in Sub-Saharan Africa, be they national polity's

or international coalitions, can begin the assessment and coordination of a portfolio of activities that were perhaps hitherto disconnected, contradictory or even superfluous.

### **(c) Needs assessment**

Having analysed current indigenous information infrastructure capabilities the next step is to undertake an assessment of needs, to pinpoint areas of weakness and to formulate a long-term strategy for development of effective information infrastructure. Again, Table 1 provides a useful analytical framework for policy planners, assessing country requirements in terms of priorities. Information infrastructure planning should hinge on a "hierarchy of needs" approach that clearly prioritises the component elements of information infrastructure in terms of necessity. For example, extending basic telecommunications services to a greater percentage of the population is a fundamental need, as is increasing awareness of information technology. This stage echoes the normative dimension of constructive technology assessment, and will involve a clear articulation of societal goals that can be facilitated by information and communication technologies.

### **(d) Strategy formulation**

Once a country has gone through an exhaustive examination of its existing facilities and has assessed its hierarchy of needs, the next stage policy-makers must engage in is strategy formulation. This process of strategy formulation also involves the articulation of a national information infrastructure vision. It is not sufficient for developing countries to jump on the "information revolution" bandwagon and announce ethereal plans. Rather, a vision is the fruit of a process of labour that strategically plans the most effective method of creating national information infrastructure to further developmental objectives. Many developing country policy-makers have fallen in to the trap of articulating where they would like to be in 20 years' time, whilst forgetting the reality of where they are now. The articulation of an information infrastructure vision will inevitably involve the creation of strategic goals and target dates around which to rally the energies and resources of stakeholders.

Specifically this would involve the identification of a portfolio of investment projects to develop and put in place the information infrastructure. Intuitively, this portfolio would consist of projects to improve the quality and extent of the physical infrastructure, and a set of policy and legal reforms to create an environment conducive to information infrastructure growth. The portfolio should also include a strategy for the development of human resource capabilities in ICTs, through appropriate education and training policies and institutions. There are a variety of approaches to strategy formulation that are being taken by countries. Table 2 presents two main strands in national information infrastructure formulation which have emerged: a conceptually useful dichotomy of a top-down and bottom-up approach to information infrastructure strategy formulation (Talero, 1996; UNECA, 1995; OECD, 1996).

**Table 2: Approaches to Strategy Formulation**

<b>Top-down Approach</b>	<b>Bottom-up Approach</b>
Identification of the strategic opportunities and needs for information and communications in the economy.	Development of an inventory of the NII-related projects currently being advanced throughout the economy.
Definition of the strategic investments needed in information infrastructure to facilitate the achievement of pre-determined development priorities.	Examination of portfolio of projects to assess their rationale and development impact. Seek concrete development impact and timely completion.
Formulation of strategic goals and target dates for the NII.	Agreement on reforms needed to eliminate constraints to successful completion and sustainability of strategic projects above.
Agreement on reforms needed to eliminate constraints to development of information infrastructure and to ensure successful completion and sustainability of strategic investments.	Assessment of the knowledge and skill gaps that threaten successful implementation of the strategic project portfolio and formulation of remedial policies.
Determination of responsibilities for implementation and regulation	Determination of responsibilities for implementation and regulation.

*Source:* Adapted from Talero (1996)

Both are, evidently, simplifications of myriad combinational possibilities, and are not mutually exclusive. The bottom-up approach is common in countries with already well-established information and communication technologies industries, and where the focus has been on private-public partnerships that divide roles between innovation and regulation respectively. The United States has typified the bottom-up approach; the private sector is seen as the engine of information and communication technology innovation and growth, whilst government is expected to play a more regulatory role (Kahin, and Nesson, 1997).

The top-down approach, on the other hand, may be more appropriate in countries without an embedded infrastructure and where the paternal state is still very much in evidence. It was the approach followed by Singapore, Korea, China and Mauritius and is also being followed by the majority of developing countries (Kahin, and Nesson, 1997; Liebenau and Harindranath, 1998). Elements of the two approaches may of course be combined, and in fact it is rare that countries follow one exclusively. This research asserts that the most appropriate approach to information infrastructure planning in Sub-Saharan Africa is a participatory top-down approach. "Top-down" in that the state is seen as the prime mover and coordinator of activities, and "participatory" to ensure the key element of the bottom-up approach: the broad involvement of a host of affected parties.

Echoing the top-down/bottom-up dichotomy, Okut-Uma (1991) asserts that governments can pursue an implicit or explicit approach to policy formulation. An explicit approach sees government as an active driving force in information infrastructure policy that mirrors the top-down approach explained above. Countries such as Malaysia and Singapore have elected to follow such an approach. An alternative is the implicit approach in which government is also an active participant, but works under the aegis of combined informal coordination mechanisms. Examples of such implicit policies include import restrictions on IT products, government procurement agencies and computer committees (Odedra, 1993) which are all common within Sub-Saharan Africa. The conceptual framework of this research asserts the importance of policy-makers pursuing an explicit, top-down approach to information infrastructure development.



### **(e) Assignment of roles and responsibilities**

Countries have also differed widely in their determination of the roles and responsibilities for strategy implementation. For countries such as Singapore, the Scandinavian countries and Japan the strategy has been top-down, with government as the executing agency. Other countries, such as Canada and Australia have delegated the task to an advisory coalition of parties likely to be affected. Countries with advanced communication infrastructures and an independent private sector, such as the U.S., have tended to combine both approaches, drawing upon the experience of appointed advisory bodies such as the National Advisory Council, whilst retaining responsibility within a government task force.<sup>22</sup> For the Sub-Saharan African region the dominance of the state indicates that, in the main, responsibility lies with government. Yet the complexity of the information infrastructure development and coordination process requires a broader coalition of responsible parties. Given the information intensity of the information infrastructure planning process and the general weakness of the developmental state in Sub-Saharan Africa, development of the national strategy is best done through a broad-based participatory process. The complexity and importance of the task at hand necessitate a broad coalition of interested actors all pulling in the same direction. The following groups need to be represented in formulating the strategy, for the reasons given:

- the government usually needs to mobilise other stakeholders to participate, organise and often lead the preparatory work, and of course play a central role in actual strategy formulation, as a policy-maker and regulator;
- the demand side of the NII, including the productive and service sectors, as well as sectoral ministries of government;
- the private sector, both supply and demand sides, which will need to provide the bulk of the investment and of the technical expertise needed to deploy the national information infrastructure;
- non-governmental organisations who have increasingly important roles as providers of services in society, particularly to the poor;

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<sup>22</sup> The Bangemann Commission of the European Union (Bangemann Group, 1994).

- researchers in science and technology for the provision of knowledge and expertise in their fields; and
- international experts from the private sector or from international development agencies, who will play a crucial role. With access to timely and relevant information plus expertise in the technological field, it is hoped that they can contribute a non-partisan perspective which has at its core the achievement of societal goals. Moreover, they can help to negotiate better terms and conditions for developing countries in the global information infrastructure.

#### **(f) Evaluation, reappraisal and research**

A final area of action-oriented policy planning involves a constant evaluation and reappraisal of the information infrastructure planning process. Given the pace of technological change and innovation in the area of information infrastructure, public policy must be flexible. Policy monitoring and continuous feedback and reappraisal will aid in this process. Policy-makers should have the authority to alter infrastructure plans in the short-term whilst maintaining overall policy consistency. Allied to this is the need for research in line with the principles of constructive technology assessment. That is studying the shaping of technological trajectories from their inception. By influencing the types and forms of technology that are developed Sub-Saharan African countries can attempt to ensure the development of "desirable" and appropriate technologies.

### **3.5 Information infrastructure planning at the international and regional level.**

There is also the need to take into account the international dimension when planning for information infrastructure. In an era of increasing globalisation no country can continue to isolate itself. Quah (1996) talks about the economic implications of the ongoing dematerialisation in economic activity. Economic value is now embedded in bits and bytes as opposed to concrete, leading to the 'growing weightlessness of GNP. Dematerialised economic value cannot respect geographical, physical or national boundaries' (Quah, 1996, p. 7). From the practical point of view, the massive investments required in communications systems, and the economies of scale in them,

mean that few countries can have an efficient information infrastructure all to themselves. This raises important questions about whether African countries will be able to overcome the financial and technical obstacles that hamper their access to digital technologies. Since reducing the ICT gap requires a major financial effort, one central concern is whether the international community is ready to provide the massive investments needed for the renovation, upgrading and expansion of networks in developing countries.

It is essential for all societies to understand that planning for the adoption and deployment of information and communication technologies can no longer be a purely local affair. Global negotiations such as the recent Uruguay Round on multilateral trade, and international institutions like the World Trade Organisation, have enormous impact on national planning. Therefore, developing countries must participate more forcefully and effectively in these institutions, basing their actions on greater policy coordination. But 'the G-77<sup>23</sup> lacks a research facility or a permanent secretariat, and is unable to carry out long-term planning or strategizing for international meetings and negotiations' (Khor, 1995, p. 18). Without policy coordination, 'many developing countries do not obtain a fair share of the benefits of globalisation, and some actually suffer net losses' (Khor, 1995, p. 16). Information infrastructure development therefore requires a broad set of governance principles to be accepted in order for them to be able to operate in a stable environment. This is increasingly the case when control and use of information and communication technology applications, such as electronic commerce, take on an international dimension. National information infrastructure, to an extent, will be linked to the global information infrastructure and will run on protocols decided internationally.

There are a growing number of organisations operating at the international or regional levels whose role it is to set the "rules of the game". Some of these organisations, like the ITU, have been in existence for some time. Others are of a more recent vintage and reflect the growing private sector involvement in establishing the governance regime for information and communication technology applications such as the Internet. The key issues which have to be addressed include intellectual property rights, preservation

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<sup>23</sup> The term G-77 refers to those countries outside the Group of Seven (G7) economic grouping.

of the right to privacy and the security of electronic transactions. It is critical that this international dimension is not neglected, that national policy-makers keep a firm eye on the ever-changing global technological horizon.

**Table 3: The International Dimension in Information Infrastructure Development**

<b>Actors</b>	<b>Sphere of influence</b>	<b>Level</b>	<b>Mechanisms</b>
International institutions	Intellectual property rights regime, telecommunications policy, development assistance	International	Technology transfer through aid and expertise, property rights law and patents and trade agreements
Regional organisations	Telecommunications policy, sharing agreements	Regional	Inter-cooperation agreements, collective bargaining
Foreign private sector	Telecommunications and information technology infrastructure.	Local	Provision of information infrastructure goods and services

As Table 3 shows, the role of public policy at each level is vital. At the international level information infrastructure policy-makers must ensure: membership and active participation of standards committees, international intelligence, and lobbying of the international governance regime to further their interests. At the regional level: insuring cooperation between neighbouring countries, sharing of information infrastructure and cooperative agreements on centres of excellence, access to submarine cable systems, and/or satellite sharing.

### **3.6 Assumptions and limitations of the framework**

One of the biggest assumptions in the framework outlined above is that of government competency. Dosi et al. have observed that 'economic theory always assumes economic

competence' (1992, p. 208). Government intervention is normally justified in cases of market of failure, but given the weakness of the state in terms of access to information, political partisanship and public sector management we must also consider the reality of government failure. Determining the rationale for policy is closely connected to what we can reasonably expect from government in terms of their ability to collect, process and act upon available information. Katz (1988), for example, argues that government intervention may in fact be detrimental to the development of an information infrastructure in developing countries. He highlights in particular the uninformed decision making that can result in negative fiscal regimes towards the IT sector. African policy-makers can be their own worst enemies, politically driven and uninformed. Moreover, the dynamic information infrastructure strategies that African states may articulate in policy are unlikely to be matched by the rapid administrative reforms needed to support the policy. According to Peterson (1994) public bureaucracies in Africa are weak organisations whose structures are fragmented and under bureaucratised and authority is personal not procedural. He asserts that 'while the image is one of centralisation, the reality is a set of competing fiefdoms run by fiat rather than procedure' (Peterson, 1994, p. 4). Drawing on the work of Moris (1977) et al., Goran Hyden (1993) notes six attributes of African public bureaucracies:

1. Personnel relations: norms about hiring and firing are rarely enforced; recruitment occurs through personal influence and security of employment is considered a generally acceptable norm.
2. Materials management: resources tied for specific purposes are often diverted to meet urgent needs in other sectors.
3. Planning: there is a flexible attitude towards both planning and scheduling and it is generally assumed that nothing occurs quite as arranged.
4. Decision-making: organisations tend to lack capacity for organisational intelligence; ability to learn from past mistakes is limited. Decision-making techniques remain personal to the managers. The result is that organisations tend to fail in managing large-scale, complex activities that are beyond the capacities of their top executives.
5. Control: large-scale organisations tend to be divided into micro-organisations controlled by individual top managers.
6. Professionalism: managers show a marked ambivalence about technical

matters, on the one hand fearing them to the extent of non-action and on the other observing them as dramatic constraints that prevent action.

Thus there would appear to be high opportunity costs associated with government involvement: their lack of knowledge and experience, bureaucratic inertia, and their captivity to vested interests. Whereas there appears to be a clear justification of the role of public planning in coordinating and/or constructing information infrastructure, there are legitimate concerns as to the capacity of the state in Sub-Saharan African countries to do so effectively. Firstly, the legitimacy of state intervention is increasingly being challenged by the incessant rise of the neoliberal orthodoxy that has at its heart the abandonment of traditional forms of government, and the illegitimisation of the concept of the developmental state. Critics of state intervention contend that this concept is no longer credible. They point to the fact that more than 30 years of government intervention in the economies of Sub-Saharan Africa have seen living standards continue to plummet accompanied by no visible signs of development (UNDP, 1999).

Despite the success of the East and South-East Asian newly industrialising countries (NICs), they argue that any state intervention will lead to a sub-optimal outcome. Economic liberalisation is deemed to be best realised under specific state-models that allow greater flexibility in the market mechanism. This flexibility, under its accompanying language of structural adjustment and efficiency gains, has effectively undone the coalitions that supported the predominant paradigm of developmental *étatisme*. Moreover, the current redefinition of the state reduces the developmental options previously utilised by modern industrialised nations. Import-substitution policies, trade barriers, the use of subsidies, and other neo-autarkic measures, are under increasing ideological attack. The ideological hegemony of neoliberalism has undermined the legitimacy of the developmental state at precisely the time it is most needed.

Secondly, the ability of government to develop effective policies depends on their capacity to interpret information relevant to the economic, social, cultural and political environment. A strong information infrastructure would allow access to information from all of these sectors, and would provide the basis for competent planning and decision-making. However, such infrastructures are vestigial in Sub-Saharan Africa.

Policy-makers are trapped in an informational "Catch-22", wherein relevant and timely information is necessary in order to promote sound information infrastructure, but without a more efficient information infrastructure governments are not able to garner the requisite information for effective decision-making.

Thirdly, the state in the majority of Sub-Saharan African countries has witnessed an unprecedented reduction in its ability to act. The past two decades have witnessed the severely declining fortunes of many economies of Sub-Saharan Africa. In a sample of 32 Sub-Saharan Africa countries, the average annual rate of growth in real per capita GDP declined from 1.19 per cent in the 1970s to about 0.99 per cent in the 1980s, with an average of 0.35 per cent for the two decades<sup>24</sup>. Most infrastructure expenditures in developing countries are publicly financed, with little in the form of private capital finance. The debt crisis and the debacle of structural adjustment have generated an erratic and generally declining investment profile in almost every Sub-Saharan Africa country.<sup>25</sup> Undermined by the conditionality of structural adjustment programmes, exploited through debt peonage, and weakened by political conflict, the majority of governments are in crisis management mode, prioritising short-term economic and political survival over long-term dynamics.

Yet despite this economic and political fragility developing countries are being encouraged to nurture sophisticated information infrastructure's that are increasingly becoming the *sine qua non* of international trade. At the same time, Sub-Saharan African countries find themselves in an unenviably defensive position. With more pressing concerns, and in the face of technological uncertainty, few have constructed policy strategies to ensure that the benefits of these technologies accrue equitably.

The weakness of the African state in general necessitates a broad coalition of actors to ensure some element of transparency in the planning process. It is unlikely that the state in Sub-Saharan Africa, left to its own devices, could successfully coordinate the

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<sup>24</sup> World Bank (1991) *The Challenge of Development: World Development Report 1991*, New York: Oxford University Press.

<sup>25</sup> The empirical evidence shows that cuts in capital budgets constituted a disproportionate share of the overall spending cuts that were part of the economic austerity and adjustment programs of the 1980s. As a result the neglect of crucial maintenance and upgrading has left the majority of infrastructure facilities in the region in a parlous state (ADB, 1998).

divergent interests and actors undertaking infrastructure development. What is needed are concerted efforts on the part of development agencies and the international governance regime to ensure equitable global access to information infrastructure, and to aid developing countries in their endeavours. Successful adaptation to technological progress is contingent upon the ability of countries and their composite parts to invest, innovate and promptly respond to changing conditions. With a view to success that may only materialise in the long-term, an appropriate policy framework hinges on consistency and credibility.

### **3.7 Summary**

This chapter has presented a conceptual introduction to the broad topics of information infrastructure and public policy in Sub-Saharan Africa. A conceptual framework has been articulated which, drawing on theories that argue that technological trajectories are not given but actor-driven, provides policy-planners with an empowering analytical perspective from which to view the construction of information infrastructure. Given the role of the state as the egregiously dominant actor in Sub-Saharan Africa, the chapter has presented the steps necessary for an effective *dirigiste* approach to information infrastructure planning: beginning with the assessment of existing strengths and weaknesses and an articulation of a vision to the assignment of roles and responsibilities and the evaluation and monitoring of public policy.

The framework is seen as a hierarchical conceptual framework for integrated national information infrastructure planning. Unlike most frameworks it does not imply the rigidity of centralised planning. Rather, it seeks to simplify the information infrastructure planning process by giving a holistic overview of an extremely complex and heterogeneous environment. The final objectives being to give policy-makers the ability to prioritise according to their national hierarchy of needs, proactively dictate the development of the requisite capabilities, and reactively deal with socio-technical contingencies; be they at the national, regional or international level.



## CHAPTER 4

### A Survey of Information Infrastructure in Sub-Saharan Africa

#### 4.1 Introduction

The aim of this chapter is to survey the state of information infrastructure in Sub-Saharan Africa in terms of two key elements: telecommunications and Internet development. The empirical evidence, whilst incomplete, does reveal a degree of similarity in the Sub-Saharan Africa region in terms of the paucity of information infrastructure that is statistically significant. By any measurement this form of infrastructure in Sub-Saharan Africa is critically underdeveloped and represents the major constraint to leveraging the dynamic gains that can be wrought from these technologies. Firstly, an analysis is made of the state of both these sectors in Sub-Saharan Africa. Secondly the chapter seeks to identify the various actors partaking in the development of information infrastructure in the region, assessing their roles and motives. At this critical time, when both countries and companies are restructuring to take advantage of new technologies and services, both government and industry need better tools to measure impact and efficacy. They must reach beyond traditional definitions of infrastructure and look at who is constructing information infrastructure and how and why. In the process, the policies and practices that enable as well as constrain need to be assessed and understood.

Any assessment of the role of information and communication technologies in Sub-Saharan Africa requires an analysis of the existing empirical evidence. However, the phenomenal rate at which these applications continue to grow has meant that the available data are inevitably out of step with the realities on the ground. The traditional lack and availability of accurate statistics on the Sub-Saharan Africa region continue to compound these problems. As Mansell and Wehn point out, 'for many of the least developed countries, useful indicators are virtually non-existent' (Mansell and Wehn, 1998, p. 21). Moreover, much of the debate on ICTs and social development erroneously describes Africa as a homogeneous continent, in which the problems – and hence solutions – are universal. Yet the challenges facing African countries are a

combination of problems shared with other countries and those created by each country's unique history.

The diversity of the African region as a whole is reflected in the very large variation in information and communication technology usage on the continent. In some countries such as Zaire, in 1999, information infrastructure activity can be described as minimal at best; however, in North and South Africa there is a significant proportion of the population taking advantage of relatively advanced networks that have been installed in metropolitan areas. For example, some of the continent's most sophisticated national networks are in Botswana and Rwanda, where by 1999 over 90 per cent of their main telecommunications lines were digital, compared to just less than 50 per cent in the United States (Obiabaka, 1999). However, the vast majority of African countries continue to subsist with grossly inadequate telecommunications infrastructures.

#### **4.2 The Telecommunications sector in Sub-Saharan Africa**

The widening disparity between access to telecommunications in the developed and developing world has already been the focus of several important studies over the past decades, most notably the 1984 report entitled *The Missing Link* by the Independent Commission for Worldwide Telecommunications Development, chaired by Sir Donald Maitland (ITU, 1985). However, empirical evidence reveals that the commission's goal – that by the early part of the next century virtually the whole of mankind should be brought within easy reach of a telephone – is still far from becoming reality. Telecommunications coverage in Sub-Saharan Africa is among the lowest in the world. Empirical data from the ITU reveals that in 1996, teledensity, the number of telephone lines per 100 inhabitants, varied from 0.09 in Chad, to 0.94 in Zambia. Sub-Saharan Africa, excluding South Africa, averaged a teledensity of 0.46; South Africa was 9.4 and all North Africa, 4.22.<sup>26</sup>

Overall the rate of expansion of telephone lines has been increasing, though at a rate slower than that of other regions. From 1986 to 1990, the average growth in telephone

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<sup>26</sup> All figures in this section from *African Telecommunication Indicators* (ITU, 1998).

lines was 8 per cent for Africa, 6.6 percent for Latin America and 12.3 percent for Asia. In the following four year period (1991-1994), the growth in telephone lines in Africa stagnated at 8 per cent while those of Latin America and Asia accelerated to 10.4 per cent and 26.7 per cent respectively (ITU, 1998a). Africa, it seems, is already at the margins of communications development even relative to other developing regions. This lack of telecommunications infrastructure has had obvious knock-on effects in terms of overall information infrastructure. In 1997, for example, data terminals per 100,000 inhabitants were 0.6 in Sub-Saharan countries compared with six in emerging economies and 111 in industrialised countries. Internet hosts per 100,000 inhabitants were 0.1 in Sub-Saharan countries compared with five in emerging countries and 1014 in industrialised countries (ITU, 1998a).

The empirical evidence provided by the ITU conveys mixed signals as to the development of the sector in the regions. For example, the 1998 World Telecommunications Development report shows whilst registered demand for telephone services continues to exceed supply, the number of people waiting for a telephone line is falling (ITU, 1998b). Such encouraging news is tempered by the statistical problems inherent in the use of certain data. The telephone waiting list, for example, which is commonly employed as a yardstick for telecommunications demand, is not generally considered an accurate reflection of the true level of unmet demand for telecommunications services (Mansell and Wehn, 1998). While it measures demand under the extant price structure, it fails to account for latent or unexpressed demand; that is those who want a telephone but have yet to register their request. With waiting lists as long as seven years in some countries, registering for a telephone line is often seen as a futile gesture. This is just one illustration of the methodological problems that are particularly acute in Sub-Saharan Africa where on average over 70 per cent of the population are rurally based.

Methodological problems aside, it is evident that the telecommunications sector in Sub-Saharan Africa is underdeveloped by any criteria. The vast majority of countries in the region must subsist with low levels of service provision, which are increasingly failing to meet burgeoning demand. There is little in the way of innovation, with a scarcity of reliable value added services. The continent is characterised by low telephone penetration, slow network growth, antiquated systems, sub-optimal reinvestment of

profits, high pricing of private facilities, poorly-dimensioned inter-city telephone links and national network infrastructures characterised by chronic underfunding for equipment (ITU, 1997b). Lack of skilled labour and the absence of strategic planning and management continues to contribute to the underdeveloped status of the sector. The cause of the weaknesses in the telecommunications sector, whilst varied, are on the whole easily identifiable. They are far from complex and can be divided into operational and political economy considerations.

#### **4.2.1 Operational constraints**

Supply-side constraints continue to hinder the ability of carriers to meet the burgeoning demand for telecommunications services. These constraints include the state monopoly of telecommunications and the existence of regulations that prevent the private sector from participating in the sector. Another contributory factor is the lack of resources necessary to augment investment in the sector. This is often as a result of the high level of indebtedness of the local operator. Even where funds are available, limited project implementation capacity may constrain network development (Kiplagat and Werner, 1994). The capacity of national operators to maintain and manage their monopolies must also be called into question. Despite an unchallenged domestic market and the huge revenues culled from over-inflated international call charges, the telecommunications industry in Sub-Saharan Africa is plagued by low levels of net profitability (ITU, 1998a)

This lack of realised profitability is the direct result of low rates of investment efficiency, lack of effective management and high installation costs. Installation costs per line in Africa are extremely high relative to the industry average, reflecting the state of investment inefficiency in the sector. It is estimated that the average cost per line in the region is over US\$4,500, more than three times the global industry average of US\$1,500 (ITU, 1997a). Thus, if the industrial average prevailed in the region, the investment made could have financed three times more lines with the same amount of funds (ITU, 1998b). The high installation costs are partly due to the large rural areas that have to be covered, but also the dependence of the region on technology imports. With the exception of South Africa, which has its own production of integrated circuits, the continent relies heavily on imports for its equipment needs. This situation ties

procurement of materials to the trading policies of its suppliers' host governments, often forcing African countries to buy equipment and make investments not suited to actual needs (Noam, 1999). Problems of maintenance and management of spare parts are also blamed on the multiplicity of incompatible and outdated equipment (Kiplagat and Werner, 1994). All these factors result in high operating costs and high subscription charges. For instance, in Mozambique the 1998 domestic telecommunications subscription cost was 69.8 per cent of GDP per capita (ITU, 1998b). Coupled with this is a lack of income diversification and price discrimination. The region's operators depend heavily on international communications traffic that tends to yield higher income. Consequently operators prefer to target wealthy elites, international hotels and export-oriented enterprises (Adetunji, 1999).

In contrast, the tariffs remain too high for the rest of the population as demonstrated by problems related to the non-payment of bills and the increasing number of disconnections. Price discrimination, which charges lower prices for households and relatively higher prices for business, has widened the market and helped to cross-subsidise rural telecommunications (Saunders et al., 1994). However, insufficient amounts of the profits from price discrimination are reinvested and operators, or more accurately the governments who control them, prefer to indulge in profit taking (Shetty, 1998b). In addition, foreign exchange restrictions continue to have a negative impact on public operators. International telecommunications tariffs in developed countries have fallen, as a result of which payments for traffic from outside have increased in Africa. These payments are often made in hard currency, although the public telecommunications authorities have noted that funds so received are absorbed by other public agencies (Shetty, 1998a). However, owing to the high international tariffs charged by local public telecommunications networks, they are increasingly being pushed aside by "parallel" networks. This has reduced the import capacity of local public operators to renew and service equipment, resulting in quality deterioration and poor service.

Another constraint is the insecurity of infrastructure. In a region in which such a high proportion of the population is living below subsistence level it is unsurprising that theft of public property is rampant. The copper cable on which the public switched network relies has a significant second-hand value. As a result theft and vandalism is a

common problem faced by all public telecommunications operators (ITU, 1999b). There have of late been more concerted responses from PTOs, such as Nigeria's NITEL, which employs guards at troublespots. However, because copper also requires more maintenance and is also susceptible to lightning damage, many operators are looking to replace links at risk with fibre optic and wireless connections.

#### **4.2.2 Political economic factors**

Whilst these operational considerations go a long way to explaining the poor rate of growth of telecommunications in Sub-Saharan Africa, the volatile political economy of the region continues to be a factor in accounting for the lack of development in telecommunications infrastructure. Civil strife and endemic political instability are partly responsible for the low densities in such countries as Somalia, Angola, Mozambique, Liberia, Sudan and Rwanda, to mention a few. Whilst the attainment of political stability in these countries will contribute favourably to the improvement of their telecommunications infrastructure, an underlying lack of confidence in the long-term stability of these countries lingers. This lack of confidence has led to minimal private sector participation; with the bulk of investments coming from self-financing and bilateral and multilateral sources (ITU, 1998b). Compared to other developing countries, the level of self-financing by local operators is high, indicative of the lack of capital from other sources. At the same time, lending from bilateral sources is declining.<sup>27</sup>

The almost endemic macroeconomic and political volatility in the Sub-Saharan Africa region has led to a lack of political direction of the telecommunications sector. Though deregulation is drastically altering the industrial landscape, for many years the telecommunications sector has been seen as a cash cow to be milked when needed. The sector has never been seen as a commercial entity but rather as a public service, heavily subsidised and free of commercial considerations (Noam, 1999). Whilst the vast majority of countries began to jettison these ideals some time ago, it is only since 1997 that developing countries as a whole, and Sub-Saharan Africa specifically, have begun the process of infrastructure reappraisal (Wilson, 1999). As a result the

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<sup>27</sup> Whereas bilateral lending for the sector was US\$431 million in 1989, it was only US\$97 million in 1994 (ITU, 1998a).

telecommunications sector, like other public utilities, continues to suffer from low revenue collection, widespread corruption and ineffective strategic planning.

First and foremost, massive investment is required – in telecommunications alone, for example, investment totalling at least \$50 billion would be required to achieve a minimum teledensity of 5 per cent or five lines per 100 inhabitants – in Sub-Saharan Africa (ITU, 1998b). This by far exceeds public sector financing capacity, making large-scale private investment a necessity. Governments will find it increasingly difficult to continue to monopolise information and communication technologies. Rather, an appropriate information and communications technology development strategy for Sub-Saharan Africa will inevitably involve private sector investment. For change to occur, the private sector has to be encouraged to invest in the continent. Yet, of the \$95bn raised worldwide for telecommunications privatisation in the period 1994-1998 only \$1.7bn was directed at Africa – and again, most of that was for South Africa (Olamiji, 1999). Evidently the presence of the private sector must be bolstered in order to mitigate the shortfalls of public investment. Without this access to capital, markets and technology and the exploitation of new opportunities and the benefits of competition, any attempt to reverse the stagnation of the information infrastructure in Sub-Saharan Africa will be handicapped (Jayakar, 1999).

Increased investment alone is clearly a necessary but not sufficient measure. Efforts must be made to tackle the operational and political constraints to information infrastructure development. In the light of global shifts towards telecommunications deregulation, and a belated recognition of the importance of information and communication technologies, African policy-makers are putting in place frameworks to deregulate and enhance competition in their telecommunications sector. There has also been sustained and increasing pressure from development agencies for public sector reform in developing countries. The World Bank, for example, is increasingly making parastatal reform a condition for many of its investments in developing countries (Mansell and Wehn, 1998). Based on the premise that increased private participation and/or competition leads to improved operability and service delivery policy-makers are being urged to reform their telecommunications sector. Typically, governments are being advised to firstly dissolve the historical partnership between the postal service and the telecommunications sector. Secondly, they are being advised to restructure the

regulatory framework so that the sector is more conducive to competition. Thirdly, to subject the national operator to commercial considerations whilst ensuring adequate regulatory provisions (Shetty, 1998a).

#### 4.2.3 Telecommunications reform in Sub-Saharan Africa

As Table 4 shows, a significant number of Sub-Saharan African countries are now instituting reforms that permit competition in basic fixed telephony, allow new value added services, introduce competition from the private sector, and establish a separate regulatory agency.

**Table 4: Privatisation of state-owned African telecommunications companies, 1987-1997**

Country	Public Telecommunications Operator (PTO)	Year of privatisation	Distribution of ownership
Cape Verde	Cabo Verde Telecom Sarl	1995	Portugal Telecom 40% Public 44% Employees 5%
Central African Republic	Societe Centrafricain des Telecommunications (SOCATEL) (domestic)	1990	France Cable et Radio 40%
Ghana	Ghana Telecom	1997	France Cable et Radio 51%
Guinea	Societe des Telecommunications de Guinea (SOTELGUI)	1995	G-Communications led by Telkom Malaysia) 60%
Guinea-Bissau	Companhia de Telecommunicacoes da Guniee-Bissau, sarl (Guinea-Telecom)	1989	Portugal Telecom 51%
Madagascar	Telecom Malagasay (TELMA S.A.)	1995	France Cable et Radio 34%
Sao Tome & Principe	Companhia Santomenes de Telecommunicacoes, sarl	1989	Portugal Telecom 51%
Senegal	Societe des Telecommunications due Senegal (SONATEL)	1997	France Cable et Radio 33.3 % Domestic investors 17.66% Employees 10%
South Africa	Telkom S.A.	1997	SBC Communications 18% Telkom Malaysia 12%

Source: adapted from the World Telecommunications Development Report 1997 (ITU, 1997a) and ITU/BDT Regulatory Database.



According to the ITU, by 1998 62 per cent of African countries had separated postal services from telecommunications, and nearly 75 per cent had corporatised their telecommunications operators (ITU, 1998b). Between 1989 and 1997, Cape Verde, Central African Republic (CAR), Côte d'Ivoire, Ghana, Republic of Guinea, Guinea-Bissau, Madagascar, Sao Tome and Principe, Senegal and South Africa had partially privatised their public telecommunications operators. In addition Chad and Niger had private participation in their international operators (ITU, 1998a). During 1998, Eritrea, Nigeria, Kenya and Zambia all announced plans to sell an equity stake in their state-owned telecommunications operator. However, as of 1998, only Ghana and Uganda had established a duopoly for the provision of basic telephony (ITU, 1998a).

Whilst the majority of Sub-Saharan African countries have begun to reform their telecommunications sector, only in the value added services segment have most permitted some element of competition. Whilst the number of fixed line services in Africa has reached a standstill, the mobile sector has continued to develop from 1997 to 1999. Cellular is one of the few market segments where private investment and competition has been allowed in the African telecommunications sector. The number of GSM (Global System for Mobile) subscribers in Africa represented 3 per cent of the world's GSM users in February 1999. A dramatic increase from a negligible figure only two years earlier according to research by the ITU (1998a). In June 1997, Sub-Saharan Africa had 1.35m subscribers, compared to 9.7m in Asia and 33.4m in Europe. As of the beginning of 1999, cellular telephone services were available in over 35 countries in Sub-Saharan Africa, mostly in the capital cities but also in some secondary towns.<sup>28</sup> Most of the cellular networks can be used to access the Internet, but the high cost of calls makes this prohibitive except for important e-mail. Yet, the vast majority of Sub-Saharan African countries have fewer than 10,000 subscribers each, and in all countries where there are mobile networks, usage is restricted to urban areas, with virtually no coverage in rural areas. Although many African countries have just one mobile phone operator, governments are being encouraged to increase competition, as they can garner much needed revenue from the fees accruing from granting operational licences. In addition there are problems with equipment supplies. Shetty (1998b) points out that in

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<sup>28</sup> Data sourced from Strategis Group available at <http://www.strategisgroup.com/reports/pubs/moblsa98.pdf>. Accessed June 1999.

Cameroon, for example, there is a mobile phone network but memory cards, which are essential for use, are often not available. Other factors such as climate and geography are also deterring the development of mobile telephony.

It is estimated that by 2002 the number of mobile subscribers in Africa will have risen to 5.7 million (ITU, 1998a). Yet despite this rapidly growing sector "plain old telephone services" or POTS, remain, for most countries, firmly entrenched in the public sector. Whilst other developing countries have rapidly deregulated their sectors and are reaping the concomitant benefits, the rate of growth of telecommunications capacity in the region still remains disappointing. This low growth rate can be attributed to a number of factors ranging from the paternalistic and nationalist attitudes towards the telecommunications sector to investor perceptions.

The telecommunications sector is considered to be a strategic asset and, as such, governments are loath to allow the control of such an asset to go to an external source. There is also the claim that foreign investors are unlikely to pay much heed to social development objectives. Such sentiments are behind the decision of the South African government to defer privatisation of Telkom SA for a period of 5 years whilst attempts are made to redress the legacy of apartheid, and correct the imbalance in telecommunications resources within the population. The World Bank, amongst others, has cited more cynical reasons for the reluctance to privatise in Sub-Saharan Africa, namely the huge revenues accruing from national monopoly. In reality the cause of the slow rate of reform arises from other factors including those listed above. Firstly, there is generally a lack of consensus from interested parties as to the merits of privatisation. With the telecommunications sector in Sub-Saharan Africa characterised by chronic over-manning<sup>29</sup>, powerful trade unions in countries such as Nigeria are actively lobbying against deregulation. Also the management of national operators are naturally wary about where the balance of power would lie in a joint venture with a foreign multinational.<sup>30</sup>

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<sup>29</sup> In Madagascar, for example, there are 10 lines per employee in the public telecommunication operator, in Tanzania there are 18 lines per employee, while in Morocco there are 80 telephone lines per employee (ITU, 1998b).

<sup>30</sup> "Unions wary of proposed NITEL plan", *Punch*, 13 March 1998, Lagos, Nigeria.

Attempts at sectoral reform have been hampered by the traditional approach to telecommunications regulation. National operators have historically acted as both operator and regulator. To some extent this is where the problems have arisen, with national operators abusing their monopoly position and overcharging subscribers. In an effort to resolve this, some 60 per cent of countries in Sub-Saharan Africa, according to the ITU, have separated operational and regulatory functions and created stand alone regulatory agencies.<sup>31</sup> Yet despite attempts to introduce greater regulation these agencies have remained, for the most part, ineffectual. With weak mandates from government and limited powers, they have had little impact on curbing the abuses of national monopolies.<sup>32</sup> Rather than being autonomous bodies, the majority of countries have reserved the right to appoint specific regulators and to issue specific directives to them. Already, some of the new generation of telecommunications regulators have run into difficulties with the ministries that were supposed to have ceded regulation of the industry to them (Shetty, 1998b). Questions are being raised with regards to the viability of the emerging global regulatory framework set by the World Trade Organisation (WTO) and the European Union. In developing economies, it is questionable as to whether telecommunications liberalisation can be sustainable without broader social and political change.

The environment of the telecommunication sector is also undergoing significant changes. The combined forces of "demand-pull" and "supply-push" have made telecommunications one of the leading growth sectors of the world economy. The telecommunication sector has a high profit potential in every country of the world. However, experience suggests that in developing countries retained earnings in the sector are not sufficient to finance all new projects because networks are underdeveloped and do not generate sufficient cash flow (Kiplagat and Werner, 1994). Sector reforms leading to greater private sector involvement and competition are new forces shaping the development of telecommunications. These new challenges of the information society and the new trade environment heightened by the agreements reached by WTO, place even greater pressure on policy-makers, regulators and operators to acquire the necessary skills to manage the new environment. In this

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<sup>31</sup> ITU (1998) *General Trends in Telecommunications Restructuring*, Geneva: ITU.

<sup>32</sup> Ibid.

respect, human resources development becomes a key success factor. In addition, governments play a key role in the development of telecommunications, and therefore need to establish appropriate policies and regulatory structures to promote reasonable and affordable access to basic telecommunication services for all.

The regulatory framework should also create a stable and transparent environment, promote fair competition while protecting network integrity and guarantee the rights of users, operators and investors. Policies and strategies for the development of telecommunications should reflect the trend towards multi-services utilising a common infrastructure platform. Yet perhaps the biggest obstacle to greater deregulation is a lack of investor confidence. The macroeconomic climate in Sub-Saharan Africa is far from ideal and there are still tangible signs of chronic political instability. From a commercial standpoint, many national telecommunications operators simply do not represent a viable opportunity given the level of risk. The majority of national telecommunications operators have suffered from decades of operational neglect and will require substantial investment from any incoming operator. Additionally, the high proportion of small countries with largely rurally based low-income populations do not represent large enough markets for foreign investors.

This thus calls into question the privatisation imperative. Privatisation of the state-owned telecommunications infrastructure is not universally feasible, nor does it necessarily improve performance (Saunders et al., 1994). It appears that there is no universal solution to telecommunications restructuring. Whilst one of the main proponents of telecommunications reform, the World Bank, argues that privatisation offers the best solution, there are successful examples of divergent strategies. Vietnam, for example, has achieved an impressive rate of sector growth without undertaking any significant restructuring of its telecommunications sector; the national operator still maintains a monopoly position<sup>33</sup>. This suggests that privatisation is not necessarily the *sine qua non* of successful infrastructure development. Rather, it points to the need for careful analysis of the sector at hand. Whilst the period from 1984 has seen an increasing deregulation of the international telecommunications sector, the reasons for

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<sup>33</sup> Legard, D. (1999) "Vietnam will not allow deregulation", *IDG News Service/Singapore Bureau* 24 September 1999.

this differ widely amongst developing countries. For Singapore, for example, deregulation arose out of a need to raise capital to fund ambitious infrastructure expansion. The 1997 privatisation of Telébras in Brazil arose out of the intention of the state to withdraw from the provision of services. In Sub-Saharan Africa the impetus to privatisation stems from more compelling reasons. Mainly the desire to have desperately needed technology transferred and the need for management expertise.

In summary the main stumbling blocks to improvements in telephone access remains the issues of financing and subsidy, and operational efficiency. For change to occur, the private sector has to be encouraged to invest in the continent. So far, local investors have been elusive. Revenues generated from the small base of existing domestic subscribers fail to allow public operators to invest enough to cater for the growing demand for telecommunications services. Moreover, with reform of the international system of accounting rates, public operators must resign themselves to a regime of reduced international settlement rates and the rebalancing of domestic rates that will inevitably follow. There is a need for a more commercial influence in telecommunications development, but only if the pace of reform is driven by national requirements and not by outside pressure. However, the acceptance of commercial imperatives by developing countries should not be confused with a necessity to progress at a pace dictated by the industrialised countries. Rather, Sub-Saharan African countries must take the time necessary to introduce sectoral and economic reforms.

#### **4.2.4 Regional telecommunications development**

Since independence, African nations have viewed intra-African telecommunications capacity as essential to their initiatives toward economic, social and political integration. Regional telecommunications networks have been seen as critical to establishing commercial and governmental cooperation between African nations. Regional networks were also seen as a method for redefining the communication structure that had been established during the colonial period. Out of the desire for closer regional cooperation arose the most ambitious African telecommunications project to date: the Pan-African Telecommunications Network (PanafTel). PanafTel was envisaged as a continental network that would alleviate the need to transmit intra-African communications through non-African transit centres. Despite its ambitious

goals, Panaftel has not developed a sustainable, integrated continent-wide telecommunications network. Certain links are sustainable and certain regions, particularly southern Africa, have advanced further than others in establishing connectivity (Akwule, 1992).

The majority of countries in the region still maintain links to former colonial rulers. For example, Francophone countries are connected to France, and the English-speaking countries to the UK or the United States. So, neighbouring African countries, instead of taking advantage of West African microwave links, route their telecommunications traffic through distant third parties. For example, between Ghana and the UK or the US and between Togo and France, but not between Ghana and Togo. However, despite the failure of Panaftel, a regional approach to solving the paucity of telecommunications infrastructure remains attractive. In recognition of this, attempts were made in the late 1970's to investigate the feasibility of a regional satellite network.<sup>34</sup> The 1976 Conference of African Ministers of Transport, Communications and Planning identified the potential of satellite networks for Africa and resolved to undertake a major feasibility study on the issue. Executed by the ITU, the study, known as the Regional African Satellite Community or RASCOM, became the largest ever undertaken in Africa on telecommunications, involving over 600 experts and a survey of 120,000 villages (Akwule, 1992). The study concluded that there was an urgent need for an African satellite programme, which was to become operational in 1993. The core objectives of RASCOM have been to rationalise existing satellite use in Africa, obtain better rates for its members through bulk discounts, and to gain operational expertise in the management of satellite resources before the launch of a dedicated satellite for the continent in 2001.

Despite the failure of former cooperative efforts, RASCOM has so far succeeded in its first two objectives. By 1997 all African PTOs were utilising the same INTELSAT satellite, with the result that all countries can now be reached through a single satellite uplink, thus increasing the economies of scale for broadcasting and data services. However, given the scope of the project and the economic disparities between the

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<sup>34</sup>The regional satellite model has been utilised throughout the world for regional telecommunications network development. The European Satellite (Eutelsat) was established in 1983; the Arab Satellite (Arabsat) was established in 1985; and the Asian Satellite (Asiasat) was established in 1990.

countries behind RASCOM, the project has been stalled at times due to political infighting.<sup>35</sup> Despite these stumbling blocks the concept of a regional approach to improving existing telecommunications infrastructure remains appealing, and perhaps necessary given the economies of scale that can be achieved by pooling resources on the continent into one indigenous satellite. The major benefit of the regional satellite model is the flexibility that a satellite system would provide. It would be a conduit for numerous types of telecommunications traffic; for example, RASCOM plans to offer television, video conferencing and data transmission services on a commercial basis. It could also offer mobile services, location identification service and remote-sensing applications. A regional satellite system also offers African countries new options for addressing the low level of telecommunications in rural areas through the use of technological innovations such as VSAT networks (Shetty, 1998c).

Efforts to coordinate telecommunications plans at the ministerial level have intensified in the wake of growing interest in the sector. At the ITU's 1998 Telecommunications Development Symposium, African telecommunications ministers embarked on an ambitious plan to double the existing number of phone lines on the continent over the next 5 years to 50 million. "The African Connection", a document released at the opening of the symposium, proposes to implement a continental plan of action by June 1, 2000, mainly as a tool to make Africa attractive to investors. The agreement was finalised at the Africa Telecom 98 conference that was organised by the ITU and held in Johannesburg. A seven-point plan of priority projects was agreed on by ministers 'to catapult Africa into the 21st century' (Shetty, 1998a). Among the proposals ministers have agreed to put before their parliaments is a "one-stop shop" for channelling investment to the region. There was also a recommendation that African centres of excellence be created to provide decision-makers with information, and a concerted effort to make terrestrial connectivity between African countries a reality.

A proposal was also put forward with a view to creating an African Telecommunications Development Fund, drawing in a number of institutions including the World Bank and other institutional investors (Shetty, 1998b). To support the

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<sup>35</sup> "Africa's grand satellite plan still beset by politics", *Communications Week International*, No. 93, March 1998.

resource mobilisation effort, the ministers propose to create common pools and databases on relevant African expertise in the areas of regulation, law and policy. Also discussed is a mechanism for continental coordination of regulators on the continent and a coordinated spectrum planning and management. There is also the aim to form a regional telecommunications market for equipment and services and common procurement arrangements on the continent. Whilst all these efforts are commendable, there are significant obstacles to be overcome. Firstly, there appears to be a lack of measurable and quantifiable targets for telecommunications development in the region (Mansell and Wehn, 1998). Secondly a pan-African agenda is difficult to forge in an environment of growing privatisation. It is difficult to implement even regional developmental accords, let alone pan-African agreements, when the majority of countries are pursuing unilateral agreements with the foreign private sector.

In summary, despite the efforts to liberalise and improve telecommunication services, the service offered by the vast majority of African countries is still far from adequate. Major and urgent improvements would need to be made if the continent is to avoid increasing marginalisation. Countries in Sub-Saharan Africa need to invest in telecommunications, as a priority sector, if they are to leverage the process improvement and information retrieval benefits that are increasingly being enjoyed by more advanced regions.

### **4.3 The Internet in Sub-Saharan Africa**

Attempts to get a true reflection of Internet usage in Africa are hampered by the lack of reliable data. Concerns abound as to the definition of a 'user' or 'subscriber' which may vary as the number of accounts being shared in Africa may be much greater than in more developed regions. For example, a survey of Internet usage in Ethiopia presented in Chapter Seven, revealed that local Internet accounts supported an average of 10 users. Despite these methodological hurdles, the level of Internet connectivity in the Sub-Saharan Africa region continues to grow apace, to such an extent that only three countries remained without local access by the end of 1998 – Eritrea, Libya and Somalia (ITU, 1998b). However, though immense progress has been made in Sub-Saharan Africa, Internet services are still largely confined to the capitals and major



towns, thus bypassing up to 70 per cent of African populations who are rurally based. In relative terms the Internet remains still in its infancy in Africa, yet despite the high costs and poor quality phone lines, e-mail and discussion groups, in particular, have been quickly embraced as powerful tools for sharing information and ideas (UNDP, 1998b).

Historically the development of networking capacity in Sub-Saharan Africa has been the result of the efforts of non-governmental organisations (NGOs) to bring connectivity to the region. Until the beginning of 1996 the majority of African countries relied on NGO-constructed initiatives to connect to the Internet (Adam, 1996). The earliest users and disseminators of Internet technology were academic and research organisations and organisations belonging to the Association of Progressive Communications (APC), such as GreenNet (London) and the Institute for Global Communications (San Francisco). These have actively supported or established networks in Asia, Africa and Latin America, and often provided countries with their first link to the Internet. These networks successfully targeted key actors in the development process – international NGOs and local civil society groups (Pruett and Dean, 1999).

Following a pattern that was set by the industrialised nations, the growth in Internet connectivity in the Sub-Saharan region is now strongly driven by commercial forces, as Internet service provision begins to mature. The Internet sector is becoming more competitive, profitable and less dependent on the efforts of the donor community. The first providers of full Internet services have typically been the public telecommunications operators (PTOs). However, there is a clear trend of deregulation in the sector as a significant number of African countries have licensed private sector firms for Internet service provision. Yet, in a significant number of African countries the public operator maintains control of the international telecommunications gateway and leaves the resale of end-user Internet access to the private sector (ITU, 1997b). In a few countries, namely Côte d'Ivoire, Mozambique, South Africa and Zambia, the PTO operates the gateway in competition with the private sector (Jensen, 1999). As of March 1999, the only countries where the public operator is not supplying Internet services are Liberia, Ghana, Democratic Republic of Congo, Uganda, and Namibia (ITU, 1998a).

Deregulation has resulted in most African capitals having more than one Internet Service Provider (ISP) and in late 1998 there were almost 400 ISPs across the region (300 excluding South Africa). Six countries had more than 10 ISPs but 14 countries still had only one (Jensen, 1999). The majority of these service providers are small businesses, often started by technicians, who learned the requisite skills through training whilst working at NGOs or at university, and have partnered with local entrepreneurs (ITU, 1998b). Some national ISPs are operated by universities, such as ZamNet in Zambia, and others have been established by larger companies; mostly those already associated with the information and communication technologies industry. By January 1999, the total number of computers connected to the Internet in the region, excluding South Africa, was estimated by Nua Surveys at nearing a million (see Table A3 in Appendix A). Africa's share of Internet host sites worldwide was only 0.025 per cent in 1997, and fell to 0.022 per cent by the beginning of 1998.<sup>36</sup> As of January 1999 there were about 24 countries in the Sub-continent with over 1000 users but only countries with over 3000 (Egypt, Morocco, Kenya, Ghana, Mozambique, South Africa, Tunisia, Uganda, Zambia and Zimbabwe).<sup>37</sup>

Most of the international connections in Africa are carried via satellite. The exceptions to this are the marine fibre optic link from South Africa to the cross-Atlantic hub in the Canaries, and Djibouti, which has access to the SEA-ME-WEA cable. Also, the countries with borders shared with South Africa benefit from the low tariff policies instituted by the South African telecom operator for neighbouring countries. By far the majority of international Internet circuits in the region connect to the USA, with a few to the United Kingdom, Italy and France. The major international Internet suppliers are AT&T, BT, Global One/Sprint, UUNET/AlterNet, MCI, NSN, BBN, Teleglobe, Verio and France Telecom/FCR. A number of other links are provided by PanAmSat and Intelsat direct to private ground stations in the US and UK, circumventing local PTO infrastructure (Jensen, 1999).

Aside from South Africa, which acts as a regional hub, there are no other regional backbones or links between neighbouring countries, which means that most traffic

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<sup>36</sup> Nua Internet surveys. Available online at <http://www.nua.com/surveys/Africa>. Accessed 5 January 1999.

<sup>37</sup> Ibid.

between neighbours must travel via expensive satellite circuits to the US or Europe and back again. Consequently ISPs, in general, must pay the entire cost of the connection to Europe or the US, further increasing the already high costs that ISPs in Africa must bear. There are efforts being made by members of the Internet community in Africa to raise the issue in international fora and to partner with other similar efforts such as Singapore and Australia's major telecommunication operator Telstra, which is also opposing a similar imbalance in Asia (Jensen, 1999).

#### **4.3.1 Regional differences**

On a sub-regional basis, the Southern African countries have benefited from telecommunications links to South Africa and as a result are, in general, the most advanced region in Sub-Saharan Africa in terms of the use of ICTs, followed by East and West Africa, with Central Africa lagging furthest behind. Francophone countries also appear to have a far greater presence on the Internet and greater institutional connectivity than the non-French speaking countries. This is due to the strong assistance provided by the various Francophone support agencies and the Canadian and French governments which are concerned with the dominance of English on the Internet. As a result, the Anglophone and Lusophone countries have considerable catching up to do to reach the same levels of connectivity and representation on the Internet. In many Francophone countries the PTO operates the major value added service provider as a joint venture with France Cable and Radio, usually called Telecom-Plus.

In summary, though Sub-Saharan Africa has been a late starter in terms of Internet development it is undergoing a rapid transformation, outpacing the global average for growth in number of host systems, according to statistics (For-Mukwai, 1999). From July 1998 to January 1999, the number of Internet hosts grew at a rate of 38 per cent, from 7,800 to 10,703, while the worldwide average growth rate stood at 18 per cent (For-Mukwai, 1999). This is largely due to the huge demand for Internet services and the relaxation of regulations governing competition in the telecommunications value added services sector. Evidently each country in the Sub-Saharan Africa region faces different obstacles. However, from a survey of Internet development in the region it is

possible to identify common national traits that are constraining the growth of Internet connectivity, and suggest ways of resolving them.

### **4.3.2 Constraints to Internet growth**

#### **(a) Poor technical facilities**

Poor general level of telecommunication facilities and high access costs are clearly the most critical inhibiting factors, but there are also a number of other constraints that need to be addressed to achieve a more amenable environment for Internet growth. In particular, the low level of computerisation in many organisations is one of the largest barriers to using new communications technologies (Woherem, 1993) Problems of access to telecommunications pale into insignificance beside those of gaining access to a working computer capable of connecting to the Internet. According to the ITU (1998a), an inhabitant of a high-income country is four times more likely to have access to a television set than an inhabitant of a low-income country; 25 times more likely to have access to a telephone; but almost 8,000 times more likely to have access to an Internet host computer. More basic still, one in three people globally lacks access to electricity (Mannisto et al., 1998) In many developing countries, demand for electricity continues to outstrip available generating capacity (UNDP, 1998b). Many rural areas do not have access of any kind to reliable electrical supplies. Alternative sources such as wind and solar-based solutions are often not viable because of the very high initial investment costs (UNDP, 1998b). This means that planning for new ICT-based projects often has to incorporate a consideration for reinforcing or creating new power supplies (Heeks, 1999b).

#### **(b) Low levels of computerisation**

Although individual countries exhibit differing levels of computerisation, a survey of the literature on information technology in Sub-Saharan Africa reveals a very low level of computerisation (Oshikoya and Hussain, 1998). Whilst there is growing awareness of the capabilities of computers in the public sector, existing machines are underused, the level of software development capability is limited, and higher level manpower such as system analysts and programmers are lacking. Other shortcomings include:

- poor physical facilities and human resources;
- no well-established centres dedicated to software development;
- poor or non-existent procedures for equipment procurement;
- inadequate maintenance of hardware; and
- limited IT industrial base.

These problems, compounded by the high price of equipment relative to the available resources, mean that many organisations remain critically under developed in their use of computers and networks. Computers cost proportionately far more in developing countries (UNESCO, 1997). For example, the cost price of an average personal computer in Ethiopia is 15 times the average national per capita GDP.<sup>38</sup> By the end of the 1990s, many machines were older 386 DOS based machines for which there are dwindling levels of support and very few are networked, locally or on a wide-area basis. Allied to this is the price of networking equipment; modem donations and initial communications subsidies continue to be an important method for development organisations to assist in building electronic links, but many require more extensive assistance with obtaining low cost computers and local area network (LAN) facilities (UNECA, 1995).

The tendency to import equipment means that obtaining local support remains an outstanding issue, especially as there is usually very limited indigenous knowledge in basic computer maintenance. Woherem (1995) asserts that 'most African countries are littered with machines...and other kinds of technical artefacts that are no longer in working order, or that worked for only a short time before they were abandoned' (Woherem, 1995, p. 5). Castells (1997b) estimates that in the 1980s, half of the computers in Sub-Saharan Africa were aid donated, most of them now technologically obsolete. He goes on to argue that as a result Africa has become a dumping ground for a mass of equipment made obsolete by the pace of technological change. As for the private computer market, it is dominated by multinationals that generally ensure that they carry out their own maintenance. Most of the systems within the region are brought off the shelf, leading to some local knowledge of how to operate, but not of

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<sup>38</sup> Survey of computer prices in Addis Ababa, Ethiopia conducted by the author in June 1998.

how to program or repair the systems (Adam, 1996; Kluzer, 1993). The scarcity of computers and small base of skills also contributes to the low level of institutionalised networking activity. E-mail and Internet access is usually limited to those with the ability to pay: a small elite who typically are employed on international projects or are comparatively wealthy. This is exacerbated by the lack of guidelines in making services more publicly available and allocating the appropriate resources for their effective use. The low level of computer literacy evidenced in the majority of African countries means that even though access may be available to users, their lack of experience can tie up the facility for inordinate lengths of time (Adam, 1996).

### (c) Shortage of skills and lack of training

At a general level, low levels of education and literacy are crippling the ability of a whole new generation of Africans to exploit information and communication. In 1997, according to UNESCO, more than 97 per cent of the population of low income developing countries had no access to secondary education (UNESCO, 1997). Limited use of English is another constraint: although increasingly multilingual, the Internet is still largely an English-language medium because of its origins in the United States. It may be that the long-term deployment and exploitation of the Internet by developing countries will depend less on technology and costs and more on their capacities to educate their young populations.

More specifically, the limited technical skills for the establishment of electronic network services and the lack of literacy in the effective exploitation of network applications by users, are clearly major impediments to the spread of these technologies. While there have been a few workshops and training courses organised in developing countries, and a number of worldwide events attended by developing countries, the numbers who have received training is still very limited. Also, there have been insufficient efforts to train the trainers in pedagogical techniques (Bell, 1998). Often trainers are co-opted from their normal roles as networking technicians and very few have any background in appropriate training methods. In addition, relevant training guides, documentation and online tutorial software to support trainers have been insufficiently developed (Adetunji, 1999).

#### (d) High cost of Internet service provision

According to the ITU, the main factor keeping Internet costs so high in developing countries is government control of telecommunication services (ITU, 1998b). In most African countries, for example, communication services are provided under the monopoly control of the national carrier and although the number of ISPs is growing, there are still too few. Competition among ISPs also helps to keep costs down. South Africa, for example, has managed to buck the trend in Africa of high Internet access prices through intense competition among ISPs; there are now more than 100 South African ISPs (Jensen, 1999). According to the Organisation for Economic Co-operation and Development (OECD), peak-rate calls were, on average, 38 per cent cheaper in countries that allow competition between telecommunications providers compared to those that did not (OECD, 1998). Competition may not be a universal recipe for success however.<sup>39</sup>

Table 5 overleaf shows that, in 1998 the average cost of using the Internet for five hours a month in Sub-Saharan Africa was estimated at US\$60 per month (ITU, 1998b). This contrasts with figures of the Organisation for Economic Cooperation and Development (OECD) which estimated that 20 hours of Internet access in the U.S. costs US\$29, including phone and provider fees (OECD, 1997). Although European charges are greater (US\$74 in Germany, US\$52 in France, US\$65 in Britain, and US\$53 in Italy) all of these countries have per capita incomes which are 10 – 100 times greater than the African average. Given the inherent diversity of the countries in the region, it is unsurprising that monthly ISP dialup charges in Africa do vary greatly – between US\$10 and US\$100 a month.

These variations largely reflect the immaturity of the markets, the varying tariff policies of the public telecommunications operators and the different national policies on access to international telecommunications bandwidth. The World Bank estimates that telecommunications costs for local and international circuits often constitute about half of an ISP's operating costs. One of the problems is that international leased line tariffs

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<sup>39</sup> Cuba is frequently held up as an example of a government that closely regulates Internet development but, despite the US embargo, accounts for over a third of the whole of the Caribbean's computer-network traffic (Pruett and Dean, 1999).

are up to five times higher than rates available from alternative providers to the monopoly PTOs (ITU, 1997c).

**Table 5: Ranked Internet Access Cost Comparisons Sub-Saharan Africa<sup>40</sup>  
July 1998**

Country	Annual cost in \$US
Botswana	136
South Africa	226
Burkina Faso	288
Senegal	290
Mauritius	300
Mozambique	348
Ethiopia	384
Gabon	440
Mauritania	582
Sierra Leone	600
CAR	616
Djibouti	640
Burundi	645
Morocco	660
Guinea	780
Algeria	880
Cameroon	965
Uganda	1105
Benin	1247
Madagascar	1341
Kenya	1681
Angola	1740

*Source:* Jensen, 1999. Available at <http://www3.apc.org>. Accessed 3 July 1998.

The high price of Internet services in some countries, as shown in Table 5, and the absence of local rate dial-up access outside almost all of the capital cities severely limit access. As for the largely rural population that are typical of countries in the region, so far there have been few attempts to provide low-cost public access facilities at drop-in centres for those without computers. Kenya, for example, despite its status as one of the most advanced African Internet markets with five licensed ISPs in 1998, exhibits all the

<sup>40</sup> Costs based on 5 hours a month of dial-up access time, and includes cost of local calls during office hours.



classic signs of Internet service provision in Africa. The chairman of the East African Association, Suchindranath Aiyerhas compared Kenya's Internet experience to that of a dirt track, as opposed the information superhighway of the West, adding that the Internet in Kenya was highly elitist. Despite the low bandwidth and frequent poor performance of the Internet, Kenyan bandwidth charges were an average of US\$10, 800 per month for a 64Kbps line in January 1999. Internet licensing fees start at US\$13, 900 and the state Internet regulator body, Kenya Posts & Telecommunications Corp (KPTC), takes a one per cent royalty of annual revenue. Kenya's state owned telecommunications company does not as yet operate as an Internet Service Provider. Moreover, their inability to implement downlink communications means that the preferred 64 kilobytes per second (kbps) line cannot be easily accessed by end users, rather users have to accept speeds as slow as 9.6 to 14.4 kbps compared with a Western average of 28kbps in 1998.<sup>41</sup>

#### **4.4 Towards improving Internet connectivity in Sub-Saharan Africa**

The plunging price and rapid spread of mobile telephony suggests that telephony could be increasingly available but widespread access to the Internet remains a distant goal. Many policy-makers echo the words of Dr Abdul Mejid Hussein, Minister of Transport and Telecommunications in Ethiopia who states that 'the Internet is not our priority in the communications sector...we are giving priority to giving telephone lines to our people'.<sup>42</sup> For countries such as Ethiopia, with some 80 per cent of the population living in often inaccessible rural areas, the obstacles to Internet development are formidable. Even when rural areas get a telephone line, they usually have to pay far more for it than urban equivalents, and the cost difference is often magnified when it comes to Internet access. A very low density of Internet nodes in developing countries, mostly concentrated in capitals, prevents easy and local phone call access from areas outside an urban centre, according to the UNDP; thus user costs continue to be prohibitive. (UNDP, 1998b).

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<sup>41</sup> "Kenya on an Information Dirt Track". *Nua Surveys*, available at <http://www.nua.ie/surveys/archives/Kenya120798>. Accessed 12 June 1998.

<sup>42</sup> Interview conducted by the author for a case study of information infrastructure in Ethiopia.

Such problems have been ameliorated in the industrialised nations by low-cost and even free calls that apply nationally for Internet access. In the US, for example, AT&T has set up more than 200 Internet access points, allowing 80 per cent of the US population to access the Internet via local telephone calls (Shetty, 1998b). Similar initiatives in a handful of developing countries are also trying to increase Internet access beyond urban centres. In Senegal, for example, Sonatel, the main telecommunications company, charges a fixed local rate country-wide to encourage the spread of Internet. The country is developing a rural/provincial Internet "backbone".

In response to the seemingly intractable problem of rural access, the telecentre concept is being promoted as an appropriate and low cost solution. According to the World Bank, such centres can provide residents, non-governmental organisations and businesses in poor rural and urban areas with economical, easy and ready access to much needed information. They could be the hub at the community level, through which a large number of information services – telephone and fax, local bulletins, document searches on demand, video libraries for entertainment and education, health and nutrition training, government services, market prices – can be dispensed. These centres are seen as multi-sectoral facilities that will eventually be self-sustaining through fees and contracts (Talero and Gaudette, 1996).

The number of telecentres and cybercafés is growing rapidly. Efforts are underway in a host of African countries including Senegal, Ghana and Uganda to provide walk-in computer centres. In the interim, as with almost any development concerning new information and communication technologies, it is simply too early to assess the impact of these initiatives. However, there is little sign of telecentres being extended to areas where they cannot at least cover their own costs – and in most developing countries this means the relatively wealthy urban areas. The signs are that market forces will guarantee fast and effective access to the Internet wherever there is a market to sustain profits, and where the necessary infrastructure exists to allow its introduction. The telecentre concept appears appropriate to Sub-Saharan Africa in that it consolidates private and public service sector needs and provides economies of scale to serve both at the community level. Various private sector companies have begun to offer such services as "communication shops" and rural telecommunications kiosks. For example, the African Communications Group (ACG) raised some US\$37 million in 1999 to

finance a roll-out of wireless payphones in rural areas in Tanzania, Ghana and Sri Lanka. The firm is also developing wireless kiosks for Internet access (Adetunji, 1999).

(a) Lack of cooperation and coordination

An additional issue is the debate over control over Sub-Saharan Africa's domain registrations. In 1999 the American Registry for Internet Numbers (ARIN) assumed responsibility for the administration of Internet Protocol (IP) address space for Africa (along with North America, South America, and the Caribbean). As a result address space is no longer free of charge and in the absence of a local African registry, networks will be required to pay US\$2500 per year to obtain a domain address. A proposal for an Africa Network Information Centre (NIC) has been discussed for some years but little progress has been made, partly because of the lack of on-the-ground national networking associations to support it and partly because of the political difficulties of identifying the appropriate host country and organisation to operate it (Jensen, 1999). Despite this, significant momentum is building up for the resolution of the issue as there are now local Internet Society chapters in all of the African regions and in most of the countries with large Internet user populations.<sup>43</sup>

A less immediate, but no less worrying issue is the short-sightedness inherent in Africa's Internet infrastructure planning. According to Labor (1999), Sub-Saharan African countries are only building connections to the Internet as opposed to their own proprietary networks. With only Internet Protocol (IP) connections, Sub-Saharan Africa's contribution to the Internet (links, content, infrastructure, applications, policy) will remain marginal at best. The digital age will remain a remote phenomenon for Africans if the indigenous ICT players resign themselves to IP connections and do not press on to build IP networks. Admittedly the small size and potential user base of some African countries militate against the construction of proprietary networks. However, larger countries and regions should justifiably be engaged in the construction of entirely new IP networks (gateway and backbones) separate from, but strategically linked to the international telephone exchange and public telephone networks. There is an urgent need for the coordinated planning and development of IP networks instead of

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<sup>43</sup> See <http://www.afrinic.org> for the proposal to set up an African Internet registry. Accessed 12 November 1999.

just retrofitting the telecommunications network (Adam, 1996).

Internet backbone operators have responded to the increased demand for Internet services by building more bandwidth to the United States; this, in turn, has reinforced the US's role as an infrastructure hub. Consequently, the fastest route between two regions, even neighbouring countries, is often through the United States. A cursory glance at any connectivity map tells a vivid story: the Internet is spreading, but the United States remains its central switching office (Goodman et al., 1994). This is unsurprising given the American origins and support of the Internet; however, this dominance has led to the use of the Internet as simply a bridge to and through the United States rather than as a tool to access and disseminate local knowledge. Unfortunately, the empirical evidence on aggregate clickstreams – that is the destination of Internet users – is virtually non-existent. However, given the lack of local content it is evident that, for the foreseeable future the Internet is far from becoming a local medium. Without concerted efforts on the part of government and the international development community, it will remain a springboard to somewhere else. To reap the maximum benefits, African countries must ensure the development of local content that the continent can properly package and capitalise on.

In summary, Sub-Saharan African countries in particular, and developing countries as a whole, face four main constraints in improving Internet services rapidly: poor telecommunications, an inability to afford computers, lower levels of education and the higher cost of providing Internet services. As a result, despite the rapid rise in growth of Internet connectivity in the region, it still remains an extremely marginal communications medium. Arguably, in the current macroeconomic environment in Sub-Saharan African there is little demand for the Internet emanating from the majority of national populations. Installing a simple, affordable telephone service comes much further up most rural farmers' priority lists than a connection to a global, computerised network – installing a safe water supply is often more urgent still. Whilst radio covers approximately 75 per cent of Africa's population and television 40 per cent, the Internet's 0.1 per cent shows just how marginal a medium it still is. Until such time as these problems are addressed, it will remain the preserve of the tiny elite who can afford the exorbitant cost of being online. What little experience there is suggests that Internet access can spread, even to remote areas, where there are enlightened attitudes,

political will and financial backing; but such examples are still rare. In countries where access to the basic needs of food, water, shelter and health care are still major problems, providing access to the Internet will have to work hard to justify a high prioritisation.

The above analysis of both the telecommunications and Internet sectors in Sub-Saharan Africa has revealed the poor state of infrastructure in the region. However, the analysis is limited to an extent by its recourse to traditional approaches to data collection. The inherent accuracy of the available data leads to the enormous difficulty of measuring information and communication technology growth and application. 'Counting telephones' continues to be an inaccurate measure of telecommunications diffusion, with lines more often than not shared within a community. Moreover, such narrow, empirical approaches fail to capture critical information: namely, the value added of information and communication technologies, how and whether they are being used productively or contributing to confusion and disorder. As Mansell and Wehn (1998) have pointed out:

Even with the statistics available on telecommunications services...we do not know which of the minutes are being used to converse with relatives and which are being used to arrange for the financing or production of goods and services (Mansell and Wehn, 1998, p. 40).

An additional limitation of these indicators is their inability to capture the importance of the societal dimension of information and communication technology development. Ohkawa and Rosvsky (1972), for example, refer to the crucial importance of social infrastructural elements if information and communication technologies are to be effectively leveraged. They argue that these are:

...the levels of general education and technical competence; the commercial, industrial and financial institutions that bear on their abilities to finance and operate modern large-scale business; and the political and social characteristics that influence the risks, the incentives and the personal rewards of economic activity, including those rewards in social esteem that go beyond money and wealth (Ohkawa and Rosvsky, 1972, p. 213).

If we are to address these common questions and concerns effectively, the development of new and different ways to measure and benchmark electronic communications is a necessity. Current definitions and measurements of infrastructure, accessibility, and use are inadequate and misleading. For example, despite the importance of other versatile and competitive delivery systems such as cellular, VSAT, and cable, not to mention the expanded role of computers and televisions, the only widely accepted measure of electronic communications deployment remains teledensity. Teledensity is a useful but outdated concept in developing countries; rather, other factors must be considered if we are to effectively measure or benchmark what information and communication technologies are having a beneficial impact and why.

#### **4.5 Catching up, falling behind**

These caveats aside, it is clear that progress to date has been far too slow to justify an optimistic future appraisal of the information and communications sectors on the African continent. The poor quality and provision of information and communications services, combined with the decline in the social infrastructure and governmental reticence towards deregulation and coordinated planning, continue to militate against effective information infrastructure construction. Nor is it just the case that Africa's information infrastructure is lacking; rather, it is that the rest of the world is increasingly pulling away and leaving the region behind. An analysis of telecommunications infrastructure growth rates on a regional basis reveals that while other developing countries are busily and, on the whole, effectively upgrading their information infrastructures African growth rates in comparison are derisory.

According to a IDC/World Times report the gap between the most and least developed regions grew significantly in 1999; and the gap is forecast to grow. Other developing regions are also showing what can be achieved with concerted and consistent government policies. For example, the Asia-Pacific region has overtaken some European countries in the development of information age infrastructures.<sup>44</sup> Evidently

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<sup>44</sup> The 1999 IDC/World Times Information Society Index Summary available at <http://www.idc.com/Data/Global/content/GB040699ISIPromo.htm>. Accessed 3 June 1999.

the strategy being pursued by African countries is failing to achieve the requisite result. The report does not cover Sub-Saharan Africa, partly because of the constraints on accurate data collection, but also because of the minimal impact information and communication technologies have had in the region. However, researchers have noted the long-term implications of the rest of the world pulling away and leaving Africa further and further behind. A senior research analyst at IDC is quoted as saying that:

With so many countries improving their ability to create, manage, and use digital information so quickly, the pressure on the more slowly moving countries is intensifying. The very real threat is countries that do not create a national information policy – and make the attainment of this policy a priority – will fall further and further behind.<sup>45</sup>

Table 6 highlights Mansell and Wehn's (1998) argument that at the current rate of growth of diffusion, the probable time frame for developing countries to "catch up" with developed nations – i.e. attaining the same levels of teledensity currently enjoyed by industrialised countries – is between 50 – 100 years.

**Table 6: Convergence projections**

<b>Convergence criteria to the lowest level in industrialised countries</b>	
Industrialised countries, first tier NIEs	Advancing at the frontier or nearly converged
Second Tier NIEs, China, European developing countries, West Asia	Convergence will take a decade
Eastern Europe, China (more realistic), Other Asia, Mahgreb, Caribbean, South America	Convergence will take a generation (15-20 years)
Other Northern Africa, and developing Oceania	Convergence will take 30 years
Sub-Saharan Africa, Central Asia	Convergence is out of sight (50-100 years)

*Source: Mansell and Wehn, 1998, p. 25.*

<sup>45</sup> Stephanie Hutchinson, quoted in The 1999 IDC/World Times Information Society Index Summary available at [http://www.idc.com/Data/Global/content/GB040699\\_ISIPromo.htm](http://www.idc.com/Data/Global/content/GB040699_ISIPromo.htm). Accessed 3 June 1999.

The inability of African countries as a whole to keep pace with growth in other regions raises the very real spectre of exponential loss. Moreover, it highlights the ineffectiveness of current strategies to improve the information infrastructure in Sub-Saharan Africa. Despite the consensus that Africa is falling behind, it is highly likely that given the size of these markets and the persistent search for high value added, by the foreign private sector, that the information infrastructure in Africa will be constructed. One only has to look at the rapid growth rates of Internet connectivity over the period 1996 – 1998. However, the question raised by what little empirical evidence exists is, in the absence of government who is creating information infrastructure in the region.

With no clear and consistent efforts by African governments to formulate policy in this area, other actors have continued to shape the African information infrastructure agenda. In the case of the information infrastructure international actors and structures play an important role throughout the process. Key players, such as the World Bank, are pressing governments to reform their telecommunications sectors. With their technical expertise, international consultants are shaping the design of policy, and in more advanced stages of the process, international investors and the foreign private sector are influencing the final regulatory framework and determining the degree of openness of domestic markets (Chambers, 1997).

The process of information infrastructure development in Sub-Saharan Africa has been and continues to be a complex phenomenon, typically involving actors playing various roles at various levels. In line with the theoretical framework outlined in Chapter Two, research into the process of the construction of information infrastructure necessitates an identification of the actors that are relevant to the process, and the nature of their influence. According to Bijker and Law (1992) technology and artefacts are shaped by actors who participate in the international negotiating process. From a survey of the literature and the available data the main actors in information infrastructure development in Sub-Saharan Africa can be identified as:

- indigenous policy-makers;
- international development agencies;
- the international governance regime;



- the local private sector; and
- the foreign private sector.

These actors are exerting influence on the development of information infrastructure in Sub-Saharan Africa in the areas of policy advice, technology support and provision, regulation and financial assistance.

## **4.6 The main actors in information infrastructure development in Sub-Saharan Africa**

### **4.6.1 National governments**

A survey of the informatics policies in Sub-Saharan Africa bears out the fears aired above. While national promotional policies are largely absent on the continent, the majority of countries still have in place an implicit information infrastructure policy: a substantial number of laws and regulations that have a negative impact on the area of information and communication technologies (Okut-Uma, 1991). These mainly come in the form of tariffs on the import of these technologies and constrain competition in the communications sector. As a result, the legal and fiscal policy environment continues to hinder rather than promote the optimal utilisation of information technologies. High tariffs and complex customs procedures have limited imports, and the absence of a correlation between telecommunications development and telecommunication policies has been an obstacle to growth. Regulations requiring type approvals of equipment and bans or other limitations on communications equipment (faxes, modems, satellites and satellite dishes) have also prevented the wider dissemination of information technology.

The vast majority of African governments have yet to define strategies for using information and communication technologies to foster social and economic development. Table A1, in Appendix A, shows that up to 1999, out of the 48 countries that comprise the Sub-Saharan Africa region, only five had clearly articulated a national information infrastructure policy, whilst less than a third had set up a dedicated NII agency. Thus, there is still a policy vacuum at the most critical of stakeholder levels. As a result, the role of other, better informed actors, is heightened.

In such a climate of governmental neglect, any talk about a serious reduction in existing information infrastructure disparities between advanced industrialised and developing countries is misguided, at least for the foreseeable future. It is an illusion to think that poor countries can "catch up" or keep pace with advances in the most technologically advanced societies. In the advanced industrialised countries the rate of technological development is very high and is supported by enormous research and development resources. This is certainly not to say that poor countries should not try to upgrade their systems. But they should not do so in the unrealistic expectation that those who are ahead will wait for them (Abramovitz, 1996). The situation may improve for poorer countries, but the present disparities are unlikely to go away. Unfortunately, in most countries concern about access to these new technologies is met by public policies that tend largely to react to an already defined technological environment – in part because the capacity to identify appropriate information and communication technologies is not locally available. This postpones necessary efforts to consider the kinds of technologies that might be appropriate for their specific development trajectory.

Such public inertia is in stark contrast to the urgent efforts of countries in other developing regions. Almost all countries in the Asia-Pacific region have articulated information infrastructure plans and are relatively well advanced in upgrading their infrastructures. In Latin America, there is a similar level of public commitment to national information policy management (Mansell and Wehn, 1998). The public policy vacuum in Africa appears to have multiple causes. Firstly, with more pressing concerns<sup>46</sup>, and in the face of technological uncertainty, few have constructed policy strategies to ensure that the benefits of these technologies accrue equitably. The sheer pace of technological growth has caught policy-makers off guard and somewhat perplexed at the myriad technological options. It is only since 1994 that most governments worldwide have begun to realise that significant structural changes are afoot in the global economy as a result of the spectacular dissemination of ICTs. It is therefore perhaps unsurprising that African governments have reacted slower than most. Secondly, suffering from information asymmetries, policy-makers find themselves unprepared to make rational trade-offs between competing technological systems. Thirdly there has been some element of 'crowding out'. Economically fragile,

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<sup>46</sup> In 1999 over half of the countries in the Sub-Saharan Africa were engaged in some form of military action.

many African governments have traditionally relied on official assistance in technological matters. This has stifled public efforts to develop indigenous technological capacity. With the immediate merits of these technologies still unproved, and only the promise of potentialities, most continue to adopt a wait-and-see attitude.

At the regional level there have been belated efforts to create an African-driven agenda. Africa's awareness of the opportunities of the knowledge-based economy was reflected in the 1998 African Regional Symposium on Telematics for Development which was organised by the Economic Commission for Africa (ECA) in collaboration with other organisation including the International Telecommunication Union. Following this, a high-level working group consisting of experts on information technology in Africa was set up to draft an action framework to take advantage of information and communications technology for African development. The working group produced a document entitled "Africa's Information Society Initiative (AISI): An Action Framework to build Africa's Information and Communication Infrastructure".

The AISI initiative envisaged that by the year 2010, a sustainable information society would have been established, such that:

- information and decision support systems are used to support decision-making in all sectors of every country;
- all Africans would have access to information and knowledge resources through computers;
- access is made available to international "information highways"; and
- information and knowledge are disseminated and used by the public at large.

This initiative, combined with the Abidjan African Regional Telecommunications Development Conference in the same month, created internally generated pressure from the concerned ministries to urge their administrations to adopt appropriate regulatory, tariff and service provision policies. Additionally, the Global Information Infrastructure Commission (GIIC) has launched GIIC Africa, a regional initiative developed to promote the African private sector and support it in its efforts to deploy and develop knowledge and information industries.

#### 4.6.2 The foreign private sector

Foreign private sector companies<sup>47</sup> are playing an increasingly important role in information and communications development on the African continent in three key areas:

- (a) Telecommunications and Internet service provision
- (b) Information technology hardware and software
- (c) Content provision

Table B1 in Appendix B shows the extent of the involvement of the foreign private sector in both telecommunications and Internet service provision, with a number of international ISPs creating local subsidiaries to serve the African market. For example, Africa Online is now the largest ISP in Kenya. In 1999 the group consolidated its presence in Africa with new local branches opening in Tanzania, Uganda and Zimbabwe, adding to its stable in Ghana, Kenya, and Côte d'Ivoire. The other three multinational ISPs which operate subsidiaries or franchises in the region are UUNET, (in South Africa, Swaziland, Zimbabwe and Namibia) and Swift Global (Kenya, Tanzania and Uganda).

One of the major problems for African telecommunications expansion has been the difficulty of expanding the physical telecommunications network to remote locations. The costs of building physical infrastructure in these areas has proved so prohibitive that many public operators see it as uneconomical to provide links to the network to these areas. Coupled with the high cost of connecting this geographically dispersed population is the small amount of telecommunications traffic that is generated by the rural population. This vicious cycle has reinforced the reluctance of PTOs to invest in rural telecommunications infrastructure. Rather, attempts have been made to find a less expensive route to improving information infrastructure in rural areas. An apparent solution to this problem has come in the shape of new connectivity options. Satellite technology, for example, ideally suited to geographically isolated regions, has been proffered as an obvious and relatively straightforward solution to the problem of rural

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<sup>47</sup> Defined as private companies operating in foreign locales and including local subsidiaries of foreign firms.

telephony. It is only with the advent of technological innovations and plummeting costs that these new technologies are now within the possibility frontiers of policy-makers in developing countries. It is in this respect that the foreign private sector is playing an important role in developing Africa's information infrastructure.

#### (a) New Connectivity Options

Hawkins (1999) points out that over the past decade, consortia have become a structural feature of technology and market coordination in the information and communication technology industries. Especially in the capital-intensive submarine cable and satellite industries. The huge initial entry costs involved in setting up such "global" projects have necessitated cross industrial alliances.<sup>48</sup> The implications for developing countries are that it is far more difficult to negotiate against such formidable alliances of private interest. The world's oceans are now criss-crossed by undersea cables laid by a number of consortia, all of which are in competition to provide high-capacity global connectivity in exchange for higher profit margins.

A number of international telecommunication infrastructure building initiatives have been announced which are likely to substantially affect the provision of infrastructure on the African continent. One of the most well-known of these is Tyco Submarine Systems' Africa One which aims to put an optical fibre necklace around the entire continent; however, following its announcement in 1995, it has still not been finalised and a large number of other competing projects have emerged.<sup>49</sup> Within the next decade, other satellite-based communication systems will be launched, and new projects are expected to radically improve access for the most remote areas of the continent. However, these technological innovations raise difficult questions in the realm of political economy, centring on such issues as access, control and expense. Who will have access to the emerging digital grids and at what price, and who will control the networks? Where will the intelligence that guides the network be stored and who will own it: the network operator or the end-user?

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<sup>48</sup> For example the Teledesic project is seeking approximately US\$ 9 billion for its broadband satellite scheme.

<sup>49</sup> Africa Analysis (1998) "Africa One Sliced Up", *World Reporter*, 20 March 1998.

Given the prohibitive costs associated with information infrastructure development, the only strategy may well be to try to keep costs down by building alliances through a mixture of regional allies and strategic alliances with the foreign private sector (Vonortas and Safioleas, 1997). Yet such alliances are inherently asymmetric, and unlikely to correlate with the long-term development objectives of African countries. This situation suggests the desirability of cooperation by regional or language groupings on communications development. Despite frequent international conflict between neighbouring countries, it is hoped that small or poor countries can cooperate in creating regional and global consortia for domestic as well as international communication. Moreover, international cooperation will be necessary to ensure crucial issues such as interoperability, and international intellectual property rights.

In reality, it is often difficult for policy-makers to assess the relative merits of one technological system over another. Policy-makers must ask how these new technologies can contribute not only to improved telecommunications but also to the wider development of a national information infrastructure. It is beholden unto policy-makers, therefore, to assess the relative merits of these providers and utilise the most appropriate technologies to upgrade their infrastructures. Otherwise, given the informational asymmetries between Sub-Saharan African countries and the industrialised nations, these issues will be decided *in absentia*.

#### (b) Local production capacity

Another key area in which the foreign private sector exerts influence is in the provision information and communication technology hardware and software. Local production capacity of ICTs is, to all intents and purposes, negligible in Sub-Saharan Africa. This lack of indigenous capacity raises major issues about obtaining access to vital telecommunication and other computer-based equipment. Very few developing countries have direct access to world-scale ICT production plants. Moreover, for the world's poorest countries, the application of finite foreign exchange reserves has to compete with other pressing requirements such as imports of pharmaceuticals and agricultural equipment. Production capacity has been expanded in developing countries, but the sector continues to be dominated by facilities located in high income industrialised countries. Several of the Asian economies have enjoyed a significant

measure of success in building indigenous ICT production capacity. Korean based multinationals, for example, have become the largest producers of computer memory chips, while Singapore, Malaysia, Thailand and Taiwan have become significant sources of supply of key electronic goods such as mobile telephones, personal computers, computer disk drives and computer monitors.

Evidently, the lack of local production capacity in the ICT sector need not be an obstacle to the expansion of ICT services. However, this reinforces their dependency on western research and development. Moreover, the technology will have to be adapted to the African environment. Sussman and Lent (1991) point out that there is at present no convincing evidence that the owners of advanced technologies will change their attitudes and policies towards the international transfer of technology. Throughout the past decades, the prevailing international policies in this field have erected formidable barriers to the reduction of North-South technology gaps. There is no indication that the current restrictive business practices, constraints on the ownership of knowledge, and rules on intellectual property rights that are adverse to developing country interests, are radically changing. Thus, there are no realistic prospects that the relations between ICT-rich and ICT-poor countries will change in the near future. Furthermore, the key actors in international ICT policy-making have expressed a clear preference for leaving the construction of the global information infrastructure to the "invisible hand": casting aside concerns about the development of an equitable information society, and letting the forces of global capitalism prevail (Kundnani, 1998).

In addition to asking critical questions about reactive public policy-making, as well as about the lack of assessment capacity and cross-border coordination within the Third World, one must also consider whether the current worldwide emphasis on deregulatory policies can contribute to reducing the digital disparity between North and South. The policies and programmes launched by many of the developing countries now seem to focus almost exclusively on the creation of favourable conditions for commercial operators in the ICT market. As the UNESCO World Science Report acknowledges that 'there has been a new shift in favour of indirect measures such as deregulation and reinforcement of market mechanisms at national and international levels' (UNESCO, 1996, p. 277). But is this shift from direct public intervention to

more indirect (deregulatory) policies adequate to enhance the potential for national development that can arise from information and communication technologies?

#### **4.6.3 The international governance regime**

Another important key player in the development of information infrastructure in Sub-Saharan Africa is the international governance regime. Comprised of a loose consortium of regulatory bodies, international institutions and governments their role in determining the shape of the so-called global information infrastructure has never been more important. Key planks of this governance regime include:

- The United States government and its communications bodies such as the Federal Communications Commission.
- The International Telecommunications Union (ITU).
- The World Intellectual Property Organisation (WIPO).
- The World Trade Organisation (WTO).
- The Organisation for Economic Cooperation and Development (OECD).
- The International Telecommunication Satellite Organisations (INTELSAT) and INMARSAT.
- The European Union.
- The international development agencies, such as the World Bank and UN system.
- The Internet Assignment Number Authority (IANA)
- The Global Information Infrastructure Commission (GIIC)

These institutions comprise an international governance regime that has an unprecedented level of influence on the development of the global information infrastructure. The increasing influence of the private sector in these organisations has tended to reinforce a belief in deregulation at all costs. For example, the 1998 World Trade Organisation (WTO) agreement on basic telecommunications commits member countries to privatise their PTOs and to introduce competition in the provision of all services. Further, the 1998 ITU Plenipotentiary Conference led to an amendment of the ITU constitution to give greater rights and responsibilities to the ITU's private sector members (Maclean, 1999).



As a result one of the key mechanisms of redistributing telecommunications wealth to developing countries is under attack. The international system of revenue sharing between public telecommunications operators (PTOs) has long been one of the cornerstones of the international public telephone network. It is based on a wholesale price which operators pay each other for terminating their calls. Thus when one PTO sends more traffic to a particular PTO than it receives, it must pay the receiver network compensation in the form of a net settlement payment. These cash payments typically emanate from the core of a network to its periphery; from well-established players to new players; and from developed countries to developing countries. Consequently settlement payments systems should, in theory, act to sustain organic network development because the developed are subsidising the underdeveloped. The international accounting rate system has been subject to much criticism: namely that it keeps telephone charges artificially high, rewards inefficiency, promotes cartel-like behaviour by PTOs and institutionalises cross-subsidy. However, it has been a very effective mechanism for transferring revenue from traffic surplus countries to traffic deficit countries (Noam, 1999). Certainly a proportion of the settlements payments is diverted away from the telecommunications sector, but at least some of this much-needed revenue goes to PTOs to reinvest in network development.

Discussions as to what should replace the existing system of bilaterally negotiated accounting rates had to be completed by the end of 1999. The argument over introducing "cost-based" tariffs, calculated from the actual cost of supporting the network which delivers the call, instead of accounting rates, is now in its seventh year. The second factor that has thrown the accounting rate deliberations into sharp relief is the U.S. Federal Communications Committee's decision in 1998 to unilaterally impose its own benchmark. Rates of between 15 cents and 23 cents a minute, depending on the level of telecommunications development, were set from 1999 for all carriers transacting with the U.S. These figures undercut some developing world accounting rates by 80 per cent in some cases, and have been met with a storm of disapproval from those who accuse the U.S. of unilateral action (Shetty, 1998b).

There also appears to be evidence of pressure from industrialised governments to further national interests. Hyun and Lent (1999), in an analysis of the Korean telecommunications industry, argue that the United States used the World Trade

Organisation's Uruguay Round to further the interests of its telecommunications sector. Whilst such evidence is hard to come by in Sub-Saharan Africa, it is true to say that the international governance regime has consistently pushed an agenda of the wholesale privatisation of the telecommunications sector in Africa (ITU, 1998b). In June 1999, for example, the U.S. Federal Communications Commission (FCC) launched a new technical assistance initiative to help developing nations build independent regulatory regimes that will promote competition, liberalisation, and privatisation in their telecommunications sectors (Obiabaka, 1999). Unfortunately the ascendance of this agenda neglects to focus on key issues such as universal access and service. Rather, developing countries are being urged to open their telecommunications sectors to the foreign private sector without due consideration of the consequences.

In conclusion, the increasing collusion amongst the international governance regime in support of deregulation and the opening of markets has undermined the ability of African countries to argue for special treatment. Unfortunately, the majority of African governments lack the resources to leverage their position at the global negotiating table. Rather, African policy-makers are finding increasingly that key decisions that will affect their communications infrastructures are being taken in their absence (Mansell and Wehn, 1998). The problem is compounded by the fact that, in many cases, Sub-Saharan African states, 'seem to have no disinterested non-governmental organisations to advise them on telecommunication technology and on the social objectives of regulation, in order to safeguard those interests that private profit will not protect' (Mody et al., 1993, p. 270). Without adequate regulatory intervention to ensure accountability to the general public, market forces will continue to respond to the needs of those actors with purchasing power, which is bound to generate unequal development. And to make matters worse, there is also a critical absence of coordination of "digital" policies among the developing countries themselves (Hamelink, 1997). Unless more concerted attempts are made to pool the collective resources on the continent, Africa will find itself perennially without a voice on the international stage.

#### **4.6.4 The role of development agencies**

The Internet has become one of the key development issues of this decade, prompting a reconfiguration in international development thinking and many donor and multilateral lending organisations are radically reshaping their policies for the so-called information age. The World Bank, for example, has begun to describe itself as the "knowledge bank" and devoted its 1998 World Development Report to the role of knowledge in development (World Bank, 1998). This shift follows a growing acceptance of the importance of the role of communications in development, an issue long debated by development theorists (Schramm, 1964, Lerner, 1958, Hudson, 1984). Development agencies have been at the vanguard of efforts to improve the information infrastructure in Sub-Saharan Africa. The United Nations and its various agencies, the World Bank, the International Telecommunication Union, and the Canadian International Development Research Centre (IDRC) have all pursued major initiatives in this area and have been largely responsible for bringing Internet connectivity to the continent. There are now over 100 organisations engaged in over 300 projects involving information and communication technology activities in Sub-Saharan Africa. Whilst these efforts have brought much needed expertise and at times physical infrastructure to the Sub-Saharan Africa region, they have been haunted by the traditional demons of haste, lack of coordination, and appropriateness (Kangulu, and Wood, 1995). These issues and a host of others that are discussed in greater depth in Chapter Six, point to the desperate need for actors in this area to actively cooperate to rationalise competing, parallel and overlapping initiatives.

#### **4.7 Summary**

Information and communications technologies are rapidly changing economic and social activities, providing both opportunities and challenges for making progress with accelerated growth and poverty reduction in Africa. If leveraged correctly these tools can help decision-makers to promote effective economic and social management and allow businesses to compete more effectively with timely and accurate market information. To exploit these opportunities, African countries need, as a matter of priority, to upgrade their capabilities through the improvement of their

telecommunication infrastructures and the acquisition of computer and computer-related equipment. National institutions responsible for data collection and processing need to be strengthened and their traditional information collection and dissemination structures need to be modernised if they are to be full participants in the global economy. Governments have to facilitate information transmission and connectivity to the global infrastructure by passing the necessary laws and regulations. Governments need to create the supportive external environment for promoting the use of information and communication technologies. These desired improvements need to be pursued within the framework of comprehensive national or sub-regional plans to link African countries to each other and to the global information infrastructure.

This chapter has analysed the state of information infrastructure in Sub-Saharan Africa in terms of two key elements: telecommunications and Internet development. The chapter has identified the various actors partaking in the development of information infrastructure in the region, assessing their roles and motives. Whilst the empirical evidence is incomplete, it does reveal statistical homogeneity in the Sub-Saharan Africa region in terms of the paucity of information infrastructure. By any measurement, the inadequate information infrastructure in the Sub-Saharan African region is the major obstacle to countries leveraging information and communication technologies for national development. Nor are policy-makers aided by the multiplicity of actors with divergent interests in the region. What is needed are clear, consistent and concerted national efforts to create an effective national information infrastructure. The benchmark of efficacy must be appropriateness to the national context, sustainability and dynamism. Without such a strategy Sub-Saharan African countries will increasingly find themselves marginalised to the global economic periphery, as other developing nations catch up and Africa falls continually behind.

## CHAPTER 5

### New Connectivity Options in Sub-Saharan Africa

#### 5.1 Introduction

In the wake of the slow pace of indigenous telecommunications reform, a host of large-scale information infrastructure projects have emerged that offer alternative connectivity options. These projects are being designed and funded by foreign consortia comprised of multinational corporations specialising in information and communication technologies. As a result, since 1994 a large number of cable and satellite projects have been announced or are being planned and implemented on the African continent. These projects are seen as bringing much needed communications capabilities to Africa. Whilst these projects have the potential to improve the Sub-Saharan African information infrastructure, they also present policy-makers with a range of issues that must be tackled.

These new solutions offer the opportunity for vastly improved communications, with increased volumes, speed and reliability, and a wider range of services, all at lower costs. However, as African governments and carriers have been approached by the private promoters of these projects, they have found it difficult to assess the merits of the various technological alternatives. Faced with rapid technological change and resource constraints, the bargaining position of countries in Sub-Saharan Africa would seem to be rather weak. Compounding this problem is that no substantive research has been conducted on the potential strengths and weaknesses of these various connectivity options. Resolving these issues necessitates, firstly, an understanding of the economics of these projects and, secondly, an analysis of the systems themselves. This chapter examines new connectivity options emerging on the continent and asks how they can contribute not only to improved telecommunications, but also to the wider development of information infrastructure in Sub-Saharan Africa. Taking satellite and submarine cable systems as proxies for technological innovations, a framework is developed to analyse the relative merits and disadvantages of each system in relation to national criteria. This comparative exercise is designed to illustrate the kind of strategy and

decision calculus that policy-makers can employ to make rational trade-offs and seek synergies amongst distinct, complex and sometimes contradictory technical systems.

## **5.2 New connectivity options**

The greatest difficulty in providing telecommunications services in developing countries has been the establishment of a comprehensive public telecommunications infrastructure (Saunders et al., 1994). Terrestrial transmission lines are expensive and time-consuming to construct and maintain. Further, demand for such services has rapidly exceeded supply and the infrastructure has necessarily, and for practical reasons, been concentrated in urban areas. The 1990s have seen mounting interest from multinational companies in offering such connectivity options in developing countries. Not content with supplying Africa with merely the apparatus of fixed telephony, European and U.S. companies are becoming increasingly involved in other market segments, from international satellite and transcontinental undersea cable services to cellular telephones and the Internet. These projects, along with an increasing number of new technological innovations, present policy-makers with a bewildering array of connectivity options.

## **5.3 Satellite projects**

An important measure of the uneven state of global communications development is the pattern of international fibre optic cable and satellite services. Most, at present, serve the Northern Hemisphere and extend from the East to the West, leaving the Southern Hemisphere grossly under-served. As a consequence, a phone call from Nigeria to the Ivory Coast – only 800 miles away – for example, is often routed through London, then Paris and finally to Abidjan. Such a circuitous route takes away call traffic control from African carriers and results in enormous revenue loss. Whilst each African country has its own satellite facilities and earth stations for international connectivity, intra-national communications capacity is woefully inadequate. It is estimated that African countries

are spending between US\$300 and US\$400 million on intra-country transit fees alone.<sup>50</sup>

Satellite systems can be used to provide basic telephony as well as radio and broadcast television with the principle advantages of reliability and durability. Capable of installation wherever necessary, they are considered to be well suited to the Sub-Saharan African environment (Gifford and Cospér, 1998). For example, small, low-cost earth stations such as those used to provide rural telephony with domestic satellites can provide isolated regions with voice and data communications. Satellite systems and operators in Sub-Saharan Africa can be classified into four categories:

1. Treaty organisations such as INTELSAT and RASCOM.
2. Private satellite systems such as PanAmSat and VITASat which offer specialised services not connected to national telecommunications operators.
3. Narrowband global mobile personal communications by satellite (GMPCS) systems such, Iridium and Globalstar.
4. Broadband satellite systems utilising low earth orbiting (LEO) technology, such as Skybridge and Teledesic.

Up till 1984, the international telecommunications satellite organisation (INTELSAT) maintained the international satellite space segment, operating two thirds of all intercontinental message traffic and virtually all live transborder television communication. Though INTELSAT still has by far the largest share of the market it is being increasingly challenged by private companies such as PanAmSat, which now has two satellites serving Africa. Prior to deregulation, INTELSAT was often criticised by developing countries for its bias towards developed countries (Blake, 1998). Its free market ethos dictated that satellite segments be allocated on a "first come first served" basis rather than an equitable sharing of a common resource. Partly as a result of this bias, and obviously due to cost considerations, there is now a huge disparity in the satellite communications capabilities of the developed and the developing world. As of 1993, there were some 184 communications satellites in geosynchronous orbit. Of these only a small number had been launched by developing countries<sup>51</sup>, severely limiting the

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<sup>50</sup> ITU (1997b) *World Telecommunications Development Report*.

<sup>51</sup> One by India, three each by Colombia and Indonesia; two each by Brazil, Mexico, and a consortium of Arab nations, and one by China.

capacity of developing countries to exploit the benefits of satellite technology. In stark contrast to the majority of developing regions who are covered by domestic satellites, Sub-Saharan Africa remains without its own domestic satellite. Instead it relies on INTELSAT for intranational satellite communications.

Though practically all countries in Sub-Saharan Africa have satellite earth stations, the technology has yet to be fully exploited. The high cost of using satellite telephony has necessarily restricted access to a handful that are willing to pay up to US\$3 per minute for the privilege. In an attempt to resolve the lack of indigenous satellite communications capacity the Regional African Satellite Communication System (RASCOM) was established in 1992 to harness satellite communications and to address continent-wide sector development. RASCOM was conceived by the Organisation of African Unity (OAU) to cut the continent's estimated US\$300 – 400 million spent on international carriers for external communications<sup>52</sup>, and to boost telecommunications traffic among African states. The RASCOM project, based in Côte d'Ivoire, is the largest pan-African investment ever conceived. The organisation is comprised of 40 African countries whose principal focus is satellite communications. Its first mandate has been to pool satellite capacity<sup>53</sup> purchased by individual national operators under the RASCOM umbrella which was achieved in September 1997. Bringing unprecedented satellite communications capabilities to Africa.<sup>54</sup>

RASCOM's second objective is to boost the communications capacity of Africa by undertaking the most ambitious pan-African project ever conceived. By launching the first pan-African communications satellite the aim is to reduce the average distance to the nearest phone in African countries by ten-fold from 50 kilometres to five kilometres. Connecting Africa's 500 million rural inhabitants to the world is a cardinal objective of the project, whose terrestrial phase alone is expected to cost US\$800 million. The organisation is aiming to install some 456,000 fixed solar-powered telephone stations with global connectivity across the continent over a period of seven years. The organisation was due to invite preliminary tenders at the end of 1998 from

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<sup>52</sup> At present the majority of the traffic emanating from Anglophone countries is routed via England, while all Francophone countries are routed to France.

<sup>53</sup> Currently Sub-Saharan African telephone operators use more than seven different satellites.

<sup>54</sup> See *Satellite News* (1997) "Groups move to improve communications In Africa", September (37:Q1).



international companies who want to join a "build, operate and transfer" (BOT) consortium to launch and manage the satellite. The organisation is also in the process of investing US\$330 million on a spatial satellite system, of which US\$130 million will go for space on an INTELSAT satellite to serve as backup. RASCOM estimates that calls from its phone stations would be around 10 U.S. cents a minute, with the cost of building one phone station projected at US\$1,000.<sup>55</sup>

#### (a) Foreign Private Sector Projects

RASCOM is far from alone in its ambitions to boost the telecommunications capacity in Sub-Saharan Africa. A number of multinational consortia have been planning the deployment of new satellite systems designed to offer services ranging from global mobile communications to broadband fixed telephony. Current satellite constellations deploy geostationary orbiting satellites that suffer from a variety of restrictions that these new systems aim to bypass. Propagation time delays arising from the lag between signal transmission and reception are problematic, and noise deterioration in the form of echoing is unsatisfactory. Also, as the power required to send a signal the distance of 36,500 km is high, large terminals for the receipt of signals are a requisite, thus making hand-held mobile communication, for the most part, impractical (Leite, 1996). In an attempt to bypass these problems new satellite communications systems are being planned and deployed which utilise the latest in satellite technology and have the potential to provide Sub-Saharan Africa with instant infrastructure. The common denominator of all these planned systems is their use of low earth orbiting satellites, which rest at relatively close proximity to the earth and therefore avoid some of the deficiencies that affect their forerunners. As of 1999, there were three types of low Earth orbit satellite systems that were being proposed.

The so-called Little LEO satellite systems are designed to use low Earth orbits to offer worldwide data communications in small tranches, at transmission rates akin to mid-1980s personal computer modems. Among the communications services offered by

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<sup>55</sup> "African Satellite Telecom Network Set for Launch", *Newsbytes*, 5 December 1997.

little LEOs are automated meter reading, remote asset tracking, vehicle messaging, personal messaging and supervisory control and data acquisition. Next are the medium-sized LEOs, that would allow global communications using hand-held GMPCS devices from any location on the planet. The system may be significant for Africa, as the coverage of terrestrial mobile services is very limited at present.

Finally, there are the super-LEOs such as Skybridge and Teledesic. The Alcatel Telecom Skybridge project is a satellite-based broadband non-geostationary orbit system that will use 64 LEO satellites and be operational in 2001. The Skybridge satellite system plans to be the first of the broadband systems using LEO satellites in 2000, with Teledesic following closely in 2003. Teledesic's 266-satellite system is designed to provide broadband communications to users globally. Teledesic's copyrighted "Internet in the Sky" motto is an apt description of a system intended, from day one of operations in 2003, to enable broadband telecommunications access for businesses, schools and individuals irrespective of location.

Formed in 1990, and backed by Microsoft chairman Bill Gates, Teledesic plans to create the first satellite network designed to provide affordable, worldwide access to digital services such as broadband Internet, videoconferencing and high-quality voice communications. The Teledesic constellation will operate in low earth orbit, eliminating the long signal delay normally experienced with geostationary satellite communications. The lower orbit also enables the use of small, low-power, terminals and antennas. The laptop-sized terminals will be mounted flat on a rooftop and connect to a personal computer or network. The system is designed to support millions of simultaneous users, with access speeds more than 2,000 times faster than the 1998 standard of 33 kbps analogue modems. However there are doubts about the launch date of the project. With the highly publicised failure of the Iridium system, similar schemes may fail to attract sufficient funding and become unfeasible.

Table 7: Planned Satellite Projects relevant to Sub-Saharan Africa, July 1999<sup>56</sup>

Name	Main Investors and industrial partners	Industrial Partners	Estimated Project Cost (US\$)	Type of system	No. of satellites	Services	Start date	Relevance to Africa
ACTEL	ACTEL Ltd.	American Mobile Systems	385 million	GEO	2	Mobile telephony, voice and data	2001	Initial coverage of Southern Africa and then pan-African
East	Matra Marconi Space	n/a	1 billion		1	Telecommunications and multimedia	2000	Pan -African coverage
Ellipsis	Mobile Communications Holdings Inc.	n/a	n/a	MEO	10	GMPCS, fixed telephony, fax, data, paging, positioning services	2001	Coverage in Sub-Saharan Africa
Globalstar	Loral Space and Communications and QualComm	Aérospatiale, Alcatel, Daimler Benz, Fimmechanica and Hyundai, Teital and Ericsson	2.5 billion	Narrowband LEO	48	GMPCS, telex, fax, data, paging, position services	1999	Partners in South and West Africa
ICO*	Inmarsat	Hughes Electronics, NEC, Ericsson, Samsung, Panasonic, Mitsubishi and Wavecom.	3 billion	MEO	10	GMPCS, fixed telephony, fax, data, paging, position/emergency maritime services	2000	Earth Station in South Africa
Inmarsat	Inmarsat International Consortium	n/a	n/a	Narrowband GEO	5	GMPCS, telex, fax, data, paging, position/emergency maritime services	1993	Global organisation providing specialised services
Iridium*	Motorola	Lockheed, Raytheon, DEVCOM, Siemens	3.8 billion	Narrowband LEO	66	GMPCS, fixed telephony, fax, data, paging.	1998	Iridium Africa holds a 1.2 per cent stake
Orbcomm	Orbital Sciences Corp and Canadian telecom provider Teleglobe Inc.	Technology Resource Bhd	500 million	Little LEO	36	2-way messaging, data, global monitoring and positioning	1998	Services available between the tropic of Cancer and Capricorn
PanAmSat	Hughes Electronics	n/a	n/a	Broadband GEO	17	TV, private communications networks, video conferencing paging.	1997	Already have a service provider in Africa
RASCOM	African governments and 40 operators in African countries	Open to tender	1.2 billion	Broadband GEO	2	Fixed telephony, distance education/health, TV, radio, data	2001	African organised
Skybridge	Alcatel	Ericsson	1 billion	Broadband LEO	64	Telehealth/education/commuting Internet access, interactive entertainment	2001	Coverage in Africa
Spaceway	Hughes Communications Inc.	n/a	1 billion	MEO/LEO	20 MEO/8 LEO	Fixed telephony, fax, data Inter/Intranet access, telecommuting, CAD/CAM transmission, videoconferencing	2001	Coverage in Africa
Teledesic	Microsoft and McCaw cellular communications	AT&T	9 billion	Broadband LEO	288	Voice, data, video conferencing, Internet access	2002	Main focus on rural and sparsely populated areas.
VITASat	NGO-	n/a	n/a	Little LEO	2	Global e-mail	1998	Service in North West Africa

Source: Collated from UNESCO World Communication Report, 1997, Fibre Optics News, Satellite Communications and BMP, 1998.

\* Both Iridium and ICO had filed for bankruptcy by the end of 1999.

## 5.4 Submarine cable projects

While competition increases apace in satellite communications, African policy-makers are also able to choose from a raft of ongoing initiatives to integrate Africa into the global information network through fibre optic underwater cables. Since the 1980s there have been several proposed projects to encircle the African continent with submarine cable systems. By utilising a system of diverse routing, the rationale behind submarine cable schemes is to provide global connectivity with the capability of direct transmission links between African countries. Optical fibre links to the outside world are already in South Africa and several North African countries. Integration of such a network into the microwave and satellite systems will enable Africa to penetrate the world network and increase the value of its existing resources. These schemes can be broadly situated within one of three categories:

1. Continent-specific projects such as Africa One.
2. Intra-continental projects planned to link Africa with other continents, such as SAFE, SAT-3 and WASC.
3. Projects designed to have landing points only in Africa such as FLAG and Sea Me We and Atlantis 2.

Africa One is perhaps the most trumpeted of a raft of fibre optic cable schemes. Originally developed under the auspices of the ITU by AT&T Submarine systems, the project consists of a 35,000 km submarine fibre optic ring that encircles the African continent. At the heart of the Africa One concept is its vast "ring-and-branch" configuration. This consists of branches connecting coastal landing points with the main fibre optic ring, allowing connection to Africa's coastal and land-locked countries as well as its islands (Blake, 1998). The scheme has adopted the latest in fibre optic technology, utilising wavelength division multiplexing (WDM). This transmission technique increases fibre optic capacity by simultaneously transmitting signals over different wavelengths within one fibre. Thus, an important element of the system is the independence of each connecting node.

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In older submarine systems, telecommunications traffic is routed uniformly; all traffic passes through the same location irrespective of origin. With wavelength division multiplexing, each country's traffic is represented by a separate colour on the fibre optic pair. Thus, only traffic originating and flowing to, for example, Nigeria will pass in and out of that country (Blake, 1998). This has been seen as a key element in convincing African policy-makers as to the efficacy of the project's treatment of telecommunications traffic. An additional selling point has been that the project will be composed of two fibre pairs, one for providing the primary traffic path and the other for automatic restoration in the case of system failure. Hence, in the event of a break anywhere in the ring, traffic is automatically re-routed via the second line.

Africa One is proposed as a three-tiered network. The first tier focuses on the populous coastal centres in Africa. These locations serve as natural gateways for international trade and, more practically, as landing points that can divert international traffic to land-based destinations throughout the continent. The second tier will connect all African nations through a regional network, integrating and supporting Africa's existing communications infrastructure. The third tier will provide global connectivity by linking the Africa One undersea fibre optic ring to existing transcontinental cable schemes. The volume of telecommunication traffic on the Africa One is projected at some four billion minutes in the first year of its operation (2001). The traffic base is then projected to grow to some 28 billion minutes by the year 2014<sup>57</sup>, whereas the total traffic for the continent in 1995 was 4.7 billion minutes. It is estimated that a single fibre pair will provide over 240,000 full bandwidth (64 kbit/s) voice circuits, thus meeting all the cable circuit requirements of African countries up till 2020. A traditional problem with cable systems has been the lack of control over indigenous traffic. Most developing countries want to maintain sovereignty over their own traffic and do not want their neighbours to have access to it. The Africa One system resolves this sovereignty issue by placing the majority of the network on the sea floor. Each country obtains independent access to the network by means of undersea branching technology. Outbound traffic from the region is then aggregated at the point of connection to the inter-regional tier (Zsakany and Marshall, 1995).

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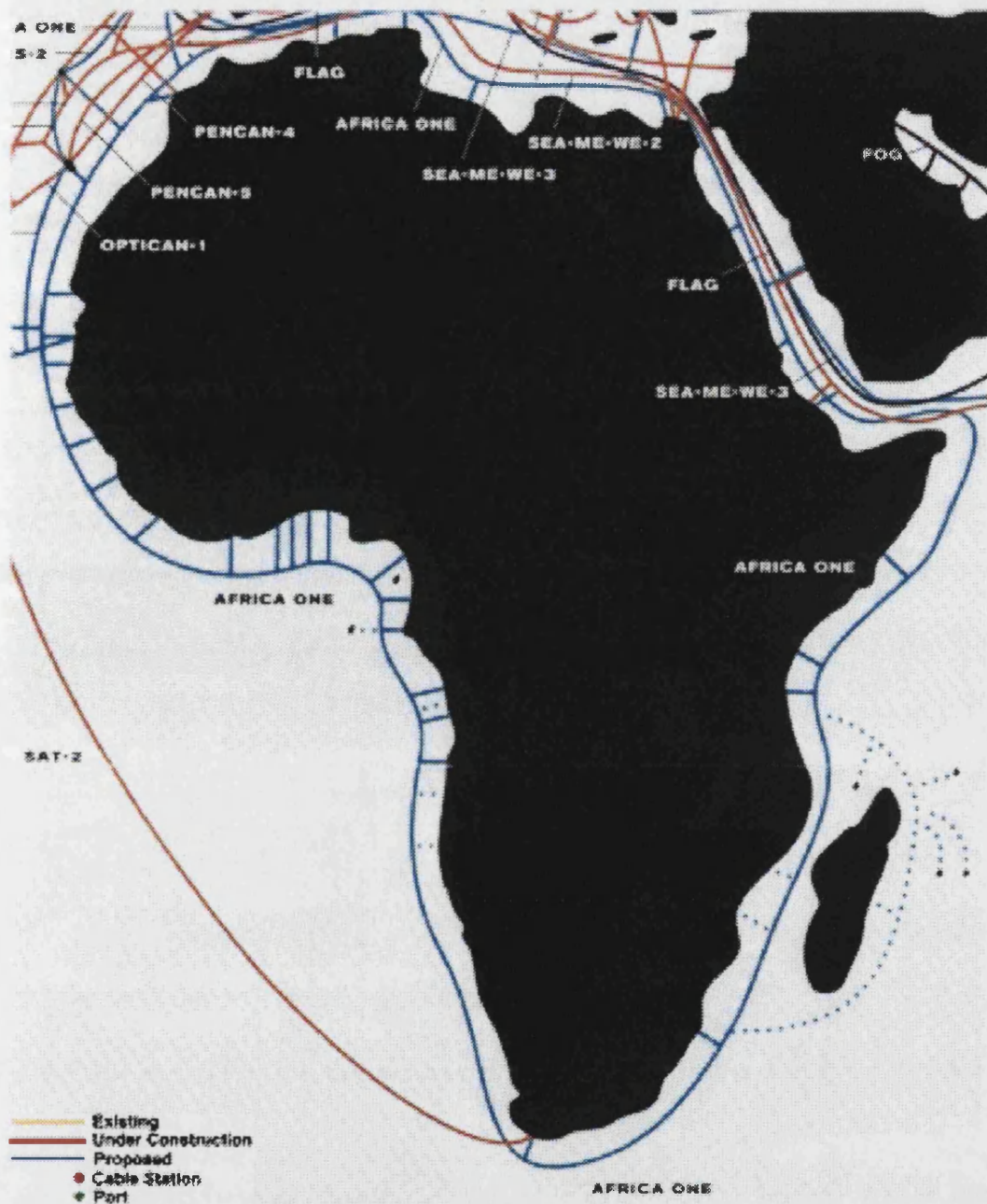
<sup>57</sup> "Africa One garners support", *Fibre Optic News*, 20 October 1997.

Traditionally, carriers who purchase capacity on the network have been the principle source of funding for submarine cable systems. However, a lack of capacity commitment precludes such an approach in Africa. Instead a build, operate and transfer (BOT) scheme has been set up. Entailing a private group of investors initially underwriting the project, limiting the liability of African carriers, but still providing them with an immediate and stable revenue stream. Consequently Africa One Ltd is to construct the project itself with African carriers buying capacity at US\$15 million per landing point. Carriers would then get the revenues from the circuits they buy immediately and, at the end of 12 years, ownership of the scheme would revert in its entirety to the African carriers.

Though trumpeted as the ultimate connectivity solution for the African continent, the project has been plagued by a number of economic and political problems. Firstly, it has faced the formidable problems of coordinating so many countries of variable size and resources. Secondly, the macroeconomic and political instability on the continent has militated against effective fund raising. Fundraising arrangements for the scheme have been 'murky and surrounded by misunderstandings' (Wilson, 1996b, p. 4). Though the project was launched by AT&T submarine systems, it was subsequently sold to Tyco Ltd in May 1997. Some governments have also been loath to commit themselves to such an expensive and grandiose project, when there are other smaller, more manageable systems available. These include competing cable schemes with landing points in Africa such as the Fibre Optic Link Around the Globe (FLAG), Project Oxygen and Afrilink.

Political problems have continued to hinder the project. Though it was to be an African project, the scheme has been designed wholly "offshore" with little input from the policy-makers of the markets it hopes to serve. Critics have claimed that such a grandiose scheme is reminiscent of Cecil Rhodes' Cape-to-Cairo railway and have denounced Africa One as an exercise in new-tech colonialism. There have also been claims that too much emphasis is being placed on coastal areas at the expense of the large number of landlocked countries. Figure 5 reveals the number of competing submarine cable projects, planned or operational that may provide additional telecommunications capacity to Sub-Saharan Africa.

Figure 5: Map of existing and planned submarine cable systems linked to Africa



Source: Tyco Submarine Systems Inc.

In June 1997, in an attempt to diffuse such criticism, the cost of the Africa One submarine cable was reduced from US\$ 1.6 to 1.3 billion to release US\$ 300 million for linking land-locked countries to the main fibre optic ring. Further political bridge building was sought with the creation of the Africa One Coordination Committee following a recommendation of the Consultative Meeting of African Member countries



of the ITU in Tunis, in November 1995. The Committee is made up of a group of African countries<sup>58</sup> representing the continent's five sub-regions, as well as the Pan African Telecommunications Union (PATU), the Regional African Satellite Communications Organisation (RASCOM), AT&T Submarine Systems Inc. (AT&T SSI), the African Development Bank (ADB), and the ITU.

In addition, each country has appointed a national coordinator to act as the focal point between the coordination committee and their administrations. Criticised by many as unfeasible, and having taken far too long to come to fruition, it remains to be seen if Africa One will provide effective communications capability on the continent. Even if it is constructed the question remains at what cost to Africans? The project appears to presume that telephone traffic is already there to be tapped. The probability is that Africa One will link up African countries and connect them to the world, but at a huge cost. Preliminary estimates are that call charges will be around US\$1 a minute, cheaper than current international charges but out of the reach for the vast majority of rurally based Africans (Zsakany and Marshall, 1995). Moreover there has been little research conducted on the most applicable connectivity option for an individual country. Small landlocked countries with sparse rural populations may well find other options such as satellite systems much more amenable to developing communications capacity.

AT&T and Tyco Ltd are not alone in their attempts to enter the African telecommunications market. Table 8 overleaf shows the large number of planned and existing cable schemes that are offering connectivity options to African policy-makers. Of the planned intercontinental schemes, by far the largest cable system in operation in Sub-Saharan Africa is SAT-2, which traces a route between the UK and South Africa and down the West Coast. SAT-3, though originally designed to increase capacity over the same route, is now likely to be combined with the proposed West African cable (WASC) and SAFE projects.<sup>59</sup>

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<sup>58</sup> The countries are Cameroon, Cote d'Ivoire, Kenya, Nigeria, South Africa, Tunisia, and Zimbabwe.

<sup>59</sup> *Fibre Optics News*, 30 March 1998.

**Table 8: Fibre optic cable projects connecting to Africa**

<b>Scheme</b>	<b>Key Player</b>	<b>Status</b>	<b>Start date</b>	<b>Capacity</b>	<b>Cost (US\$)</b>
FLAG	Bell Atlantic	Operational	1999	10 Gbit/s	1.2 bn
Africa One	Tyco	Planned	2000	40 Gbit/s	1.3 bn
SAT-2	Telkom South Africa	Operational	1993	565 Mbit/s	150 m
Sea Me We 2	France Telecom	Operational	1994	n/a	n/a
Sea Me We 3	France Telecom	Installation	1998	40 Gbit/s	737 m
Sea Me We 3 Extension	France Telecom and Singapore Telecom	Planned	1998	n/a	436 m
SAFE/ SAT-3/ WASC	Telkom South Africa	Planned	2000	20 Gbit/s	n/a
Oxygen	CTR	Planned	2004	320 Gbit/s	14.7 bn
Afrilink	Siemens	Planned	n/a	n/a	n/a
Atlantis 2	Embratel	Planned	1999	5 Gbit/s	231 m

*Source: Infodev, 1998; Foley, 1998; Gifford, James and Cosper, 1998*

Sea Me We 3 will also connect to SAFE, thus providing a total circumnavigation of the African continent, though neglecting the East coast. This omission, however, may be rectified by Africa One and Afrilink which may have landing points in all the coastal states. The Atlantis 2 cable scheme links South America and Europe and has a landing point in Senegal, whilst project Oxygen remains by far the most ambitious project of them all. Designed to be the first truly global project, and still at the design phase, it envisages truly global cable coverage with links between the Americas, Africa, Europe and Asia, as well as a round Africa cable.

The service offered by Project Oxygen is a global undersea optical fibre cable network with 101 landing points in 74 countries and locations. It will have a minimum throughput of 640 gigabits per second on long-haul routes over 350 km in length, and 1.9 terabits per second on shorter and terrestrial routes. Its first phase will consist of 158,000 km of cable; 150,000 km undersea and 8,000 km terrestrial. It will connect locations that account for 90 per cent of international telecommunications traffic. Phase

2 will add further connectivity under a "living network" concept, with the network continuing to grow in response to global demand. In contrast to existing submarine cable systems, in which carriers buy point-to-point circuits, Project Oxygen is planned from the start as a network. Customers buy access capacity, which they can then use between any landing points on the network, changing the direction and volume of their traffic at will. They can also re-sell the capacity, and allocate or re-allocate it among any number of locations and routes, without restriction. A second important player is the Fibre Optic Link Around the Globe (FLAG) project to provide increased telecommunications capabilities and access to Africa, the Middle East and Asia. Upon completion, the submarine cable system will stretch from London to Tokyo, landing in Africa in Egypt. Other landing points include India, Malaysia, Hong Kong and China.

The critical commercial question for any African cable scheme is whether, and how, sufficient traffic can be generated from the countries in order to provide a service that is competitive with current and envisaged communications systems. With the significant exception of South Africa, there is widespread acknowledgement that no one single African country generates sufficient volumes of traffic to justify the construction of a single cable link. Thus, co-operation will be the *sine qua non* of these cable projects. In particular, prospective schemes should be integrated with the PANAFTEL terrestrial network, the RASCOM satellite network, and any emerging global mobile personal communications by satellite (GMPCS) systems, as well as the national networks in every participating country.

## **5.5 Other technologies**

An increasing number of African governments and businesses who operate over long distances are linking their telephones to wireless systems, so that voice and data telecommunications can get through without relying on terrestrial infrastructure. So-called wireless infrastructures are emerging as an important technology for developing countries. Emerging in the 1940s as a method of interconnecting telephone company facilities using point-to-point microwave systems, the locus of use has shifted towards providing untethered communications facilities. The evolution of higher frequencies and compression algorithms, coupled with cheap electronics, has allowed greater use of

mobile telephony in African countries – in some cases substituting for conventional fixed telecommunications (Faulhaber, 1995). Conventional hard wire copper cable telecommunications systems are prone to ruptures in the network due to environmental hazard or even thieves stealing the copper or chopping down poles for firewood. In order to circumvent these hazards, many countries now utilise multichannel microwave radio-based systems that obviate the need for laying copper cable. Instead telephony can be transmitted via microwave radio networks, comprising repeater stations.

This wireless technology is being increasingly deployed to solve the so-called "local loop" problem. Traditionally, the local loop is the most expensive segment in telecommunications installation (Faulhaber, 1995). This is especially true in Sub-Saharan Africa where placing copper cables in remote and often inaccessible areas has proved prohibitively expensive. With radio and satellite options for the local loop, widespread deployment of telecommunications becomes affordable, and national operators can provide better service at a much lower cost compared with prevailing rates (Forge, 1995). Wireless local loop technologies (WLL) are cheaper than mobile cellular and can be installed more quickly than fixed line. A growing number of countries in the region are installing WLL, including Benin, Ghana, Nigeria and South Africa (Palumbo, 1998).

Several benefits are claimed for WLL over alternative access technologies. Firstly, it can be deployed in places where, because of adverse terrain, building density or antiquity, wire and cable are simply not feasible. Second, for certain loop distances and population dispersions, wireless can be more economic than the alternatives. Labour and loop lengths are the two main cost considerations here. The cost of wired systems is critically dependent on the distance between households and the penetration levels achieved, whereas the cost of wireless is broadly independent of those factors. Rather, it is dependent on the cost of subscriber units, which tends to fall over time with increasing economies of scale (Palumbo, 1998). A third factor is that WLL is often much quicker to deploy than wired infrastructure. Faster to deploy than copper, it can reduce waiting lists for telephone lines in low teledensity countries (Palumbo, 1998). The use of radio to transmit traffic has additional benefits in the sense that as nothing physical exists in the space between the endpoints in a WLL system, wireless can be easier to maintain and protect than wired systems. In some countries, such as Africa,

buried copper cable is routinely stolen. Even fibre optic cable seems to have some second-hand value (Palumbo, 1998).

Traditionally, point-to-multipoint (PMP) radio systems, often working at microwave frequencies, have constituted a rather specialised form of WLL. PMP solutions are primarily used to hook subscribers clustered in remote villages or small suburbs into the mainstream public network. In addition to the original PMP remit of connecting up remote subscribers in areas of sparse and dispersed population, WLL is now viewed as a relevant "quick fix" in moderately or densely populated locations with low telephone penetration. When existing service providers want to add advanced features quickly and inexpensively without laying additional copper or fibre into their customers' homes (Dexter-Smith, 1998). However, this solution is itself infrastructure intensive, requiring repeater stations in line-of-sight, at least every 40 km, and a consistent power supply.

Irrespective of which of the above technologies or connectivity options policy-makers choose, it is undeniable that there are now a bewildering number of communications options open to African policy-makers. These options offer the distinct benefit of vastly improving the capacity to communicate on the continent. But policy-makers should not be seduced by the alluring concept of "instant infrastructure". Rather, the burgeoning number of connectivity options raise serious issues that must be tackled prior to their introduction. Firstly, there must be a recognition that no single technology – no matter how advanced or powerful – can alone solve the problem of connecting a continent as vast as Africa. These new connectivity options are not designed to supplant existing telecommunications infrastructure, but rather to work in full complementarity with the existing domestic infrastructure. Secondly, these projects will be run according to commercial criteria with little scope for developmental considerations. International operators whose only concern is profit maximisation will have little truck with ideals such as universal service. Finally, there is the control dimension: in all likelihood, these projects represent only the beginning in an era of global connectivity that will increasingly see information flows bypassing national boundaries. For countries used to the lucrative revenues from international call transmission and control over their citizens this period may well be a rude awakening.

At the same time, policy-makers in Sub-Saharan Africa are not in the most enviable of positions. Faced with rapid technological changes, resource constraints and a long-term decline in commodity prices as well as international aid flows the bargaining position of countries in Sub-Saharan Africa would seem to be rather weak. Compounding this problem is that no substantive research has been conducted on the potential synergies and trade-offs that exist between these various connectivity options. To improve international links, should a Sub-Saharan African country invest its limited foreign exchange in underwater fibre optic cable or should it focus on satellite communications and buy into a GMPCS system or Teledesic?

The highly publicised failure of the Iridium satellite system in March 2000 highlights the importance of investing in appropriate connectivity options. The company, formed in 1991, and backed by an international consortium that included Motorola launched its 66 LEO satellites over the period 1997 – 1998. However, the ambitious service, which sought to connect people "anytime, anywhere" through satellite phones, failed to attract more than 50,000 users worldwide. Factors including the US\$3000 handset costs, high call tariffs, the large size of the phones and their failure to function indoors discouraged the build up of a large subscriber base. As a result, the company was forced to file for bankruptcy in August 1999, with debts totalling more than US\$4 billion. Unable to find a buyer for the company, and forced to comply with US law on space debris, each satellite will be de-orbited, burning up in the Earth's atmosphere, leaving 50,000 users bereft of service and providing an ignominious ending to the first in a raft of GMPCS systems.<sup>60</sup> Whether a GMPCS system is appropriate for a particular African country or which GMPCS to back is thus a crucial strategic decision. Resolving these issues necessitates firstly an understanding of the economics of these projects and secondly an analysis of the "pros and cons" of each system in relation to each individual country.

The following section analyses the economics of cable and satellite projects. First an individual consideration will be made of the respective systems, with illustrative cost structures produced for both. Then, taking two countries, Nigeria and Ethiopia, a hypothetical analysis is undertaken to determine the amenability of these connectivity

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<sup>60</sup> See Grimes (2000) "Iridium's 66 satellites to crash", *The Financial Times*, 17 March 2000, p. 4.

options within Sub-Saharan Africa. Finally, an assessment is made of the potential impact of these projects and the role that government should play.

## **5.6 A comparative analysis of planned cable and satellite projects**

Given the pent-up demand for extra communications capacity in Sub-Saharan Africa and the continent in general these cable and satellite schemes can bring much needed capacity to the continent. The question that must be raised, is at what price to Africans? These new schemes offer higher capacity and lower costs for international telephone calls, access to data and services with better quality of transmission, higher bandwidth and the benefits of digitalisation. Primarily, through a reduction in the economic cost of information retrieval, and an increase in national capacity, they represent an obvious way of improving access to information. Secondly, they can also provide much improved access, at a theoretically lower cost, to national and regional and international networks. However, just constructing or investing in these projects is a necessary but not sufficient condition. In order for cable and satellite projects to truly contribute to the construction of the African information infrastructure further conditions must be met:

- **Need to upgrade the domestic infrastructure.** These projects only represent potentialities. If countries fail to upgrade their national networks, users will continue to be frustrated by the availability of world-class international links that are dependent upon an archaic and inefficient domestic counterpart.
- **Need for domestic service providers.** In order to effectively exploit the services on offer, such as the Internet and distance education, a community of service providers is needed that can respond to users' specific requirements.
- **Reduction in call charges.** The cost of international access to users will have to be reduced to give a truer reflection of actual transmission costs as opposed to profit objectives. With increased capacity and competition amongst transmission systems national operators have greater capacity to reduce call charges.

These aggregate benefits may well appear enticing to Sub-Saharan African countries but it is impossible to ascertain the true worth of these projects without recourse to an analysis of the economics of the various connectivity options.

### **5.6.1 The economics of submarine cable systems**

The variables involved in the economics of cable systems are varied and complex. The main factors to be taken into consideration for those considering connecting to submarine cable projects are length, capacity, number of landing points, network design and capital and operational costs (Blake, 1998). Whilst there is no standard pricing structure for cable systems, it is possible to illustrate a potential cost structure for a pan-African cable system based on hypothetical estimates of call traffic and costs. Though an approximation, it allows an illustrative comparison between cable and satellite systems to be made. The figure overleaf represents the potential capital and running costs for a 35,000 km cable around Africa connecting almost all coastal countries in order to achieve maximum connectivity. Based on AT&T Inc.'s estimates the model assumes 40 Gbits/s of capacity and that there are 45 coastal landing points (Zsakany and Marshall, 1995).

As can be seen from Figure 6 overleaf the project, from the assumptions above, provides transmission capacity far in excess of current levels of African traffic. As with land based cable installation, the laying of the cable is a sunk cost and, along with additional equipment such as repeaters, accounts for the majority of the project cost. Hence it is more efficient to create excess capacity over and above what is required. The critical commercial question is, then, how can sufficient traffic be generated to ensure that call costs are kept at a level commensurate with, and preferably below that of other competing systems?



**Figure 6: Illustrative costs of a round Africa Cable Project**

<b>1. Capital costs</b>	<b>\$US</b>
Costs of cable laid with repeaters	1.3 billion
Cost per landing point	15 million
No. of landing points	45
Projected capital cost = 1.3 billion + (15*45)	1.975 billion
<b>2. Running costs</b>	
Cable maintenance: US\$7 million per ocean segment. For Africa, three ocean segments- Mediterranean, Atlantic and Indian.	21 million
Network management: US\$5 million per year	5 million
Total project running costs	26 million
<b>3. Annualised costs</b>	
Capital costs amortised over 12 years	165 million
Interest cost in first year (7%)	138 million
Running costs	26 million
Total annual running costs:	329 million
<b>4. Total costs per call minute</b>	
Estimated total minutes to and from African coastal countries in 1998:	2.35 billion
Average cost per minute for international transmission:	0.14 c
Estimated originating and terminating costs:	0.5-10 c/ end
<b>Total costs per minute (US\$)</b>	<b>0.19-24 c</b>

*Source: BMP, 1998 and Foley, 1998, Zsakany and Marshall, 1995*

One of the reasons for the lack of pan-African cable systems in the past has been that the small amount of individual traffic generated by the majority of countries. With the obvious exception of South Africa, no single African country generates sufficient traffic to justify the creation of a link to any other country or region. However, if the cable system were to carry the majority of traffic for landlocked countries and

international calls for coastal landing points, then there would be sufficient levels of telecommunications traffic generated.

The capital costs of the project are estimated to be US\$1.3 billion for laying the cable and repeaters, with a further US\$15 million per landing station, giving a projected capital cost of US\$1.975 billion, amortised over 12 years, after which ownership is due to revert to African carriers. Operational and maintenance costs are estimated at a total of US\$26 million with a further five per cent interest charge. As Figure 6 indicates, the total annual cost is estimated at US\$329 million. Though AT&T Inc. (Zsakany and Marshall, 1995) forecast traffic levels of 4.7 billion minutes in the first year, this seems wildly optimistic given that this figure represents close to the total annual traffic for the whole continent. For the purposes of illustration a more realistic figure of 2.35 billion minutes has been estimated. The cost per minute of international transmission by cable is then the annual cost divided by the projected number of minutes of international traffic, which is 14 cents. This figure is likely to be an overestimate of transmission costs as it is assumed, for the purpose of simplicity, that cable capacity is used exclusively for switched voice telephony. Though in reality there will be significant demand for leased circuits from large corporations and governments.

Figure 6 gives a realistic illustration of the likely costs and per minute costs that would arise if the cable scheme were built. It shows that at around 20 cents a minute the scheme would compare favourably with current transmission costs and would allow for significant reductions in the cost of telecommunications in Sub-Saharan Africa. If we extrapolate data from estimates provided by AT&T Submarine systems it is possible to illustrate an approximate level of cost. From a national point of view, the costs of connecting to the scheme at a landing point must be considered. Connection to a cable scheme will invariably be via a landing point, which is in turn connected to the network of the national operator.

Given that the majority of cable schemes which are connected to Africa are intercontinental, there will typically be only one landing point per country, with a limited number of countries connected. Evidently the most popular sites of landing points will be in coastal areas. Thus, for landlocked countries access agreements must be negotiated in order to allow participation in these schemes. Countries access

submarine cable schemes via another country or directly depending on their location vis-à-vis landing points. For direct access to be feasible, international traffic originating externally can be concentrated across borders, or by linkages to other cable schemes. International links can be made by via terrestrial cable or microwave or satellite. For small coastal countries that do not generate significant levels of traffic and landlocked countries, connection throws up different cost scenarios. Connectivity to cable schemes for these countries will involve additional costs, whether connection is through satellite or terrestrial methods. Thus, the continued use of existing transmission systems may compare favourably with the advantages of newer systems.

## **5.6.2 The economics of satellite systems**

### **(a) Technical specifications**

Satellite systems are comprised of two segments: a space segment, the satellites and an earth segment comprising all ground-based equipment. The space segment consists of satellites that are commonly solar-powered, and have a maximum life span of 10 years or less. The earth segment consists of:

- earth stations which communicate with the satellites;
- operation centres that monitor and correct the satellite movement and position;
- gateways which connect satellite to the public switched telecommunications network (PSTN); and
- subscriber terminals which can either be mobile (a handset, for example) or fixed (for example, a payphone).

At present the treaty organisations<sup>61</sup>, such as INTELSAT and INTERSPUTNIK, own the satellites and the operation centres used to control them, whilst countries own the earth stations themselves. The distinguishing characteristic between satellite types is essentially the method in which they orbit the earth. There are three main satellite types:

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<sup>61</sup> RASCOM plans, eventually, to become a treaty organisation.

- Geostationary or geosynchronous earth orbiting (GEO)
- Medium earth orbiting (MEO)
- Low earth orbiting (LEO)

**Table 9: Satellite System comparison by orbit<sup>62</sup>**

<b>System overview</b>	<b>GEO</b>	<b>MEO</b>	<b>LEO</b>
<b>Spectrum Resources</b>			
Satellites necessary for global coverage	3	10-12	48-840
Altitude (km)	35,680	2000-10,000	400-1401
Global Roaming	Not available (but possible via connection to PSTN)	Yes	Yes
Frequency coordination complexity	Medium	Medium	High
<b>Telecommunications</b>			
Antennas	Large multibeam	Small	Small
Hand-held	No	Yes	Yes
Call Handover	None	Infrequent	frequent
Coverage(footprint)	Very large	Large	Small
Time for signal round trip (seconds)	0.25-0.5	0.1	0.05
<b>Estimated Costs</b>			
Space Segment min/US\$	~0.20	~0.40	~1.00
Ground Segment	Low	Medium	High-medium

The GEO satellite appears stationary from earth as it revolves around the earth in exactly 24 hours. Its great distance from earth ensures that it has a large footprint; in principle only three are required to provide global coverage. INTELSAT and the other treaty organisations all use GEO satellites. However, their higher orbit means that there are noticeable delays in transmission and large dishes are required to receive satellite signals. LEOs on the other hand, due to their lower orbiting altitude, require less power to reach the satellite hence receptive antennas can be smaller. Whilst this leads to an almost imperceptible time delay in transmission, more satellites are required to provide

<sup>62</sup> Collated from Leite (1996) and Noll (1996).

global coverage. LEOs can be placed as close to 400km from the earth, transmission delay is therefore imperceptible and signal strength is greater. Moreover receivers can be truly mobile and hence these are utilised by GMPCS services. However, mobile LEO phones cannot be used indoors and are vulnerable to erratic weather systems.

In terms of pricing and costing GEOs are evidently the most expensive of satellites, being more expensive to build and launch. MEOs and LEOs are smaller and less expensive but consequently more satellites are required and they have a shorter life span (Ackroyd, 1996). The total cost of a LEO scheme is therefore higher. The business risks are also higher with LEOs as the satellites are less versatile, and if insufficient demand is created for GMPCS services, then operators may face serious financial loss.<sup>63</sup> For these reasons the new GMPCS operators are planning to launch their services in as many countries as possible, banking on rapid growth of call traffic and revenues. Private satellite systems have tended to target niche markets such as television or proprietary networks. Countries with a large, sparsely populated landmass that is difficult to serve with terrestrial infrastructure can utilise satellite links as an economic alternative.

### **5.6.3 The GMPCS System**

The Global Mobile Personal Communications by Satellite (GMPCS) system has garnered much attention of late in developing countries. GMPCS is compatible with all the current non-stationary and geo-stationary orbit systems and can provide universal service for telecommunications services for all types. It is especially appropriate for rural and remote areas lacking conventional infrastructure. It is envisaged that operators will offer, from 1999, services such as global mobile telephony, fixed telephony, paging and data communications (Leite, 1998). Initially, due to the high cost and international treaty restrictions, GMPCS will focus on mobile telephony services with fixed services to payphones as a secondary line of business. Thus the market for GMPCS in Africa is projected to be quite small. According to the ITU there will only be eight million GMPCS subscribers by the year 2002 (ITU, 1997b). There are two

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<sup>63</sup> The first LEO scheme to go to market, Iridium, filed for bankruptcy in August 1999, and was judged to have failed for precisely these reasons.

main markets for GMPCS satellite services: international business travellers and cellular phone users that need to roam into areas with non-existent cellular networks. Such users will utilise such systems as Globalstar and ICO, which are satellite-based systems designed to allow any type of transmission to reach its destination irrespective of geography. However, such a niche service, at such high costs cannot solve the lack of telecommunications infrastructure in rural areas.

GMPCS operators are likely to concentrate initially on the domestic market for mobile telephony (Leite, 1998). Given the available technology, GMPCS represents a less expensive service for mobile communications; a challenge to existing commercial operators. However, given the high cost of handsets, operators are likely to attract customers by positioning themselves as a complementary service and offering users dual mode handsets. As such, the new services they offer will have little impact on domestic communications capacity (Leite, 1998). In terms of fixed services GMPCS offers substantial opportunities to improve the communications capacities of countries with rurally based populations where the existing infrastructure in this area is practically non-existent. Fixed telephony tariffs are projected to be approximately US\$0.60 per minute. Representing a substantial saving on current mobile cellular services, and also comparing favourably with the average US\$1 per minute tariff for international calls. However, operational costs and subscription charges for GMPCS systems are envisaged to raise tariffs to US\$0.85 per minute (Leite, 1998). Handsets are projected to cost from US\$750 to US\$3000. Each cell phone will be digital and assigned a unique phone number with a system-defined "country code". This code will allow those using the public network to locate a mobile user anywhere (Faulhaber, 1995).

The GMPCS system should not, therefore, be seen as a competitive threat to national operators, more a complementary service, which can aid governments in their endeavours towards improving national service, without requiring expensive and unproductive infrastructure. Rather, the GMPCS system will generate additional revenue for the national fixed and mobile operators through the interconnection of calls generated by the system.

**Table 10: Estimated GMPCS interconnection charges**

Transmission	US\$ per minute
Fixed to GMPCS	0.20
GMPCS to Fixed	0.05
Land Mobile to GMPCS	0.20
GMPCS to Land Mobile	0.09

*Source: Global Telephony, May 1998*

As it is unlikely that any one country will have sufficient demand for capacity to justify a single GMPCS satellite link, it is envisaged that there will be regional hubs on the continent (InfoDev, 1998). Intuitively these will be based in South Africa, Nigeria and probably Egypt, given the large numbers of projected users in these countries and also their relatively advanced existing international links. The more profound implications of mobile satellite services are their ability to side step the public switched network, which may have revenue implications for national telecommunications operators. In order to adjust for this loss of revenue governments may wish to levy licence fees on GMPCS operators that reflect the estimated loss from public network bypass. However, the consensus is that, at least for the foreseeable future, the amount of traffic generated by GMPCS systems will be modest (InfoDev, 1998).

Figure 7 overleaf is an illustration of the cost structure of a satellite system. Based on data from Inmarsat's planned ICO system, it estimates that total costs per minute will be in the region of 34 – 39 cents. The method of calculating the satellite system cost structure is essentially the same as with the previously analysed submarine cable scheme. Costs are calculated on an annualised basis and total annual costs are divided by an estimated total volume of traffic. Here, the total projected level of traffic refers to the global market for the GMPCS, as opposed to just the Sub-Saharan African market.

**Figure 7: Illustrative costs of a satellite system**

<b>1. Capital costs</b>	<b>US\$m</b>
Satellites and Control Systems	1,084
Launch and Insurance	1,064
Other capital expenditures	1,287
Business Operations	84
Early Operational Costs	709
Marketing and Branding	70
<b>Total Capital Costs</b>	<b>4,298</b>
Net Interest and Financing	354
<b>Total pre-operational costs</b>	<b>4,652</b>
<b>2. Annualised costs</b>	
Annual operating costs	150
Pre-operational costs amortised over 12 years	388
Interest cost in first year (7%)	326
<b>Total annualised costs</b>	<b>864</b>
<b>3. Total costs per call</b>	
Cost per minute at 3 billion minutes per year	29c
Estimated originating and terminating costs	5 – 10c
<b>Total costs per minute</b>	<b>34 – 39c</b>

*Source: BMP, 1998*

#### **5.6.4 Submarine cable versus satellite systems**

The new cable and satellite projects being promoted world-wide constitute an important new dimension in the struggle to develop modern information infrastructures. However, each system has advantages and disadvantages that must be placed in a national context in order to optimise infrastructural development objectives. Comparisons between such diverse systems remain fraught with complexity, given the multitude of factors to be assuaged in each project and their differing capabilities.



Rather, an aggregation of a number of key factors must be taken into account when assessing their relative merits. In all likelihood the issue will not be one of straight trade-offs between competing systems, but rather divining the most effective combination of available connectivity options.

From a systemic and technological point of view it is relatively straightforward to decide which connectivity option is superior. Succinctly put the particular advantages of submarine cable systems are that they:

- offer far greater capacity;
- are unaffected by atmospheric conditions;
- are less expensive than satellite systems; and
- are more flexible as operators divide traffic amongst a host of users and charge for direction and volume.

On the other hand the particular advantages of satellite systems accrue mainly to countries with sparsely populated rural areas. Theoretically, universal access can be achieved more effectively with a satellite system. Satellite also represent the closest thing to an "instant infrastructure", bypassing the national network, thus remaining the cheapest option in regions where the volume of telecommunications traffic is slim.

Thus the advantages of satellite systems are that they:

- remain the cheapest option for countries looking to instantly boost telecommunications infrastructure without committing scarce foreign exchange;
- are more amenable to the concept of universal service. Satellite systems appear to be the only viable option for countries with isolated populations and where the volume of telecommunications traffic is low; and
- can provide mobile services beyond the reach of terrestrial fixed and mobile networks.

The above summary hints at the fact that straight comparisons, in the absence of factoring in the contextual dimension, are of little use to policy-makers. Any attempt to

arrive at an optimisation strategy must encompass a variety of variables. Such variables include:

- tariff levels;
- revenues;
- infrastructure costs;
- geography and demographic characteristics;
- current and projected levels of domestic and international traffic;
- existing communications infrastructure;
- demand for new services;
- development priorities; and
- connectivity purpose: people-to-people, or new services such as telemedicine.

In order to illustrate how some of the variables above should weigh heavily in strategic decisions, two countries in the Sub-Saharan African region, Nigeria and Ethiopia, with very differing demographic and infrastructural make-ups are examined below.

### **5.7 Case study: Nigeria**

Nigeria is a coastal country with significant volumes of traffic and significant levels of unmet customer demand. Nigeria's telecommunication infrastructure is well developed but not to such an extent that it is unrepresentative of Sub-Saharan Africa. It has made some progress in restructuring its telecommunications sector, having liberalised some elements of the communications sector. In terms of mobile telephony the country is relatively well advanced, having a number of competing operators. The national operator has, at present, a *de facto* monopoly in the fixed voice telephony market. There are ambitious plans to increase the number of lines from 1998 levels of 600,000 to 1.5 million by 2001 (FMOC, 1996). As a result, commitments to investment are large and increasing. Despite plans to license a second national operator, international tariffs remain at a rate significantly higher than the global average and telecommunications remains a lucrative sector with an average annual revenue per line of US\$720 (ADCG, 1998).

### **(a) International services**

Currently international calls are transmitted internationally via a combination of terrestrial microwave links to neighbouring countries and via an earth station to more distant countries. International calls to African countries are charged at the equivalent of US\$1.00 per minute, and to other countries at US\$3 per minute. The relatively high tariffs for international calls results in a lucrative imbalance between incoming and outgoing traffic. This imbalance has led to substantial net revenues for the national operator, in addition to the profits made on international call charges. In order to maintain this lucrative revenue stream national operators are reluctant to reduce the accounting rate for international calls. However, international accounting rates are declining by an average of nine per cent per year (ITU, 1998b).

### **(b) Impact of the submarine cable**

As a coastal country, Nigeria chooses to construct a landing point, thus making a substantial investment in the submarine cable scheme. The landing point costs US\$15 million to construct, has a life expectancy of 25 years and costs US\$1.35 million a year to operate and maintain. Depreciating the landing point over its life, and allowing for financing costs, the operator has annual costs of US\$3.8 million from its involvement in the scheme (BMP, 1998).

The revenue from the scheme arrives principally in the form of lower transmission costs for international calls. The risk of losses is very small, assuming that enough other coastal countries participate in the scheme to create critical mass. If all outgoing international traffic is transferred to the cable scheme the reduction in costs for international traffic would be in the region of 18 cents per minute, worth US\$11.5 million in the first year (BMP, 1998). In practice re-routing all traffic in this manner will be spread over two to three years, and even then will only account for up to 80 per cent of international traffic. In addition some landlocked countries in Africa would still be reached by satellite and terrestrial cable or microwave. Taking all these variables into account, the annual cost savings arising from membership of the cable scheme are projected at US\$7 – 8 million. The national operator will also gain from revenues

generated from landlocked countries using its landing point to gain access to the submarine cable.

## **5.8 Case study: Ethiopia**

Ethiopia is an independent republic that lies in the north-east corner of Africa and forms part of the North-East African region. Since the secession of Eritrea in 1993, Ethiopia has been a landlocked state. The country has an estimated 1995 population of 55.2 million people. Less urbanised than Nigeria, Ethiopia has a significantly lower population density and over 80 per cent of its population living in rural areas. Despite the fact that Ethiopia was the pioneer of telecommunications in Sub Saharan Africa<sup>64</sup>, the country has failed to capitalise on its early lead. The national operator is still the only licensed operator of fixed telephony and there are no plans to introduce a second national operator. Cellular services are also monopolised by the national operator. There are 200,000 lines in the country, mainly in the capital and yet average revenue per line is US\$500 per year (ITU, 1997a). Given that much of the country is inaccessible by road, there are few telecommunications connections outside the main urban areas. The public telecommunications operator, the Ethiopian Telecommunications Corporation, receives lucrative revenues by charging a high price for international calls but much of this money is used to cross-subsidise other industries within the public sector. Thus, there is far greater resistance to reducing long distance call charges. As a result, these are only projected to fall minimally by one per cent per year.

### **(a) International services**

Ethiopia is connected to other countries by a combination of terrestrial microwave links to neighbouring countries and via an earth station to more distant countries. The transmission costs for international calls is estimated at 25 cents per minute, but the average accounting rate is US\$1.00 per minute to other African countries and US\$4 for international calls (ITU, 1997a). The relatively high tariffs for international calls result

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<sup>64</sup> The first international call on the African continent was made from Addis Ababa in 1896.

in a lucrative imbalance between incoming and outgoing traffic. This imbalance has led to substantial net revenue for the national operator, in addition to the profits made on international call charges. In fact the net profits from international services exceed those of national revenue from domestic usage.

### **(b) Impact of GMPCS**

The less favourable economic environment reduces the potential market for GMPCS. With a GDP per capita of less than US\$200 and a largely rural population it is unlikely that satellite mobile communication will make any significant inroads into increasing teledensity. However, in inaccessible rural areas, it is likely that GMPCS will represent a significant difference to disaster relief agencies and aid relief agencies in the field. In addition GMPCS has potential in terms of village payphones, which can have a significant impact if the national operator is willing to subsidise them. Thus, though the GMPCS system does not represent an effective mechanism for inexpensive rural telephony, it does complement the national network by providing some access in traditionally neglected rural areas.

### **(c) Access to submarine cable**

In order to access a submarine cable system Ethiopia must connect to a landing point in a coastal country. This link is via terrestrial cable between two capital cities and would therefore be approximately 400 km long. Taking the cost of the cable link and the saving in transmission costs the cost saving will be in the region of 14 cents per minute for international transmission. This produces an annualised saving of about US\$1.5 million for the national operator. However, call charges will probably only fall by 3.5 per cent due to desire on the national operator's part to retain profitability.

## **5.9 The pivotal role of public policy**

The above illustrative examples of two very different countries highlight that the choices facing policy-makers in Sub-Saharan Africa are far from straightforward. They constitute an extremely important added dimension to the current arguments on

telecommunications restructuring. However, it is paramount that one remembers that the majority of international schemes are focused on one overriding objective: profitability through increasing communications capacity. Most of the schemes fall into one of two categories. Either they are designed to strictly increase the transmission capacity for international telecommunications traffic and/or they provide new or existing services to a wider audience and at a much-improved level of quality. These potentialities have thrown up three important dimensions that must be addressed by policy-makers:

1. The regulatory dimension which involves issues such as licensing and regulating operators, landing rights and planning permission.
2. The economic dimension which focuses on issues such as investment participation, allocation of revenue and interconnection issues.
3. The political dimension which focuses on issues of access to these new services, regional issues, such as co-operation and sharing of resources, and control issues.

### **5.9.1 The regulatory dimension**

The regulatory dimension focuses on the need for regulatory approval by national polities. The fruition of these new cable and satellite schema is likely to give new impetus to reforms underway in the telecommunications sector in Africa. But governments now face a new challenge in terms of regulation. Already facing difficulties in privatising national carriers, the situation is being compounded by the rash of foreign private sector consortia bidding to exploit the African market. However, the capacity of national governments to cope is constrained by a number of key factors:

- information deficiency;
- weak bargaining position;
- lack of organisational and management competency;
- weak political will;
- little positive experience of regional cooperation;
- geo-political considerations; and
- cost considerations.

In spite of this weak bargaining position countries must implement a drastic overhaul of tariffs, institute regional co-operation in various guises and new methods of operation for international telecommunications services. In the majority of African countries, the institutional capacity is not suitably developed to allow the effective handling of such complex regulatory issues. How, for example, the new global infrastructures will connect with existing public networks is a key issue that policy-makers have yet to address.

A critical area for regulation is the effect these projects will have on the deregulation of telecommunications within the domestic market. Undoubtedly, if countries allow access to these new connectivity options this represents a *de facto* acceleration of deregulation. All the schemes outlined above require the installation of new infrastructure, thus ownership issues would have to be dealt with. Moreover, national operators have historically enjoyed a monopoly over domestic telephony, this need not apply with infrastructure used for international communications. Traditional arrangements have dictated cooperation amongst national monopolies to provide international links. Given that the consortia planning to set up these satellites and cable projects are privately owned, there are now alternative arrangements for financing infrastructure. Thus, at least in the short-term, such arrangements will not directly challenge the domestic monopoly of national operators.

In terms of the accounting rates and the costs of international transmission, though increased capacity for transmission of international calls will inevitably lead to lower prices, such falls will be slow to arrive. Firstly, because the cost of call transmission is shared equally by two operators at a previously agreed price or accounting rate. Each operator then bears the cost of transmitting its half of the route. An annual payment is also made for any discrepancy between the number of call minutes flowing each way over the route. Thus the operator sending more call minutes than it receives pays for the difference at half the accounting rate. A reduction in costs benefits the operators but does not automatically feed into lower call charges (Forge, 1995). But charges are falling with the advent of competition from resellers and callback services.

Overall cable and satellite projects, and other connectivity innovations, present new opportunities for the provision of transmission capacity and access to new services. At

the same time, they pose significant challenges to national operators and to regulatory authorities. For example, at a minimum, cable projects are likely to require planning permission, and a regulatory framework guarding against discrimination between rival schemes. However, they do not compel a fundamental change in sector policies, nor is it necessary to devise radical licensing schemes. Rather, licensing policies need to be adapted to facilitate the take-up of the services that will be provided over new infrastructures. In conclusion, regulatory intervention is needed to ensure that consumers benefit from the reduced cost of international access; rules are needed to ensure that any exclusivity granted should not restrict the choice available of new technologies and services.

### **5.9.2 The economic dimension**

In terms of the economic dimension new connectivity options provide African policy-makers with much food for thought and, more importantly, a need for action. A primary concern for national operators must be the fear of network bypass. Satellite services essentially offer users the opportunity to bypass the public network and link directly with international connections. Such bypass will lead to some loss of revenue for national operators. All international infrastructure projects could in principle circumvent national operators' gateways and connect to public networks at the local level or even direct to customers. Thus technical by-pass is inevitable – the question is how can it be accommodated without losses to national operators.

Answering this question is difficult due to the nascent nature of the majority of schemes. In the short term, the threat from these satellite operators is minimal for a number of reasons. Firstly, international treaties restrict their entry into international fixed voice telephony; secondly, from an economic standpoint it is unlikely that satellite services such as GMPCS can compete internationally in terms of price. GMPCS is rather a niche service which, as a result, will attract a suitably high premium (Infodev, 1998). At present the use of satellite systems is strictly regulated by international treaties, principally those governed by INTELSAT. Hence there are no private fixed satellite systems offering public telecommunications services, and none of the projects outlined above depend on amendments to this provision. However, current treaty provisions in this area are likely to be changed in the near future in the face of



international pressure to allow greater competition (InfoDev, 1998). Several countries, including some within the Sub-Saharan Africa region, are in the process of liberalising their international gateways. In countries that enjoy advanced networks callers have seen a corresponding drop in international call charges. Yet in Sub-Saharan Africa the avowed policy aim is different. Permission to operate an international gateway typically involves a *quid pro quo* to develop the domestic infrastructure, hence prices have yet to fall appreciably.

A second important area in the economic dimension is that of creating a climate conducive to private investment. Given the massive sums necessary for upgrading the telecommunications networks in almost all African countries, governments need to encourage private sector participation. Given the speed at which information and communication technologies are changing, policy-makers need to encourage the participation of the domestic, regional and global private sector. In order to do this the following investor expectations must be satisfied:

- good market prospects;
- attractive business environment;
- a reasonable well-defined regulatory framework and/or strong contractual arrangements; and
- access to foreign exchange.

At the same time those who finance these projects also have expectations that must be met, namely:

- commercially viable and bankable projects;
- assured return, with an upside potential;
- long-term commitment from lead sponsors;
- good management and proven technology;
- necessary permits, including interconnection agreements, completion arrangements; adequate security packages; and
- access to foreign exchange.

### 5.9.3 The political dimension

In terms of the political dimension, new connectivity options will force policy-makers to confront a number of issues; namely those of regional and international co-operation. The political manoeuvrings over RASCOM and Africa ONE during 1998 have highlighted the political problems of coordination amongst such a diverse number of countries (Mouka, 1998). Given that the majority of African country telecommunications traffic is slim, it is vital that Sub-Saharan Africa unites in an attempt to improve information infrastructure within the region. As social shaping theorists such as Bijker and Law (1992) have argued, it is actors who shape technologies in negotiation processes. The leading actors in the first phase of debates on the information society, were the manufacturers and suppliers of communication technologies. However, whilst in the U.S. and Europe the locus of attention has shifted to the role of public policy in structuring an effective information society, in Africa, these manufacturers and suppliers are still amongst the dominant actors seeking to shape the continental information infrastructure. As Cronberg (1997) points out at this critical juncture emerging technologies are still 'black-boxed, with power relations stabilised within the competing technologies as the actors participating in the negotiations agree on its particular meanings' (Cronberg, 1997, p. 120). It is in the interests of African policy-makers to combine their negotiating strengths to work on improving the terms of trade for the region as a whole.

For example, moves towards the launching of a Pan-African satellite are welcome but have taken a long time to build momentum.<sup>65</sup> Even at this late stage there are lingering doubts over the likelihood of nations overcoming the fractious nature of their regional relations (Mouka, 1998). The 1998 escalation of serious conflicts at the heart of Africa suggest that this may well rule out any attempts at regional information infrastructure solutions in this area for some time to come. However easy is it to succumb to Afro-pessimism, African policy-makers must realise that the continent as a whole is much stronger than the sum of its individual parts. A united front is essential at such a crucial stage in the face of the commercial onslaught from international players who are far better informed.

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<sup>65</sup> The idea was first proposed in the 1970s.

Another example of the efficacy of a united front are negotiations over satellite frequencies. Policy-makers in Sub-Saharan Africa could, for example, demand that big LEO satellite services be subsidised by users in developed countries so their citizens can receive more affordable services<sup>66</sup>. In return providers could be given preferential market access. Though operators are unlikely to want to grant preferential rates to Sub-Saharan African countries, systems are likely to have extra capacity on satellites operating over less affluent areas and operators probably will have to offer better rates to attract business in those areas (InfoDev, 1998). Realistically, subsidies may be difficult to deliver even if operators were inclined to grant preferential rates as LEO users will roam from country to country and region to region, making it hard to establish who is eligible for subsidy. However, it may be more practical to set up subsidy programs for rural users of fixed big LEO services, such as those planned by Globalstar.

Whilst promoters of new connectivity options have argued that fundamental regulatory changes are unnecessary, there are a host of roles that government must play to optimise any benefit that may accrue from them. The majority of new connectivity options being touted will reduce the transmission costs of telecommunications. However, national and international operators are likely to want to maintain high tariffs in order to maximise profitability. Yet affordability remains one of the key barriers to the effective use of these systems to improve information infrastructure in the region. African policy-makers must articulate explicit strategies that address the regulatory, economic and political dimensions in order to develop, implement and sustain affordable access.<sup>67</sup>

## 5.10 Summary

This chapter has concentrated on the burgeoning number of new connectivity innovations – such as submarine cable and satellite systems – that have emerged over

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<sup>66</sup> "Developing countries seek big LEO subsidies", *Communications Daily*, 9 October, 1996, Vol. 16, No. 197, p. 2.

<sup>67</sup> Organising the sharing of facilities can overcome the high cost of access in rural areas, through schemes such as village payphones, telecentres, and community information centres.

the last decade. These connectivity options appear to offer seductively simple answers to the slow growth of Sub-Saharan African communications capacity. Yet few have asked the critical question as to what extent they can contribute effectively to the development of information infrastructure in the region. Illustrating the need for a closer analysis of these connectivity options with case studies of Nigeria and Ethiopia, the chapter has shown the areas in which government must play a pivotal role. It has shown that while new technological innovations increase the number of options open to African policy-makers to improve communications capacity, there is an urgent need for regulation and economic and political coordination. The choice of which technologies to modernise and improve the quality and extent of information infrastructure is a crucial one. As the above analysis has revealed, there is no universal solution, rather choices about which system to use are dependent on an in-depth analysis of requirements at the national level.

## **CHAPTER 6**

### **The Role of Development Agencies**

#### **6.1 Introduction**

The majority of initiatives in pursuit of information infrastructure are being designed, implemented and funded by international development agencies. As of May 1999, there were over 100 organisations engaged in over 300 projects involving information and communication technology activities in Sub-Saharan Africa. Whilst these efforts have contributed to the development of information infrastructure in the region, bringing much needed expertise and physical infrastructure, there are legitimate concerns as to the effectiveness of these initiatives. This chapter provides an analysis of the role of development agencies in constructing information infrastructure in Sub-Saharan Africa. Firstly, an introduction is provided to the history of development assistance to African countries in the ICT-related field. Secondly, a survey of projects is conducted to determine the main areas in which development assistance is being applied and the rationale behind these activities. Finally a case study of the United Nations Development Programme's Internet Initiative for Africa is carried out.

#### **6.2 Development theory**

The role that the availability of information should play in economic development has historically been the subject of considerable debate (Schramm, 1964 and Lerner, 1958). Works such as Lerner's "The Passing of Traditional Society" (1958) put forward a structuralist-functionalist view that industrialisation in developing countries would be accelerated by the transplantation of western media technologies and models (Nordenstag and Schiller, 1992; Boyd-Barrett, 1977). Nebulous and somewhat naïve, it implied that the very introduction of media would lead to development. Proponents argued that if 'Third World countries would only invest in communication infrastructure...they would be able to begin the long arduous climb towards development' (Jayaweera and Amnugama, 1987, p. 26). Despite the lack of empirical evidence and intellectual validity, this development model held considerable sway in the early 1960s. So much so that development agencies such as UNESCO were at the

forefront of large scale, top-down efforts to develop the communications infrastructure in Sub-Saharan Africa. Under the guise of promoting development through increasing communications capacity, the majority of African governments invested heavily in constructing broadcast infrastructures. Whilst these efforts on the whole were successful in improving the regions capacity to communicate, it soon became clear that structural distortions in African society saw elites benefiting disproportionately from the increases in the capacity to communicate. Moreover, policy-makers, keen to hold on to the reins of power, often exhibited a remarkable ambivalence towards efforts to extend uncontrolled communication into rural areas (Bourgault, 1995).

Despite the flaws in the development communications approach, the recognition of fundamental changes in the global economy has seen a resurgence in the importance attached to communication by development organisations. Replacing radio and television, much has been written of the potential of information and communication technologies to support economic development (Hanna, 1991; Oshikoya and Hussain, 1998). However, it is only with the spectacular growth of applications such as the Internet and the explosive diffusion of information and communication technologies that talk of the information society has gained credence. This prompted a change in development thinking that has led to many donor and multilateral lending organisations radically reshaping their policies to take into account the importance of information and communication technologies. Yet this realignment and reassessment of the role of technology in development raises some important issues.

Firstly, the enthusiasm for the potential of the so-called information revolution seems to be predicated on a bout of historical amnesia. Development agencies<sup>68</sup> appear to be in a state of denial as to the historical pattern of technological progress (Kudnani, 1998). With any true revolution, there is an initial period of chaos in which established relativities are distorted and it seems as if almost any wondrous possibility can take shape. As Jones puts it:

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<sup>68</sup> For the purpose of this chapter, donor agencies are defined as those organisations or programs that fund the conduct, support, or coordination of information and communication technology initiatives in developing countries. The analysis of the chapter does not extend to the non-governmental organisational sector, but rather focuses on those international non-indigenous agencies that provide the financial assistance to these organisations.

...canny theatregoers never assume that the pleasure of an enjoyable first act will necessarily be sustained throughout the entire play. In the drama of human change...explosive developments can lead to dark countervailing reactions. Initial chaos gives way to a longer and more involved phase of struggle and consolidation in which ancient relativities are reformulated in fresh forms (Jones, 1999, p. 13).

Secondly, one must ask whether the enthusiasm amongst donors for spending on ICT development is diverting funds from more traditional forms of development assistance. The focus of the current debate centres on the utility value of the Internet and more specifically on prioritising needs. Therefore, legitimate concerns can be raised at the sudden rise in the number of organisations dedicated to spreading connectivity in developing countries. The worry is that coordination between these initiatives is poorly developed. While there may be consensus that an effective information infrastructure is essential for the economic survival of developing countries, donors have yet to agree a common strategy to support this development.

### **6.3 International initiatives in information and communication technologies**

From as early as 1979 development agencies began to envisage the introduction of information and communication technologies (ICTs) to strengthen national capacities for the collection and dissemination of information on development themes. Organisations such as Canada's International Development Research Centre (IDRC) and the United Nations Economic Commission for Africa (UNECA) pioneered efforts to improve networking amongst African countries and those working in the development field (Adam, 1995; Mansell and Wehn, 1998). However, it was not until the early 1990s, with the advent of low cost electronic networking, and greater awareness of the Internet that development agencies began to focus on the widening gap between the information "haves" and "have-nots". To prevent what they perceived to be a growing "technology gap" between industrialised and developing countries, a significant number of development agencies took it upon themselves to put into action programmes designed to improve the information infrastructure in developing countries. As a result information and communication technologies are becoming an increasingly important component of development initiatives. For example, the World

Bank's lending in the Sub-Saharan Africa region for information technology projects has been increasing at a rate of 30 per cent per year since 1981, reaching US\$570 million in 1989 (Moussa and Schwere, 1992). Specifically, the international development community responded in a variety of ways:

1. Setting up a specialised internal departments or institutes. Notable examples include InfoDev, the World Bank's "information for development" department and the United Nations Information Technology for Development department.
2. Creating special initiatives and networks aimed at the transfer of advanced technology to developing countries. Such as IDRC's ACACIA programme, and USAID'S Leland Initiative.
3. Strengthening the international component and outreach activities of advanced national research institutes in industrialised countries.
4. Supporting special advisory programs on the policy and management aspects of information and communication technologies.

Consequently there is now a loose coalition of development organisations who provide grants to a wide spectrum of organisations – supporting efforts that use technology to improve education and health, reduce poverty and mitigate the exclusion of low-income countries and social groups from the benefits of information and expertise. Such projects cover a very wide array of activities and sectors, but they inevitably seem to involve the transfer of these technologies from Western to developing nations (Newsum 1994, Roche and Blaine, 1996).

According to the Bellanet Donors Database<sup>69</sup>, as of May 30 1999, there were some 437 initiatives supporting the development of information and communication technologies in transitional and developing countries. Of these, 273 were devoted to the Sub-Saharan African region. According to one estimate, from 1996 – 1998, the various organisations covered by the Global Knowledge database contributed an estimated US\$ 60 million in

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<sup>69</sup> The Global Knowledge donors' database is itself a product of project funding from the Partnership for ICTs in Africa (PICTA). PICTA is composed of donors and executing agencies that have made a commitment to collaborating and sharing information on their African ICT strategies. One of the most important outputs of PICTA has been the creation of an online donors database, maintained by Bellanet, that allows authorised agencies to update their activities via the Internet, and also see who is doing what in each region. It is available at <http://gkaims.globalknowledge.org>.



grant funds to the support of international ICT initiatives in developing countries.<sup>70</sup> Institutions providing support for the introduction or enhancement of ICTs in Sub-Saharan Africa can be categorised as follows:

- **The Bretton Woods Institutions:** for example, the UN system of agencies, and the World Bank: Information for Development (InfoDev) department.
- **Bilateral Donors:** for example, the United States Agency for International Development (USAID) and Canada's International Development Research Centre (IDRC).
- **Private Foundations:** for example, the Global Education Network for Africa (GENA).

#### 6.4 Project areas

From a textual analysis<sup>71</sup> of all the projects it is possible to fit the majority of ICT projects into one of three overarching areas: capacity building, employment of information and communications technologies and advisory activities. The sample reveals that whilst some 221 projects were devoted to capacity building and the employment of information and communication technologies, only a fifth of these projects were devoted to advising governments and aiding them in the design of their national information infrastructure. This neglect of the advisory aspect of information infrastructure development is partly a reflection of the lack of research into the developmental impact of these technologies. Table 11 overleaf categorises the ICT-related projects listed on the Bellanet donors' database by project type. The table shows that the majority of projects fall within the capacity-building sector, with development agencies contributing to the development of telecommunications and networking within the region.

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<sup>70</sup> Estimate from the GKD database available at <http://gkaims.globalknowledge.org>. Accessed June 1999.

<sup>71</sup> Abstracts from all projects based in and around Sub-Saharan Africa were analysed using the NUD\*IST qualitative analysis software, which allows the identification of common themes in texts.

**Table 11: ICT-Related projects by Category**

<b>Project category</b>	<b>No. of Projects May 1996 – May 1999</b>
<b>Capacity Building:</b>	
• Internet connectivity and Networking	93
• Telecommunications	23
• Telecentres	30
<b>Total</b>	<b>146</b>
<b>Employment of ICTs:</b>	
• Education	30
• Supporting women's development	9
• Health	9
• Environment and resource management	11
• Private sector development	16
• Rural development	
<b>Total</b>	<b>75</b>
<b>Advisory</b>	
• National Information infrastructure design and policy reform	3
• Telecommunications reform	49
<b>Grand Total</b>	<b>273</b>

*Source:* Global knowledge database, available at <http://gkaims.globalknowledge.org>

## **6.5 Major African initiatives**

### **(a) The United Nations System**

The United Nations System of agencies remains the most active of the multilateral agencies in the field of ICT development in Sub-Saharan Africa. As a reflection of the fact that Africa is a major priority for the United Nations system as a whole, there is now the New Agenda for Development in Africa as well as the System -Wide Initiative on Africa. ICTs are one of the major components of these efforts, now named the HITD/SiA, which is supported by the various UN partners and executed by UN Economic Commission for Africa and UNDP. These two agencies are the most prolific of development agencies in the ICT support field.

## UN Economic Commission for Africa (ECA)

### *African Information Society Initiative (AISI)*

The ECA has been at the vanguard of attempts to improve the capacity of Sub-Saharan Africa to overcome the information and technological gap. A landmark event, the Conference of African Ministers, drafted a resolution on 3 May 1995, entitled "Building Africa's Information Highway" and resolution (XXXI) entitled "Implementation of the African information and communications infrastructure". From these resolutions came the African Information Society Initiative (AISI). The AISI is designed as a framework to mobilise governmental support and strengthen collaborative efforts within Africa to create information and communication networks for planning and decision-making.

## United Nations Development Programmes (UNDP)

The United Nations Development Programmes (UNDP) is one of the largest single source of grant funds for development projects. Its many initiatives include:

- The Sustainable Development Networking Programme (SDNP), a US\$12 million project which focuses on increasing electronic networking. In Africa, there are operational or formative nodes in Angola, Benin, Cameroon, Gabon, Malawi, Morocco, Mozambique, Chad, Togo, and Tunisia.
- The Internet Initiative for Africa (IIA), the UNDP Africa Bureau's programme to reinforce national Internet development in 12 countries through two to three-year project partnerships between government, UNDP, the national PTO and the private sector.

Other significant initiatives include UNESCO's Regional Informatics Network for Africa (RINAF) project, the United Nations University (UNU) Africa Network which provides research input and UNCTAD's Tradepoint initiative.

## (b) International Development Research Centre (IDRC)

The Canadian government's International Development Research Centre (IDRC) has taken a pioneering role in promoting the use of information and communications technologies in developing countries since the late 1970's. The innovative stance of IDRC has been supported by a solid program of technical assistance in the form of grants to developing country institutions for studies in the use of ICTs. One of the significant projects of its Africa-focused initiatives is the Acacia Programme. A major IDRC initiative for Sub-Saharan Africa which is expected to invest CAN\$60m over the period 1998-2002 researching the use of ICTs in communities in Africa. South Africa, Mozambique, Senegal and Uganda have been identified as the initial priority countries and a number of major projects have been launched, such as:

- Telecentre development: South Africa, Mozambique, Senegal, Uganda.
- SchoolsNet: South Africa and Mozambique.
- Support for developing National ICT strategies: Mozambique and Senegal.

## (c) The World Bank

The World Bank, too, has fully committed itself to supporting the development of information infrastructure in developing countries. Most notably through its creation of an information for development department – InfoDev – that continues to be an important source for funding. Key InfoDev initiatives include:

- The African Virtual University (AVU), a \$1.2m project using satellite technology to deliver distance education with telephone callback for voice intervention from the pupils from 25 sites. Internet and video-based lectures courses are envisaged to provide freestanding education to those involved. A digital library program to make scientific information available to African students and faculty was developed and negotiations with content providers have provided access to 1700 journals using a customised library interface gateway.

Conceptually the World Bank has also realigned itself as a "Knowledge Bank", which was reflected in the Bank's "Knowledge for Development Report" (World Bank, 1998).

Other initiatives of import include:

- WorldLinks for Development (WorLD), providing support for linking 1200 public schools in developing countries to the Internet.
- Regional Environmental Monitoring Programme (REIMP). A programme to support environmental information management in Central Africa (Cameroon, Gabon, Zaire, Congo, Central African Republic and Equatorial Guinea).

The Bank also continues to be a critical source of finance provision for ICT-related projects. The International Finance Corporation (IFC), the World Bank's financing arm, was lending to forty connectivity projects in 25 African countries (InfoDev, 1998). In 1999, most of those projects included some form of privatisation of public companies and a wide range of telecom technologies, fixed phone, payphone and cellular.

(d) International Telecommunications Union (ITU)

Given the paucity of the telecommunications network in Sub-Saharan Africa the ITU has recently resolved to allocate more funds to alleviating this problem. It is implementing a significant number of projects including:

- Centres of Excellence for Human Resource Development. Designed to develop the telecommunications marketplace in Africa by training policy-makers and regulators in the development of national priorities and regulations.
- Afritel, which is designed to provide seed money to attract other funding partners, in order to strengthen the capabilities of national telecommunications operators to develop and better manage, operate and maintain the African telecommunications networks.
- Industrialisation Africa, an initiative aimed at promoting know-how in the creation and operation of manufacturing at national, sub-regional and regional levels.
- Application of new technologies. A series of pilot projects to establish the feasibility of using new technologies and new organisational methods to deliver information and telecommunications services.

(e) La Francophonie (ACCT) and other Francophone Agencies

Known collectively as La Francophonie, the Ministère de La Coopération Française, the Canadian Ministry of Foreign Affairs and the provincial government of Quebec play a key role in supporting the development of information infrastructure in Africa. The Canadian International Development Agency (CIDA), and more recently the Swiss Government are the principal funders of the activities of Agence de la Francophonie (ACCT). This role has been almost exclusively confined to French-speaking countries and is an attempt to ensure the maintenance of a significant French language presence on the Internet. Major initiatives to support ICT development in Francophone countries have been channelled through the following organisations:

- Institut français de recherche scientifique pour le développement en coopération (ORSTOM).
- Association des universités partiellement ou entièrement de langue française.
- Agence francophone pour l'enseignement supérieur et la recherche (AUPELF).
- Le réseau électronique francophone (REFER).
- Le conférence des ministres de l'éducation des pays ayant en commun l'usage du français (CONFEMEN).
- Le Centre international pour le développement de l'inforoute en français (CIDIF).

These agencies are providing a great deal of support for ICTs in African Francophone countries. According to one estimate, approximately US\$16 million has been made available for ACCT's ICT related programmes in 1997/98 (Jensen, 1999).

(f) The United States Agency for International Development (USAID)

Like many countries with bilateral aid agencies, the US has not been slow in creating a programmes of initiatives in the support of ICT diffusion in Africa. The most publicised of these is the Leland Initiative, a project to provide about US\$500,000 per country to assist with developing Internet connectivity in 20 African countries. Assistance has initially been directed toward national telecom operators and has been in the form of equipment, expertise, training and free circuits for the first year. Support is

contingent on agreements to liberalise the market to third-party Internet service providers and to adopt policies that allow for the unrestricted flow of information.

Other significant USAID initiatives include:

- AfricaLink, which provides support for dial-up Internet or e-mail connections and modems for specific African researchers, mainly in the agricultural field.
- GLOBE initiative, designed to electronically link US high schools with secondary schools in developing countries for environmental monitoring projects.
- Greater Horn of Africa Initiative (GHAI): support for institutions in the countries of the Horn of Africa concerned with food security planning, including the Ministries of Agriculture and Foreign Affairs, to connect to the Internet.

The preceding sections show that an impressive range of activities have been generated by development organisations in support of information infrastructure development in Africa. Yet, whilst development organisations continue to play a key role, little academic analysis has been conducted of the efficacy of these efforts. This section represents a preliminary examination of the dichotomy between the promise and problems of ICTs in development assistance projects. Firstly, a textual analysis of a sample of projects listed on the Partnership for ICTs in Africa (PICTA) database is conducted in order to convey a generalised understanding of the issues that affect these projects. Secondly, an in-depth case study of the UNDP's Internet Initiative for Africa is presented that allows a more specific illustration of the issues raised earlier.

## **6.6 An evaluation of development assistance in support of ICT development**

Evaluation can be defined as process in which, at a certain point in time, the outcome of a defined input in to a system is systematically assessed and analysed (Rebian, 1996). Whilst the result of a project or its outcome can be assessed in a variety of ways, the underlying assumption is that assessments are based on defining causality and impact. Various organisations have taken it upon themselves to standardise evaluation techniques. For example, the OECD defines evaluation as an 'examination as

systematic and objective as possible of an ongoing or completed project or programme, its design, implementation and results, with the aim of determining its efficiency, effectiveness, impact, sustainability and the relevance of its objectives' (OECD, 1998). Evaluation of the effectiveness of these projects involves an assessment of the extent to which the resources and methods deployed have succeeded in achieving the agreed objectives set out in the project document.

One of the major difficulties in evaluating the impact of an ICT project is the problem of measurement. Hudson (1997) has pointed out the inherent difficulties in assigning a measure to the indirect benefits arising from improving, for example, a community's capacity to communicate. The indirect benefits of investment in ICTs are generally short-term and more tangible than other investments. They may include increases in output, productivity or exports. However, though these approximations as to the value added by these technologies remain uncertain, they still represent an important yardstick for judging the relative merits of projects. The logical conclusion arising from this discussion is the importance of project evaluation. Such evaluations, both *pre* and *ex post* can be invaluable in assessing the constraints and issues in project implementation and providing a yardstick of the benefits that should arise. In the absence of a conceptual framework for dealing with ICT evaluation strategies it is hard to link project outputs, results and impacts to the role played by technology. Evaluation tends to treat ICT as a technology and factor input in the project's pursuit of its mission. Yet the pursuit of evidence about the role of ICT, either implicit in questions asked or singled out as a direct question, is seldom adequate (Lanfranco, 1997).

In reality an explicit conceptual framework is important when evaluating developmental factors or evaluating the project's capacity building in terms of efficiency, effectiveness and sustainability. The majority of evaluation mechanisms are constructed around a results-based approach and single out project management and operational factors for evaluation. In practice an effective evaluatory mechanism must pay more than lip service to the project at hand and is vital to correctly framing the correct investigative techniques; aiding in the effective collection of appropriate empirical evidence. This will help to draw out transferable lessons learned, for use within the ongoing project but also for other projects.



The history of development assistance in Africa has generated a wealth of literature and apocrypha on the problems of implementing aid projects that have at their core information and communication technologies (Kirkpatrick, 1991; Crewe, 1998). Despite these problems, external funding for the development of information infrastructure on the continent remains a key resource for Sub-Saharan African countries. In an attempt to examine the efficiency of their initiatives, project evaluation has typically been based on cost-benefit methodologies (Palmedo, 1989). Yet, such an approach fails to capture the true impact of these technologies in development projects. Development agencies are also guilty of seeing information and communication technology as *deus ex machina*, stressing a technical solution to existing development problems as opposed to seeing information and communication technologies as a tool for supporting existing activities (Dow, 1989).

Much has been written on the appropriateness of information and communication technologies in development projects (Cyranek and Bhatnagar and Bjørn-Andersen, 1992 and Woherem, 1993). Yet little in-depth research has been conducted by the academic community on evaluating ICT-related development assistance projects. Those evaluation frameworks that are in existence have been designed by the implementers of projects themselves. Such systemic bias has meant that evaluation of these projects is often superficial at best. A review of evaluatory approaches within information and communication technologies application reveals a serious lack of rigorous testing and methodology (Lanfranco, 1997). Despite the absence of effective evaluatory mechanisms, the number of projects with information systems as their main concern continues to spiral. According to the Bellanet donors' database there were some 57 current or planned activities as of April 1996 supporting the development of ICTs in Africa. However, by December 1998 the figure had risen by over 500 per cent to over 300 current or planned activities.

The fact that a significant proportion of project descriptions still focus on broad policy frameworks is a reflection of their infancy. More importantly, though, it points to the reality that the type of positive rhetoric often present in project descriptions is as yet largely untested. It is thus premature to suggest either that their rhetoric is unjustified, or that they have some legitimate foundation. However, there are legitimate concerns

over their potential impact (Lanfranco, 1997). These concerns stem from three major problematics in donor assistance to developing countries. These are:

1. Issues deriving from project design and conceptualisation.
2. Issues deriving from the nature of information and communication technologies.
3. Issues deriving from the nature of the African context.

### **6.6.1 Issues deriving from project design and conceptualisation**

#### **(a) Poor project conceptualisation**

As Bell (1998) points out information and communication technologies and development projects have not been easy companions. The approach taken by the vast majority of development agencies has been to jump on the technology bandwagon with inadequate thought as to improving the impact of the projects that they purport to implement. There appears to be little conceptual thought behind the introduction of information and communication technologies as a developmental aid. A textual analysis of the project abstracts of 273 of such projects that were completed or current between 1 January 1996 and 31 May 1999, reveals a startling homogeneity in the stated justifications and rationales behind these projects. The vast sums of money that are being spent on increasing the use of information and communication technologies are justified by vague and nebulous statements about technological potentialities and "leapfrogging". For example, the United Nations Development Programme's Internet Initiative for Africa has, as one of its avowed goals 'fostering a new generation of men and women in Africa who use information and communications technologies to leverage the development of their nations'.<sup>72</sup> These projects are seemingly imbued with the spirit of the "Field of Dreams"<sup>73</sup> metaphor, which simply states 'if you build it they will come'. Consequently, information infrastructure is often being thrown up with little regard for issues such as equity and access.

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<sup>72</sup>UNDP (1997) RBA Internet Initiative for Africa Project Document, p. 4.

<sup>73</sup>Based on the film "Field of Dreams" which concerns the plight of an impoverished farmer who is visited by the ghosts of legendary baseball players and encouraged, with the words "if you build it they will come", to transform his remote farm into a baseball pitch. Despite the absurdity of building a pitch in such a remote area with no apparent demand, on its completion, people come from miles around to visit it.

## (b) Over-ambitious objectives

It is also clear that many projects have set unrealistically ambitious objectives. Such ambitious projects are thrown into sharper focus when one examines their financial provision for achieving stated objectives. Their budgets often simply do not contain sufficient money to ensure sustainability of initiatives. This is most clearly seen when one examines the amounts of money set aside for maintaining projects and for training those people who are expected to benefit (Dow, 1989, Baark and Heeks, 1998). Indeed, it can rightfully be claimed that the establishment of unrealistic objectives in some projects is a symptom of a lack of thorough implementation planning (Honadle, 1986). It is, however, clearly also a reflection of the enormity of the tasks at hand:

In setting project outputs, and the related roles of the project organisation, the temptation to do "a little bit of this, and a little bit of that" should be avoided...By contrast, project achievements were greatest where there had been a clear focus of staff and resources on a very small number of roles and outputs (Baark and Heeks, 1998, p. 15).

While stated project objectives such as "improving Internet connectivity" are intrinsically valid, and worthy of donor funding, there is often a discontinuity between the social validity of project objectives, and the narrow focus of project outputs. Baark and Heeks (1998) point out that outputs often appear to be overly technical, too heavily focused on processes within the recipient organisation, and too little focused on beneficiaries and the external social environment. Almost all development agency projects have identifiable human beneficiaries, yet too little is known about them at the planning stage. In the process of project appraisal or – less favourably – in the early days of project implementation, such beneficiaries need to be identified and surveyed. Armed with such information, it would be easier to create outputs that were oriented to the beneficiaries, and which were more in line with project objectives (Baark and Heeks, 1998).

A more serious concern of these projects is the rationale behind them. For example, a significant proportion of ICT-related initiatives are attempting to connect developing country schools to the Internet as a way of improving educational delivery. However,

the Internet remains a truly unpredictable environment. Whilst there are hundreds of thousands of educational and learning sites, there are probably even more sites with all manner of attractions, distractions and temptations for students – all within a few key presses or mouse clicks. Because of the Internet's increasingly advertising-driven culture, these sites are in fact easier to find than the educational ones. Used carefully, the Internet can be helpful for doing a number of things, but it is currently a poor environment for education and learning because it can destroy the carefully designed school learning process (Hazemi, et al., 1998).

Nor are development agencies devoting adequate human resources to what, by their own admission, is a critical area development assistance. The fourfold increase in ICT-focused development assistance has not been matched by a concomitant rise in human resources. Given the pressures – often political – to spread aid money to as many different projects in as many different sectors and regions as possible, and given the pressure to reduce administrative costs development agencies have begun to suffer from the "more is less" phenomenon (Baark and Heeks, 1998). Namely, that as the number of projects rises they are handled less and less efficiently, resulting in diminishing returns for more effort.

### (c) Underutilisation of local expertise

Neither have many of these projects sought or taken on board the views of local experts. Chambers (1997) has emphasised the fallacy of the "expert" consultant and has criticised the traditional development project as being essentially non-participatory and working from the "expert's" perspective rather than that of local stakeholders. He concludes that expert opinion, grounded in local need and undertaken with local consent and participation, has a greater likelihood of success and sustainability than approaches that are characterised as remote, aloof, and technology-driven (Chambers, 1997). Chambers goes on to argue that many projects in this region are founded on a *tabula rasa* framework in which the culture of taking stock of existing knowledge, skills, experiences and information as an input to planning and project management remains rare. Coupled with this is the lack of local ownership of development projects. ICTs are most effectively leveraged when the projects designed to benefit communities are initiated and driven by people from those communities (Crewe, 1998). Visions for

social development created by international or national agencies simply cannot replicate the energy and understanding of people whose future is inextricably linked to the success of these initiatives.

(d) Lack of coordination

Despite efforts to improve coordination there is still a widespread acknowledgement that the majority of development activities in these areas are insufficiently coordinated with each other. As Jensen (1996) points out:

Multiple foreign consultants with similar expertise are sent to the same country, different types of equipment are provided for the same tasks and parallel communication links are established (Jensen, 1996, p. 24).

Given this reality the key, then, is for improved coordination and more appropriate planning by those development agencies. Carlos Braga, the Director of the World Bank's InfoDev programme acknowledges that 'there is much greater scope for coordination' (InfoDev, 1998, p. 34). Since 1997, efforts have been made to increase the utilisation of information networking among donors and NGOs themselves, especially through electronic Internet networks such as Bellanet, which offers support for incorporating ICT-enabled electronic workspaces into the development community's institutional structures and programme activities. As shown in Table 12 overleaf, the effects of a lack of coordination are already manifesting themselves in a bewildering array of network protocols that have led to little interoperability between networking projects. It would appear that, so far, the African computer network infrastructure has been installed mainly taking into account the strategies, and perhaps even interests, of aid providers (Adam, 1995). The proliferation of incompatible network protocols reflects the evolutionary nature of electronic networking and the lack of internally generated capacity to identify appropriate network design (Cyamukungu, 1996; Mansell and Wehn, 1998).

**Table 12: Electronic networks in Africa<sup>74</sup>**

Country	Types of Network				
	FIDO	Hnet	UUCP	Co.IP	Comm.IP
Algeria	x		x	x	
Angola	x				
Botswana	x	x	x	x	
Burkina Faso			x		
Cameroon	x	x	x		
Central African Rep.	x				
Chad	x	x			
Congo		x	x		
Côte d'Ivoire	x		x		
Egypt				x	x
Eritrea	x	x	x		
Ethiopia	x	x	x		
Gambia	x	x			
Ghana	x	x			x
Guinea				x	
Kenya	x	x		x	
Lesotho	x	x	x		
Madagascar	x		x		
Malawi	x	x			
Mali	x	x	x		
Mauritius			x	x	
Mozambique	x	x	x	x	
Namibia			x	x	
Niger			x		
Nigeria	x		x		
Senegal	x		x	x	
Seychelles			x		
Sudan		x			
Swaziland			x	x	
Tanzania	x	x		x	
Togo			x		
Uganda	x	x	x		
Zambia	x	x			x
Zimbabwe	x	x		x	

*Source: Adam (1995)*

(e) Aid conditionality

In the case of donor-supported ICT development, there is explicit evidence of aid conditionality obfuscating the effectiveness of donor assistance. Collier et al. (1997) argue that the use of conditionality to induce reform has led to rather disappointing results. However, increasingly development agencies are redesigning the aid contract toward a shorter period and more detailed conditions. For example, the criteria for

<sup>74</sup> These acronyms, FIDO, Hnet, UUCP, CO.IP and Comm.IP are methods of transferring data over networks.

receiving assistance under the USAID's Leland Initiative is an agreement to liberalise the telecommunications market to third-party Internet service providers and to adopt policies which allow for the unrestricted flow of information.

The prevailing form of information and communication technology transfer continues to be grants, donations, and closed packages, with multinationals supplying and installing equipment that their home countries have paid for<sup>75</sup>. In addition technology transfer agents, such as multinational corporations, often manage the operations or training of local technicians and engineers (Kluzer, 1993). This has resulted in developing countries importing closed technologies, limiting the opportunity for effective technology transfer, and maintaining technological dependency (Sonaïke, 1989; Odedra, 1990b). Such aid conditionality undermines efforts to ensure an even and equitable development of information infrastructure on the continent. For example, Ethiopia was originally chosen as one of the countries to benefit from the Leland Initiative: however, a refusal to fully deregulate its telecommunications sector led to USAID's removal of support. This "inducement" function of aid conditionality continues to be intrusive and damaging to the overall effectiveness of project-based assistance.

#### (f) Poor project planning

Some ICT projects have also exhibited the classic signs of poor project planning. Zetter and Hamza (1997), in a study of three cases of development projects in Egypt, found limitations arising in the following areas: project formulation; the desire for short-term project visibility and the lack of adequate conceptualisation of models of participation. Others argue that ICT- centric projects have little in-built sustainability, as planners fail to incorporate the future-proofing essential to ensure that the technology chosen will

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<sup>75</sup> In 1977, the Ghanaian government decided to install an earth satellite station, which was designed to improve the telecommunications landscape. Spar Aerospace, of Canada, won the contract and supplied an international telephone switch that was obsolete, poorly designed and incompatible with the specifications of the station. In addition, the TV transmission chain they developed soon became defective after the station was commissioned in 1981. The company also failed to supply the automatic tracking system required to readjust the dish were it to go out of focus with the satellite. As a result Ghanaian technicians have to focus the dish manually by climbing up its mast (Rogers-Akpathah, 1986).

still meet project needs in the medium term. Allied to the paucity of effective project planning has been the failure to address the issue of local content. The "Field of Dreams" approach to these projects has concentrated on building the infrastructure first without questioning the implicit value of the information provided by these networks. The absence of the development of local content has meant that, more often than not, Internet users in Africa are unable to fully leverage the networks at their disposal (Adam, 1996).

Allied to this short-termism is a distinct lack of research into the more fundamental issues raised by these technologies, such as equality of access. An analysis of the sample of projects within the PICTA database reveals a preponderance of top-down initiatives that focus on improving, for example, Internet connectivity in urban centres. Inevitably this neglects rural dwellers who represent the vast majority of Sub-Saharan African populations, thus exacerbating inequality. Moreover, despite long lists of target beneficiaries, those most likely to benefit from an Internet service are the donor community themselves and relatively wealthy urban dwellers (Mansell and Wehn, 1998). There is also a lack of initiatives devoted to the more fundamental problems of building indigenous capabilities in these technologies. Without a greater emphasis on this aspect, Sub-Saharan African countries face being tied into even greater technological dependencies.

#### (g) Provision of Finance

A key reason contributing to the above problem is the fact that the vast majority of projects in this area rely on "soft" money – money from funding agencies or earmarked finances – for their funding. Thus, models of financial sustainability do not emerge, rendering the medium – to long-term future of projects very fragile. These financial models must change if projects seeking to harness the capacity of ICTs to accelerate social development are to make a meaningful impact. Moreover, in the lending programs of multilateral institutions, the information and communications sectors are yet to receive the priority they deserve. It is estimated that in the period 1990 – 1997,



multilateral spending on ICT development in developing countries constituted less than one per cent of their total lending for development assistance worldwide.<sup>76</sup>

(h) Lack of effective evaluation mechanisms

Development agencies have increasingly seen the evaluation of their projects as an essential mechanism for assessing the efficacy of design and implementation, and an attempt to avoid repeating past mistakes (Dow, 1989). However, the evaluation mechanisms built into these projects tends to take a rationalistic cost-benefit approach (Lanfranco, 1997 and Hecht, 1989). This evaluatory bias approach fails to capture more subjective factors that are critical to understanding how and why projects fail or succeed. For example, projects designed to increase Internet connectivity have traditionally been adjudged successes or failures based on the number of users added or quality of service improvements. These empirical results fail to record more meaningful data such as the patterns of usage and the utility value of information gleaned. Even if more accurate evaluation mechanisms are introduced there will always be the problem of "moral hazard".

Evaluation, by definition, will tend to expose shortcomings in the rational and objective purposes of such projects when, in fact, the projects often serve other, more subjective purposes. Namely the political capital for the agency that ensues from investments in recipient countries. Clements (1999) presents evidence of informational standards and development impacts from four US Agency for International Development (USAID) and four World Bank projects in Africa. He found significant positive bias in project document arguments and that promotional and analytical purposes are often in conflict. Further, that weak informational standards undermine incentives to manage for impact, and reduce the prospects for bureaucratic learning. Finally, effective, thorough evaluation of many projects is relatively rare because recipient managers have a strong preference for funds to be spent on tangible goods rather than evaluation.

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<sup>76</sup>UNDP (1997) RBA Internet Initiative for Africa Project Document.

### (i) Crowding out

There is also a legitimate fear that the scramble of development agencies to improve the information infrastructure in developing countries has in fact stifled indigenous efforts. This crowding out, while on a small scale, is the result of the expectational nature of donor recipients. African governments have become accustomed to development aid, and this dependency reduces, to an extent, their desire to utilise scarce resources when development agencies are more than willing to plug the gap.

### **6.6.2 Issues deriving from the nature of ICTs**

As Bell (1998) points out, information and communication technologies and development projects have not been easy companions. Others have commented on the appropriateness of projects with a significant information technology component to the development process (Cyranek, Bhatnagar and Bjørn-Andersen, 1992 and Woherem, 1993). It would appear that there are unique problems raised by the utilisation of ICTs in development projects (Montealegre, 1999). Firstly, there is a very real danger that the technology becomes an end in itself. In other words, the threat that the information system is mistakenly shifted from an enabling to a core function. Such approaches are technologically deterministic and represent aloof, technology-driven fixes which neglect to bear in mind that the most important facet of these technologies is the information they purport to give access to. Secondly, there is the issue, touched upon above, of obsolescence. This can be a particular problem for aid-funded technology transfer projects because there can be significant time delays between decision-making and installation (Dow, 1989). Allied to this is the widespread problem of incompatibility and lack of flexibility, making it sometimes problematic to upgrade and expand information systems with new hardware or software components. Together these factors often lead to a situation where users who have purchased advanced computer systems feel after a few years that they need to purchase completely new computer systems or abandon the previously installed system (Woherem, 1995).

Finally there are also the difficulties inherent in information technology project management. There must be an explicit acknowledgement that ICT-centric projects may be more difficult to implement due to the inherent problems associated with

information systems implementations. Taylor (2000), in recent research on why IT projects fail in the UK, found for example, that out of 1207 projects sampled only 12.7 per cent were deemed to have succeeded.<sup>77</sup> Delving further he found that managers were asked at which stage failure could occur and the majority cited the project definition stage. He found that projects are often started when they are not clearly thought through or without measurable deliverables. He goes on to argue that requirements definition, change management and scope management are major causes of project failure. These particular problems must be borne in mind by development practitioners. Greater emphasis should be placed on effective project design in the initial phase and closer monitoring during execution.

(a) The technology transfer problem

Technology transfer has long been identified as a key issue within the development process, (Odedra, 1990a). It is a fallacy of the highest order to assume that countries can "leapfrog" technologies by buying these technologies "off the shelf". Many of the most productive applications of ICTs require not just one process or piece of equipment, but also a host of capacities that are not present in the majority of African countries (Grant, 1996; Hanna and Boyson, 1990). For example, effective Internet usage requires users to have more than a familiarity with basic computing, not to mention a good understanding of the English language. All these are necessary before we even consider the technological requirement of access to a personal computer, the requisite software and a reliable and consistent phone connection to an Internet service provider. From a systems point of view there are significant problems associated with the choice of the individual components of a system (Palmedo, 1989). In a developing country the job of choosing components and integrating them is particularly difficult because of a lack of current information, a multinational cast of vendors, and a variety of sources of equipment and program financing. Odedra (1990a), for example, cites a case in Zambia in which computing equipment remained unused due to a lack of necessary systems development skills within the recipient organisation.

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<sup>77</sup> Success is defined as 'delivering to the sponsor everything specified to the quality agreed on and within the time and costs laid out at the start' (Taylor, 2000, p. 24)

It was appropriate technology advocate E.F. Schumacher, author of the widely acclaimed book *Small is Beautiful* (1993), who once said that technologies often carry a built-in ideology which is so deeply embedded that one cannot have a technological transplant without getting, at the same time, an ideological transplant. ICTs embody within themselves a host of ideological assumptions that are based upon the market for which they were originally intended. Thus the problem of technology transfer is compounded by a lack of neutrality. These technologies embody a host of biases that have yet to be tackled. The first and most obvious problem is that of language. Almost 80 per cent of the world's software is produced for the English-speaking market, but English is only the official language of five countries in Sub-Saharan Africa. Software is becoming an increasingly important component of the total information system. This means that there is a need for systems integration bringing together the computer hardware with suitable applications software.

Sussman and Lent (1991) argue that the majority of the expenditure for information infrastructure development is earmarked for high-technology imports. These technologies tend to leave little scope for local labour or expertise development. They assert that invariably these investments will 'ultimately end up as huge subsidies to leading industrial capitalist equipment manufacturers and consultants' (Sussman and Lent, 1991, p. 139).<sup>78</sup> In an in-depth examination of the World Bank's operations in the Philippines, they found that the advice espoused by the World Bank led to 'an increased dependence of scarce Filipino capital upon advanced imported technology...[which] contributed significantly to the country's US\$28 billion foreign indebtedness' (Sussman and Lent, 1991, pp. 125-149). Development projects, it can be argued, focus on areas that offer the quickest returns, and have made the location of communications infrastructure a matter of the ability to pay. Projects designers also appear to favour multinational corporations and their local partners over national capital formation. Sussman and Lent also assert that 'all digital telecommunications infrastructure of this sort...serves to help restructure the economy, supporting the absorption of Philippine human and material resources into subsidiary, largely marginal, "trickle-down" relationships in an emerging new international division of capital and labour' (Sussman and Lent, 1991, p. 138).

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<sup>78</sup> See Payer's (1982) landmark study of World Bank project lending in the energy sector.

Simply purchasing hardware is seldom an appropriate solution. On the other hand, software engineering tools and methodologies are becoming essential to ensure that the programs and systems created are of high quality and are effective in meeting the needs of the users. Furthermore, manufacturers of ICTs in the industrialised countries often incorporate particular social and cultural assumptions that may not apply in developing countries. Lind (1991), for example, blames the failure of some information systems introduced into Egypt on their Western assumptions of a business environment in which formal information was valued, the supply of goods relatively certain, and legislative stability the norm. Manufacturers also assume the existence of a reliable and abundant supply of electricity, which again is not the case in the majority of African countries. Climatic factors vary widely, and air-conditioned environments are often necessary to protect against extremes of temperature and high humidity levels (Byass, 1989). Consequently installation costs may be considerably more expensive than the purchasing costs alone.

### **6.6.3 Issues deriving from the nature of the African context**

#### **(a) Political considerations**

One of the fundamental premises of the transition to a knowledge-based economy is that timely, relevant and accurate information represents a new form of competitive advantage (Drucker, 1970; Freeman, 1987); that access to this information is power. However, in government bureaucracies power traditionally arises from withholding information (Peterson, 1994). Proponents of the merits of information and communication technologies argue that an effective information infrastructure is predicated on the decentralisation of power and the creation of a new social structure in which decisions are decentralised and made by an array of actors. However, such a decentralisation implicitly undermines the traditional balance of power. The advent of technological systems such as the Internet, has led to the unprecedented sharing of relevant and timely information amongst precisely those communities African governments have tried to disinform.

The speed with which information now navigates the globe has led to the ironic phenomenon of African expatriates often having a greater insight into affairs at home than the locals on the ground. Constant news feeds and the inability of governments to censor journalists who are only an e-mail away from filing reports with a potentially global audience, has led to growing suspicions in some quarters as to the value of the Internet. For example, there have been much publicised efforts by the Chinese and Singaporean governments to censor content on the Internet. Some African leaders have also expressed their discontent. Former President Sani Abacha of Nigeria, for example, stated in 1997 that his opinion of the value of the Internet had been undermined on using it for the first time. On entering "Nigeria" into a search engine, he was alarmed to see a page of results that depicted him as, amongst other things, a "barbaric dictator", a "military thug" and the "scourge of Nigeria".<sup>79</sup>

#### (b) Policy and regulatory framework

The effectiveness of projects have also been hampered to some extent by the realisation that complex and sometimes byzantine regulatory regimes in African countries have led to an over preponderance of the top-down approach to improving networking in the region. Despite some very public pronouncements, a significant number of governments are loath to deregulate those areas that involve control over the flow of information. Development agencies have on the whole been able to circumnavigate these restrictions if their initiatives are partnered with the government. However, grass roots initiatives, for example, are more likely to flounder in the wake of punitive import restrictions.

#### (c) Political risk

Another factor for consideration is the seemingly endemic political instability in the Sub-Saharan African region. Madon (1993) asserts that 'systems designers have assumed that development planning is a rational process and therefore ignored the fact that planning is heavily shaped by socio-political and cultural factors' (Madon, 1993, p. 126). Project designers must therefore gauge country risk factors prior to project

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<sup>79</sup> Reported in *Punch*, Lagos, 1 May 1998, p. 8.

implementation. The instability in the central African region led to, for example, the cancellation of the proposed UNDP Internet for Africa initiative in Zaire. Also the escalation of civil strife in Sierra Leone saw the suspension of Leland initiative activities at the end of 1998. Ironically it is often precisely those countries that periodically implode who are in need of the most development assistance. Angola, for example, has had to virtually reconstruct its information infrastructure from scratch in the wake of an internecine struggle that continues to smoulder menacingly.

#### (d) Information asymmetries

Having neither the necessary information nor financial resources to tackle this difficult problem effectively on their own, developing countries are somewhat dependent on exogenous help. As a result, they have been all too keen to allow development agencies to pursue their agendas without thoroughly analysing the impact of their projects (Dow, 1989). In order to ensure that these projects offer sustainable methods of improving the information infrastructure policy-makers must subject proposals to far more rigorous examinations, based on long-term objectives rather than short-term needs.

#### (e) Infrastructural deficiencies

Evidently, the existing infrastructure in a target country plays a key role in determining the functionality and sustainability of an ICT-related project. As touched on above, much of the basic physical infrastructure that is taken for granted in developed countries is either non-existent or poor (Woherem, 1993; Bhatnagar and Bjorn-Andersen, 1990). Public goods such as an effective transportation network and utilities such as electricity are severely lacking or unreliable and restrictive. These deficiencies lead to a list of additional project requirements such as air-conditioning, surge protectors and generators that adds significantly to the cost of implementation for development agencies. The lack of human resources is particularly acute in the information and communication technologies sector, thus donors invariably find that this takes a significant proportion of their project budget (Palmedo, 1989). Another serious constraint to the sustainability of these projects is the lack of indigenous ICT support services. Though the information technology market continues to exhibit signs of healthy growth in the region, initiative implementers often find it extremely difficult

to source spare parts and servicing. This represents a serious constraint to the long-term sustainability of ICT projects.

## **6.7 The contribution of development agencies**

Despite a seemingly interminable list of problems associated with development projects it is undeniable that development agencies continue to play a key role in the development of information infrastructure in Sub-Saharan Africa. They have been especially valuable in the following areas:

- Agenda setting and consensus building.
- The utilisation of ICT applications in key development areas.
- Capacity building.

### **(a) Agenda setting and consensus building**

Through the hundreds of meetings on the continent involving policy-makers, development agencies have managed to sensitise policy-makers as to the importance of information infrastructure construction. Examples of such initiatives include the African Global Connectivity Conference, co-sponsored by InfoDev together with the World Bank, the United Nations Economic Commission for Africa (UNECA), the ITU and the African Development Bank. This conference brought together industry, government and consumers in Addis Ababa in June 1998 to examine the options for connectivity in Africa. Discussions at a ministerial level, and with major telecommunications providers covered several options, including satellite technology and undersea cables. The momentum from this conference has resulted in planning and discussion at the national level in several African nations. Another significant output has been the Economic Toolkit and workshops for Internet connectivity in Africa (created by the World Bank's InfoDev department), which provide insights on how to extend the reach of the Internet.

One of the areas in which the development agencies have achieved the most has been in the area of increasing public awareness. The effect of countless workshops, conferences



and small-scale projects has been to favourably alter the perception of information and communication technologies (Hecht, 1989). However, the extent to which development agencies have succeeded in forging an information and communication technology agenda in Africa is difficult to gauge. Policy-makers continue to debate the issue, but there has been little sign of concrete strategies.

Policy reform is often a difficult and costly endeavour involving many partners, including government and highly specialised experts. Yet though this has been an avowed intent of many development agencies, few have the capacity or the resources to engage in major and complex policy reforms in the realm of ICTs. Nonetheless, development agencies continue to play an instrumental role in facilitating the reform process by improving both the quality and quantity of information available about the options and the consequences of policy issues, ensuring a more informed debate. However, there is evidence to suggest that organisations such as the World Bank and bilateral agencies such as USAID have been at the forefront of attempts to push the deregulation of the ICT sector in Africa at all costs. An example of this has been the debate in international communications concerning the impending collapse in the method of charging for international telephone calls, a system known as the accounting rates regime; which has seen one of the key mechanisms of redistributing telecommunications wealth to developing countries come under attack.

Rather than proposing alternative mechanisms to support the growth of telecommunications in Sub-Saharan Africa, the major donor organisations have accepted the collapse of the accounting rate system as a *fait accompli*. This illustrates that while development agencies have on the whole provided much needed awareness to policy-makers in the region on information and communication technology development, they have at the same time advanced an agenda that seems, at times, at odds with development objectives.

#### (b) The utilisation and employment of ICTs in developing countries

The application of ICTs in addressing development issues continues to be a primary focus of many development projects. Results from these projects have demonstrated

that applications of ICT in such areas as education, health care and environmental issues can yield important economic and social benefits to developing countries. For example, the education system in developing countries faces a number of problems in which technology can theoretically help provide solutions (Cassiolato, 1997). With limited infrastructure and a large population of under-trained teachers, one of the most important areas is teacher training. However, despite the numerous projects devoted to the use of information and communication technologies to facilitate the delivery of education in Africa, it is too early to gauge their effectiveness. Projects such as the African Virtual University have set in motion mechanisms to facilitate information sharing, but without a greater generosity and commitment from educational content providers such projects will remain merely interesting educational experiments.

In the sphere of healthcare, development agencies have successfully shown the feasibility of applying cutting-edge technologies to solve traditional problems. The HealthNet project, for example, utilised low earth orbiting satellite technology to establish a network of satellite earth stations to establish a store-and-forward e-mail system for the dissemination of medical information. Such projects, while small-scale in orientation, nonetheless provide an important demonstration effect as to the efficacy of using such technologies. Moreover, they have improved the quality and reach of health care in selected African countries and laid the framework for improved collaboration.

### (c) Capacity building

Perhaps the area in which development agencies have had the greatest impact has been in capacity building. They deserve credit for introducing electronic networking to the Sub-Saharan Africa region through such initiatives as the SDNP, CABECA and PADIS. They have also been instrumental in building indigenous human resource capacity in these technologies. But such praise must be qualified by the lack of coordination amongst agencies that has led to the implementation of a complex web of data networks whose only shared quality is their lack of interoperability (Adam, 1995). Moreover, there is really very little evidence that development agency initiatives have done anything other than improve their own and urban elites' communications capacity in the Sub-Saharan Africa region. Many of the major initiatives have succeeded in

improving Internet connectivity in urban locations whilst neglecting the rural areas. Whilst latterly, more emphasis has been placed on smaller grass roots efforts in rural areas, these are typically pilot projects that are still exploring the most effective dissemination method for these technologies.<sup>80</sup>

In conclusion, the above section has explored a range of initiatives that attempt, in different ways, to harness ICTs to accelerate social development. In analysing the trends emerging from this, it becomes clear that the potential of ICTs remains largely unfulfilled. The sample survey above, of the 273 projects centred on Sub-Saharan Africa, reveals a surprisingly high level of duplication of effort. Many project leaders are unaware of similar initiatives in the same city, let alone in the same country (Jensen, 1996). From a technological standpoint many projects have different technological and implementation philosophies which have resulted in incompatible approaches. Furthermore, the lack of sufficient local participation in these projects has meant that issues such as equality of access are being displaced by narrower, technical concerns.

An overall assessment of the efforts of the main development agencies reveals a mixed picture. The United Nations' attempts to improve the Sub-Saharan Africa information infrastructure would receive a satisfactory mark for effort but a somewhat lower score for achievement. Despite much pomp and circumstance, the United Nations system of agencies continues to ineffectually tackle the issue of Africa within a global information society. One only has to look at one of the UN's most trumpeted initiatives, the Africa Information Society Initiative, for confirmation of this. According to a slim pamphlet<sup>81</sup> – the only public relations documentation produced on the initiative – the AISI is designed to act at the national level, encouraging, and supporting governments in their endeavours to create national information infrastructures. In 1999, four years after its inauguration, it has yet to design a single information infrastructure. Rather,

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<sup>80</sup> According to the InfoDev 1998 annual report, during the period June 1995 – June 1998, 41 per cent of its initiatives in Sub-Saharan Africa were classified as pilot projects.

<sup>81</sup> UNECA (1995), "An action framework to build Africa's information and communication infrastructure African information society initiative (AIS)", Addis Ababa: UNECA.

like so many grand pan-African initiatives, it has become stuck in the rut of the conference circuit.

Nor have bilateral development agencies fared much better. The overt political and economic conditionality of USAID's ICT-related initiatives brings into sharp relief the often hidden agenda of national development agencies (Hyun and Lent, 1999). Whilst on the one hand acting publicly out of enlightened altruism, they are all too often the modern equivalent of battering rams, breaking down regulatory barriers in developing countries and allowing their national cohorts to storm the ramparts. National development agencies often make it a condition of the extension of aid that their expatriate firms provide the necessary equipment and expertise. Evidently, this has a significant impact on the effectiveness of development efforts. The close ties of the French government to their former colonies and the decline of the French language globally has ensured continued support for "la Francophonie". But serious questions must be asked about the fact that France Cable and Radio, the French public telecommunications operator, has a stake of at least 30 per cent in the public telecommunications operator of over 70 per cent of former French colonies in Africa.

There is also little evidence that organisations such as ITU have Africa's best interests at heart. The 1998 ITU Plenipotentiary Conference led to an amendment of the ITU Constitution to give greater rights and responsibilities to the ITU's private sector members (Maclean, 1999), diluting the likelihood of a more ethical approach to telecommunications planning. Rather, developing countries are being urged to open their telecommunications sectors to the foreign private sector, without due consideration of the consequences. The ITU's failure to defend the position of developing countries in the dispute over the accounting rate system does not bode well for an organisation that claims it is committed to improving telecommunications development in developing countries.

The above analysis has examined the literature and a sample of development agency ICT related projects to convey a generalised picture of the key issues. The following section takes this analysis further by conducting a case study of a UNDP funded and executed initiative to improve Internet connectivity in Sub-Saharan Africa. The case study was designed to illustrate the issues, touched upon above, that arise in donor

assistance for the support of information and communication technologies in Sub-Saharan Africa.

## **6.8 Case study: The Internet Initiative for Africa**

The case study was designed to test some of the assumptions underpinning the use of ICTs in development assistance projects and to illustrate some of the issues raised above in the survey of 273 sample projects. Although the project is still ongoing and is not due to finish until June 2000, the compartmentalised nature of the 12 countries participating in the Internet Initiative for Africa means that it is possible to draw conclusions prior to the project running its full course.

### **6.8.1 Background**

In 1996, The United Nations Development Programme (UNDP) launched an Internet Initiative for Africa (IIA), a three-year program designed to introduce and promote Internet access across Sub-Saharan Africa. The aim of the project is to establish or enhance direct national Internet access where such access does not exist or where it is limited. The project is based on the rationale that access to reliable and up-to-date information is a prerequisite for sound decision-making throughout the sustainable human development policy process, and the Internet is a medium that provides an efficient and reliable means of achieving this objective. The aim of the Internet Initiative for Africa is to establish Internet services, as well as enhancing the current services in 12 Sub-Saharan African countries, as a means of strengthening economic and social development. The project is designed to be collaborative, seeking to establish links with African governments, UNECA and the UNDP Country offices. It is estimated that African governments and UNDP country offices will provide 50 per cent of the cost of the installation, with the remainder being supplied by the UNDP Regional bureau for Africa (RBA). UNDP country offices are envisioned as acting as the fulcrum of activities, communicating with governments, NGOs, academics and the private sector on establishing Internet services, as well as being subscribers to the services themselves. The project is in line with the UNDP Strategy for sustainable human development, ECA's Africa Information Society Initiative and the UN system-wide

Special Initiative for Africa. However, the Initiative is not designed to be entirely altruistic in that there is an explicit acknowledgement that local UNDP country offices will be beneficiaries of each project:

The benefits of the regional project will not only pertain to the economics and social development of the selected countries, it will also provide benefits for the donors and the UNDP, providing reliable and cost-effective communication links between the Country Offices and with Headquarters (UNDP/RBA, 1997, p. 4).

### **6.8.2 Project overview**

Two years after its launch in July 1997, the Internet Initiative for Africa (IIA) has conducted eight Internet Assessment missions to the following countries: Burkina Faso, Chad, The Gambia, Ethiopia, Mauritania, Namibia, Nigeria and Swaziland. All of these countries have signed cost-sharing memoranda of understanding (MOU) between the respective governments and UNDP. These agreements have listed a number of activities to develop Internet access and technical capacity in the respective countries. Each of the country initiatives of the US\$12 million project is based on a cost-sharing mechanism whereby selected countries agree to contribute half the costs of the project. Each project is allocated approximately US\$1 million, thus the participation from African countries is typically in the region US\$500,000. Originally, 12 countries were picked: Angola, Burkina Faso, Cape Verde, Chad, the Gambia, Mauritania, Namibia, Nigeria, Sao Tome & Principe, Swaziland, Togo, Zaire. The selection of these countries was based on a number of criteria:

- that they were not already receiving funds from other development agencies;
- there was a firm commitment from the government;
- there was a commitment from the country for allocation of 50 per cent of the activity cost for the next two to three years; and
- that there was evidence of a viable private sector that is capable of competing in an open and level playing field to become Internet service providers.

### 6.8.3 Objectives

The project was designed to contribute to the strengthening of the information infrastructure of the selected countries by achieving the following objectives.<sup>82</sup>

- the creation and consolidation of a national information infrastructure that will be the coordinating vehicle for civil societies to join the information age;
- enhancing and building capacity in the use of information technologies and formulating a policy environment that ensures the free flow of information;
- increasing the level of employment in both the public and private sectors;
- building technical capacity in the information communications sectors, highlighting the Internet as a tool for sharing information, experiences and knowledge;
- assisting in the design and implementation of appropriate policies and actions in the pursuit of national goals and objectives;
- enhancing capacity for informed and participatory decision-making by stakeholders in the pursuit of sustainable development at all levels of society;
- increasing Sub-Saharan Africa's capacity in the use of information and communications technologies to leverage the development of their nations;
- encouraging and facilitating the coordination and growth of national regional and international technological and institutional networks;
- encouraging the growth of regional networks utilising direct links between African countries; and
- fostering a new generation of men and women in Africa who use information and communications technologies to leverage the development of their nations.

If we assess these objectives in the light of the previous section it is clear that the project design failed to build in the requisite mechanisms for achieving the stated objectives. Section 6.6 highlighted that one of the typical flaws of ICT-related project design is the setting of over-ambitious objectives that are rarely achieved. For example, though one of the objectives of the Internet initiative project in Ethiopia was the encouragement of the free flow of information and the reduction of government

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<sup>82</sup> UNDP/RBA Internet Initiative for Africa Project Document, unpublished.

restrictions on access to information, there was no mechanism for achieving such an objective built in to the project. Rather, given the political sensitivities of the government to allowing free flowing information, no mention was made of this aspect during the course of interactions between the project coordinators and government representatives. Nor were there mechanisms for 'encouraging and facilitating the coordination and growth of national, regional and international technological and institutional networks' (UNDP, 1998b, p. 6). Rather, it appears that the stated objectives of the project as a whole are vague and typified by generic statements that fail to convey a precise impression of the potential impact on participating countries.

Whilst the technological objectives appear straightforward, namely improving Internet connectivity in the selected regions, the wider implications of the Initiative are not elucidated. Again it appears that the rationale behind the UNDP's Internet Initiative for Africa project is in the spirit of the flawed "Field of Dreams" approach highlighted in section 6.6.1 (a). This flawed approach to project design has led to an initiative that is technocentric and pays lip-service to important issues such as who will access and ultimately benefit from these improved Internet infrastructures.

#### **6.8.4 The implementation process**

In order to ensure the suitability of the countries selected, a preliminary feasibility report was prepared by regional consultants for each country. On the acceptance of the report by the steering committee the next stage in the implementation process was the organisation of a mission to each country in order to obtain a commitment of funds and a detailed operational plan, a memorandum of understanding, for the country concerned. This memorandum of understanding:

- lists the principles which will guide the project;
- clarifies the goals of the project;
- specifies the activities and obligations of each of the partners; and
- indicates a timetable for completion of the activities under this project.

Once a memorandum of understanding had been signed by the respective parties, the project coordinators, in concert with local partners, proceed with identifying the most



suitable organisations capable of installing and implementing the technological aspects of the project. The bid process involves the submission of bids by companies, which are in turn reviewed with the government and local partners. The actual implementation of the Internet node is subcontracted to institutions that are deemed to have the required expertise. The training of the national public telecommunications operators and private sector members is also subcontracted to institutions with prior experience in the field.

### **6.8.5 The evaluation process**

The performance criteria against which the project is to be measured is that Internet nodes will be available in the 12 chosen Sub-Saharan African countries and will be fully accessible by target beneficiaries. Other criteria include:

- commitments from the selected countries to a long-term strategy for maintaining Internet access points;
- the number of Internet service providers to have increased in the selected countries;
- the establishment of national partners and committees who will be responsible for formulating a strategy to broaden access to the Internet;
- an increased percentage of the population that has access and can comprehensively use the Internet; and
- establishing and enhancing Internet connectivity for universities, schools, and medical institutions, so that they can share information nationally regionally and globally.

The project was to be reviewed by a steering committee which was to meet twice a year in the first year and then once in the next two years, with a final evaluation meeting in the final year.

## **6.9 The Internet Initiative for Africa: Ethiopia**

### **6.9.1 Background**

As of June 1998, Ethiopia's Internet service was still run on a monopoly basis by the Ethiopian Telecommunications Corporation (ETC). The Internet network is configured for both dial-up and leased line capabilities. Dial-up users are charged on average US\$ 25 for five hours of monthly connection. ETC has set leased line rates at \$3000 for a 64kbps bandwidth. Services provided include electronic mail, news, WWW and FTP services. ETC has received several applications for leased lines and has stated its intentions to offer dedicated internet access to organisations such as UNECA, Addis Ababa University (AAU), Ethiopian Airlines, Commercial Bank of Ethiopia, NGOs and embassies based on their request. However, the current system is not quite ready for this service. As of July 1998, in addition to 1330 active Internet users, Ethionet had 1020 registered potential users who could not be added to the network because of the technical problems mentioned earlier. As part of efforts to assess the feasibility of an Internet initiative for Ethiopia project, an end-user survey was conducted to assess the extent of Internet use. The survey found that in June 1998 there were only an estimated 2000 users in Ethiopia. The service was only available in the capital, Addis Ababa and that there were widespread complaints over the reliability of the service. One interviewee said that on average he had to attempt to log on 30 times before succeeding. There were also complaints about the subscription costs and the lack of network bandwidth and support.

### **6.9.2 Project origins and guidelines**

Though not one of the original 12 countries selected by the Regional Bureau for Africa, the political upheaval in the Congo region led to the substitution of Ethiopia for Zaire as a project beneficiary. Although Ethiopia already has an Internet gateway, UNDP assistance was requested in extending the Internet into eight rural towns and also in expanding the capacity of the existing gateway. The three-year project involves coordination of the public, private and other sectors (including academic institutions, research institutes and non-governmental organisations) to expand and enhance the existing national Internet network in Ethiopia.

## **(a) Project objectives**

The project will enhance the Ethiopian National Information Infrastructure and will specifically foster Internet access in the country. The specific components are as follows:

- **Implementation of an Internet gateway in Ethiopia**

The project is designed to strengthen the national Internet gateway to foster Internet access to universities, hospitals, businesses and rural communities in Ethiopia. The gateway will be managed by ETC in such a way as to ensure access to the Internet by all segments of Ethiopian society on a non-discriminatory basis and at a reasonable price. While the current gateway has a 256k bandwidth connection to the Sprint network, the project will add an additional gateway in Addis Ababa with 512kb of bandwidth to either the GlobalOne network or an alternative bandwidth provider.

- **Establishment of telecentres**

One major goal of this project is to help extend Internet access to the Ethiopian population beyond the capital, Addis Ababa. To help accomplish this, Internet nodes will be implemented in eight regions. An important component of the project is the establishment of telecentres in the same eight cities where the Internet nodes will be implemented as described above. The telecentres are seen as tools that will allow the average citizen to send and receive e-mails without having to own a computer.

- **Training**

Another major component of the project is capacity building. Training is a critical element of building capacity and ensuring sustainability of the project. A training centre, which already exists at the ETC, will be enhanced. The project will help provide instruction for various categories of Internet-related training.

- **Promotion of an enabling regulatory and policy environment**

The project is designed to promote an enabling regulatory and policy environment for Internet use and growth within Ethiopia. Specific objectives include the following:

- to encourage universal access as appropriate through deployment of Internet infrastructure, particularly in the rural areas and in schools; and
- to encourage the adoption of a reasonable fee structure for access to the national network, including leased lines and dial-up services, for the purpose of accessing the Internet.

**(b) Roles and responsibilities**

UNDP Africa

The UNDP agreed to provide approximately half of the funding for the project, estimated at US \$600,000 for the project. In addition the UNDP was to provide the necessary coordination and logistical support for the three-year duration of the project through its Ethiopian country office. The UNDP also agreed to subscribe to the service created by this project through its local country office. In addition the organisation was to assist in the bidding process for the project by identifying organisations to undertake the agreed upon activities.

Ethiopia Telecommunications Corporation

Under the project document ETC was to be the owner of the national Internet gateway and associated backbone facilities developed under this project. The government agreed to coordinate with the local UNDP Country office to provide their portion of the cost of the project in accordance with the agreed payment schedule. The government also stated that it would create an enabling policy environment to provide for the greatest access to the Internet. This was largely to be achieved by ETC providing synchronous digital hierarchy (SDH) lines in the major regional cities (Awassa, Dessie, Mekele, and Jima) to facilitate the planned Internet connectivity in these four regions.

### **(c) Timetable for Implementation**

#### **First Year**

- Enhancement of the national Internet gateway in Addis Ababa.
- Implementation of training program.
- Assessment of first year's activities.
- Review of Internet access and usage (Internet culture).
- Review of training requirements and development of additional training programs.

#### **Second Year**

- Upon completion of SDH lines, implementation of regional nodes and telecentres.
- Review and expansion of Internet access.
- Continuation of training programs.
- Further review of local content creation.

#### **Third Year**

- Wrap-up activities.
- Evaluation of project.

### **6.9.3 Methodology**

A project team was sent on a mission to Addis Ababa, Ethiopia in June 1998, and was charged with the following major tasks:

- To assess the information technology and Internet connectivity environment in Ethiopia, including the technology, policy, economic conditions as well as the user needs.
- To discuss a strategy for implementation of the Internet project with government, businesses and various user communities and offer recommendations.
- To negotiate the terms of a Memorandum of Understanding (MOU), which was to serve as a formal agreement between UNDP and the Government of Ethiopia.

The group held one or several meetings with the following individuals and/or groups during the period 8 – 18 June 1998:

- The Minister of Economic Development & Cooperation.
- The General Manager, Ethiopia Telecommunications Corporation (ETC).
- Head of Ethio Internet Centre (ETC's Internet Centre).
- The Training School Manager.
- ETC's Senior Management.
- Members of the Chamber of Commerce.
- Officials of the Local UNDP office.
- Addis Ababa University Officials.
- Several NGOs.
- Senior staff of the University of Addis Ababa.

These meetings were designed to enable the project team to accomplish the following specific objectives:

- Produce a list of the technical, policy, staffing, training and tariff requirements for the Internet project.
- Design an Internet backbone based on the existing infrastructure.
- Produce a budget for the project.
- Make specific policy recommendations for creating an enabling environment for Internet provision in Ethiopia.
- Negotiate a Memorandum of Understanding (MOU) between the Ethiopian Government and UNDP.

As part of the assessment process of the Internet Initiative for Africa a series of fact finding meetings were held with the private sector, non-governmental organisations (NGOs) and academia in Addis Ababa, Ethiopia, from 8 – 19 June, 1998. These meetings focused on a range of issues arising from the provision of Internet services by the Ethiopian Telecommunications Corporation (ETC). Specifically, the discussions centred on the following issues:

- Quality of Internet service provision.
- Training.
- Pricing.
- Support services.

The core recommendations derived from these meetings can be summarised as follows:

- greater gateway capacity to enhance internet connectivity and the provision of web pages;
- a subsidy for internet access and web page creation and hosting for non-profit making organisations;
- the creation of a committee to assist and establish dialogue with ETC on its Internet development plans;
- opening of Internet provision to the private sector; and
- the articulation of government policy on the development of information and communications technology.

#### **6.9.4 Status of the Internet Initiative for Africa: Ethiopia**

A memorandum of understanding (MoU) was signed between the Ethiopian government and the UNDP's Regional Bureau for Africa on August 10, 1998. This MoU coupled with the report was to be used as a basis to prepare the Request for Proposals (RFP). The RFP for the development of Internet gateway and rural communications was then sent to the government and cleared. In 1999 the contract was awarded to an Ethiopian firm based in Washington and will be implemented in 2000.

#### **6.10 An evaluation of the Internet Initiative for Africa: Ethiopia**

The case study is not designed to test a hypothesis, but rather is of an exploratory nature and is designed to illustrate issues arising from ICT-related development projects in Sub-Saharan Africa. The primary unit of analysis is the Internet Initiative for

Africa project. Within this unit two elements of investigation are conducted. Firstly, the overall design of the Internet Initiative for Africa is examined. Secondly, an evaluation of the Ethiopian Internet Initiative for Africa project is conducted. Both segments are evaluated according to the three categories used to illustrate the traditional problems surrounding donor assistance support for ICT development in the preceding section, namely:

1. Problems deriving from project design and conceptualisation.
2. Problems deriving from the nature of information and communication technologies.
3. Problems deriving from the nature of the local context.

In order to ascertain the answers to these questions 21 semi-structured interviews were conducted with individuals from one of four key sectors, identified as NGOs, academia, the indigenous private sector, and international development agencies. Appendix D, provides an account of the methodology employed. Table D1 in the appendix shows a comprehensive listing of the individuals interviewed along with their respective. This section of the research summarises the findings and recommendations from the meetings/interviews.

#### **6.10.1 Non-governmental organisation perspective**

Interviewees from the following Non-Governmental Organisations (NGOs) were interviewed:

- ActionAid – Ethiopia;
- Africare;
- CARE-Ethiopia;
- Christian Relief and Development Association

There are a substantial number of international and national NGOs (approximately 140) in Ethiopia, with the majority based in Addis Ababa. Prior to ETC's introduction of Internet services, January 1997, the majority of NGOs used PADIS or FIDONET mainly for e-mail services. Subsequent to ETC's introduction of Internet services, FIDONET has been stopped, and indications are that the PADIS offering may wind



down in the near future. All the interviewees from the NGO sample sector had an initially positive reaction to the project. With the exception of AFRICARE, all the NGOs visited were connected to ETC's Internet service, and all reported having major problems with their connectivity to the ETC network, pointing out that it sometimes took up to 70 attempts before they could connect. Thus any initiative that was designed to improve the situation was welcome.

In terms of the strengths of the project all interviewees highlighted the extension of the Internet to the rural centres as important. Positive comments were also made on the design of the proposed Internet node in Addis Ababa, which included the ability to cache content on the three main servers and to have a back-up router in case of primary failure. The majority of interviewees also saw the training component as an important element in ensuring the sustainability of the project. In terms of project weaknesses, four interviewees expressed concern at the small number of people that were to be trained by the project. There is a chronic shortage of human resources in the ICT field in Ethiopia, and the interviewees felt that UNDP should expand the training aspect of the project. All the respondents commented on the lack of local content available in Ethiopia. As NGOs, all but two of the organisations had homepages on the World Wide Web, but these were hosted by partner institutions in the U.S. Ideally, such content should be held locally to facilitate information dissemination in Ethiopia. Finally, concerns were voiced over the relationship with the Ethiopian Telecommunications Corporation (ETC). Six of the eight interviewees argued that by entering into a joint agreement with ETC the UNDP were condoning its monopoly position and reducing the likelihood of private sector competitors emerging. One respondent argued that ETC should only be provided with advice rather than funds as it was already 'awash with cash from lucrative international call revenues'.

Despite the long list of beneficiaries highlighted in the project document, the overall view of NGO interviewees was that in the short-term the beneficiaries would be international development agencies and organisations such as themselves. The prices for phone calls were thought to be far out of the reach of the average Ethiopian. However, in the long-term the regional telecentres would help to broaden access. No interviewee felt that the project would have anything more than a minimal long-term impact on the rural communities. Access for these communities – 80 per cent of

Ethiopia's population – would be hampered by illiteracy, the lack of communications infrastructure in the hinterlands and cost.

In terms of constraints, all interviewees voiced a number of concerns that were viewed as constraints. Namely the war with Eritrea which was destroying infrastructure in some rural areas, the ability of ETC to sustain the network once the project had finished and the attitude of the government to the free flow of information over the Internet. In order to overcome these constraints the interviewees from the NGO sector made a number of recommendations. It was unanimously felt that there should be a greater gateway capacity to enhance Internet connectivity and the provision of web pages. Moreover, that training programmes should be extended to more ETC employees and there should also be courses on web page design to encourage local content development. It was also felt that the UNDP should actively lobby the government to deregulate the Internet service provisions sector.

#### **6.10.2 The private sector**

Respondents from the following private sector organisations were interviewed:

- Afcor
- City Business Services
- Addis Ababa Chamber of Commerce
- Ethiopian Airlines
- Commercial Bank of Ethiopia
- National Bank of Ethiopia

Both Afcor and City Business Services are key players in the Ethiopian IT vending industry. Afcor is the official IBM partner in Addis Ababa and City Services has licensing deals with the U.S. company Compaq. The Commercial and National Banks of Ethiopia are both ostensibly private sector firms, but their status is qualified by their strong connections with the government. Ethiopian Airlines is the only airline in Ethiopia. Formerly a public sector firm, it is one of the most sophisticated of IT users in Ethiopia.

Given the high level of private sector dissatisfaction with the quality of ETC's Internet service provision, all interviewees were very favourable to the UNDP project, when asked about their initial impressions. However a number of weaknesses were perceived. There were concerns that the project was strengthening ETC's control over the sector. Five out of the six interviewees feared that such ICT-related projects were crowding out the private sector, and made it even more unlikely that the service would be deregulated in the short-term. Three out of six interviewees echoed the NGO interviewees and argued there should be a greater emphasis on training. There were severe doubts that ETC would run the service efficiently at project end. Concerns were also voiced at the lack of indigenous consultants on the project.

On the issue of project strengths, again all interviewees pointed to the much needed extension of telecommunications services to the rural areas as a key strength. However Recommendations from the private sector included a unanimous feeling amongst interviewees that Internet service provision should be deregulated as soon as possible. To this end, it was felt that UNDP should lobby for an immediate privatisation of Internet service provision, and a reduction in tariffs on importing ICT-related goods. In terms of the project itself there was again consensus that it should offer training to the private sector as well as ETC employees. One respondent argued that in order to improve the quality of the Internet service, the project should fund an integrated call management system which would allow ETC to better cope with maintenance and operational issues. Two interviewees also argued that the project should offer training to private sector firms that encompassed marketing Internet services and web page design. Concerns were also voiced about the paucity of local content and applications. Four interviewees bemoaned the fact that the project seemed intent on only upgrading the technological infrastructure without improving the capacity of locals to produce local content.

### **6.10.3 Academia**

In this sector interviewees were drawn from the following academic institutions:

- National Computer & Information Centre (NCIC), Ethiopian Science and Technology Commission

- University of Addis Ababa

The academic community in Ethiopia is well founded, especially in Addis Ababa and the neighbouring regions. Relations between the academic community and ETC are good, especially as a number of students from the University of Addis Ababa go on to work for ETC. The NCIC formulates government policy on information technology issues, and also coordinates research amongst institutions throughout the country. Due to the lack of funding many academic institutions cannot finance full connectivity to the Internet. The University has limited access for mainly post-graduate students, who can finance access through external grants. NCIC was not fully connected, but was a pioneer in the use of the PADIS system and FIDONET, which allowed the sending and receiving of e-mail at very low cost. As a result initial impressions of a project designed to improve accessibility were favourable. All interviewees highlighted the extension of the Internet to the rural centres as an important strength. Both interviewees argued that the telecentre concept was an innovative approach to solving the lack of information infrastructure in rural areas.

However, both interviewees expressed concern at the small number of people that were to be trained by the project. It was felt that UNDP should expand the training aspect of the project to include academic institutions. An important concern voiced by one of the interviewees was that the project seemed to be too focused on the technological aspects. Hence there was little in the project document concerning how UNDP would target beneficiaries. It was pointed out that issues such as language barriers and user-friendly interfaces were not mentioned.

The overall opinion of the academic interviewees was that in the short-term they the academic sector, would benefit from a faster service. However, there were fears that as more and more students used the service congestion would return to current levels. Echoing the views of the NGO interviewees, both interviewees had little confidence that the project would have any long-term impact on the rural communities. Like interviewees in the other sectors all respondents voiced the same raft of concerns with regard to constraining factors, namely: the continued conflict with Eritrea, the capacity of ETC to sustain the network once the project had finished, and the government's hostility towards the Internet.

The recommendations from the academic interviewees revealed a desire for greater freedom in utilising the Internet and frustration at the lack of service choice. The academic interviewees appeared to be better informed with regards to the issues at hand. This, it emerged, was as a result of their ties with research institutes abroad. There was a recognition of the large number of development agencies working in this area and three out of the four interviewees expressed the need for greater coordination amongst donor initiatives. All interviewees argued that UNDP should lobby the Ethiopian government to create an information and communications infrastructure policy which would, amongst things, encourage ETC to reduce connection costs for academic institutions. Project-specific recommendations included the need for increased Internet bandwidth to be built into the project, and one respondent recommended a back-up Internet gateway be built.

#### **6.10.4 International development agencies**

Interviewees from the following local offices of international organisations were contacted:

- United Nations Economic Commission for Africa (UNECA)
- Emergency Unit for Ethiopia, UNDP.

UNECA remains the most active of international development agencies in Ethiopia. It pioneered the use of electronic networking with the store and forward FidoNet e-mail service – PADIS – and through its Africa Information Society Initiative is coordinating a number of key initiatives designed to improve the information infrastructure in the Sub-Saharan African region. The UNDP's Emergency Unit for Ethiopia is also pursuing a raft of initiatives in the region focussed on providing emergency support during natural disasters. It was one of the earliest users of the PADIS network in Ethiopia

Both the interviewees from this sector expressed favourable opinions of the project. In terms of project strengths, both interviewees highlighted the extension of the Internet to the rural centres as an important strength and that the telecentre concept was an

innovative approach to solving the lack of information infrastructure in rural areas. However, a number of project weaknesses were identified. One respondent expressed concern that the "UNDP was rubber stamping the government monopoly of local Internet service provision". Moreover that the huge latent demand for Internet services would exceed the current bandwidth that the project was to provide. Both echoed the sentiments of the other interviewees with regard to the minimal training element within the project. It was pointed out by both interviewees that while there was detailed justification for the hardware and software, and other technical issues in the project outline, there was little or no information on the user population. The project document had no information on how many users would be added, who these users would be and what effects could be expected in terms of improved service.

One respondent pointed out that though the project was designed to increase capacity and quality of service there was no mention of a commitment by ETC to reduce its prices for Internet access. Given its monopoly position ETC could happily maintain the current high prices and increase its profit margin. Strengthening ETC's belief that it was capable of providing the service, rather than encouraging local entrepreneurs. One respondent, citing experience on a similar project, worried that some trainees who went abroad would not return. This form of "brain drain" was extremely costly and should be guarded against. The same respondent also pointed to the expectation that trainees returning from abroad were expected to undertake further training of their colleagues involved in the project. More often than not, it was argued, there was no such post-training dissemination, thus limiting the benefits from the money invested. The interviewee went on say that overcoming this may be difficult given the tendency to see training – and the skills/information thereby gained – as a personal possession.

When asked their opinions on who were to be the likely beneficiaries of the project, the overall opinion of the international development agency interviewees was that in the short-term they, and other expatriates based locally, would benefit the most from improved Internet connections. Both, however, added that their organisations had proprietary connections via VSAT, which allowed them to bypass the inefficiencies of the public switched telecom network. Thus the likely local beneficiaries would be the

NGO and academic sectors. However, a host of constraining factors were highlighted which threatened to restrict the effectiveness of the project, namely:

- the escalation of conflict with Eritrea;
- the ability of ETC to sustain the network once the project had finished;
- the attitude of the government to the Internet;
- the cost of telephone calls and computer hardware and peripherals; and
- the punitive ICT tariff regime.

In order to lessen the impact of these constraints the international development agency interviewees recommended:

- greater coordination amongst donor initiatives;
- dissemination of lessons learned to other development agencies;
- lobby the Ethiopian government to create an information and communications infrastructure policy committee; and
- encourage ETC to reduce connection costs for target beneficiaries, especially rural dwellers.

### **6.11 Summary of sector survey**

Overall, there were a number of consistent themes that emerged from the respondents interviewed above. Almost unanimously it was felt that the Internet Initiative for Africa was a worthwhile project and would have a positive impact on the development of Internet services in Ethiopia. The majority of interviewees felt that the extension of telecommunications capacity and Internet services to rural areas through telecentres was an important element of the project. However, concerns were echoed as to the design of the project itself. Far and away the biggest concern was the lack of adequate training provisioning. Interviewees unanimously felt that the project should expand its small commitment to training to encompass groups other than ETC. Another consistent theme was the lack of focus on the end-user. It was pointed out by over half of all interviewees that there was scant mention in the project document of the creation of local content. Rather, the emphasis was

firmly technocentric, concentrating on the physical infrastructure and neglecting the all-important human dimension. As a result of this bias it was felt that the impact of the initiative in rural areas would be lessened.

It has been widely acknowledged that the successful introduction of any new technology, or even idea, requires a careful elaboration of the strategy of inducing the users to participate and to have a sense of ownership (World Bank, 1996). Although the strategy is evidently dependent on a particular situation, a common requirement is achieving best fit between the users' behaviour patterns with the use of the intended new technology. Aggregate measures of the ability of the project to fulfil this prerequisite, such as productivity and capacity, are rooted in end-users' behaviours and their usage of the technology. Content development would help African institutions to become not only passive consumers of imported technology but also active contributors to the global knowledge bank. The primacy of the end-user is especially applicable in the context of projects such as the IIA, which seek to improve networking capacity in developing regions. The process of introducing a technology into a region or environment that is unaccustomed to it, is fraught with enough challenges as it is, without having to worry about the additional problems arising from a lack of planning.

An issue raised by a number of interviewees in the private and also international agency sectors was that of crowding out. The fear emanating from interviewees in these sectors was that by improving ETC's Internet service provision the UNDP was implicitly condoning its monopoly position reducing the likelihood of private sector competition. The Initiative's project document states one of its avowed intents as:

...ensuring conditions of fair competition, the local PTT will manage the infrastructure of the Internet, but should not be the only Internet Service Provider. The local PTT will determine a reasonable fee structure for the distribution of a bandwidth, that will allow any entrepreneurs access to the infrastructure (UNDP, 1997, p. 5).

Yet no such strictures were placed on ETC, rather as some interviewees pointed out, it appears that ETC has been given *carte blanche* to do as it sees fit with the upgraded



Internet service. As a result a unanimous concern emanating from the interviews centred on ETC's ability to maintain the service in the face of undoubted user growth.

In terms of constraints, it was unsurprising that all those interviewed saw the escalating border clashes with Eritrea as an important issue. The fighting in the months leading up to the UNDP mission had been confined to the border regions, and it was felt by the project leader that the conflict would be short-lived. As it happened such optimism was worryingly naïve. The fears voiced by all interviewees turned out to be prescient, as a week prior to the signing of the memorandum of understanding the head of ETC was deported to the Eritrean border. Despite the fact that he had lived in Ethiopia and worked for the ETC for over 15 years, the fact that he was of Eritrean origins and in such a position of power meant that, to the government, his position was untenable. Consequently, the mission team found themselves in the awkward position of having to postpone the entire initiative whilst a new incumbent was chosen. Luckily for the UNDP, the support of the government and the uncontentious nature of the initiative meant that the only result of this incidence of political risk was a slight delay of one month. However, it does illustrate the lack of foresight that can endanger a project, and therefore the need for in-depth political risk analysis prior to implementation on the ground.

Finally, there was scant mention in the project document with regards to evaluation. The project review, reporting and evaluation section merits only four lines in the document. The project document states:

The project will be subject to review after the first three Internet nodes are in place to determine if the intent of the project is being achieved. At this stage, the format will be evaluated to determine if any changes are needed. There will be a second review after the sixth node is established, and a final review after the last one (UNDP/RBA, 1997, p. 7).

The intent in the quote above is simply that it can be demonstrated that there is a broadening of the Ethiopian population of users, and that they can send and receive information more efficiently. Such simplistic performance evaluation criteria appear to be common currency in the majority of development agency-funded ICT-related

projects (Picciotto and Wiesner, 1998). Such narrow evaluative criteria fail to capture empirical evidence that can be utilised in any meaningful way. Such one-dimensionality fails to tell us what kind of traffic was being sent, whether users were spending their time productively, and what proportion of users benefited from the increased capacity.

Whether the UNDP, despite its avowed aims to increase access for a broad cross section of users, will actually do little more than decrease the Internet frustrations of the tiny elite who could afford to wait remains to be seen. However the results above reveal that even prior to implementation there were a number of issues that had not been adequately addressed, namely:

- The lack of adequate training provisioning.
- The lack of sufficient political risk analysis.
- The lack of emphasis on the creation of local content.
- The lack of any strictures on ETC to maintain a favourable price regime.
- The absence of effective evaluation mechanisms.

## **6.12 Recommendations**

The analysis above, both in the case study and analysis of 273 sample projects, reveals that there are serious concerns with regards to development agency projects designed to improve the information infrastructure in Sub-Saharan Africa. Clearly, there is a need for more effective approaches to overcoming the traditional problems highlighted above that affect ICT-related initiatives.

### **a) The need for better planning and design of projects**

ICTs will only be leveraged effectively when considerable attention is paid to several issues, including:

- equality of access to ICTs;
- strategies for harnessing ICTs to maximise South-to-South and South-to-North communication and information-sharing, and not just North-to-South "dissemination" of information;
- programs that embed ICT deployment in broader knowledge and empowerment of strategies for poor communities, rather than assuming that the mere provision of ICTs will by itself solve poverty, social and economic inequity, and power differentials; and
- the need for international agencies to focus more on supporting, and helping to replicate the successes of small-scale projects that engage the active participation and "ownership" of, local communities in developing countries;

At the same time development agencies need to be more innovative with the resources at hand.

#### **b) Effective leveraging of information and communication technologies**

There is an urgent need to foster greater lateral knowledge-sharing in the field. Development agencies are guilty of hypocrisy when, despite the rhetoric that is continually preached to developing countries on the merits of information sharing, development agencies fail in the self-application of their advice. Many of the problems above, including the lack of coordination and information sharing amongst donors, can be effectively tackled by the innovative application of technology. One way forward is for the development agency or donor organisation to identify and capture all the knowledge created within its ambit and channel it into an organised retrieval structure (human or computer) within the organisation itself; and then develop mechanisms by which it can be disseminated narrowly or broadly. In practice, this might mean that knowledge generated by all participants (agency staff and others) within a given development project funded by the agency is recorded through evaluation and monitoring techniques. This could then be documented and transferred to a database and made available to other projects. This approach has its benefits: it can lead to genuine sharing of experience and knowledge within and between agencies and their projects, avoiding mistakes and replicating successes. But there are also a number of problems associated with this model. For one thing, the resources available for the

identification and documentation of knowledge generated by development projects are far too small.

More serious, perhaps, is that the methodologies deployed to do this work are put through the prism of the organisation funding the project. It is a development agency that decides what is relevant and useful knowledge, and how it should be documented; In addition projects are often implemented by external consultants or agency staff. Thus, a huge proportion of the knowledge created is lost; especially, that generated at the ground level by local participants and NGOs (including indigenous knowledge), which may lie beyond the reach of the methodologies used (Chambers, 1997). Furthermore, the proportion that finally gets recorded is undergoes a centralisation process, with access through headquarters or offices of the agency involved. And of course the use of that knowledge may, in practice, be largely restricted to the agency itself and other similar ones, from where, hopefully, it filters back down to the development project on the ground.

There is possibly another way, which has yet to be explored or tested – to support the creation of a horizontal exchange network between development projects themselves, unmediated by the agencies. The first step here would be to build the capacity to identify and document knowledge within projects themselves, and by the local experts, beneficiaries and organisations implementing them. Through internet-based exchange, such knowledge could then be communicated and networked directly with other development projects, building up a database along the way of proven useful exchanges. The identification of such knowledge would be undertaken on the basis of what the project staff themselves feel is useful to others, and what they would like to receive from others. Furthermore, the network should not be limited to one agency, but rather extended across the spectrum.

The difference between these two approaches is, in many respects, fundamental. In the second case, the local capacity to identify and document knowledge is built up, and remains local; the knowledge resides there and benefits are received directly through interaction with other projects as against being mediated through western-based agencies. Knowledge is also more likely to address real needs, felt by local participants. Much deeper exchanges and interactions between projects could develop alongside the

more formal system of knowledge exchanges. The fact that the agency may centralise the knowledge is merely a by-product of the horizontal exchanges between projects – the "ownership" of the network and the knowledge that remains with the project participants.

What is necessary is a development agency wide "knowledge audit" of a few projects, assessing what useful knowledge is produced, by whom and where; and what might be needed from other projects. This could form the basis for a process by which identification, documentation and exchanges could be implemented by the project itself. Guidelines for replication elsewhere could also be developed. Such an approach faces many challenges – indeed it is more difficult than a vertical, centralised approach. It must build not only the capacities described above, but also develop project connectivity and the skills needed to network effectively. It requires a rethink of information and communication within projects, and presumes a highly participative approach by the projects themselves.

Given the huge number and range of information and communication technology projects that have taken place and are taking place on the African continent, it is imperative that project designers and implementers mine the rich seam of extant literature on lessons learned. The project leader can increase the chances of a successful implementation, by incorporating a group of factors that are known to facilitate project success. These factors and the part they play in a project's success or failure have all been well documented.<sup>83</sup> While each case is evidently different, there are some common themes that emerge as vital for consideration. For example, issues such as the expertise of consultants, relationship with the government and the role of the public telecommunications operator are all known to determine the outcome of a project (Baark and Heeks, 1998). By observing these characteristics as part of the pre-evaluation process, rather than discovering them as unexpected obstacles at implementation time, it may be possible to increase the degree of success and to avert unnecessary expense for donors and end-users.

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<sup>83</sup> For example, see Rosenthal, 1986; Picciotto and Wiesner, 1998; Angelsen et al., 1994.

Development agencies can also become a source of information for developing countries. Organisations such as the World Bank could lower the cost of information systems for African countries by providing an information systems clearinghouse. There are only a few key information systems that governments require (budget, accounts, tax, inventory, etc.) and each government need not reinvent the wheel. By cataloguing the systems developed and by providing a clearinghouse to African governments, custom information systems relevant to their requirements could be borrowed, adapted and quickly implemented. An indirect but important effect of the clearinghouse would be to improve the documentation of information systems, an often neglected area.

In general terms, projects need a greater focus on the processes of diffusion and dissemination. These are the elements that finally bring project results to the beneficiaries and the wider world, yet they are not seen as sufficiently important. There needs to be more training in dissemination skills: writing, locating channels for dissemination from the traditional (conferences, journals, newsletters via mailing lists) to the more recent (e-mail lists and the World Wide Web), running training courses, and opening access to in-house information. Project documents also need to consider how diffusion will take place, to build in time and money for this, and to provide training. All this needs to be built in early, whilst donors are still focused on immediate projects and before attention drifts onto subsequent projects. By leveraging information and communication technologies, development agencies can tackle such problems head on and increase the knowledge return from projects.

### **c) The urgent need for practical research**

There is little disagreement with the premise that information and communications technologies can be powerful tools for empowering individuals and communities with information and knowledge relevant to their development. However, insufficient research has been conducted into how this can be achieved. A reflection of the conceptual confusion haunting development agencies in the ICT field is the striking number of pilot projects that are being conducted in Sub-Saharan Africa. The 1998 InfoDev report, for example, reveals that 41 per cent of its ICT-related activities are

pilot projects (InfoDev, 1998). No one is precisely sure of how these technologies can be leveraged most effectively to support development. One major concern, for example, is the lack of debate on the impact on developing countries arising from the domination of major international communications and information media by a shrinking number of global companies.

During the 1960s and 1970s development agencies such as the United Nations pioneered research and investigation into the information dependency of developing countries (Bourgault, 1995). A notable output of this era was The MacBride Commission report of a UNESCO commission in 1980, which accurately reflected the fears of developing nations. The report called for a "new world information and communications order" which would reflect more accurately the particular problems of the developing nations, guarantee the rights of citizens to communicate, and take action to right the acknowledged imbalances in the ways in which international communication was run. However, such critical questions have been lost in the fog of information revolution rhetoric. Such issues have been swept away as organisations such as UNESCO have been compromised by member states into promoting the mantra of the "free flow of information" (Woods, 1993).

The great risk for developing countries is that they will end up with the worst of both worlds: a glut of Western "information" and entertainment content, and a scarcity of specific, contextualised information and knowledge that helps them face their specific development challenges. The challenge for international agencies, then, is not simply to help developing countries increase the aggregate amount of global information resources to which they have access. Rather, they must help them derive concrete information and knowledge strategies that permit them to gain access to the specific information they need to enrich their lives and prospects.

### **6.13 Summary**

The above analysis reveals that the use of information and communication technologies in development assistance projects is characterised by a lack of coordination, and a short-termist technologically determinist approach to planning. This approach is

unnecessarily wasteful of time and resources, neither of which Sub-Saharan African countries can afford. What is necessary is a more coherent framework for planning and implementing ICT projects. The implication is that ICTs must be driven first and foremost by needs, rather than a "Field of Dreams" approach. The adoption and appropriate use of information and communication technologies in Sub-Saharan Africa will not happen spontaneously; hence the crucial role of development agencies and NGOs. Development agencies for their part must understand where and how these technologies can be applied to the problems of development, choose the appropriate technology, and implement programs so that the potentialities of these technologies cease to be a moot point. Above all it must be remembered that information and communication technologies have value only as they contribute to an objective. Their most effective use occurs when the potential impact of the adopted medium is well understood and a strategic action plan developed. The use of the medium needs to be grounded in the community and local forms of expression. The most fundamental lesson is that the euphoria surrounding the use of these technologies should not override the fact they are a means to an end, not an end by themselves.



## CHAPTER 7

### An Assessment of Information Infrastructure in Ethiopia

#### 7.1 Introduction

The Ethiopian government, like those in the majority of developing countries, has yet to apportion significant resources to solving the complex issue of information infrastructure development. Without concerted and consistent effort Ethiopia will find that, bereft of access to timely and relevant information it must formulate policy and negotiate in the global economy from a point of weakness, and will still be unable to effectively manage its resources. In an attempt to reverse the paucity of information infrastructure in Ethiopia, efforts have been made to expand the telecommunications network and utilise innovative information and communication technologies. Though efforts over the period 1990 – 1997 have succeeded in reversing the stagnation of the telecommunications network these efforts remain, as in the majority of Sub-Saharan African countries, piecemeal and *ad hoc* (Adam, 1996). Into this policy vacuum coalitions of varying levels of influence are taking shape around the telecommunications and information technology industry. This chapter analyses the forces that are influencing the construction of information infrastructure in Ethiopia. The analysis conceptualises the activities of the main actors in terms of two key dimensions: their sphere and degree of influence over the development of the telecommunications and information technology sectors.

#### 7.2 National context

Ethiopia is an independent republic that is situated in the north-east corner of Africa. The capital city is Addis Ababa, headquarters of the Organisation for African Unity and other major development agencies such as UNECA. Since the secession of Eritrea in 1993, Ethiopia has been a landlocked state. The country had an estimated 1995 population of 56.9 million people, comprising some 76 ethnicities and 95 languages. The official language is Amharic, but English, Arabic and Italian are also used in commerce.

After a brief period of Italian colonial rule (from 1936 to 1941), Ethiopia was ruled autocratically for nearly 40 years by Haile Selassie. He was overthrown by a military council known as the Derg, in September 1974. The Derg installed a government that was socialist in name and military in style. However, led by Lt. Col. Mengistu Haile Mariam, the country was plunged into perhaps the darkest period of its history, marked by a totalitarian-style government. Adopting Marxist-Leninist policies and financed by the Soviet Union and Cuba, Mengistu embarked on a programme of mass militarisation (EIU, 1997b), in the process torturing and killing thousands of suspected enemies in a purge known locally as the "red terror". Communism was officially adopted during the late 1970s and early 1980s with the promulgation of a soviet-style constitution, politburo, and the creation of the Workers' Party of Ethiopia (WPE).

This period of internal unrest saw a marked rise in external conflicts. Firstly with Somalia which, taking advantage of the deep rifts in the country, invaded and occupied nearly a third of the country before being forced back by a hastily conscripted peasant army. Secondly, in the north, the Eritrean People's Liberation Front (EPLF), which had long campaigned for independence, began to step up its hostilities. This war has proved more difficult than that with Somalia and, as the EPLF gained strength, the situation within Ethiopia worsened.<sup>84</sup> Coupled with fending off both external aggressors and internal factions, a succession of environmental disasters increased the fragility of the state. Though the country has periodically experienced severe drought, the period 1984 to 1985 saw a prolonged drought that was to be forever etched in the consciousness of the West. Perhaps as many as a million people perished through disease or lack of food. The situation was further exacerbated by the forcible resettlement of over 700,000 people to other parts of the country that were wholly unsuited to agriculture or settlement, serving only to turn a disaster into a catastrophe (Diriba, 1995). The Derg's collapse was hastened by successive droughts and famine, as well as by insurrections, particularly in the northern regions of Tigray and Eritrea. Further weakened by the collapse of communism in the Soviet Union, the widely unpopular Derg was overthrown in 1991 by the Ethiopian People's Revolutionary Democratic Front

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<sup>84</sup> Eritrea, which had been a separate country until it was ceded to Ethiopia by the United Nations in 1952, allowed Ethiopia access to the sea. However, in 1993, after a long and bitter struggle, Eritrea regained its independence and consequently Ethiopia is once again a landlocked state. With the recent resumption of hostilities with Eritrea Ethiopia has had to devote resources, of which it has precious few, to maintaining its national security.

(EPRDF), comprising opposition groups drawn mostly from the northern province of Tigray.

While the new political situation has provided a degree of stability in Ethiopia, pressures elsewhere are mounting. Throughout the central highlands, in which the majority of the population lives, deforestation and soil erosion are evidence of pressures on the environment. In a country where some 85 per cent of the population depend on agriculture, and where farming methods have changed little since over the centuries, the land is under severe pressure (Diriba, 1995). At the start of the century, as much as half the country was forested; in 1998 the figure was below four per cent (EIU, 1998).

For those who live in urban areas the situation is little better. The capital, Addis Ababa, is finding it increasingly difficult to cope with its growing population. Urban-rural migration has seen the population of the capital city swell from about 1.6 million in 1984 to an estimated four million in 1999 (EIU, 1998). Such rapid growth has outstripped the capacity of the city's already inadequate infrastructure. As a result few have access to running water and Addis Ababa remains the largest city in the world without mains sewerage. The living standard for all but the most wealthy of Ethiopians has declined significantly (Diriba, 1995). Matters have worsened with the 1995 devaluation of the currency, the birr, coupled with the removal of subsidies on a wide range of essential foods. These measures were part of a structural adjustment programme as a condition for receiving aid from the World Bank and several western nations. Although devaluation provides an incentive to export more goods, in practice, apart from coffee, there is little that Ethiopia produces for the overseas market. Over and above the effects of devaluation, the price of coffee has fallen on the world market in recent years and the long-term trend for commodities prices remains downwards (EIU, 1998). Meanwhile the cost of foreign goods has increased significantly, making it difficult for industries dependent on imported machinery and raw materials to survive (Diriba, 1995). Some attempts at import substitution have occurred, such as the growing of tea, and a few export industries have developed, such as the manufacture of leather goods in and around Addis Ababa. But, by and large, structural adjustment seems to have made it even harder for the country to develop its economy (Diriba, 1995).

Under pressure from Western nations to liberalise the economy, current government policy is to promote a free market and to create a federal state, a process that may unleash a tide of ethnic unrest. For example, instead of learning Amharic in school, children from the main linguistic groups – and there are over 95 distinct languages spoken in the country – will be taught in their own ethnic tongue.<sup>85</sup> This may help to preserve cultural diversity and to foster regional autonomy but it may make the task of political unity even harder to achieve. In an attempt to legitimise and consolidate political power the government adopted a constitution that established the Federal Democratic Republic of Ethiopia in 1995 and adopted a five-year development plan in which the nation's development efforts focus on improving the macroeconomic environment through agriculturally led industrial development (Diriba, 1995).

One of the key planks of improving the macroeconomic environment is the creation of an environment conducive to foreign investment. The revised government policy is expected to result in the opening of additional sectors of the economy for investment and lowered initial foreign investment requirements. As part of its economic development program, the Ethiopian government has engaged in a privatisation program over the past two years, during which 150 state-owned stores, hotels, restaurants, and factories have been sold through public tendering. Foreign investment, however, is prohibited in large-scale power production, telecommunications, financial services, and many small-scale personal services.

Since 1992, the new government has undertaken economic reforms under the auspices of the International Monetary Fund and the World Bank. In an effort to transform a centrally planned economy into a market-oriented economic system, Ethiopia has removed price controls and many regulations and restrictions which had been stifling market forces and private sector initiatives. Macroeconomic stability has been maintained through a tightening of fiscal and monetary policies (EIU, 1998). Gross domestic product growth was more than seven per cent in 1996 and is expected to exceed seven per cent again in 1997. Inflation was less than 1 per cent in 1996 (EIU, 1998). However, the relative stability over the period 1996 – 1998 cannot hide

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<sup>85</sup> Under the new federal system, there are eleven ethnically based semi-autonomous regional governments.

underlying points of stress that threaten to undermine the country's fragile success. With the resumption of hostilities with Eritrea, a long-term projection of falling commodity prices, and the ever-present spectre of environmental disaster, Ethiopia stands, once again, at a crossroads. For example, official foreign aid assistance now comprises over three-quarters of all foreign imports in Ethiopia and as much food is being shipped into the country as during the height of the famine in 1984 and 1985 (Diriba, 1995). Meanwhile, the pressures for Ethiopia to conform to the requirements of the international community mount, and the country's future hangs delicately in the balance.

### **7.3 The telecommunications network**

Historically, Ethiopia has been at the vanguard of telecommunications development in Sub-Saharan Africa. The first long-distance telephone line in the world was installed between Boston and New York in 1885, yet it was only nine years later that Ethiopia's long-distance telephone line between Addis Ababa and Harar (spanning 480 kilometres) became operational. Indeed the first telephone call on the African continent was conducted in Addis Ababa in 1897. Despite such an auspicious start, a 100 years hence Ethiopia is home to only 200,000 telephone lines serving a population of over 55 million – a low "teledensity" of one for every 367 people (ITU, 1998b). The majority of the Ethiopian population has little access to phones and the waiting list is long. The government-owned Ethiopian Telecommunications Corporation (ETC) was established in 1953 in order to provide both national and international telecommunications connectivity services and remains the sole provider of telecommunication infrastructure. At the end of June 1995 the number of telephone subscribers in Ethiopia was 142,452, an increase of 3.4 per cent over the previous year.<sup>86</sup> In its annual report the ETC came to the conclusion that the subscription demands are increasing every year at such a fast rate that the corporation could not cope with it. As a result, the growth trend of subscription realised from 1991/92 to 1994/95 was only about 3.9 per cent while the growth trend of demand alone for the same period was 13.6 per cent.<sup>87</sup>

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<sup>86</sup> Ethiopian Telecommunications Authority (1995), *ETA Annual Report 1994*, Ethiopia.

<sup>87</sup> *Ibid.*

The number of people on the waiting list for a telephone line was 178,992 at the end of June 1995 (Damena, 1996).

The Ethiopian telecommunications network is comprised of one national centre and six district centres selected according to traffic density. The district centres are located in provincial capitals and towns. In total there are 36 automatic exchanges in 22 towns, and 375 manual exchanges. The bulk of the telecommunications service is concentrated in urban centres. At present 543 cities and towns are connected to the public network within the country. 187 towns are provided with automatic and semi-automatic exchanges. The remaining 247 rely on manual systems and 109 are rural radio call and payphones. The country's sole fibre optic trunk line is located in Addis Ababa, connecting two major exchanges in the centre of the city. There are 254 direct international satellite circuits to 18 countries. The corporation provides its services to the public through various communication media such as microwave, UHF, VHF satellite and open wire systems. A newly introduced facility, digital radio multi-access system (DRMAS), was added to the national network in 1998 to serve remote towns (Demessie, 1998).

Over the periods 1983 – 1984 and 1992 – 1993, the Ethiopian telecommunications network has exhibited substantial growth. The volume of telecom traffic has also increased substantially, with international calls representing the fastest growing sector. Over the same period, the volume of international calls increased from 0.21 million to 2.8 million, representing an average annual growth rate of 34.8 per cent.<sup>88</sup> In general terms, the telecommunications network has been expanding since the early 1970s. The expansion in terms of telephone line units can be seen from Table 13 overleaf.

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<sup>88</sup> Ibid.

**Table 13: Number of telephones in Ethiopia**

<b>Year</b>	<b>No. of telephones in 1000 Units</b>	<b>Telephone Density per 100</b>
1970	46	0.2
1975	67	2.4
1978	80	2.7
1979	82	2.7
1980	86	2.8
1995	140	2.8

*Source:* Ethiopian Telecommunications Corporation at <http://www.telecom.net.et>.

Accessed 15 September 1999.

ETC restructured in 1997 in order to respond to the general move towards a market-based economy within the country. One of the outcomes of the restructuring study was its integrated accelerator Seventh Development Programme, which began in 1998 and will run until 2001. According to the ETC the programme is set to increase the telephone penetration rate from 0.3 per cent (three to 1000 people) to at least one per cent (one to 100 people). The number of telephone lines, according to ETC's plan, would be raised from the 1999 level of 192,806 to 760,000. By December 1999 some 600,000 lines had been procured and over 200,000 of these had been installed in some rural and urban areas of the country. In addition to these, it is planned that over 650 villages in rural areas would have access to telecommunications by installing 470 very small aperture terminals, 270 Digital Radio Multi Access Subscriber Systems (DRMAS) and a Wireless Local Loop (WLL) system. According to ETC's ambitious plans, by the end of the Seventh Development Program, almost all villages will have at least one telephone each. African governments are often guilty of failing to deliver on ambitious development plans, however, it is reported that ETC installed 84,000 telephones over the period August 1998 – June 1999, in both the capital Addis Ababa and the regions.<sup>89</sup> An unprecedented growth rate for telecommunications capacity in Sub-Saharan Africa. This figure thus puts the total number of telephones in Ethiopia at over 200,000.

<sup>89</sup> "Ethiopia: 84 Thousand Telephones in 12 Months", *Addis Tribune*, 7 September 1998.

Cellular services were introduced to Ethiopia at the end of 1998, thus squaring the circle on a process that has taken some 11 years to come to fruition. ETC signed an agreement in 1998 with Ericsson for the installation of the mobile network around Addis Ababa to serve around 36,000 subscribers, based on the GSM standard. Cellular telephony now covers Addis Ababa, the road to Sodere (a resort centre 120Km from Addis Ababa) and the town of Nazereth (100Km from Addis Ababa).<sup>90</sup> The system will be gradually extended to other cities. Subscriber fees in 1999 were set at 597 birr (US\$85) annually, with subscribers required to deposit about 30 per cent of the total sum for registration. The subscription fee, considered to be one of the lowest in Sub-Saharan Africa, is designed to make mobile telephony more affordable to potential subscribers. Registrations, which began in June 1998, were predictably heavily oversubscribed and by August 1999 there were 7000 subscribers, all based in Addis Ababa.

The Ethiopian Telecommunications Corporation has traditionally been one of the few well-managed and effective public agencies in Ethiopia. It has attracted some of the best talent in the country and has been aggressive in its introduction of new technologies and service. As a major hard currency generator, however, it has always been a victim of its own success. The state has been unwilling to loosen its grip on the agency for fear of losing one of its major sources of hard currency. This monopolistic control has stifled innovation and retarded expansion (Da Costa, 1996). As a result, the non-profitable sectors, mainly in the rural areas, have been left bereft of telecommunications infrastructure. Though the relative quality of telecommunications in Ethiopia is good in comparison to other developing countries, the public network is still far from adequate. Waiting times for new telephone installations can be up to five years. The title of an article in *African Business*, "Ethiopia stuck in telecoms stone-age", sums up the extent to which ETC has to improve the level and quality of its service provision. One person interviewed in the article lamented that, "I have been waiting for 20 years now to get a telephone, but it is all in vain. I think I will die before I get one".<sup>91</sup> Those without phones make do with the 1,027 coin-operated public telephones in the country; most of the time, however, they are out of order. The few

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<sup>90</sup> "Ericsson awarded contract by Ethiopia telecom", *European Report*, 23 July 1998.

<sup>91</sup> 50-year-old Telahun Habtu quoted in 'Ethiopian Telecoms', *African Business*, January 1998.



public telephones that exist are virtually non-operational, as a result of a combination of neglect and vandalism (Ruphael, 1995). Most rural towns do not have digital exchanges and the quality and standard of the urban telecommunication network leaves a lot to be desired. At the same time, as Table 14 shows, call transmission charges are still high.

**Table 14: Call transmission charges in Ethiopia, July 1998**

Category	Installation charge (US\$)	Monthly Rate (US\$)	Local automatic call (US\$)/minute
Business	305.00	17.00	0.20
Residential	305.00	8.00	0.20

*Source:* Ethiopian Telecommunications Corporation at <http://www.telecom.net.et>, July 1998.

### **7.3.1 Constraints to network growth**

Historically the telecommunications network in Ethiopia has experienced two types of problems that have hindered the provision of fast and reliable telecommunications service and inhibited the desired rate of telecommunications development in the country: external macroeconomic and political factors, and internal operational factors.

#### **(a) External Factors**

##### **(i) Macroeconomic environment**

The massive debt accumulated by the country to finance its civil war and its consequent dependency on foreign aid to meet its budgetary requirements, coupled with the lack of foreign exchange, have seriously hampered the capability of the country to upgrade its telecommunications infrastructure. Ethiopia, regarded as one of the poorest countries of the world, even by African standards, has a low level of customer purchasing power, which is very small and unevenly distributed among the population. Since 1974 the economy has exhibited a chronically weak macroeconomic profile. The civil

disturbances and regional conflicts of the 1970's and the 1980's have badly damaged the already fragile telecommunications infrastructure. Continued political instability, inconsistent government policies, and the regional partitioning of the country have also created an environment that is less than favourable to inciting confidence in any large-scale capital investment in the country (Ruphael, 1995). The dependency on rain-fed agriculture remains the country's main structural weakness. Whilst recent success has seen Ethiopia's economy growing at an average annual rate of seven per cent since 1992, the economy's dependence on agriculture will continue to cause fluctuations in growth and the impact of the deregulation policy has so far been disappointing.

## **(ii) Monopoly status**

The institutionalised nature of the telecommunications sector in many developing countries is often highlighted as the major cause of communications infrastructure stagnation. The ETC has traditionally been one of the few institutions in the country that provides a relatively reliable service. However, given the levels of revenues it generates it is something of a cash cow for the Ethiopian government. This has led to an unhealthy level of interference and control by government (Da Costa, 1996). This has in turn stifled innovation, retarded expansion beyond the relatively well off areas, and has resulted in massive and continued unmet demand.<sup>92</sup> The telecommunications operator in the country is restricted by a lack of autonomy and lack of incentive to perform as a commercial entity. Low and distorted tariffs, political objectives that conflict with the main business of the entity, and lack of access to capital markets are some of the symptoms of this lack of autonomy. Kiplagat and Werner (1994) highlight what they call the paradoxes of the telecommunications sector in the majority of African countries: where monopoly national operators reap high rewards by catering for a captive market and yet, paradoxically, have shortfalls in reinvestment revenues. The high revenues accruing from the provision of a national network are effectively used to cross-subsidise other areas of the public apparatus. As a result there is little left for much needed reinvestment in the public switched telecommunications network.

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<sup>92</sup> In 1995, for example, there were about 320,000 customers that expressed demand for basic telephone service, and about 161,000 of these customers have been registered as "actively waiting" (Bekele, 1996).

## **(b) Internal Factors**

### **(i) Operational inefficiency**

Acute shortage of basic telephone connections, poor maintenance and non-existent customer service has brought the efficiency and effectiveness of the Ethiopian network well below that which would be considered standard in the rest of the world. Absence of advanced services such as data communications networks as well as the restricted flow of information in and out of the country has dwarfed the development of information technology and related services.<sup>93</sup> Poor maintenance of the public network has contributed in no small way to the inefficient utilisation of Ethiopia's existing network. The maintenance problem itself can be attributed to such factors as a lack of, or inadequate supply of tools, test equipment, and materials for maintenance; government policy on procurement of spare parts; poor maintenance organisation; and the poor work attitude of maintenance personnel (Damena, 1996). The corporation also continues to suffer from overstaffing, employing 6573 employees as of June 1999.

### **(ii) Lack of indigenous technological capacity for plant construction and installation**

Ethiopia has been unable to build indigenous capacity in telecommunications technology development, hence it remains almost totally reliant on foreign suppliers for critical spare parts. Thus, in times of foreign exchange restrictions the maintenance of the public network has suffered.

### **(iii) Weak government policy**

With little hope of maintaining control over the revenues it generates there is little incentive for management to be more efficient or increase productivity. Nor is there much scope for innovation and long-term strategic planning. These factors have all adversely impacted on the development of telecommunications in Ethiopia. Though there is a considerable amount of expressed and unexpressed demand for

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<sup>93</sup> "Internet-Ethiopia: Information Control Slows Economic Development Business and Industry", *Inter Press Service*, 19 November 1997.

telecommunications facilities in Ethiopia, the ETC continues to struggle with providing the most rudimentary of services to its existing customer base. However, the sector remains one of the most profitable sectors of the country's economy as telecommunications remains a vital service, for which significant sections of the population are prepared to pay a premium. The above constraints to the improvement of the telecommunications infrastructure suggest that the most pressing problems that face the Ethiopian telecommunications sector are the product of a heady cocktail of historically specific factors and internally generated operational deficiencies.

### **7.3.2 Reform efforts**

Since the beginning of 1991, the public operator has relaxed some aspects of its long-held monopoly position. Up till 1996 the regulatory framework concerning telecommunications was particularly onerous. For example, only one type of facsimile machine was approved for use by the government and fax paper could only be purchased from the ETC. However, in 1996 a policy was promulgated that allowed subscribers to operate their own facsimile equipment on the ETC's network. This policy further stipulated that the private sector could import facsimile machines that met the ETC's specifications as well as distribute them to subscribers. This move was the beginning of a new, more liberal policy toward private sector participation in the provision of Ethiopia's telecommunications services.

The emerging trend of encouraging private participation in the provision of terminal facilities should ease some of the burden carried by the ETC. In order to increase the significance of the liberalisation policy, the ETC will first have to allow wider private participation to cover at least the telephone apparatus and teleprinters. Second, private participation will have to be extended to cover the provision of certain telecommunications services on value-added networks (VANs). The areas of data communication and information may also be included in the list of services for private sector participation. In an effort to improve the existing telecommunications infrastructure the government commercialised the telecommunications industry by incorporating the Ethiopian Telecommunications Corporation (ETC) in early 1997 and establishing a separate telecommunications regulatory body, the Ethiopian Telecommunications Agency (ETA). The ETC is supervised by its own Board of

Directors, which reports to the Board of Public Enterprise Supervision (as opposed to the Ministry of Transport and Communications). The ETA operates under the Minister of Transport and Communications. The ETC is charged with:

- constructing and maintaining telecommunications equipment;
- providing domestic and international telephone, telex, telefax, Internet, and other communications services;
- providing integrated information technology services, including re-broadcasting television signals;
- repairing, assembling and manufacturing telecommunications devices; and
- rendering training services to telecommunications personnel.

The ETA has responsibility to:

- ensure that telecommunications services are operated to best serve the country's economic and social development;
- specify technical standards and procedures for telecommunications services;
- ensure telecommunications quality;
- regulate telecommunications tariffs;
- license and supervise operators of telecommunications services;
- regulate types of telecommunications equipment which may be utilised;
- authorise and supervise allotted frequency use;
- represent the government at international conferences and organisations concerned with telecommunications;
- ensure the implementation of telecommunications treaties to which Ethiopia is a party;
- collaborate with educational institutions to promote technical training in telecommunications; and
- collect licence fees.

Though there are signs that the government will deregulate the sector further the telecommunications sector remains the largest profit-making, state-controlled industry next to the national airline, so full-scale privatisation is unlikely to take place before

2002 (Da Costa, 1996). Moreover, the impressive growth rate of new lines since 1998 has highlighted ETC's ability to implement change quickly.

The Ethiopian government has given attention to the transformation of the telecom sector, and according to ETC's web site the government has realised that 'the state-owned and monopolistic approach to the sector is now found incompatible [sic] with the new trend of the telecom world'.<sup>94</sup> The government is thus looking to create a strategic partnership through transferring partial ownership of the public operator to an international company or a consortium; thus it is hoped enhancing ETC's capacity in terms of capital, technology and management. Those who want to be strategic partners with the existing public operator will be given licenses for one or part of or all of the following four telecom services:

1. Public switched telecommunication service
2. Cellular mobile service
3. Internet service
4. Data communication service

As an indication of the desire for foreign investment the government is offering potential licensees 'a monopoly, with exclusive right(s) for the provision of the services listed in its (their) license(s) for a period of five years with the possibilities of extension depending on performance records. The license(s) could remain valid for 25 years'.<sup>95</sup>

#### **7.4 Main actors**

Dahl's "interest groups" approach argues that domestic policy formulation arises out of the interaction between key interest group coalitions (Dahl, 1967). Though in Ethiopia, as in almost all developing countries, the state is predominant, less attention has been paid to other influential interest groups. As in many Sub-Saharan African countries there are a multitude of actors within the telecommunications sector. In Ethiopia, the government is evidently the main actor in the industry, on its own and through the

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<sup>94</sup> The ETC Web site, <http://www.telecom.net.et/services.htm>. Accessed 25 December 1999.

<sup>95</sup> Ibid.

telecommunications regulatory agency (ETA) and the public operator the Ethiopian Telecommunications Corporation. Table 15 identifies the main actors, and highlights the spheres and degree of their influence.

**Table 15: Actors and their influence on the Ethiopian telecommunications sector**

<b>Actor(s)</b>	<b>Spheres of influence</b>	<b>Degree of influence</b>
Government	Regulation and public policy	High
ETC	Provision of public network	High
Development agencies: UNECA, USAID, World Bank	Development assistance, policy advice, technical knowledge and funding	Medium
Foreign private sector: Gilat, Ericsson, Sprint. Teledesic, ICO, Iridium	Telecommunications equipment and network provision and management.  The development of new connectivity options	Low
Domestic private sector	Network provision and retail of telecommunications equipment	Low
Regional African organisations: Panaftel, PATU, RASCOM	Regional telecommunications policy	Low

#### **7.4.1 The Ethiopian government**

The present system of regulation seeks to protect the sovereignty and security of the country by keeping the national telecommunications operator under government control while, at the same time, making the telecommunications service less dependent on the government. In this respect the administrative and policy matters of telecommunications remain under the remit of the Ministry of Communications, which represents the country at the International Telecommunications Union (ITU) and other international telecommunications organisations. Evidently the Ethiopian government remains the most influential actor in the telecommunications sector. It remains the chief

architect of telecommunications policy and, through its ownership and regulation of ETC is the final arbiter of the dispensation of revenues accruing from the national service.

#### **7.4.2 The Ethiopian Telecommunications Corporation**

During the first two decades of its existence, the ETC enjoyed a certain degree of autonomy: for example, its board of directors determined its annual capital expenditures, and appointed the general manager. However, following the nationalisation drive of the previous government, the management autonomy of the ETC, along with all other state-owned enterprises, had been drastically curtailed. This was the case until a new enterprise law issued in 1992 paved the way for hundreds of public sector companies to be run on commercial principles. Though still part of the public sector, the Ethiopian government has been keen to restore some of the autonomy that ETC enjoyed prior to the incumbency of the Mengistu regime in 1974. The new incorporation of the public operator into the Ethiopian Telecommunications Corporation has rendered it capable of making its own investment decisions and it has been able to reinvest a healthy part of its revenues. However, it is still beholden unto the government, and political manoeuvrings continue to play a part in its management. For example, the 1998 resurgence of conflict with Eritrea, saw the forced repatriation of all those of Eritrean origin in the capital, to the Eritrean border. This included the head of ETC who found himself repatriated with thousands of his countrymen who, despite full integration and acceptance into Ethiopian society, were deemed security risks. Future restructuring of the ETC, however, should at least restore the level of management autonomy that prevailed in its early years (Demissie, 1998).

#### **7.4.3 The private sector**

There is currently little scope for private sector participation in the Ethiopian telecommunications sector. Regulations strictly forbid any competition in the provision of telecommunications or equipment. However, there are numerous illegal payphones set up in small shops which manage to flout the law and provide a clandestine service to the public. Whilst the influence of the private sector is small, it is likely that as the government relaxes its grip on the sector, it will increasingly look to the domestic private sector as providers and users of value added services. At present the



involvement of the private sector in the telecommunications sector is limited to the retail of government-approved facsimile and telecommunications apparatus.

#### **7.4.4 Regional and continental organisations**

Though regional organisations in Africa have had, by and large, a negative press over the past decades (Kasumu, 1998), there have been renewed calls of late to strengthen regional ties. An offshoot of this in Sub-Saharan Africa has been the creation of the Abidjan-based Regional African Satellite Communications Organisation (RASCOM). RASCOM's plans for regional telecommunications development in Africa include installing 500,000 fixed solar-powered telephone stations with international access across the continent over a seven-year period. This represents an important dimension for the development of telecommunications infrastructure in Ethiopia: the use of new innovations in information and communication technologies to extend services to rural areas at lower cost. Ethiopia is also a member of Panaftel and PATU, however, the degree of influence of these regional bodies remains quite low. Historically they have failed to achieve their objectives – increasing interconnection between African countries – and with increased liberalisation of the sector will probably see their influence on regional telecommunications infrastructure development diminish.

#### **7.4.5 Foreign private sector**

Whilst the provision of telecommunications services in Ethiopia remains firmly within the remit of the government, the participation of the foreign private sector continues to grow. For example, in 1998 a contract was signed between NEC and ETC for the installation of a second earth satellite station in Mekele in Northern Ethiopia that would serve as a second international gateway and would provide reliable telephone, data and Internet services in the country. Evidently, with no indigenous capabilities in the manufacture or design of telecommunications equipment Ethiopia is dependent on the research and development of the foreign private sector.

One of the major problems for Ethiopian telecommunications expansion has been the difficulty of expanding the physical telecommunications network to remote, rural locations. Coupled with the high cost of connecting this geographically dispersed

population is the small amount of telecommunications traffic that is generated by the rural population. This vicious cycle has reinforced the reluctance of ETC to invest in rural telecommunications infrastructure. Rather, attempts have been made to find a less expensive route to improving information infrastructure in rural areas. An apparent solution to this problem has come in the shape of satellite technology. Ideally suited to geographically isolated regions, satellite technology has been proffered as a solution to the problem of rural telephony. However, it is only with the advent of technological innovations that satellite telephony is now within the possibility frontiers of policy-makers in developing countries. It is in this respect that the foreign private sector may have an important hand in developing Ethiopia's telecommunications infrastructure.

The 1990s have seen a raft of technological innovations that have presented countries such as Ethiopia with economically viable technological alternatives that correlate with their particular contexts. One of the most applicable of technological innovations for developing countries has been very small aperture terminal (VSAT) technology. Traditionally utilised by large corporations and international organisations that need to ensure reliable communications irrespective of cost, the inherent cost of the technology has continued to fall with successive technological breakthroughs. Specifically, the introduction of more efficient and cheaper PC-based network control systems, along with new low-cost switching technologies have reduced infrastructure costs (Leite, 1996). VSAT's now allow for reliable data, voice and video communications using small satellite antennas.

Service providers have traditionally been hesitant to commit large amounts of revenue to finance rural telecommunications infrastructure. The cost of creating infrastructure in often inhospitable and inaccessible areas has far exceeded the revenue that could be garnered. Thus substantial investment in rural regions is hard to justify. However, with the advent of communications innovations such concerns are mitigated. Utilising VSAT technology the first telephone line in a village can be installed for a minimum investment. This soon becomes profitable after deployment, as traffic increases, the number of channels can be increased at little marginal cost.<sup>96</sup> This then becomes a

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<sup>96</sup> "Rural telephony comes in to town", *Satellite Communications*, October 1998.

feasible option for those countries with a high percentage of their population in relatively inaccessible rural locations.

It is the ability to install such a low cost wireless network that has attracted the ETC to VSAT technology. In its bid to increase telecommunications capacity in the regions, the ETC has chosen to adopt a VSAT network comprising 500 site terminals transmitting via Intelsat's Indian Ocean satellite. This allows for service to over 50,000 telephone subscribers. Each site has been tailored to the population it serves. In the smallest sites, terminals provide around 13 lines in a village. Villagers then typically make calls at a payphone or in a local shop whose owner collects fees for service. Larger sites are designed to replace or extend the existing telephone network. Whereas villages of about 1000 people typically shared one or two rather unreliable lines, they will now have up to 16 new, and above all reliable, VSAT lines. The country also plans to implement distance learning over its VSAT network to provide enhanced teacher training around the country (Gifford, and Cosper, 1998).

### **7.5 Needs assessment**

The analysis above has shown the wide coalition of actors in the development of telecommunications infrastructure in Ethiopia. Evidently there are conflicting interests amongst competing coalitions, and it is in the interests of allocative efficiency that the indigenous policy-makers coordinate these multivariate groups in the interest of national development. Whilst the ETC have begun to look at alternative ways to at least attempt to fulfil universal service objectives, they have yet to clearly outline an effective strategy. Nor are there plans, in the near future, to further deregulate the sector and allow greater competition.

Ethiopia, thus, continues to be poorly served by its existing telecommunications infrastructure. Much research points to the importance of telecommunications infrastructure for economic development (Saunders et al., 1988; Hardy, 1980; Hudson, 1997). Whilst the flow of causality is difficult to prove it is undeniable that a lack of telecommunications infrastructure hampers international and domestic commerce. Moreover with Ethiopia dependent on increasingly narrow channels of aid, the need to

attract foreign investment becomes tantamount. However, foreign investment is unlikely to flow to countries with poor communications links to the global economy.

Nor can Ethiopia hope to compete in a new world of electronic commerce when the foundation of this new trading environment is an effective information infrastructure. Even if such new forms of economic commerce are deemed to be niche services, catering to only the industrialised countries, its impact on international trade in the near future will have serious implications for those countries which find themselves technologically disenfranchised (Castells, 1997b). With the telecommunications infrastructure the foundation of newer value added services such as the Internet, effective service provision is vital if Ethiopian policy-makers are to fully leverage the power of new information and communication technologies. In order to tackle such particular concerns as environmental and resource management, disaster prevention and education, policy-makers must design an information infrastructure that is firmly based on a set of strategic goals and developmental objectives.

The developmental objectives for the telecommunications infrastructure should encompass the following dimensions:

- the reform of the telecommunications sector to increase operational efficiency;
- extension of services to rural areas;
- the digitalisation of current networks;
- investment in new value-added services; and
- regulatory reform.

The direction of current Ethiopian telecommunications policy broadly mirrors the first four of these objectives, namely: the reform of the sector, the digitalisation of current networks, a planned extension to rural areas and investment in value added services. However, there is concern as to the commitment of the government to these objectives (Ruphael, 1995). Moreover, the government has yet to announce operationally feasible plans for establishing standards of interoperability. Nor has attention been paid to upgrading indigenous skills in the technical and operational management of domestic telecommunications services. Rather, Ethiopia, in common with its developing country

counterparts, seems content to allow external actors to develop their information infrastructure in their own image.

**(a) The reform of the telecommunications sector to increase operational efficiency**

There has been a significant slowdown in the modernisation effort of the Ethiopian telecommunications network in the last few years. The legacy of continued mismanagement and lack of planning on the part of successive governments is that a large percentage of the country's population has limited or no access to basic telecommunications services. What is required is an efficient policy and regulatory framework that is transparent, minimises instability and uncertainty, and fosters confidence in the country. There are a host of reform options open to Ethiopian policy-makers in terms of deregulation, ranging from full-scale privatisation to regulatory reform. Given the socialist legacy of the country and the revenue generating capabilities of the sector, it is unlikely that the Ethiopian government will consider full privatisation of the sector; nor is this necessary. Rather, what is important is that the overall operational efficiency of ETC is maximised through improved financial performance, enhanced economic efficiency, and sustained improvements in the quality of service it provides to subscribers. Hence what is needed is extensive regulatory reform within the sector.

**(b) Regulatory reform**

The regulatory framework in Ethiopia, like the few remaining pre-reform-era countries, lacks authority and sufficient powers. There is a need for a new regulatory framework that encourages the liberalisation of the industry, and promotes competition, regional cooperation and globalisation. This regulatory framework has to be based on liberalisation and flexibility of policies in compliance to, and adherence with, prevailing international and regional regulations. In a country like Ethiopia that does not yet possess well-developed institutional capabilities, and has constantly been under prohibitive regulations of one kind or another, the design and implementation of a regulatory structure can be problematic. At the same time, the replication of existing regulatory regimes in other Sub-Saharan African countries is likely to lead to sub-

optimisation. Rather, what is needed is the application of a regulatory framework that represents a suitable fit with the context in which it is to be applied.

Once regulatory requirements are clearly identified and grouped, responsibility should be assigned to the appropriate administrative bodies who in turn will draft and administer the corresponding regulatory environment. Concomitantly there is a need for a national legal framework that clearly outlines the procedures to be followed by regulators. Without legislative authority and clearly defined procedures, a regulatory entity may have truncated jurisdiction and power, especially, in times of political instability. Thus, the administrators of this new regulatory environment should enjoy some degree of autonomy. Their accountability should be to the judiciary as opposed to the pragmatism of political expediency.

At the same time any such regulatory framework must be rigid enough to safeguard against commercial abuse whilst at the same time flexible enough so as not to stifle entrepreneurship and innovation. The rapid pace at which technology changes dictates a certain degree of flexibility in any proposed regulatory framework. Outdated regulatory frameworks inhibit initiatives from users as well as service providers for developing the industry. This has been the case in Ethiopia where the regulatory regime continues to monopolise the provision of Internet services.

### **(c) Structural reform**

There is a need for greater liberalisation of the telecommunications sector in Ethiopia. The introduction of competition in the telecommunications sector can accelerate the implementation of new services and restricts the monopolistic definition of service prices (ITU, 1997c). More capital, both local and foreign, is attracted to a competitive market than a market where only a state monopoly is functioning. Competition speeds up the pace of change for the dominating operator, like the ETC, to become more commercial in orientation. Basing investment decisions on commercial criteria rather than political expediency. Policy-makers have expressed, albeit *sotto voce* that shares in ETC will eventually be available to the indigenous population and perhaps the foreign investment community. However, in order to attract the requisite levels of investor participation, investment security and efficiency of the sector are of paramount

importance. To attract a reasonable amount of foreign investment, especially for long-term infrastructure development, the country has to be competitive by ensuring a good rate of return, and reducing uncertainty as well as potential risk.

#### **(d) Operational reform**

Good management structure and practice, both at the macro-level and micro-level, are critical for the proper development of the telecommunications sector (West, 1997). At the macro-level, such issues as national telecommunications strategy, radio frequency spectrum, satellite orbit position, and national information infrastructure initiatives, have to be planned, drafted, and managed effectively. At the micro-level, there are a host of operational aspects that are critical to successful development ranging from the management of technology and human resources development to service development and marketing. Ethiopia's many apparently conflicting infrastructural priorities make it essential for the creation of a management structure at both the macro-level and micro-level to ensure that the effective development of the industry is guaranteed. A management structure and business practice based on sound engineering management and business administration principles should be instituted in the industry. Management at every level of the industry should aim at market growth, infrastructure development, customer satisfaction, quality of service, and achieving overall economic efficiency (Kiplagat, 1994).

The development of Ethiopia's telecommunications infrastructure should be assessed primarily in relation to the overall economic and social development of the country. The external macroeconomic and political environment, as well as internal operational factors, have all played an important role in the development of the telecommunications sector. Despite the resource and policy constraints that the telecommunications sector has endured in the past, there has been progress. Ethiopia has a relatively efficient telecommunications services sector, affordable to thousands of citizens and a telecommunications administration run by an adequately trained, all-Ethiopian staff.

From the analysis of this chapter, it is clear that the most critical issue facing Ethiopia's telecommunications industry is the huge gap between the demand for the most basic telecommunications service and the existing level of service provision. Other problems

of increasing importance include quality of service and the demand for new services. The provision of efficient, adequate, and reliable telecommunications services requires the availability of adequate resources – financial, human, and material. Overcoming the constraints described in this chapter is a prerequisite for modernising Ethiopia's telecommunications network and extending services to the rural areas. This will be a protracted process, calling for short-term measures to remove immediate hurdles and a long-term plan that takes into account the need for the sustainable development of local telecommunications manufacturing capabilities.

## **7.6 Information technology in Ethiopia**

Information technology was first introduced in Ethiopia in 1961 when Ethiopian Airlines pioneered the application of information technology in its daily operation (Kebede, 1996). At the same time data processing was also introduced into the country when the Central Statistics Office began utilising data-processing equipment for the compilation of census statistics. The Ministry of Finance began in 1968, with budget and capital authorisation and payroll computerised in the period 1969 – 1976 (Kebede, 1995, p. 93). Over the years, with the growth of the economy, the country has witnessed a concomitant rise in the number of computer installations, most notably in local satellites of international development agencies and in the major sectors of banking and telecommunications and airline transportation. Yet despite these early instances of information technology utilisation, the dissemination of computing technology as of 1999, is a very limited phenomenon in Ethiopia. According to Odedra's (1993) classification of the information technology sophistication of developing countries, Ethiopia is at the "initial-basic level" of computerisation. The information systems in use are mainly deployed for data and transaction processing, little hardware and software is produced locally, there are low levels of IT education and training and no policies or plans have been made for the computerisation of the public sector (Odedra, 1993, p. 113)

Whilst more advanced business applications such as decision support systems, and planning and decision-modelling tools are evident in some niches, on the whole computer installations in Ethiopia are clustered around data and transactional processes,



and operational and management control systems. Moreover, local, wide and metropolitan area networking has yet to be adopted on a large scale. At the end of 1999, the use of information technology in Ethiopia appears to be very much the exception rather than the rule. It is difficult to estimate accurately the number of computer installations in the country, but according to a recent survey conducted by the UNDP there are between 20,000 and 30,000 units in Ethiopia, with approximately 500 home personal computers. The estimated growth rate is 50 – 60 personal computers (PCs) per month in the capital.<sup>97</sup> The biggest customer in the PC market is the government which, through its central procurement agency, accounts for some 80 per cent of new PC purchases.<sup>98</sup> The rapid economic growth in Ethiopia in the early 1980s saw a dramatic increase in the number of computer users and a concomitant rise in the number of firms offering computer-related services. The industry is still, however, plagued by unreliable maintenance services. Even where service facilities exist, replacement parts are often unavailable or prohibitively expensive. The quantity and range of spare parts are often insufficient and waiting times for imported spare parts are notoriously lengthy.

### **7.6.1 The Internet in Ethiopia**

By 1995, Ethiopia had yet to develop its own national communications network and, for electronic mail use depended on a network established by the Pan African Development Information System (PADIS) based at UNECA. Established under the auspices of UNECA with funding from Canada's IDRC, the project was part of a wider capacity building initiative (CABECA) that was designed to establish low-cost store-and-forward Fido-based<sup>99</sup> electronic connectivity to some 24 African countries in the region. In Ethiopia the CABECA project established a node with a user base of over 1000 users by 1995. By 1998, the PADIS e-mail system had attracted 2,600 subscribers – 20 per cent of whom lived outside the capital Addis Ababa – who benefited from a highly subsidised and relatively efficient service linked to an ISP in the UK. This Fidonet network raised awareness, developed the human resource capacity in Ethiopia and established a large user base. A 1996 survey undertaken in Ethiopia, Uganda,

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<sup>97</sup> Forthcoming report on " UNDP Africa Internet Initiative: Current levels of Internet Usage in Addis Ababa, Ethiopia", New York: UNDP Regional Bureau for Africa.

<sup>98</sup> Ibid.

<sup>99</sup> Fido is a public phone-based store and forward network which connects users with personal computers. Fido has proved effective for countries with a poor telecommunications infrastructure.

Zambia and Senegal on the impact of electronic communication technology, under a project sponsored by IDRC, showed that academic and research institutions were able to conduct joint projects effectively, improve resource mobilisation and carry out research between distant sites inexpensively (Rorissa, 1996).

Another networking initiative operating in Ethiopia is HealthNet. Utilised exclusively by the medical community, users have access to health information via the HealthNet<sup>100</sup> satellite, part of an international project, SatelLife, based in the USA. The ground station in Ethiopia was licensed in April 1994 and the medical faculty library of Addis Ababa University is the national node. A number of health, research and training institutions are connected including the African Health Resources Institute library, the library of the National Health and Nutrition Research Centre and the National Computer and Information Centre (NCIC). The HealthNet link assists communication between health professionals and aims to expand medical knowledge to and within rural areas. In addition the NCIC also established a satellite node under the PADIS network which links a number of research and academic institutions in Ethiopia. The network, EthioNet, began in November 1995 and has generated over 20 institutional users, most located outside Addis Ababa. Institutions benefiting from this network include the majority of universities as well as the Addis Ababa Chamber of Commerce and the Science and Technology Commission. (Rorissa, 1996).

In May 1995, indigenous efforts to provide a domestic Internet provision were given a fillip by the formation of a technical and advisory committee to push for Internet provision by the ETC. The "Bring Internet to Ethiopia" or BITE group consisted of representatives from the Ethiopian Telecommunications Authority, the NCIC, Addis Ababa University, PADIS, UNDP, the Constitution Commission and the non-government organisation sector. The group's aim was to investigate the necessary steps to establishing an indigenous node for the country and, more importantly, to produce a working document to be delivered to government. The 80-page final working document, "Proposal for Internet Connectivity in Ethiopia",<sup>101</sup> details the resources

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<sup>100</sup> Utilising FIDO technology the HealthNet uses radio technology instead of the public telecommunications network. Relying on Low Earth Orbiting (LEO) technology, this system has a free connection to a communications link that can send and retrieve information two to four times a day.

<sup>101</sup> "Proposal for Internet Connectivity in Ethiopia", unpublished report available from UNECA, Addis Ababa.

necessary to set up and maintain a national network and proposes an organisational framework within which Internet connectivity could be managed. One of the key recommendations is the setting up of a national public service network in Ethiopia that would expand as the telecommunication infrastructure develops and is able to accommodate data communications. Addis Ababa is envisaged as being the hub of the Ethiopian Internet network but its introduction would be primarily aimed at bringing vital information to locations where the development effort is most urgent. The report also recommends that a public network service provider be established to assist the broadest range of users. This public service network would be managed and operated on a non-profit basis, with the main objectives of serving the public and developing services. On completion of the report a detailed project proposal and action plan was submitted to the Ethiopian government.

The initial reactions to the proposals were positive and there were signs that its recommendations would be implemented. However, it soon became apparent that whilst the technical aspects of the BITE report were palatable to the government, ceding control to some non-governmental Internet management organisation was not.<sup>102</sup> The problem for the BITE group was that it was envisaged originally as being an independent autonomous and semi-permanent group that would advise government on matters of information infrastructure construction. But by recommending, amongst other things, competition in provision of Internet services it offended the government's, and ETC's, delicate sensibilities about ceding control (Da Costa, 1996). The security conscious mentality of the Ethiopian government is such that control of the flow of information is deemed essential to the survival of the regime. As Da Costa (1996) points out, this mentality, engendered under the former Marxist President Mengistu Haile Mariam, accounts in part, for the underlying wish of the current regime to control information. More pertinently, President Zenawi's experiences of the Internet have probably been far from positive, with several Ethiopia-specific Internet discussion groups generating a lot of messages on the Internet attacking individuals in the government. Evidently, keeping such politically negative information out would necessitate total control of all indigenous Internet nodes, with strictly monitored

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<sup>102</sup> Personal communication to the author from UNECA staff.

firewalls. Mirroring the attempts of other developing countries, such as Singapore, to control the flow of information on the Internet.<sup>103</sup>

Following the recommendations of the BITE group, and in the face of growing public demand for public Internet service provision, the ETC signed an agreement in 1997 with the U.S. telecommunications company, Sprint, to bring full Internet connections to Ethiopia. However, rather than coexisting with the PADIS network, the only dial-up e-mail service to the Internet in the country, ETC ordered UNECA to cede its network provision to ETC. The PADIS network was effectively told to terminate its operations and was asked to hand over all relevant expertise and equipment to the telecommunications authority<sup>104</sup>; an acute indication of the unwillingness of the regime to devolve any responsibility for building the information infrastructure. It also reflects the regime's desire to have total control over the flow of information within the country. Following ETC's decision to establish itself as a network provider, there has been widespread dissatisfaction with the level and quality of service provision. The government underestimated the level of demand for the service and failed to adequately prepare for the complexities of Internet service provision.<sup>105</sup>

In July 1998, there were an estimated 2,600 Internet subscribers within Ethiopia, all based in the capital, Addis Ababa. The service is only available in Addis Ababa, but the public operator is in the process of adopting a local call tariff throughout the country for Internet calls. A survey of users conducted by the UNDP reveals that the majority of users emanate from UN-affiliated agencies and NGOs, embassies, SITA (the airline network) and the Commercial Bank of Ethiopia (UNDP, 1998a). It is evident that important sectors such as the agricultural sector, educational establishments and the public sector are either unaware or grossly under-informed as to the potential of computer-based information services. In reality, indigenous use of the Internet, as of 1999, remains a rarity. Though some national institutions have access to the Internet, important local institutions, such as local government institutions and educational establishments, rank low in Internet usage terms.

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<sup>103</sup> "Internet-Ethiopia: Information Control Slows Economic Development Business and Industry", *Inter Press Service*, 19 November 1997.

<sup>104</sup> However, UNECA continues to operate an e-mail service (PadisNet) which has now been subsumed under the new Department of Information Services and Documentation (DISD).

<sup>105</sup> "Ethiopia: Internet Center Suspends Login Inquiry Service", *Source Express*, 3 October 1998.

The reasons behind the apparent poor take-up of Internet services in Ethiopia are clear cut. Firstly, high access cost remains a decisive factor for many. Under the PADIS network e-mail access for low-end users, who comprised nearly half of the users, averaged around US\$10 to US\$15 a month (Furzey, 1996). ETC was charging two to three times that amount for monthly subscription in 1998 (see Table 16 overleaf). This, combined with the high cost of telephone calls, has meant that the Internet remains an expensive luxury for the average Ethiopian. The estimated annual cost for Internet subscription in Ethiopia is US\$ 384; more than Ethiopia's GNP per capita. In a country where a university lecturer earns the equivalent of US\$150 a month, these connection charges are exorbitant.

Secondly, despite the detailed technical recommendations contained within the BITE report, the Ethiopian Telecommunications Corporation has failed to adequately prepare for the high level demand for Internet services. As a result, almost two years from inception, ETC continues to have problems providing dial-up and leased line services. The dial-up service is often busy or does not answer, necessitating at least 10 dials to obtain a connection, whilst leased line services have been promised for many months but have yet to be implemented.<sup>106</sup>

As Damena points out, Internet usage in Ethiopia is characterised by low quality of service, confined to a minuscule and often expatriate clique' (Damena, 1996, p. 24). The United Nations Development Programme recently conducted a survey of a broad cross section of Internet users in Ethiopia as part of an assessment for their Africa Internet Initiative. Given that practically all current users of the Internet in Ethiopia connect through their workplace or institution, a sample of 30 such establishments were visited. In series of semi-structured interviews, interviewees were asked to provide their experiences of ETC's Internet provision. Without fail, all interviewees were critical of the quality and extent of service. One respondent detailed how he had made over 70 attempts to connect to the service before being successful. Another spoke of how his

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<sup>106</sup> "Ethiopia: Internet center suspends login inquiry service", *Source Express*, 3 October 1998.

institution employed a member of staff to log on at five o'clock in the morning in order to avoid network congestion.<sup>107</sup>

**Table 16: Rates and subscriptions for Internet services, July 1998**

<b>Subscriber</b>	<b>Connection (US\$)</b>	<b>Monthly Fee (US\$)</b>	<b>Charge Per Hour (US\$)</b>	<b>Free Hours / Month</b>
Individual (reduced rate, student)	56	19	4	8
Individual normal rate	75	34	4	15
International, NGO's, Embassies, and Business sectors	113	75	4	40
Public educational, health and agricultural sectors	38	25	2	40
All non-profit organisations	56	38	2	40

*Source:* Ethiopian Telecommunications Corporation at <http://www.telecom.net.et>

Despite its seeming inability to provide an effective service, the ETC continues to rule out any competition in the domestic Internet service provision market. This ignores the mounting evidence that competition in the Internet providers' market impacts positively on the level of prices and degree of Internet penetration within countries (ITU, 1997a). In Ethiopia, those favouring privatisation as a means of generating greater accessibility to information, say that the government monopoly over Internet services is incompatible with moves to increase Internet use in Africa.

<sup>107</sup> Forthcoming report on " UNDP Africa Internet Initiative: current levels of Internet usage in Addis Ababa, Ethiopia", New York: UNDP Regional Bureau for Africa.

In summary the main factors hampering the growth of Internet services in Ethiopia are:

- high connection costs;
- poor levels of service and coverage;
- lack of competition in the sector;
- poor telecommunications infrastructure;
- a chronic shortage of skilled networking professionals; and
- absence of appropriate public policies.

### **7.7 Main actors**

An analysis of the spheres and degrees of influence of the various actors, shown in Table 17 overleaf, in information infrastructure development in Ethiopia reveals a contradictory and complex web of interactions that has led to both the strident promotion and government neglect of information infrastructure issues. Ethiopia has been fortunate in many respects in comparison with other Sub-Saharan African countries. The broadly constituted advisory group, BITE, produced the most detailed plans on information infrastructure development in Sub-Saharan Africa and actively lobbied government to act on their recommendations. Secondly, as the home to a vast array of international development organisations and a correspondingly high number of NGOs, it has been the beneficiary of their wider efforts to improve information infrastructure in Africa. For example, UNECA's Africa Information Society Initiative is based in Ethiopia and is one of the most high profile Africa-specific development projects to promote information infrastructure. Additionally, Ethiopia benefited enormously from UNECA's PADIS project, which introduced electronic networking to the country for the first time. At the same time, public pronouncements on national information infrastructure plans have been few and far between, and the dissemination of information technology is still hampered by a negative policy regime.

**Table 17: Actors, and their influence on the development of the Ethiopian IT sector**

<b>Actor(s)</b>	<b>Sphere(s) of Influence</b>	<b>Degree of Influence</b>
Government	Regulation and public policy	High
Government-funded institutions: Ethiopian Science and Technology Commission (ESTC), the National Computer and Information Centre, Addis Ababa University	Expert input into public policy, dissemination of public policy, research and development and provision of training	High
Development agencies: UNECA, USAID, World Bank	Development assistance, policy advice, technical knowledge and funding. Network provision through PADIS and other initiatives	High
ETC	Internet service provider	High
Foreign private sector: PC manufacturers: IBM, Compaq etc. Sprint/Global One	Telecommunications equipment and network provision  Internet provision	Medium
Domestic private sector	Retail of information technology, provision of training	Medium
Interest groups: BITE consortium	Public policy advice, networking expertise	Low

### **7.7.1 Public policy: The role of the government and its agencies**

Given Ethiopia's turbulent past, the reasons for the dearth in information technology utilisation seem almost understandable. Typically policy-makers have viewed new technology with extreme suspicion. A "national threat" as opposed to a potential national asset, which had to be legislated against rather than encouraged (Damena, 1996). The reasons for this attitude are complex and stem from a traditional resistance to technology and information sharing. As in many Sub-Saharan African countries, the



resistance to new technology seems to stem from a protective culture on the part of those who make policy decisions (Woherem, 1993). The seeds of this resistance appear to have been sown in the ignorance and mystification of information technology at one extreme, and from fear of loss of power and control to the unknown, on the other (Damena, 1996). Consequently Ethiopia suffers from an underdeveloped culture towards information and information sharing at the governmental level. The level of penetration of information technology in the public sector is low and the application of computing is restricted to data and transaction processing systems, and operational and management control systems. However, the ruling EPRDF party has recognised, in its five-year programme, the importance of infrastructural development in promoting economic growth and facilitating integrated rural development.

More importantly, at senior government level a small group of electronic communication "champions" were instrumental in sensitising ministerial colleagues to the importance of a national network with full Internet connectivity (Furzey, 1996). Though it has yet to make any coherent and long-term plans for information infrastructure development, discussions are in progress to draft a policy framework within which a national network can be established.

Specifically, the government has relaxed the restriction on the importation of some information technology appliances, and has implemented initiatives such as the observation of a "national information day" to increase awareness of information technology applications. These initiatives, whilst welcome, fall short of what is necessary. A 1998 survey of the domestic information technology retail industry in Addis Ababa, revealed widespread frustration at delays of up to a year for imports to clear customs.<sup>108</sup> There continues to be tremendous scarcity in terms of computer peripherals, educational materials, software, networking components such as modems, and trained professionals to sustain a steady growth of the sector. Whilst the Ethiopian government has been slow to announce any concrete plans for the development of its information infrastructure, it has been active through its funded institutions.

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<sup>108</sup> Forthcoming report "UNDP Africa Internet Initiative: Current levels of Internet usage in Addis Ababa, Ethiopia", New York: UNDP Regional Bureau for Africa.

### **(a) Ethiopian Science and Technology Commission**

Attempts to address the issue of technology at the public policy level began in the early 1970s, with the establishment of the Ethiopian Science and Technology Commission (ESTC) in 1975. The commission was designed to be the principal public body deciding on issues relating to science and technology issues. Its *raison d'être* was to create a conducive environment for the development of indigenous scientific and technological capacity within Ethiopia. A typical policy area within its remit is the evaluation and monitoring of imported technologies and identification of areas where indigenous technologies can be developed (Kebede, 1995: 87). Through the creation of a number of specific institutions under its aegis the ESTC is the most influential public sector institution in the field of national information infrastructure.

### **(b) The National Computer Committee**

Established under the auspices of the Ethiopian Science and Technology Commission in 1987, the remit of the committee is ostensibly to prepare policy statements on national information technology policy. But it also plays an important role in monitoring and controlling the evaluation of computer-related projects. The NCC is responsible for the approval of information technology products and makes decisions according to a number of criteria, namely: appropriate cost and foreign exchange criteria, availability of local maintenance facilities, software availability and compatibility, and upgradeability. Equally important objectives include: the conduct of research and development into information technology; the promotion and development of computer knowledge in the country; provision of maintenance and consultancy services; and human resource training through its national computer centre.

### **(c) National Computer and Information Centre (NCIC)**

The NCIC is a semi-autonomous government institution operating under the overall direction of the Ethiopian Science and Technology Commission. Since 1987 it has been responsible for promoting computer technology and information systems and services in the country. The objectives of the centre include:

- capacity building at the national level in the areas of information systems and services, computer hardware and software training, consultancy and data communication;
- collecting, processing, analysing and organising information sources on science and technology to provide computer-based library and information services; and
- developing, strengthening and coordinating national and sectoral information systems to improve information sharing and data communication (Furzey, 1996).

The NCIC has achieved notable successes in the development of indigenous applications. It has been the guiding force in the development of a range of Amharic software, producing the Amharic operating system "AGAFARI" and creating the Amharic publishing system "MAHTEME". To make these operational under the MS-DOS operating system, the NCIC developed a peripheral device and printer codes for Amharic script and developed a range of Amharic keyboards. One of the key areas being actively addressed by the NCIC is the problem of information dissemination. To this end, it is developing a strategy to improve the information resources infrastructure particularly between the federal states and the central government. The NCIC has played a pivotal role in increasing the capacity for information sharing amongst academic institutions. Prior to the introduction of full Internet connectivity the NCIC utilised a satellite node of the PADIS network in order to link, for the first time, 25 institutions that had hitherto been isolated by geography.

One of the key recommendations of the BITE report was the creation of a full Internet hub, based at the University of Addis Ababa campus, which would form the nucleus of a phased expansion toward a national network academic and research network, linking ESTC's 18 national research centres (BITE, 1996). However, due to a lack of funds these plans were indefinitely postponed. Since the cessation of the PADIS network, ESTC now utilises ETC's Internet service, and has been granted permission to act as a service provider for linked institutions. Yet repeated requests for a dedicated leased line to the public switched network have, as of 1999, remained unfulfilled. If and when the link is approved it is not envisaged that undergraduate students will have access to this academic network due to the limited resources of universities (Adam, 1996). Even though the ETC has reduced prices for public institutions, the costs are still so high relative to budgets available that many subscriptions have lapsed and others are only

used for urgent communications. Consequently, while the ESTC has done a commendable job of increasing awareness of the potential of electronic networking, prohibitive connection costs militate against the effective exploitation of the resources and services made available through the network.

#### **(d) The Commission for Disaster Prevention and Preparedness**

The Commission for Disaster Prevention and Preparedness (CDPP) recognised the need for computer networking in 1994, to integrate early warning, relief transport operations, air services and food-aid management in line with the national strategy of Disaster Prevention and Preparedness. The Commission has been implementing a management information strategy based on a wide area network, integrating three independent networks based in Addis Ababa. The long-term objective is to develop a networking structure, which systematically integrates the ports, warehouses, and the various CDPP departments to enable access to data and information both by the CDPP and regional bureaux, partners in the UN system, donors and NGOs through establishing a common database.

#### **(e) Addis Ababa University (AAU)**

Addis Ababa University is the key academic institution in the country and a major user of international data communication networks. The university, with considerable support from the Ethiopian Scientific Society (ESS) in the U.S. and UNECA, has developed a university-wide network, inter-connecting many stand-alone computers into local area networks (LANs). Over 18 departments are actively involved and the university has its own networking committee. According to the recommendations for AAU departmental computer networking<sup>109</sup> a university-wide network with international connectivity will be established through a phased approach. The 1998 appointments of a new university president and Academic Vice-President who is also the Chair of the University Networking Committee are likely to promote and champion existing initiatives in the belief that the university has much to contribute to regional,

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<sup>109</sup> Nemo Semret, <http://www.ctr.columbia.edu/~nemo/ESS>. Accessed March 1998.

sub-regional and African networking. The university is also a partner in the InfoDev/World Bank African Virtual University project, which may provide some resources for student access to the Internet.

### **7.7.2 Development agencies**

Stepping into the policy vacuum, which should be filled by government, development agencies are major players in the development and diffusion of information infrastructure in Ethiopia. The country has benefited enormously from the presence of a large number of development agencies based in Addis Ababa. It is host to the United Nations Economic Commission for Africa which was established in Addis Ababa in 1960 to spearhead and coordinate the efforts of the United Nations in Africa. At the same time, in the aftermath of a series of highly publicised environmental and human disasters, the country is host to a multitude of non government organisations, dealing with issues ranging from famine prevention to AIDS Prevention. From a practical standpoint UNECA has played a crucial part in the development of networking in Ethiopia. Most development agency initiatives being conducted locally fall into one of two categories:

- **Practical development assistance:** namely developing local area networks that facilitate institutional and inter-institutional computer and information resources sharing and communication. Examples of this are the PADIS, CABECA, TINET, IGADD and RTNS projects. Practical assistance is also offered in developing the user base and promoting optimal utilisation of the networks through training users and system operators.
- **Policy advice:** The last five years has seen a mushrooming of activities designed to improve awareness in Ethiopia of the importance of information and communication technologies. UNECA is spearheading the most high profile of these initiatives, the African Information Society Initiative (AISII). This is designed to harness the use of information and communication technologies for development with an emphasis on the participation of all stakeholders. As a result UNECA, in partnership with other development agencies, has held a series of high profile

conferences and workshops designed to sensitive policy-makers to the importance of information infrastructure.

These development agencies have played and continue to play, a crucial role in the area of technological transfer. Through a number of key projects, above all the PADIS project, organisations such as UNECA, UNDP and USAID have been instrumental in the setting up of networks and raising awareness of the importance of information and communication technologies in Ethiopia. Development agencies have also been instrumental in improving the level of skilled information and communication technology specialists in Ethiopia. For example, the School for Information Studies in Africa (SISA) was established in 1990 by the IDRC and UNESCO to help southern and eastern African countries build indigenous capacity for human resources in the information sciences. The institution now offers a Masters degree program in information sciences for students from eastern and southern Africa and a Bachelor degree program for Ethiopians.

### **7.7.3 The Ethiopian Telecommunications Corporation**

The Ethiopian Telecommunications Corporation (ETC) exercises total control over Internet services in the country. As the only Internet Service Provider (ISP) ETC controls probably the most salient proxy of information infrastructure. As there are no immediate plans to allow competition in this sector the ETC wields a disproportionate level of influence in the development of information technology infrastructure in Ethiopia.

### **7.7.4 The domestic private sector**

The almost total dominance of foreign suppliers in the information technology market in Ethiopia leads to a vestigial role for the domestic computer manufacturing industry. Though local assembly of computers is increasing and local software houses are becoming more and more commonplace, most companies source their information technology requirements from abroad. Most software in usage in Ethiopia, by both government and private sector, is pirated. Though no official statistics exist, 90 per cent of the interviewees questioned in a UNDP survey of information technology usage in

Ethiopia, had no qualms in admitting that they engaged in software piracy (UNDP, 1998a). The main domestic drivers of information technology usage in the private sector are the Central Bank of Ethiopia, and Ethiopian Airlines. Given the nature of their businesses, both organisations are intensive users of information technology. However, neither is particularly advanced in comparison to other Sub-Saharan African countries. For example, in 1998 the Central Bank of Ethiopia had yet to introduce a wide area network between its Addis Ababa branch and its branches outside the capital. The private sector is also an increasingly important sector in human resource training. It has responded quickly to the growing demand for basic computer training in software applications. For example, most computer retailers now offer information technology courses in popular software applications. But the number one complaint amongst retailers remains the lengthy import process that can result in goods clearing customs a year after first entry. In addition, the inherent difficulty of sourcing correct spare parts has significantly hampered the growth of the PC repair and service industry (Kupkes, 1996).

Reflecting the large diaspora in the USA, there is also an active Ethiopian Scientific Society, (ESS) which is based in Washington which has held a series of annual conferences on information and communication technologies. One of the goals of ESS is to encourage collaboration among technical experts in Ethiopia or abroad on projects that would contribute to development in Ethiopia.

## **7.8 Constraints to the growth of the information technology sector**

The major problems facing the expansion of information technology in Ethiopia are:

- The policy vacuum in the sphere of national information technology policy, import restrictions and outdated government policies towards the sector.
- The scarcity of experienced and skilled software and management personnel trained in information technology.
- The macroeconomic environment which has resulted in a small and weak middle class with very low purchasing power for such items as computers and information goods.

- Infrastructural deficiencies, namely a weak and expensive telecommunication infrastructure, which has hampered the growth of information networks and an erratic electricity supply.
- The lack of an information culture.

Having already discussed the reasons for the lack of and effectiveness of government policy in the area of information technology development, the next biggest constraint to information technology diffusion is the lack of skilled personnel.

#### **(a) Lack of skilled personnel**

In order to maximise value added from information infrastructure, a fundamental reappraisal of capabilities is required. This calls for an increase in expenditure on human resources; precisely the opposite of what is happening in the majority of developing countries (UNESCO, 1998). The basic characteristics of these technologies all point to an indelible fact. To be an effective user of them requires skills and capabilities that far exceed those received from the simple importation of sophisticated technology (Grant, 1996; Odedra, 1990b). Gaining access may be a first step, but it only leads to static efficiencies; what is necessary is dynamic gains. These will only arise through a long interactive process of learning-by-doing, where the user-producer relation plays a crucial role (Cassiolato, 1997).

The introduction of information technology training in Ethiopia has generally coincided with the importation of computing equipment. Thus the earliest forms of training were normally for proprietary equipment by companies such as NCR and BURCO in the late 1960s (Kebede, 1993). Since this period Ethiopia has gradually begun to develop a small but competent base of qualified computer professionals. The quality of technical training in the country is low but slowly improving. The number of professionals trained in areas of computer science and information technology is growing due to improved training opportunities and also due to an increase in the number of Ethiopians returning to their country after extended periods abroad. While these are very positive trends, technical skills in computer science and information technology are still scarce. Although the overall level of computer literacy in Ethiopia is low, as more private



businesses and public institutions are becoming computerised, the demand for competent computer users is rapidly escalating.

Whilst there has been an appreciable increase in the number of qualified personnel during the last decade, the current level and quality of expertise available in the information and communication related fields is far from adequate (Adam, 1995). Rather, shortages of skilled information and communication technologists have militated against many information technology initiatives in the country. In an attempt to resolve this skills crisis the Ethiopian government has sought to build institutional capacity to improve and increase the existing human resource levels in the country. The main providers of computer training are the Ethiopian Science and Technology Commission (ESTC), Addis Ababa University, ETC, the CABECA project and the private sector. The academic and research institutions are the main source of experts in the field of data communications and networking, while the private sector is meeting the demand for basic application training in word processing, spreadsheet and database use (Rorissa, 1996). The largest single training provider in the country, the ESTC, began to offer a wide range of accredited courses at different levels in 1988. The commission has a good reputation and is well respected in the country. It has a software research department for developing Amharic applications<sup>110</sup> and a strong maintenance and repair department. A wide range of courses are also offered by the computer department based at Addis Ababa University. The University has been offering a range of courses and training programmes in computer science since 1986, which are run by the faculty of Mathematics' Computer Department. However, further development of additional training courses is needed so that graduates from the university can become both computer and network literate. Meanwhile, the ETC is using its Ethiopian Telecommunications Training Institute (ETTI) to provide Internet training courses for users in aspects ranging from basic introductory courses to more advanced website development.

Considerable resources are needed to support the efforts of academic institutions in Ethiopia to develop skilled resources in communication engineering and computer

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<sup>110</sup> Amharic is the official working language of the government and is spoken by the majority of the population in addition to their mother tongue.

science. Considering the future needs of the country, emphasis should be given to developing a national computing science curriculum and the establishment of a faculty or department in computer science. Data communication, networking and communications engineering should be developed at higher education institutes to underpin and assist the growth of the industry and telecommunications sectors (Furzey, 1996). In the long-term, human resource development needs cannot be fulfilled without diffusion of knowledge to younger generations and a national strategy for the computerisation of high schools, training centres, and colleges should be developed.

In the public sector, staffing levels are often adequate to handle only routine data processing tasks using accounting packages that may have been modified and are maintained in-house. In such an environment, there is little time or incentive to engage in original software development aimed at extending or intensifying the degree of computerisation. However, the problem arising from inadequate staffing is not the result of a lack of trained personnel, but more a lack of highly skilled computer specialists. The problems facing data processing departments are, according to Nwachuku (1992), 'low status, lack of management support, poor staffing levels, and lack of cooperation bordering on outright hostility from departments "in danger" of computerisation' (Nwachuku, 1992, p. 63). As a result, there exists a severe under utilisation of computing equipment as well as low productivity amongst staff.

#### **(b) Macroeconomic environment**

The huge sums involved in funding the ongoing internecine civil war with Eritrea continue to divert resources away from national development. Though Ethiopia has made significant strides towards market liberalisation and has achieved commendable growth rates in GDP over the period 1995 to 1998, its economy is still delicately poised. Attempts to diversify the economy have as yet failed to lessen the country's dependence on agricultural exports such as coffee, cotton and oilseeds and the hallucinogenic drug Khat. Reliant on agriculture for more than 80 per cent of its GDP, the country now finds itself hostage to the vagaries of weather systems that determine the viability of national crops. Such a fragile economy has not been conducive to national income growth. Following the devaluation of the birr in 1995, the GDP per

capita in dollars was only US\$40 (in 1995). This has prohibited the vast majority of the population from information technology products that remain very much a luxury.

### **(c) Infrastructural Deficiencies**

An acute problem that continues to affect the use of information technology arises from the erratic provision of electricity in Ethiopia. The supply of energy is restricted to the large cities and some of the smaller surrounding towns. Some of the rural towns only have electricity supplied for a limited number of hours per day. Power interruptions are frequent, and it invariably takes several hours to restore the electricity supply. During periods of drought there is a shortage of hydroelectric power and large areas of Addis Ababa are deliberately shut off from electricity for one day per week. Due to power fluctuations computer users are forced to buy additional equipment, such as adapters and power surge protectors to protect sensitive equipment, adding significantly to the cost of computing.

### **(d) Socio-cultural factors**

One of the major constraints to the spread of information technology has been linguistic diversity. Though the Science and Technology Commission has managed to develop Amharic keyboards and an Amharic operating system and software, other minority languages utilise different alphabetic scripts. Information technology use is further constrained by educational levels. Though Ethiopia enjoys a relatively high literacy rate of 66 per cent, thanks to the government's enlightened policy of free education, the majority of the population have enjoyed only a few years of primary education (UNESCO, 1998). National levels of computer literacy remain virtually non-existent, as computer literacy remains the reserve of a tiny minority at universities and colleges, and those who can afford tuition offered by the private sector. Nor have the lack of library facilities, inadequate resources for journals and books, poor documentation and archive collections, and central resource sites, helped to overcome the lack of information sharing. Public libraries are small in number and poor in quality. Information in public or ministry libraries is out of date and usually are not available to the public. As Benalfew argues in Ethiopia, [for] researchers, historians, private

enterprises and various individuals and organisations, information is something to be won in a battle, not with guns but usually through "connections" (Benalfew, 1999, p. 1). Though Ethiopia is a prodigious producer of information, getting access to archives can prove a formidable task. Benalfew (1999) conveys this frustration succinctly:

First, you don't know where to look, as there is no public information, and even if you know where it is, there is no proper cataloguing. Second, the information is deposited irregularly. Many research results are not found in the right place and in the right order and number, thereby endangering their safety as well as their future availability and accessibility (Benalfew, 1999, p. 1).

The inadequate facilities and difficulties of accessing information have led to low expectations, and a consequent under utilisation of the existing information resources.<sup>111</sup> The lack of access to relevant information is acknowledged as a major factor affecting the success and quality of research and development activities, trade and industry.<sup>112</sup> At the same time there is a critical need for greater evaluation and monitoring of government action. There is fundamental need for checks against government failure, and in general for greater transparency.

The paucity of accurate data collections and archive material has an obvious knock-on effect on development planning, which appears to be done without accurate statistics. Poor information systems for macroeconomics and sectoral policy formulation and monitoring, impinge upon the ability of policy-makers to accurately forecast or even plan for the immediate future. For example, government statistics on the agricultural sector invariably throw up interdepartmental inconsistencies between the Ministry of Agriculture, Regional Agriculture Development Bureaux and the Central Statistics Authority (CSA). Or the livestock data of the International Livestock Research Centre and CSA both provide differing figures on the size of the agricultural sector in Ethiopia. This lack of access to reliable information also extends to the private sector. According to Berhane Mewa, president of the Ethiopian Private Industries Association,

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<sup>111</sup> Adam, L (1995) Draft Proposal for Internet Networking in Ethiopia, Addis Ababa: UNECA.

<sup>112</sup> Editorial note, Nastis Newsletter, National Computer and Information Centre, ESTC, December 1995.

information is considered a privilege and not a right'.<sup>113</sup> Benalfew (1999) reveals the frustrating route that an information seeker must tread in Ethiopia:

The scenario of access to information is that in most places, they don't have information desks, and even if they have one, it will be limited to giving information on office numbers – only if you manage to mention the appropriate department. After you get to the right place, nobody is willing to talk to you first of all. If you are seeking information, you will be referred to somebody else, and this may go on until you are finally told that it is difficult to give out the information you're looking for. It will take days, if not weeks, depending on the type of information you require, before you get it officially. Of course, you always have the option to get what you want through the back door. Nor does the educational system provide adequate knowledge and techniques on how to receive and disseminate accurate and up-to-date information. Children are thus brought up in a society where information is a "forbidden fruit" (Benalfew, 1999, p. 6).

Some authors have pointed specifically to a different "African" mentality towards information. For example, Owomoyela (1996) argues that, 'African culture tends to be less individualistic or rationalistic than most western cultures. The idea that information should be freely accessible to everyone whenever required is a new concept in most African settings. The withholding of information has, up to this time, been the dominant mode of maintaining power' (Owomoyela, 1996, p. 112).

The reasons behind the low level of information sharing in Ethiopia are due in part to the lack of information-sharing facilities and the poor level of communications, but also to the repercussions arising from Ethiopia's recent history. An article by Sutton (1994) provides an illuminating example of the effects of the civil war on the cultural attitude towards telecommunications in Ethiopia's neighbour, Eritrea. Sutton found that 30 years of isolation, war, and espionage have meant that amongst Eritreans, the telephone is still associated with the murky world of spying and espionage, that 'for years the telephone was regarded with extreme suspicion by the ordinary Eritrean'. She goes on

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<sup>113</sup> Quoted in Benalfew, 1999, p. 7.

to point out that 'even [in 1999] telephone requests to pass messages on or to provide data are often met with a refusal. Information is relayed by hand on tiny scraps of paper painstakingly torn from scarce notepads and business is largely a face-to-face affair conducted over endless cups of tea and pleasantries' (Sutton 1994, p. 33). Though Ethiopia is vastly more developed than Eritrea, there are parallels with Eritrea in the lack of a culture of information sharing. The period of Marxist-Leninist rule under Mengistu undermined community relations and led to a lack of trust.<sup>114</sup> The managing director of one of the companies interviewed in a UNDP survey of the information technology sector bemoaned the lack of cooperation amongst information technology vendors that is so common in developed countries (UNDP, 1998a).

Amongst the military junta in Ethiopia there is more than a lingering suspicion of computing and the access to information it brings. For example, there was a widespread lack of awareness of the Year 2000 issue in Ethiopia. The government had done next to nothing to test the compliance of the thousands of computers strewn through its ministries. Nor had it endeavoured to sensitise the private sector as to the potential pitfalls that it may see in the new millennium. Rather, it has been left up to the developing agencies, namely the World Bank, to hold workshops and increase awareness about compliance and critical systems. There is a widespread feeling that the level of computerisation in Ethiopia is so low that any impact felt would be minuscule. Indeed, some interviewees in a UNDP survey of information technology in Ethiopia said that the Year 2000 problems were not an issue as, according to the Ethiopian calendar it would only be 1993. The attitude of the government as well as the private sector appears to be a mixture of indifference and ignorance. For example, the state minister for higher education Abel Rwendire, was recently quoted in a magazine calling for a national ban on the importation of computers that are not Year 2000 compliant.<sup>115</sup>

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<sup>114</sup> "Internet-Ethiopia: information control slows economic development business and industry", *Inter Press Service*, 19 November 1997, p. 32.

<sup>115</sup> "Ethiopia susceptible to Millennium Bug" *Addis Tribune*, 26 June 1998, p. 6.

## **7.9 Needs assessment: Ethiopian information technology policy objectives**

The goal of any information infrastructure policy in developing countries must be, first and foremost, to support national developmental goals. One of the key factors in allowing policy-makers to be effective decision-makers is access to timely and relevant information. Greater strategic use of information technology in the public sector can help in this endeavour. By utilising information technology, the efficiency of the delivery of public services can be improved. The level of technology introduction into the state's operations must of course be commensurate with the capacity of the state and the current technology level in the country. National databases of different data must be organised and made available to policy-makers, the public and potential foreign investors. The systematic collection of such national data can improve the effectiveness of the public sector and reduce administrative costs. At the same time access to timely information can improve Ethiopia's ability to manage its fragile environment and increase its agricultural efficiency.

The above review of the existing capabilities of Ethiopia in information technology reveals an industry increasingly left to develop on its own. The reduction of government intervention in the importation of computers is welcome but the lack of concrete proposals in such key areas as education does not bode well for long-term dynamics. This thesis is underpinned by a theoretical framework, which places public policy at the centre of a world in which information and communication technologies appear increasingly important. However, the Ethiopian government is doing little to create domestic capabilities in this field.

## **7.10 Summary**

The above case study of the Ethiopia information infrastructure has shown the extent of its underdevelopment. Within the telecommunications sector, despite the early introduction of service in 1896, only 100,000 lines had been added a century later. Since then, however, the government has implemented a number of ambitious development plans which had managed to double the existing capacity of the network. Moreover, the public telecommunications operator is profitable and relative to other

African countries, well managed. However, the government has yet to full deregulate the sector and the country still subsists with a public network that covers only a small of the population.

The primary need for Ethiopia in the area of information infrastructure development is for long-term coordinated and consistent national public policy. In the information technology sector hardware and software are being acquired by different organisations with little coordination and planning. Such *ad hoc* acquisition and use of information and communications technology militates against effective utilisation and reduces the developmental potentiality of the technology. Government must introduce a legal framework to protect intellectual property rights, simplify information technology acquisition procedures, and institute a positive fiscal stance towards information infrastructure activities. What is required is public policy that promotes, structures and supports the orderly development of information technology.

This chapter has provided an in-depth analysis of the information infrastructure in Ethiopia in terms of the telecommunications and information technology sectors. It has provided a review of existing capabilities, identified short-term needs, and pointed to a strategy to achieve longer-term objectives. The chapter has also identified the key actors in the development of information infrastructure in Ethiopia and assessed the sphere and degree of influence they exert on the creation of information infrastructure.

Given the political and economic instability that have been typical of Ethiopia since 1970 it is unsurprising that the current level of sophistication of the country's information infrastructure is inadequate. With over 80 per cent of the country living in rural, often inaccessible areas, the vast majority of Ethiopians are reliant on the traditional forms of communication, and national usage of information technology, even in government, is limited. Given the structural problems facing the country it is vital that the indigenous information infrastructure is upgraded. The long-term solution to Ethiopia's seemingly intractable problems lies in the creation of an effective information infrastructure that furnishes policy-makers with timely and accurate information. This information in turn will improve the capacity of government to manage such information-intensive issues as environmental deterioration and demographic management.



## CHAPTER 8

### An Assessment of Information Infrastructure in Nigeria

#### 8.1 Introduction

Despite its abundance of natural resources Nigeria has consistently failed to fulfil its potential as the economic giant of Sub-Saharan Africa. Rather, its post-colonial history has been typified by political and economic instability, to such an extent that living standards for all but a tiny elite have not improved since 1960 (UNDP, 1998a). With less than 10 years of civilian rule since independence, successive military regimes have been typified by policy inconsistency and short-termism resulting in economic mismanagement. This *ad hoc* approach to national development has led to an inadequate level of public infrastructure provision. This inadequacy is so pronounced that it is seen as an obstacle to national development and a constraint on economic growth. In this atmosphere of political instability and financial weakness it is unsurprising that Nigeria has yet to tackle the subject of information infrastructure with any serious conviction.

While the government has finally begun to deregulate the telecommunications sector, it has yet to announce concrete and operationally feasible plans to upgrade its information infrastructure. The approach of this chapter is to analyse the forces that are influencing the construction of information infrastructure in Nigeria. This framework conceptualises the activities of the identified main actors in terms of two key dimensions: sphere of influence and degree of influence. Specifically this chapter analyses the Nigerian information infrastructure in terms of the telecommunications and information technology sectors.

#### 8.2 National context

Nigeria remains one of Africa's most influential countries blessed with vast oil reserves and unique human resources. It represents Africa's most populous state with a population estimated at around 100 million and the capacity for enormous prosperity

and regional leadership. However, the country has consistently failed to live up to its potential, embodying both the worst and best aspects of typical development trajectories in Sub-Saharan Africa. British conquest brought together, within Nigeria's borders, a wide range of cultures and ethnic groups. This colonial "unity", however, was a top-down authoritarian creation (Garba, 1995). In spite of the efforts of the nationalist movement for independence to foster a sense of national identity, the continued existence of ethnic and religious cleavages have meant that building a nation based on popular political participation remains a work-in-progress.

Despite the recent transition to a civilian government, the Nigerian economy continues to be plagued by political uncertainty, corruption, and poor macroeconomic management. Nigeria's military rulers have failed to make significant progress in diversifying the economy away from a dependence on the capital intensive oil sector which provides more than half of the country's GDP, 95 per cent of foreign exchange earnings, and about 80 per cent of budgetary revenues (CBN, 1997). Officials also appear divided on how to redress fundamental economic imbalances that result in persistent inflationary pressure and the discouragement of foreign investment. The government's resistance to initiating greater transparency and accountability in managing the country's multibillion dollar oil earnings continues to limit economic growth and prevent an agreement with the IMF and bilateral creditors on debt relief (EIU, 1999). The largely subsistence agricultural sector has failed to keep up with rapid population growth, and Nigeria, once a large net exporter of food, now must import food to feed its growing population.

### **8.3 The telecommunications network**

In recognition of the importance of a national telecommunications network the Federal government of Nigeria formed a partnership with Cable and Wireless in 1962 to create Nigerian External Telecommunications Limited (NET). In 1972 the Nigerian government bought out Cable and Wireless' 49 per cent holding and provided external telecommunications services to the populace. NET was a self-financing parastatal which, apart from monitoring by the Ministry of Communications, enjoyed relative autonomy from the state. Internal telecommunications traffic was transmitted and

controlled by the Posts and Telecommunications Department which remained a department within the Ministry of Communications and depended wholly on the state for funding. The existence of these two separate bodies led to a duplication of investment and allocative inefficiency (ADCG, 1998).<sup>116</sup> Moreover, the lack of coordination between the two organisations, which had very different objectives, did not augur well for the creation of an efficient national telecommunications network.

In an attempt to reduce these inconsistencies, Nigerian Telecommunications (NITEL) was established in 1985 to provide more efficient telecommunications services to all of the states in Nigeria. On 25 March NITEL became a commercialised public limited company. As of 1998, the Nigerian telecommunications sector comprises the Federal Ministry of Communications (FMOC) as the supervising authority, the Nigerian Communications Commission (NCC) as the regulatory agency, and NITEL plc, currently the only public telecommunications operator. It also includes private commercial operators offering telecommunications services like private network links, fixed and mobile cellular services, voice mail and paging services. There are also telecommunications equipment vendors and manufacturers. The FMOC, as the supervisory agency through the NCC, sets goals for the overall development of the sector, monitoring performance and improving the regulatory environment.

The public telecommunications network is structured into four levels: The first level, the international level, consists of three digital and one analogue satellite earth stations, with current capacity of 7500 international trunks to other countries. The second level of the PSTN hierarchy consists of six digital secondary switching centres, while the third and fourth levels, representing infrastructures for regional traffic and local traffic, are made up of 49 primary centres and 195 local exchanges (ADCG, 1998). Total telecommunications capacity in Nigeria has risen to approximately 780,000 lines with about 15,000 cellular telephones (NITEL, 1998). There are some 14 telex exchanges with a total installed capacity of 12,800 and 20 voice frequency telegraph terminals.

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<sup>116</sup> For example there was no effective means of compelling subscribers to settle their international bills, and revenue sharing between the two bodies proved overly complicated.

In terms of the telecommunications transmission system there were 264 microwave terminal stations and 172 unmanned repeater stations in 1998. In addition fibre optic cables were developed to link primary and secondary telephone exchanges in the capital city, Lagos. In addition Nigeria operates a domestic satellite system by leasing three transponders from INTELSAT, which are serviced by 19 earth stations. Initially these transponders were under-utilised: mainly being used for television transmission for only a few hours daily. However, they are now utilised for both television and telephony. There is a submarine cable link that provides a transmission system from Lagos through Abidjan, Dakar, and Casablanca to Europe. In terms of international telecommunications transmission there are two gateways at Lanlate and Kujama linked to switching centres at Lagos and Kaduna respectively. In 1992 two new gateways were commissioned – one at Victoria Island, Lagos to cater for the ever increasing traffic in the South West and the other in Enugu to cater for the traffic in the Eastern part of the country.

### **8.3.1 Scope of national service**

Nigeria's telecommunications services – especially telephony – are not sufficient to meet the needs of all those who require them, especially in the big cities such as Lagos, Ibadan, Enugu and Kano. This has led to long waiting periods for obtaining facilities (the average was above 10 years in 1993) and congestion of existing exchanges. New telecommunications facilities such as facsimile, international business services, and high-rate data transmission are not readily available. The quality of the service is regarded generally as unsatisfactory from both the technical and the customer service points of view. Line quality is characterised by frequent failure, especially in the case of the older analogue exchanges and trunks, while customer services are notable for frequent disconnections, irregular and often inaccurate billing, and a poor credit control system (ADCG, 1998). Nigeria's telephone penetration rate was still low, in 1994, at about eight direct exchange lines (DELs) per thousand inhabitants (ADCG, 1998). Its major challenge in extending its facilities continued to be the provision of telecommunication services in the rural areas, where there is little or no penetration. In the mid-1990s, however, the telecommunications facilities in the urban areas continued to be inadequate as well. Nevertheless, in recent years, attempts were made by the

Nigerian authorities to spread the telecommunications facilities throughout the country, and in the mid-1990s all the 21 state capitals as well as the new capital, Abuja, and many of the 589 local government headquarters were connected to the national network. Over the period 1985 to 1995 an estimated 300,000 new telephone lines were added to the public network. Rural exchanges were installed in some states in order to extend telecommunications services to smaller, geographically dispersed communities; under the Rural Communications Service (RCS), the official policy name given to governmental efforts to broaden telecommunications services to the rural areas.

**Table 18: Statistics of the Nigerian Public Switched Telephone Network**

Service	1992	1993	1994	1995
International (No. of paid minutes in millions)	52.6	40.4	44.3	106.8
Domestic (No. of trunk calls in millions)	1,298.3	1,798.5	2,277.4	2,611.5
Total connected lines	320,934	363,285	368,066	405,073
Network capacity	494,663	505,780	592,826	597,325
No. on waiting list	263,879	231,357	194,793	n/a

Source: CBN (1995) Annual Report and Statement of Accounts and Ministry of Communications Digest 1992-1995.

### 8.3.2 Pattern of telecommunications traffic

Despite declining standards of living for almost 99 per cent of the population (EIU, 1998), NITEL continues to enjoy consistent growth in telecommunications traffic. International traffic rose to 106.8 million paid minutes in 1995. Similarly internal traffic rose from 1.3 billion units in 1992 to 2.6 billion units in 1995 (ADCG, 1998). However, as shown in Table 18 above, the number of those on the official waiting list has declined only slightly. It is estimated that about 45 per cent of international traffic generated by Nigeria is directed toward continents other than Africa. 40 per cent of this

large traffic volume terminates in the United Kingdom, which has had a long-standing historic and economic bond with Nigeria. About 30 per cent of the traffic from Nigeria is now directed toward North America, a reflection of the growing trade relations between the two and the large Nigerian diaspora. Although there are terrestrial networks linking Nigeria with its neighbours, most of these networks are either non-operational or frequently unavailable (ADCG, 1998).

### **8.3.3 Constraints to Network Growth**

Historically the telecommunications network in Nigeria has experienced a number of problems that continue to hinder the provision of a fast and reliable telecommunications service:

#### **(a) Inadequate capacity**

Inadequate capacity has hindered considerably the rapid and cost-effective expansion of telephone services. Considering the size of the population and the level of economic development in the country, the number of installed telephone lines is inadequate to meet demand, and the resulting shortfall in capacity is responsible for poor call completion rates, subscriber dissatisfaction, and hence loss of revenue. According to official figures established and suppressed demand in 1997 is estimated at three million telephone lines and 200,000 cellular lines (FMOC, 1997).

#### **(b) Poor maintenance**

Poor maintenance continues to be one of the biggest obstacles to achieving operational efficiency. The maintenance problem itself can be attributed to such factors as lack of or inadequate supply of tools, test equipment, and materials for maintenance; government policy on procurement of spare parts; poor maintenance organisation; and the poor work attitude of maintenance personnel (Osaghae, 1998).

**(c) Low revenue generation**

The revenue being generated from the existing public telephone service continues to be low in comparison to the cost of providing the service. This is attributable partly to inefficiencies in management, partly to unproductive use of capital, and partly to an inefficient billing system (ADCG, 1998). Historically NITEL has often found that for political reasons it cannot collect revenues owed from larger users of telecommunications. According to one author, practically every government agency or parastatal is indebted on utilities (Osaghae, 1998). Compounding this problem are the large number of domestic users who fail to pay their monthly bills. As a result, NITEL is dependent on international telecommunications traffic and settlements arising from the surplus of Nigerian's calling home (ADCG, 1998).

**(d) Lack of indigenous capacity for plant construction and installation**

The basic support industries for telecommunications manufacture and assembly in Nigeria can be found mainly within the private sector. A growing number of enterprises, mostly sole proprietorships, sell telecommunications equipment. These small companies sell customer premise equipment such as teleprinters, facsimiles, answering machines and radio transceivers. Production levels for some of these products, however, remains small: typically 5,000 telephone handset units per year, 30,000 intercom units per year and 500 key telephone units per year (NCC, 1996). Both Nigeria's telecommunications and electronics subsectors are in their infancy stages. Because domestic manufacturing input to telecommunications development is very small, large amounts of foreign funds are required for telecommunications projects. Export of electronic and telecommunications products is non-existent in Nigeria, and importation still continues on a large scale in all sophisticated consumer and industrial electronics. Nor can domestic assembly fulfil the demand for simple consumer items, with importation widely used to supplement local production (ADCG, 1998).

**(e) Monopoly status**

Though a commercial entity, NITEL has always been treated as an extension of government (Osaghae, 1998). As a result, management has often been forced to place social and political considerations above commercial criteria. A 1998 report on the telecommunications sector in Nigeria asserts that:

Political considerations often dictated investments in terms of size and location, and social pressures impacted on charges, leading to sometimes uneconomically low tariffs and sometimes unreasonably high charges, particularly on high net worth customers (ADCG, 1998, p. 105).

**(f) Weak or non-existent government policy**

The lack of a clear and consistent policy lead from the government has exacerbated the structural weaknesses of the public operator. The lack of coordination and strategic planning has led to the proliferation of technologies, and the lack of consistency in standard setting has exacerbated the problem of maintenance. As a result no less than five types of automatic switching systems are in use in the country. Standardisation of network equipment has yet to be achieved and this imposes further problems, creating inflexibility in the use of human resources and spare parts. Moreover, as Table 19 shows, the government continues to maintain a negative fiscal stance towards the industry.

**Table 19: Tariffs for Telecommunications Products**

Item	Customs Duty Rates (%) 1995-2001	
	1995-1998	1999-2001
Telephone sets, videophones	25	20
Line telephone sets with cordless handsets	25	20
Other (Telex and teleprinters)	25	20
Fax machines	25	20
Telephone parts	25	20
TV/ cameras	25	20

*Source: Nigerian Customs Duty Rate Approved 1995-2001*



## 8.4 The main actors in the Nigerian telecommunications sector

The main actors in the telecommunications network in Nigeria, as set out in Table 20 below, can be divided into one of two categories: internal and external actors.

**Table 20: The main actors, internal and external, in the Nigerian telecommunications sector**

<b>Actors</b>	<b>Sphere of influence</b>	<b>Degree of influence on sector</b>
<b>Internal</b>		
Government: NITEL, NCC	Telecommunications supply and regulation	High
Domestic private sector: Association of Telecommunication Companies of Nigeria (ATCON).	Telecommunications supply and maintenance	Medium
<b>External</b>		
Foreign private sector	Telecommunications supply	Medium
Development agencies	Telecommunications policy, financial assistance	High
Regional organisations	Interconnection agreements, collective bargaining for regional telecommunications development	Low

### 8.4.1 Main internal actors

#### (a) The Nigerian government

Four prominent institutions have been identified as crucial to the success of the Nigerian telecommunications industry. These institutions are expected to cooperate with one another and to streamline their operations in the best public interest. The

institutions are the government executive, the Ministry of Communications (MOC), the National Communications Commission (NCC) and NITEL. The present system seeks to protect the sovereignty and security of the country by keeping NITEL under government control while, at the same time, making the telecommunications service less dependent on the government. The motivating force behind the decision to incorporate rather than privatise is the fear that control of the national network might be lost to foreign companies. The incorporation has also brought about increases in the cost of telecommunications services in the country. The administrative and policy matters of telecommunications remain within the remit of the ministry of communications, which represents the country at the ITU and other international telecommunications organisations.

(i) Management Structure of NITEL

In the mid-1990s, NITEL continued to operate under a government appointed board. The structure of the company is based on a three-tier system of territorial administration, zonal administration, and headquarters in order to decentralise functions and optimise operational efficiency. Abuja, the federal capital, and each of Nigeria's twenty-one states<sup>117</sup> constitute a single territory, while Lagos constitutes two territories. There are five zones: the north-west, north-east, south-west, south-east, and Lagos, and each zone is made up of between four and six states or territories. The zones are semi-autonomous in their operations, however, the functions of the zones are coordinated at the centre through the office of the managing director, who is the chief executive.

(ii) Telecommunications regulation

The Cable and Wireless Act of 1962 established the Ministry of Communications (the Ministry) as the regulatory body for telecommunications in Nigeria. The Ministry regulated NITEL until a decree in 1992 established the Nigerian Communication Commission (NCC), which was charged with the duty of regulating the telecommunications sector. The NCC became operational in September 1993. The Decree established NCC as an independent regulatory body. The broad objectives of

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<sup>117</sup> Nigeria was divided into 36 states in 1997.

the Commission include creating a regulatory environment for the supply of telecommunications services and facilities and promoting fair competition and efficient market conduct, among others. The NCC's is responsible for the following:

- licensing telecommunications operators;
- facilitating private sector participation and investment in the telecommunications sector;
- ensuring the improvement of Nigerian telecommunications penetration;
- establishing and supervising technical and operational standards and practices for network operators;
- overseeing the quality of service provided by operators;
- setting terms for the interconnection of carrier networks; and
- ensuring that the interests of telecommunications consumers are protected by promoting competitive pricing and guarding against abuse of market power.

(iii) Public telecommunications policy

Historically public service imperatives have determined the shape of public policy in the telecommunications sector. Such influences continued in the aftermath of the deluge of public expenditure in the light of revenue windfalls from the 1970s OPEC oil price increases. Nigeria set out on an ambitious plan of expansion in all public services. However, despite the surplus of financial resources, few of the telecommunications growth targets were met (Okome, 1998). With the subsequent collapse of the oil price in the mid-1980s, Nigeria was forced to implement a stringent structural adjustment programme which focussed on deregulation as a condition of receiving IMF loans.

It was not until 1992, however, that the government actually began to deregulate the telecommunications sector. Decree No. 75 of 1992, the first explicit government statement on the issue of deregulation stated:

- an acknowledgement of the poor state of NITEL;
- the government inability to continue subsidising the sector;
- the need for private sector participation; and
- the need for a more efficient and comprehensive national service.

In the wake of this landmark decree, Nigeria embarked slowly on the road to deregulation. Indeed, for four years after the promulgation of Decree 72 not a single licence was granted. Rather, vague policy statements appeared periodically regarding the need for incrementalism and guarding against "over hasty" action. However, by the end of 1995 over 700 applications had been screened, and in 1996 the first full licence, for a mobile telephone operator, was approved. By March 1997, an additional 23 licences were released for activities within the entire range of deregulated telecommunications services. NITEL, however, maintains a monopoly over the provision and operation of public switches and trunks and their associated infrastructure, and the provision and operation of international network links. Since becoming operational, the NCC has taken aggressive steps to open the telecommunications sector to private investment and enterprise. In June 1994, the following services were open to private sector participation:

- Customer Premises Equipment (CPE);
- the provision and operation of public payphones;
- the provision and operation of private network links;
- the provision and operation of community telephones for rural areas and industrial parks;
- the provision and operation of value added network services for the banking and airline sectors, including packet-switched networks;
- the repair and maintenance of telecommunications facilities; and
- telephone cabling.

By March 17, 1997, over 250 companies had been licensed by the NCC. The activities for which these companies are applying for are diverse and span the whole communications spectrum. Most of the companies are based in Lagos and each of the companies is licensed to provide one or more of the following services:

- satellite broadcasting;
- high-frequency radio facilities;
- payphone installation and operation;
- the provision of community telecommunications with exchanges;

- provision of value-added network services;
- repair and maintenance of telecommunications facilities;
- cabling; and
- mobile telecommunications services.

In addition, some are licensed to provide private network links and public mobile communications services. As of 1999, to participate in Nigeria's telecommunications sector a company must be either owned by a Nigerian citizen or be registered in Nigeria; this measure is designed to encourage joint ventures between foreign companies and Nigerian companies. The NCC also requires that a licensee submit technical and organisational plans that demonstrate a commitment to sustained service and that the equipment is compatible with the existing infrastructure. Licensees have to pay five per cent of the capital value of the system as a license fee and 2.5 per cent of the turnover as an annual concession fee. Additionally, there is a 2.5 per cent surcharge for special licenses. Since 1997 the policy environment has become more favourable to accelerated deregulation and has shifted to more radical measures.

A second national carrier is expected to be licensed to compete with NITEL by 2001. This duopoly regime will be expected to subsist for a given period, before an open market can be declared. Two international telecommunications carriers, AT&T and the MCI, both of the U.S., and a telecommunications equipment manufacturer, Siemens AG of Germany, have expressed an interest in running the second carrier that the Government hopes to appoint to compete with NITEL. Also mooted is the privatisation of NITEL. While NITEL is a public limited company, it is nevertheless wholly owned by the government. Current indications are that some degree of privatisation of the company can be expected by 2002, when some or all its equity will pass into private hands. There is however, a certain anxiety over the transfer of a public monopoly to a private monopoly (ADCG, 1998).

In the spirit of deregulation, appropriate and cost-effective technology is also being encouraged. For example, wide-scale wireless local loop technology is expected to dominate the expansion of telecommunications, particularly, as regards rural coverage. The European digital standard for mobile cellular telephony, GSM, has been adopted for national coverage. But regional or local mobile cellular services will be permissible

on any standard or technology, whether analogue or digital, European, American or others.

There are also efforts to increase local manufacturing capability in telecommunications equipment. The Government is focusing on achieving a 30 – 50 per cent local manufacture capability in telecommunications equipment such as switches and telephone handsets, in a market conservatively estimated to grow to US\$5 billion, by the year 2005 (ADCG, 1998). The planned public network expansion under NITEL's strategic plan requires a manufacturing base for telecommunications equipment. NITEL's major equipment suppliers will be required to set up assembly plants, as a condition for continued patronage. NITEL has announced its intention to consider joint-venture agreements for local manufacture of telecommunications equipment and spares, and to conclude such arrangements by 1998. More licences are being given for repairs and maintenance and the trend is expected to increase as the local manufacture of telecommunications equipment picks up.

Plans have also been announced to modernise the network. Up till 1989, all the exchanges and transmission facilities were based on analogue technologies. Since then, however, NITEL has begun the digitalisation of the telecommunications network, with the result that over 160,000 digital lines have now been set up. The telecommunications administration decided to adopt digital technology for the national network with a view to improving services for the existing customers as well as meeting new demands. Since then, more than 70% of NITEL's network has been digitalised, and expectations are that the entire network will become fully digital by 2002. Optical fibres are being laid in various parts of the country to boost transmission of data and large volume traffic which will result from expanding the network. These are expected to complement the international gateways in Lagos, Enugu and Kaduna.

Due to financing issues, the implementation of the digitalisation was divided into three phases with the priority areas – mostly multi-exchange areas and the international gateways – being digitalised during the first phase. It was also decided that: Abuja, the nation's new capital, should be made a "digital island," that all existing analogue switches should be gradually phased out, to be replaced at the end of their lifetime by a digital switch; and that all new exchanges would be digital. In addition, all further

telecommunications expansion and development in Nigeria was to be digitalised in order to surmount the problems associated with maintaining the old analogue network and to meet the increasing demand by customers for value added network services. Specific targets include:

- achieving an increase in teledensity from 1 telephone line per 200 people to 1 per 50;
- attaining the goal of universal coverage, "access to anywhere, at any time," global connectivity, with a communications network connected to the international information superhighway; and
- boosting rural telecommunications services. About 70 per cent of Nigerians reside in the rural areas, hence there is the urgent need for the extension of telecommunications facilities to the rural areas in Nigeria. NITEL's strategic plan for the period 1997 – 2010 provides that about 548 local government areas identified as lacking telephone services will be linked using a combination of VSAT and a microwave system to connect small capacity switches to the national network (FMOC, 1997).

**(b) Private sector: phone companies and value added network service suppliers**

The first private company to compete with NITEL was Multi-Links Ltd, a wholly owned Nigerian telephone company. Multi-Links is due for rapid expansion with 50,000 fixed wireless lines planned for 1999 in the commercial capital, Lagos. It plans to eventually expand into the rest of Nigeria. Five private telephone operators have since followed in the wake of Multi-Links, beginning to provide services as of March 1998, strengthening the deregulation of the telecommunications sector which began via Decree 75 of 1992.<sup>118</sup>

In 1999 the government announced a major tax relief and import duty reduction for all telecommunication equipment coming into Nigeria from January, in order to help private telecommunications operators to amortise their investments before paying tax.

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<sup>118</sup> The five companies – Em-International Systems Limited (EMIS), Intercellular Nigeria Limited, Mobitel Limited, Independent Telephone Network and Communications Infrastructure Limited – will among them deploy 45,000 digital lines within Lagos and its environs.

With the new policy on taxation, it is expected that the prices of a telephone line offered by these private companies, which range from N140,000 (US\$1,627) to N182,000 (US\$2,116), will fall. The prices are about 50 per cent above what NITEL charges and about 60 per cent above what the ITU prescribes for Sub-Saharan Africa (ADCG, 1998).

The domestic private sector is also pioneering the deployment of cellular telephony. This service was first introduced in 1992 with the introduction of two mobile cellular services, a national one (NITEL) with about 10,000 subscribers and a Lagos service (MTS) with some 2,500 subscribers. A joint-venture agreement between NITEL and Digital Communication Limited (DCL), an American private company, led to the formation of Mobile Telecommunications Services (MTS) Ltd. In 1994, MTS had a nation-wide monopoly over cellular services, providing an analogue mobile cellular telephone network and some value-added services such as voice mail and pager services from the three switches at Lagos (Lagos and south-west), Enugu (south-east) and Abuja (North). MTS began with a capacity of 10,000 lines, and due to the high level of unmet telecommunications demand, the system was filled to capacity within one year. Subsequently, in February 1994, MTS added an additional 20,000 lines and had plans to add an additional 25, 000 lines. Even with this additional capacity, lines are frequently engaged during periods of network congestion. Nigeria's cellular market is expected to grow at a rate of 25 per cent annually through 1997 (ADCG, 1998). In 1996, over half of the cellular equipment was supplied by U.S. companies; and over half of the equipment purchased was produced by Motorola (ADCG, 1998).

## **8.4.2 Main external actors**

### **(a) Regional and continental actors**

As a member of the Economic Community of West African States (ECOWAS) and the Organisation of African Unity (OAU), Nigeria has been collaborating with the member nations of these organisations to develop telecommunications services at the sub-regional as well as continental levels. The telecommunications project of the Economic Community of West African States is an example of regional collaboration. About 85



per cent completed as of March 1998, the project involves the linking of all capital towns through telephones and telex facilities conceived to improve the telecommunications facilities in African States and enhance trade relations. The project is being funded by the ECOWAS fund with loans from the European Investment Bank. Further collaboration has taken place in the form of meetings among the telecommunications engineers and planners of the various member countries to discuss the technical issues involved in planning, operating, and designing telecommunications systems suitable for use in Africa's environment. The segment of the Pan-African Telecommunications Network (PANAFTEL) linking the eastern part of the continent with the western part passes through Nigeria and uses portions of its domestic network.

#### **(b) Foreign private sector**

Foreign private sector firms are active in the Nigerian telecommunications sector in a number of areas. Firstly, in the provision of telecommunications equipment where there is essentially no local production of equipment. Multinational corporations such as the German company Siemens have been active in the Nigerian telecommunications equipment market for over 20 years and constitute 35 per cent of the market (IBS, 1999). The ongoing upgrade of the public switched network from analogue to digital switching system has seen increasing reliance on foreign manufacturers for equipment and installation expertise. Aside from the provision of equipment, the foreign private sector is increasingly playing an important part in the provision of alternative telecommunications services. Aside from the traditional telecommunications new connectivity options such as satellite links, microwave radio systems and intercontinental submarine cable systems are increasingly offering the potential of cheaper telecommunications capacity. Other submarine cable systems that provide telecommunications facilities to Nigeria include the East African Submarine Cable System which links West Africa to Europe.

### (c) Development agencies

Development agencies continue to play a key role in Nigeria in terms of funding and agenda setting. During the 1990s, the European Union funded various projects in Nigeria, including the Aeronautical Satellite Telecommunications Project, which sought to improve air traffic safety in Central and the West African. However, efforts to source funding from development agencies have been hampered by Nigeria's political instability and status as *pax non grata*. Table 21 reveals the extent to which Nigeria has managed to lose significant funds from development agencies for telecommunications development due to the nature of its governing regime.

**Table 21: Major Development Agency Telecommunications Projects in Nigeria**

Agencies	Target Area	Value
World Bank/IBRD	Lagos	US\$225 million*
OECD/Japanese Government	East	US\$110 million*
EEC	NITEL	ECU 10 million*
Turkish Government	National	US\$125 million
Siemens	North	DM 441 million

Source: ITU Stars Telecommunications database. \*Offers cancelled.

The most high profile example is the World Bank which entered into agreement with NITEL, with the guarantee of the Federal Government of Nigeria, for a loan of over \$225 million for a telecommunications project in 1990. The major objectives of the project were to support the strengthening of the institutional and policy framework, facilitate commercialisation of NITEL and improve the access to and quality of telecommunications services. In 1993, a European Community grant of 10 million ECU was negotiated for manpower development and training in support of the commercialisation programme of NITEL Plc. Both projects were cancelled in the wake of political sanctions against Nigeria, following the annulled 1993 national elections which would have handed power to a civilian regime. In a similar vein the Japanese Overseas Economic Cooperation Fund's loan package for the provision of 63,800 digital lines at a cost of US\$110 million was also withdrawn. However, the new

civilian regime installed in May 1999, and is likely to be more amenable to the donor community.

## **8.5 Needs assessment**

According to the review of the telecommunications sector above it would appear that the main priorities for improving the telecommunications sector in Nigeria are:

- the reform and accelerated deregulation of the telecommunications sector to increase operational efficiency;
- extension of services to rural areas;
- investment in new value-added services; and
- a clear and consistent telecommunications policy.

The direction of current Nigerian telecommunications policy broadly mirrors the first three of these criteria, namely: the reform and deregulation of the sector, the digitalisation of current networks and a planned extension to rural areas. However, there is concern as to the commitment of the government to these objectives. The government has yet to announce operationally feasible plans for investing in value added services and establishing standards of interoperability. Nor has attention been paid to upgrading indigenous skills in the technical and operational management of domestic telecommunications services. Rather, Nigeria, in common with its developing counterparts in Africa, seems content to allow external actors to bring efficiency to the communications process.

Despite this policy shortfall, there are considerable opportunities for private sector investment in Nigeria's telecommunications sector. Hence, the main focus of government is to deregulate the sector and allow competition, since the existing infrastructure cannot satisfy demand. It is estimated that Nigeria needs US\$6 billion to improve its telecommunications network and is seeking foreign investment to help achieve this (ADCG, 1998). Apart from the initial US\$6 billion investment, it is estimated that Nigeria would also require US\$600 million annually for network expansion resulting in, it is envisaged, eight million lines in Nigeria by 2010 (EIU,

1997b). With such ambitious goals, it is quite obvious that NITEL would not be in a position to finance these ambitious objectives alone. The investment is expected to come largely from the following: corporate consumers/customers of telecommunications services, such as the oil-producing companies and the banks, new private telecommunications operators (PTOs), end-users, and NITEL itself. In addition financial assistance is being sought from multilateral development agencies.

However, the reform process has been fraught with difficulties. Whilst nescient observers have argued that the government has been stalling the process, in reality, for Nigeria, and for the majority of developing countries, such deregulation must be a carefully managed process. Foreign investors are not queuing up to put their money into Nigeria, which has won a reputation for bureaucracy, corruption and crime. In order to overcome this risk aversion, the temptation is to offer far too large a slice of the national pie to international telecommunications companies. One can take the extraction of petroleum as an apt parallel to what may happen in the telecommunications sector. Nigeria's lucrative petroleum resources are extracted offshore by multinational corporations, so powerful that they are seen by many as quasi-governmental (Garba, 1995). Whilst the profit from the sale of oil accounts for 95 per cent of GDP, the communities in the midst of these explorations are some of the most underdeveloped in the country. In reality offshore multinational oil companies have no stake in the developmental goals of countries, and are purely concerned with profit maximisation followed by swift and total profit repatriation. Thus an element of caution is necessary if Nigeria is to maximise its share of the benefits arising from deregulation. To paraphrase Thomas Jefferson, the price of liberalisation is eternal vigilance. This is especially applicable to Nigeria, where successive ruling juntas have been content to seek personal enrichment from multinational operations at the expense of long-term national development.

In November 1999, the new Nigerian civilian government announced its preliminary ideas on the development of the telecommunications sector. Firstly, the incoming government disowned all the licences for telecommunications services granted by the previous administration. Secondly, it asserted the importance of maintaining NITEL's public monopoly on data and international traffic, effectively banning private competitors from offering international services for the foreseeable future. As part of

the new policy, the Nigerian government announced that it was opening up the bid process for six licences to provide GSM mobile services on a national basis. Each bidder had to post a bond of US\$100 million, in order to qualify for the bid process. However, despite receiving 17 bids from local and foreign consortia, the government cancelled the bid process in March 2000 and announced that the whole process was to be delayed and handled by the World Bank. Such policy inconsistency and procrastination serves only to discourage foreign investment in the sector and does not bode well for further deregulation.

### **8.6 Information technology in Nigeria**

Information technology was first introduced into Nigeria in 1960 by the Federal Census Office of Nigeria in order to analyse the 1962/3 census data. In the following 10 years the total number of computers remained under 30, with six of these belonging to multinational corporations. Despite growing interest from educational establishments and public companies, up to 1977 there were only three suppliers. These were, respectively, ICL, IBM and NCR; all three were local subsidiaries of overseas computer manufacturers dealing almost entirely with mainframes and mini-computers. Government policy in this area was, unsurprisingly, non-existent. The extent of domestic usage of information technology was minimal and information technology as a whole had made little impact on the continent. The information technology industry's first brush with public policy came in the wake of the 1977 indigenisation decree. Designed as a populist measure and born of the radicalism of the time, its goal was to return certain industrial activities to local control, or at least increase the participation of Nigerians in industrial activity (Nwachuku, 1992).

One of the activities deemed ripe for indigenisation was the fledgling information technology industry which, at the time, was composed entirely of foreign corporations. Rather than comply with the strictures of the decree IBM decided to divest itself of its operations in Nigeria. The decree had two other important effects: firstly, it led to an increase in the level of indigenous suppliers of information technology equipment. Secondly, the sudden emergence of domestic retail rivals to traditionally captive markets led to more aggressive marketing and competition amongst suppliers

(Nwachuku, 1992). Consequently the number of computer installations in the country rose dramatically. At the same time the discovery of oil led to massive expenditure on public sector services, and with it came a headlong and disorganised rush to modernise. The first real attempt to measure the extent of information technology in Nigeria began in the 1980s. In 1983 the first edition of the *Nigerian Computer Users' Directory*<sup>119</sup> (NCUD) was published. Table 22 shows data from this and subsequent editions. The figures published by the NCUD also reveal the extent to which these installations were concentrated in the then capital, with Lagos accounting for 72 percent of the total.

**Table 22: Growth of industrial computer installations since 1977<sup>120</sup>**

Year	Total no. of Installations	Industrial installations	
		No.	As % of total
1977	115	20	17.4
1980	235	45	19.1
1983	390	80	20.5
1985	496	110	22.2
1988	754	177	23.5

Source: NCUD Directory 1988<sup>121</sup>

(a) Size and composition of market

Current official statistics of the size of the installed computer base in Nigeria, whilst showing growing demand, fail to reflect the burgeoning demand for computers. Table 22 reveals that whilst some statistics of the number of computer installations nationwide do exist no recent empirical survey has been conducted. The most recent government research, conducted by the Nigerian Communications Commission (NCC), claimed that there were about 400,000 computers in use in Nigeria (NCC, 1996).

<sup>119</sup> Ogis and Ododo Assoc. Ltd. (1983) *The Nigerian Computer Users' Directory*, Lagos, Nigeria.

<sup>120</sup> Despite the limited number of computer installation per year the annual was published sporadically and thus the table lists available statistics.

<sup>121</sup> Ogis and Ododo Assoc. Ltd. (1988) *The Nigerian Computer Users' Directory*, Lagos, Nigeria.

Industry experts and market analysts, on the other hand, estimate that the population of computers in Nigeria lies somewhere between 600,000 and one million (ADCG, 1998; IBS, 1998).

In the event these estimates are likely to be understated as, since 1998, there has been a surge in the demand and importation of computers. Accurate statistics of imports do not exist largely because of the rent-seeking behaviour of officials at points of entry. Many importers do not submit accurate import data to inspection agents and tax officials, in order to cut costs. In fact, market analysts estimate that over 60 per cent of computer hardware and peripherals imported into the country are not declared in import statistics at the point of entry (Agu, 1997). Many circumnavigate the prohibitive bribes that must be paid to pass items through customs, by transporting computer hardware and peripherals imported from the U.S. as accompanying passenger baggage on international flights. Market analysts estimate that large numbers of Nigerian resellers and distributors are importing a total of between US\$800,000 and US\$1 million a year (IBS, 1999). However, the consensus is that the total population of computers in Nigeria lies between 600,000 and one million and the annual growth rate is projected to remain high (over 25 per cent) over the next five to 10 years (Agu, 1997).

Nigeria is almost totally reliant on foreign manufacturers for supplies of information technology. Over 80 per cent of computer hardware and peripherals sold in Nigeria is made by U.S. firms or U.S.-licensed firms located around the world, but much of the imports reported in Nigeria's official statistics of imports come from Europe, mainly the United Kingdom and France (NCC, 1996). Imports from the Far East have grown significantly since 1996, as Asian firms expand their total share of this market sub-sector, drawing on the goodwill and dominance they enjoy in Nigeria's consumer electronics market. Major U.S. brand names marketed in Nigeria include IBM, Compaq, Dell, Lucent, AT&T, Hewlett Packard, Digital, APC, Unisys, Apple, Gateway 2000, Texas Instruments and Sun.

Imports from East Asia and Europe account for most of the local assembly of computer clones in Nigeria, especially those being used by most small and medium sized enterprises and home offices. Fierce competition resulting from the influx of computer clones, mostly from Asia, is an important feature of the market. Imports from Asia

consequently are challenging the continued U.S. dominance of this huge market, which serves as a gateway to several smaller markets in West and Central Africa. Price is the most competitive factor in this market. Asian firms supplying IBM compatible clones have learned to cash in on this critical selling factor, especially where individual end-users and private commercial establishments are concerned. Recently, market reports indicate that IBM compatible clones assembled locally have been used to implement even major orders from government establishments (IBS, 1999). With regards to software there is very little locally produced software available. The majority of software is still purchased from abroad and adapted to the domestic environment. Software piracy is rife with some estimating piracy rates of up to 98 per cent (IBS, 1994).

#### (b) End-user profiles

Previously a preserve of multinational corporations and a wealthy minority, information technology in Nigeria is becoming more commonplace in most medium to large enterprises (IBS, 1999). During the 1980s the majority of computers in industry were used for financial accounting and payroll processing (Nwachuku, 1992). In this respect the financial sector plays an important role in terms of its employment of cutting edge technologies. It remains the most intensive user of information technology in Nigeria, followed closely by the oil industry. These two sectors have an intense need for state-of-the-art information technology to enhance their growing operations and are expected to buy much of Nigeria's imports of computer hardware and peripherals over the next few years.

A new generation of banks have brought with them a keen desire to keep abreast of the latest technologies, spawning several new banking services and products. Rather than relying on outdated erstwhile technologies the banking sector is blazing the trail in the utilisation of cutting-edge technologies. Apart from accessing one's account from any branch nationwide, certain customers in 1999 could access their accounts directly through their own computers in their offices. Electronic savings cards also enable customers with accounts to get service from any branch of the banks. Diamond Bank introduced the "PayCard" in 1999, an electronic purse that enables customers to carry large sums encoded in the card, with several others banks planning similar services. It



was announced in 1998 that an Irish smart card software company, Card Services International (CSI), in partnership with IBM, was to supply the technology for a multibank smart card payment scheme in Nigeria. The £1.48 million contract is to provide application software, smart cards and point-of-sale devices for a national electronic purse smart card scheme awarded by Smart Card Nigeria (SNP), a consortium of 19 banks. The first phase of the contract began in the summer of 1998 reaching 22,000 cardholders and 200 merchants representing the largest multibank smart card payments project in Africa to date (Lyons, 1998).

New private commercial establishments, universities, colleges and computer schools are also prominent end-users of computer hardware and peripherals. For these groups, price is the key purchase factor, and they tend to use less expensive, locally assembled IBM compatible clones. Nigeria's government ministries and agencies are beginning to computerise some of their activities. Most of these establishments operate on a tight budget and buy most of their supplies through a ministerial tender board (IBS, 1999).

### (c) Demand for information technology

Growing awareness and interest in electronic commerce, plus the urge for better information management, are fuelling demand for information technology products in Nigeria. This in turn is generating demand for computer hardware and peripherals. The Nigerian government is also urging its ministries and agencies, including educational institutions, to computerise their operations and also to introduce computer appreciation and data management courses in their training curricula (Agu, 1997). This demand is reflected in the growing interest in computer training and applications across Nigeria. Even government establishments are computerising their activities despite tight budgets and bureaucratic bottlenecks. There are a burgeoning number of computer training schools springing up seemingly daily, especially in Lagos and oil producing areas such as Port Harcourt and Warri Town, and in the capital city of Abuja.

#### (d) Standards

Computer hardware and peripherals imported into Nigeria are expected to conform with internationally acceptable standards. However, market analysts and vendors confirm that neither the Standard Organisation of Nigeria (SON), the Computer Firms Registration Counsel of Nigeria, the Computer Association of Nigeria (COAN) nor the Computer Vendors Association of Nigeria (COVAN) have been able to ensure that Nigerian imports comply with internationally acceptable standards (Agu, 1997).

#### (e) The computer manufacturing and service industry

A significant number of computer vendors and distributors have begun or are beginning local assembly of computer systems using casings manufactured locally or imported mainly from Asia, and IBM compatible components such as mother boards, microchips and power units, originating from Asia (IBS, 1999). Though Nigeria does not as yet have the requisite infrastructure to manufacture such high precision components, this sector can be developed via distribution arrangements that recognise and tap into local talents and the enterprising spirit of the Nigerian private sector. This business philosophy seems to be the bedrock of the marketing strategies that most Asian suppliers to this market are adopting. In dealing with local distributors and value-added resellers, Asian suppliers have encouraged the local private sector to embark on local assembly of computer systems using less expensive IBM-compatible clones and peripherals imported mostly from East Asia (NAN, 1998).

The economic boom in Nigeria in the early 1980s saw a dramatic increase in the number of PC users and a concomitant rise in the number of firms offering computer-related services. The industry is still, however, plagued by unreliable maintenance services. Even where service facilities exist, replacement parts are often unavailable or prohibitively expensive. The quantity and range of spare parts are often insufficient and waiting times for imported spare parts are notoriously lengthy (IBS, 1999). There are no official statistics to determine the volume and spread of local assembly across the country. Additionally, COVAN has begun training and certification programs for members wishing to become industry specialists. Service support is playing a more

significant role in selling computer hardware and peripherals in Nigeria. Service support denote a number of after-sales services. Namely training for end-users, availability of spare parts at competitive prices, repair services and replacement of faulty equipment and training resellers, distributor sales and engineering staff. Major distributors organise training workshops and seminars for their valued customers and prospective clients. Most of these firms focus on their engineering and service support capabilities, product performance, cost-benefit analysis and free professional services such as systems analysis and recommendation (Agu, 1997).

### **8.6.1 The Internet and networking in Nigeria**

The growth in networking has been hindered by Nigeria's poor telecommunications network. The very limited telephone network means that only four or five cities have international direct dialling, thus limiting usage to the main urban centres. In addition, those Internet service providers that are available remain prohibitively expensive. For example, in 1999, InfoWeb, a Nigerian ISP, charged US\$25 for connection and then 50 cents per minute and US\$1 to send electronic mail per addressee. While these prices may appear reasonable relative to global rates they are out of reach for the average Nigerian. Through funding by various development agencies the majority of universities have radio links and rely on telex at a minimum, with four having full Internet access. There are about 30 universities and 25 colleges in Nigeria, of which 20 have large computing facilities. Table 23 overleaf reveals that there were, as of August 1999, a significant number of ISPs operating in Nigeria. However, the diffusion of ISPs has been limited by the reluctance of NITEL to provide local ISPs with leased line access to international gateways. As a result all ISPs are forced to connect to the international gateway via the PSTN and thus incur large telecommunications fees in so doing.

**Table 23: Internet service providers (ISP's) in Nigeria**

<b>Internet Service Providers in Nigeria, March 1998</b>		
<b>Name of ISP</b>	<b>Country of Origin</b>	<b>Location</b>
Centel	Nigeria	Lagos
Dimensions Systems Technology	Nigeria	Lagos
Global Access	Nigeria	Lagos
Infoweb Organisation	Nigeria	Lagos
Linkserve Communications Ltd	Nigeria	Lagos
ONATEL	Netherlands	Lagos
Ross Clayton Ltd.	Nigeria	Lagos
Solutions Online Inc.	Nigeria	Kano
Stork Ltd	Nigeria	Lagos
Teleglobe	UK	Lagos
Vanrem Enterprises Corporation	Nigeria	Lagos

*Source:* www.ripe.org. Accessed March 1998

### **8.6.2 Human resources in the information technology sector**

In Nigeria information technology training began with the foundation of the IBM African Education Training Centre at the University of Ibadan in 1963. This centre was established to train local technicians in operating procedures and basic maintenance of IBM computers (Nwachuku, 1992). The first full degree programme in computer science began in 1971 at the University of Ife. Since that period computer science has become firmly established as an academic discipline in almost all of the major universities. There are now over 400 computer science programmes on offer at educational establishments in Nigeria, including computer engineering courses at four universities. With the 1998 National Universities Commission (NUC) minimum standards decree, all university students are required to attend a computer science course during their first year of university. In addition the commission has been supporting efforts at curricula development, via newly established computer science programmes at the undergraduate and postgraduate levels. The computer literacy programme is designed to establish a computer culture that permeates all activities at

university level, producing a general level of computer literacy in all graduates irrespective of discipline.

In conjunction with these university level initiatives the National Board for Technical Education (NBTE) has responsibility for ensuring standards of education in polytechnics and technical colleges, and also in coordination the development, management, and funding. Within this framework the NBTE has had an important role to play in the introduction of computer education in the institutions under its jurisdiction. It has been responsible for integrating the curriculum for computer literacy at the secondary and tertiary levels, into the programmes of polytechnics and technical colleges nationwide and developing syllabuses for a higher national diploma. Under the guidance of NBTE, polytechnics have been utilising information technology to fulfil a number of important roles, such as the training of technicians in hardware maintenance and software design and adaptation and providing courses in software design. Computer courses are also increasingly being catered for by private companies. These companies are filling an important demand for computer education. Unfortunately they are hampered by a lack of hardware and software resources (Olamiji, 1999). Although there would seem to be a wealth of training facilities, there is a greater need for the provision of training courses targeted at developing applications more specific to Nigeria.

### **8.6.3 Constraints to information technology diffusion**

- **Lack of adequately trained staff**

The low levels of qualified or skilled computer specialists means that most employees in firms and government departments are typically engaged only in routine data processing tasks using accounting packages that may have been modified and are maintained in-house. In such an environment, there is little time or encouragement to engage in original software development aimed at extending or intensifying the degree of computerisation. The problems facing data processing departments are, according to Nwachuku (1992): low status; lack of management support; poor staffing levels; and lack of cooperation bordering on outright hostility from departments "in danger" of

computerisation'. As a result, there exists a severe underutilisation of computing equipment as well as low productivity amongst staff.

- **Infrastructural Deficiencies**

The most acute problem arises from the erratic provision of electricity in Nigeria. Though there has been no attempt to quantify the impact of this on information technology users, one can intuitively sense that the additional requirement of private generation of electricity acts as a serious financial deterrent to wider information technology diffusion. The Nigeria Electricity Power Authority (NEPA) does not publish official statistics on the reliability of their power supply; however, during the author's most recent visit to Nigeria in July 1999, over a three-week period there were on average five power cuts per day, each lasting up to an hour. Consequently, generators are obligatory for anyone wishing to use a computer for a significant length of time. This evidently raises the cost of computer ownership and acts as a deterrent to potential purchasers. It has been estimated that it would take US\$15 billion to bring reliable power to 85 per cent of the population by 2010, thus it is unlikely that the government can fund such a huge investment without recourse to private investment.<sup>122</sup>

- **Macroeconomic environment**

The economic crisis in Nigeria over the period 1990-1999 has caused real wages to fall significantly. This deterioration in the official value of the currency has seriously undermined consumer purchasing power. As a result, consumers have had to rationalise their demand for many products. The situation has kept Nigerian manufacturing capacities underused by 32.5 per cent in 1996 (EIU, 1998).

## **8.7 Main actors in the information technology sector**

Table 24 overleaf shows that there a variety of actors participating and determining the development of the information technology sector in Nigeria. These actors can be

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<sup>122</sup> Wallis, W. "Crisis prompts direct control", Nigeria FT Survey, *Financial Times*, 30 March 2000, p. 6.

divided into internal, indigenous actors of which the government and the private sector are the biggest players, and external actors such the foreign private sector and development agencies.

**Table 24: The main actors, internal and external, in the Nigerian IT sector**

<b>Actor</b>	<b>Sphere of influence</b>	<b>Level of influence</b>
<b>Internal</b>		
Government	Policy, tariffs, end user	High
Domestic private sector	Supply, maintenance and training	High
Banking/Oil industry	Significant source of demand, use of latest technologies	Low
<b>External</b>		
Development agencies	Networking infrastructure, agenda setting, training	High
Foreign private sector	Supply of hardware and software, training	Medium

**(a) The Nigerian government**

The first attempts to coordinate information technology in Nigeria began in the late 1970s when the Central Computer Committee (CCC) was instituted with the aim of assembling available national data on computing. The main objective of the committee was the development of standards for users, retailers and consultants on computer projects. The committee was also charged with laying the groundwork for a national policy on information technology. The most direct influence the committee had was over the reviewing of all applications for the importation of computers and making recommendations to the Ministry of Finance for the approval of licences. It was not, however, designed to address issues of planning and policy. In fact, as soon as the initial import and regulatory measures were abandoned the CCC ceased to function actively.

Though, the majority of countries in Sub-Saharan Africa are characterised by the absence of an explicit strategy towards the information technology sector (Okut-Uma, 1991), the sector in Nigeria continues to suffer from implicit policies that discriminate against it. Such policies include government procurement agencies, import restrictions or tariffs on the purchase of computers, and bureaucratic and lengthy import procedures. The government has also been guilty of policy inconsistency towards the IT sector. For example, in April 1996 it reviewed its import guidelines and decided to subject all imports regardless of value to pre-shipment inspection at the point of export; with the importer bearing the inspection cost. Nevertheless, two years later the 1998 budget abolished pre-shipment inspection for imports originating from most Asian countries, Great Britain, the United Arab Emirates and Africa. Further, the Nigerian government promised to phase out pre-shipment inspection for imports from other countries including the U.S. before the end of 1998, but as of October 1999 this procedure was still in place (Agu, 1997).

Overall public policy in Nigeria towards information technology has been negative, with the maintenance of unfavourable tariff regimes and a few *ad hoc* government initiatives. For example, in an effort to boost local initiatives and private sector efforts toward local production of computer and electronic equipment, the Nigerian government established the National Committee on Acquisition of Computer and Electronics Technology (NACACET) in 1997. By 1998 the committee, which consisted of representatives from the government and private sector, had yet to achieve any recognisable objectives and was in fact disbanded in 1999.

In response to the stagnation of the Nigerian economy and in an attempt to prepare the country for a new era of global competition the Nigerian government convened a committee of experts in the summer of 1997 to articulate a definitive statement of policy intent which would articulate a policy blueprint to reposition Nigeria by 2010<sup>123</sup>. The so called "Vision 2010" committee consisted of 172 "experts" drawn from a collection of career politicians, retired military officers, businesspeople, technocrats and economists. However, this very public policy exercise was fraught with difficulties. Ernest Shonekan, committee chairman admitted in 1998, at the inception of the

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<sup>123</sup> "Nigeria announces set up of Vision 2010 Committee", *Reuters*, 12 April 1997.



exercise, that Nigeria's Vision 2010 policy blueprint was "too complex" for immediate clarification. "One cannot at this stage delineate the scope of the assignment," said Shonekan.<sup>124</sup> Moreover, even if the absence of clarity and the problems of working with such an unwieldy body were overcome, there were serious doubts as to how Vision 2010 could be achieved in the atmosphere of political instability that continued to plague the nation. Shonekan acknowledged that "without political stability, meaningful planning will continue to be frustrated".<sup>125</sup> In reality, the average Nigerian knew too little about the government's Vision 2010 project. The "Vision 2010" Committee failed to provide any substantial insight as to how Nigeria could utilise information and communication technologies for its development goals. The only objective mentioned by the committee was to attain the goal of universal coverage, "access to anywhere, at any time," global connectivity, with a communications network connected to the international information superhighway.<sup>126</sup> In the end the committee failed to produce a clearly articulated long-term policy document and what recommendations it did produce were pointedly ignored by the incoming civilian administration of Olesgun Obasanjo in May 1999.

There is thus general scepticism over the ability of Nigerian government's to draft long-term policy plans that will be adhered to by successive regimes. There have been at least five development plans since independence from Britain in 1960, all detailing grandiose schemes to revitalise the economy. Not only did these plans fail to lead Nigerians to the promised land of economic, social, and political advancement, but those that were implemented suffered from mismanagement. According to a UNDP (1993) report on development in Sub-Saharan Africa, none of the high-flown intentions of the Nigerian government could change the fact that Nigerians are at present worse off than they were at the time of independence in 1960. The report noted the reasons for the malaise as:

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<sup>124</sup> Ibid.

<sup>125</sup> Ibid.

<sup>126</sup> NAN (1997) "People Have Little Faith in Vision 2010 Plan", *Inter Press Service*, 6 September, Lagos.

...local managerial incompetence, failure to translate policies into projects, bribery and fraud, external intervention with particularly devastating social effects of externally inspired, and other incoherent policies of reform.

(UNDP, 1996, p. 43)

Despite the lack of an explicit policy on information technology, the Nigerian government plays a key role as the biggest user of information technology. Government procurement departments still represent by far the largest market for local computer vendors. At the same time the increasing drive to computerise government offices provides key exposure for a significant section of the population. With the transition to civilian regime in May 1999, there have been renewed hopes of a more coordinated policy response to improving the climate for information technology growth in Nigeria. However, information technology continues to suffer from weak public policy in this area. Despite the absence of clear direction from government, the domestic private sector are doing their utmost to fulfil the burgeoning demand for computing.

#### **(b) Private sector**

The over preponderance of foreign suppliers in the information technology market in Nigeria leads to a vestigial role for the domestic computer manufacturing industry. Though local assembly of computers is increasing and local software houses are becoming more and more commonplace, most companies still import off-the-shelf hardware and software from abroad. In contrast to the paucity of advanced computing in the public sector, the private sector is busily computerising operations. With the streamlining of import procedures and the fall in the price of computing it is envisaged that the private sector will become an increasingly important actor in the drive for information infrastructure.

#### **(c) The development agencies**

The development agencies have largely been responsible for raising awareness of value added service such as the Internet in Nigeria and funding a number of significant initiatives to improve the networking capacities in the country. For example, the UNDP

is contributing US\$500,000 to upgrading the Internet capacity of NITEL during the period 1998-2000.

## **8.8 Needs assessment**

The above review of the existing capabilities of Nigeria in information technology reveals an industry increasingly left to develop on its own. The reduction of government intervention in the importation of computers is welcome but the lack of concrete proposals in such key areas as education does not bode well for long-term information infrastructure development. The Nigerian government is doing little to create domestic capabilities in this field. A well-designed national information infrastructure policy should address the weaknesses identified above. In the short-term government should firstly undertake a thorough and holistic appraisal of existing capabilities as outlined above. The feedback received from this exercise is crucial in pinpointing areas of weakness on which public policy should be focussed. This identification of current and long-term needs will hopefully avoid the tendency towards *ad hoc* public policy-making. The second stage is the identification of a suitable strategy to facilitate the achievement of objectives.

## **8.9 Summary**

The country case study above revealed that the diffusion of information infrastructure in Nigeria continues to be hampered by lack of an effective public policy strategy. In the telecommunications sector, as of 1999, there are still no firm plans to fully deregulate the provision of public telecommunications. As a result value added services, such as Internet provision, remain a niche phenomenon and out of reach for the vast majority of Nigerians. In an era of rapid technological change Nigerians still find themselves saddled with an inefficient public telecommunications network that functions sporadically at best, and continues to serve only a small section of the population. Without the deregulation of the sector it is unlikely that Nigerian's will be able to leverage the gains that can be wrought from the information economy.

This chapter also investigated the extent of information technology diffusion in Nigeria. The level of computerisation of government and the general extent of IT diffusion in the country remains low. This was found to be due to a combination of the ongoing macroeconomic crisis and lack of public policy in the area. There is, however, clear evidence of burgeoning demand for IT products despite high government tariffs and the unreliability of key related industries such as electricity provision. Though the indigenous production of IT products continues on a tiny scale, the private sector is increasingly satisfying demand through local production. The level of sophistication of information technology use is being spurred on by Nigeria's off-shore oil industry and banking sectors which continue to be most intensive users of advanced communications.

Government policy towards both sectors remains negligible and consistently negative. One of the biggest hurdles to national information infrastructure planning has been the endemic political and economic instability in the country. Despite the 1999 change to a civilian regime the present government continues to exhibit the tell tale signs of procrastination and policy inconsistency that has become a trademark of successive Nigerian regimes. A year after the swearing in of a new regime there is still an absence of any clear statement on a coordinated strategy for information infrastructure development. Moreover, should the current civilian regime fall it is likely that, as is the norm, any such policy would be swiftly disowned. This chapter has provided an in-depth analysis of the information infrastructure in Nigeria in terms of the telecommunications and information technology sectors. It has provided a review of existing capabilities, identified short-term needs, and pointed to a strategy to achieve longer-term objectives. The primary need for Nigeria in the area of information infrastructure development is for long-term coordinated and consistent national public policy in this area.

## **CHAPTER 9**

### **Policy Recommendations**

#### **9.1 Introduction**

This chapter builds on the foundation provided by the earlier research and applies the conceptual framework articulated in Chapter Three to arrive at policy recommendations for information infrastructure development throughout Sub-Saharan Africa region. It is argued that the best approach to meeting the challenges to Africa of globalisation and the information economy is strategic planning and implementation that involves public, private and voluntary sector participation and partnerships, at national, regional and international levels. The case studies of Ethiopia and Nigeria presented respectively in Chapters Seven and Eight and the general survey of the information infrastructure development in Sub-Saharan Africa region reveal that the key challenges include:

1. The stagnation of the Sub-Saharan African economy and the continuing challenges faced by countries struggling to meet basic needs.
2. The lack of an effective installed base of information and communications infrastructure capabilities in both the physical and human dimensions.
3. Political instability and the lack of good governance that has restricted the growth of the private sector and led to sub-optimal returns on public policy.

These unique challenges have made the development of information infrastructure in the region all the more difficult for African policy-makers. These challenges call for a multilevel strategic framework for information infrastructure development.

#### **9.2 National information infrastructure planning at the national level**

Strategic planning and implementation to confront these challenges has to begin at the national level. There are critical roles for both internal and external actors to play in this

complex process. Key actors such as the development agencies and the foreign and indigenous private sector must be at the heart of this process as their exclusion will only hinder the development of an effective vision and national plan that will meet the needs and objectives of all relevant parties. Within a national information infrastructure framework, government acts as the supplier, user and regulator of information infrastructure. But there is an explicit recognition of its role as a coordinator of disparate resources, ranging from the indigenous private sector to the international governance regime.

The conceptual framework outlined in Chapter Three details a multilevel strategic framework for information infrastructure development, which has at its core the role of government. This sequential and multidimensional matrix begins with an acknowledgement of the importance of information infrastructure for supporting national development. It is only with the advent of such value-added services as the Internet and the ubiquity of information technology that African policy-makers and their industrialised country counterparts have begun to devote the requisite resources to assessing the impact of these technologies. This belated realisation has emerged in response to a number of factors, namely: the sensitisation efforts of development agencies, the global supply push of the foreign private sector and the general consensus emerging from the media that Africa is increasingly being left behind (Castells, 1997b). This realisation is, however, necessary but not sufficient. Whilst few African policy-makers would decry the importance of information infrastructure, at this critical juncture African policy-makers must move beyond the simple acknowledgement of the issue to active and constructive engagement.

### **9.2.1 Getting the right team in place**

Research in developed and developing countries supports the thesis that successful information infrastructure development is to an extent contingent on the existence of "champions". David Runge (1985) observes that in 83 per cent of the information systems deployments studied, a particular individual was deemed to have played a vital role in the implementation process. The role of the product champion was most often considered the single most important enabling factor in determining the outcome of systems deployment. Extrapolating this concept to national information systems

deployment, a number of authors have highlighted the importance of a "champion" in developing countries as the *sine qua non* of the successful deployment and application of information systems (Liebenau and Harindranath, 1997; Odedra, 1993; Madon, 1993). In the light of this research it is imperative that any proposed committee reports directly to the highest office in the land be it the office of the Prime Minister or the Vice President or the President in order to ensure that their recommendations are enforced. In African politics there is often only a thin distinction between those who design policy and those that make decisions. It is imperative that the institutional mechanism created for the coordination of information infrastructure development activities has the ability to implement the policies it designs.

Information technology is often misperceived on the African context as a destroyer of jobs and a facilitator of the control mechanism (Obijiofor, 1998). For example, the introduction of an information technology-based resource management system is likely to lead to a reduction in the opportunities for rent-seeking. The Sub-Saharan Africa context, which is characterised almost without fail by a top-down, risk averse bureaucratic culture, necessitates a champion or a number of champions who have the power to force through reforms which may well prove unpopular in the short-term. The ability of developing countries such as Malaysia, China and Singapore to achieve widely acknowledged ICT-related success can be credited to the importance placed on technology by the ruling elite. Sisodia (1992) argues, for example, that Singapore's pre-eminent position as the most advanced national information infrastructure is the apotheosis of the importance of technology champions assuming an instrumental position in shaping and managing the environment. To initiate and sustain such a reform in the face of social ostracism requires uncommon dedication. Prospective champions must be committed to the reform process and have sufficient political connections to insulate the implementation of information infrastructure projects. It is imperative that there is consistent and persistent advocacy of information infrastructure issues throughout the upper echelons of power and that this advocacy be insulated from the political instability that is so common in Sub-Saharan Africa.

Thus the initial steps in the first critical stage in the information infrastructure development process are: a recognition of the challenges emerging from a shift to a new technoeconomic paradigm, the emergence of an information infrastructure

champion(s), and the identification and mobilisation of the requisite human resources and stakeholders that will comprise the key decision-makers in the strategy formulation process. Many commentators have pointed to the lack of efficacy that characterises the African policy-making process. Highlighting in particular the inexperience of decision-makers and role of patronage and cronyism in dictating political appointments (Adam and O'Connell, 1998). It is vital that the process of "getting the right team in place" is based on merit rather than political expediency. It may be beneficial to employ an advisory committee of experts whose designated role would be to aid in policy implementation by ensuring effective coordination in all sectors concerned. This committee should represent a broad coalition of stakeholders who rather than just representing the various interests in society must be knowledgeable enough to understand the economic and technological intricacies of information infrastructure development.

This national committee should have the following broad missions and functions:

- designing and coordinating information infrastructure policy;
- designing and coordinating information infrastructure vision-setting;
- developing information infrastructure strategic thinking within the country by organising sensitisation seminars and identifying objectives in all sectors;
- supporting the promotion of information and communication technologies in all sectors of the economy;
- setting the rules for competition in the information and communication technology market;
- refining the regulatory and ethical framework at the national level;
- defining and implementing a coordinating mechanism for all ICT-related projects in public institutions and playing a harmonising role for their development in the private sector;
- developing a mechanism for periodical technological review and information about new technologies;
- serving as an interface for donors and external parties interested in investing in the domestic infrastructure; and
- developing strategies for proper cooperation and coordination between private and



public sectors, for continued, harmonious and secure ICT development.

### **9.2.2 Surveying the existing national information infrastructure and needs assessment**

The next important stage in the information infrastructure development process is the assessment of the existing information infrastructure and national needs. The key step at this stage should be the development of an inventory of the elements of information infrastructure within the country. These can be classified as infrastructure: the physical infrastructure comprising key elements such as the telecommunications and information technology sectors, and human resources, applications and content, and finally the macro environment.

The role of assessment will be to identify the various policies, both explicit and implicit, and associated policy instruments, which influence the use of information and communication technologies within the national context. This inventory needs to be highly selective and yet provide an economy-wide view. It must include data for each area, agencies responsible for implementation, budget and staff resources, sources of funding, main stakeholders and their representatives, current schedule and budget status, critical success factors, main constraints and problems encountered, and suggested inputs or policy support for successful completion.

For telecommunications infrastructure, the assessment criteria should include target population; type of services (basic telephony, and value-added services); service standards; broad institutional set-up (ownership, and regulation); likely investment needed; and prospective financing strategies. Data collection must extend above and beyond the mere quantification of telecommunications lines, to more useful indicators such as line location, how they are being utilised and by whom. Progress measures should move from internationally proposed benchmarks, toward national benchmarks defined by internally generated criteria. This empirical exercise is designed to furnish the coordinators of information infrastructure policy with critical data on the affordability, reliability, sustainability, and quality of existing services. Data analysis will then allow for the formulation of a strategic policy response that prioritises

national needs. For strategic information systems, the definition should include a broad description of each system, investment cost, and financing strategy. This assessment will lead to an identification of the key areas for national applications deployment in areas such as trade facilitation, business and property registration, payment clearing and settlement systems.

For human resource development this stocktaking exercise should also include an assessment of the knowledge and skill gaps that threaten successful implementation of the information infrastructure development strategy. To devise and recommend the creation of institutional structures and procedures for the continuous and effective formulation and assessment of national information infrastructure policies. There is also a need to assess the level of indigenous knowledge and skills required in the workforce to implement the national information infrastructure (NII) strategy and formulation of related education policies and institutional reforms. An NII requires researchers and technicians in the spectrum of information technologies, a workforce skilled in the use of these technologies, and a general population capable of operating electronic appliances and computers and able to consume information products intelligently. Appropriate education and training policies and institutions need to be proposed to develop these human resources.

### **9.2.3 Creating a vision**

The next logical stage after examining the existing information infrastructure and assessing national needs, is to translate these findings into a vision in which national aspirations and needs are taken into account to describe the destination of the information infrastructure development process. This national vision articulates where and how a national information infrastructure will facilitate and support national development in the future, whereas the policy formulation process strives to map out the journey. A national vision should not be a flight of fancy rather it should be realisable and future-oriented. Evidently the creation of a vision is intimately bound up with the unique needs and aspirations of each country, but it should be sufficiently broad and inspiring to encompass most sectors of society and be long-term in orientation.

A national information infrastructure vision should represent a statement of intent, predicated on common principles and shared values. Firstly, the centrality of the user is of paramount importance. In the African context this entails devising policies that democratise access. The information infrastructure, and the applications that utilise it, must not become another factor that serves only to distinguish the rich from the poor. Secondly, it should be aspirational and proactive. The process of designing and information infrastructure vision must not be determined by the current sophistication of information and communications technology. Such an extrapolation of current trends will only serve to restrict the boundaries of public policy. Rather, an information infrastructure vision should be based first of all on national need and not current technological possibility frontiers.

The major value-added of creating a vision is its symbolic value. The largely illiterate and rural populations in Sub-Saharan Africa are likely to find it easier to grasp the importance of information infrastructure, if they are encapsulated in a simple expression of intent rather than being conveyed as a series of statements on the intricacies of technological architecture. In addition, by being aspirational an information infrastructure vision is optimistic in orientation and is therefore designed to bolster national pride at what can be achieved in the long-term if the foundations are put in place in the short-term. Singapore's "IT2000 – a vision of an intelligent island", is perhaps the most commonly cited example of a concise statement of intent which heralds an initiative designed to transform Singapore into an "intelligent island" by year 2007. The vision should concentrate on a number of concrete objectives in areas such as:

- information industry development: a primary objective may be to create a domestic information technology or software industry;
- economic growth: policy-makers may hope to promote the awareness, take-up and use across the population, industry and government, of sophisticated and productive computing, communications and multimedia services and applications; and
- transformation of government business process and service delivery: utilising the power of new information and communication applications to transform the public sector and improve public service delivery.

Though 1999 saw the articulation of a number of information infrastructure plans in the Sub-Saharan Africa region, few have proceeded past the expression of their "Vision 2010's". As Adeya and Yahaya (1999) point out 'African policy-makers appear to have jumped on the information society bandwagon and, keen to be seen to be doing something, have announced visionary statements that amount to little more than wishful thinking'.<sup>127</sup> For example, the case study of Nigeria in Chapter Eight revealed that the government announced a "Vision 2010" blueprint at the end of 1999 yet failed to mention concrete objectives. The survey of national information infrastructure policies in Chapter Four revealed that this was representative of Sub-Saharan Africa.<sup>128</sup> By the end of 1999 few countries had proceeded past the exploratory stages and many are even yet to begin any such exploration. Given the complexity involved and importance of information infrastructure planning, this delay in itself is not problematic. However, the cause of the delay should be the time necessary for in-depth analysis of the issues at hand rather than excessive caution.

The articulation of a national information infrastructure vision is an important aspect of successful information infrastructure planning. It is not sufficient for developing countries to jump on the "information revolution" bandwagon and announce ethereal plans. Rather, a vision is the fruit of a process of labour that strategically plans the most effective method of creating national information infrastructure to further developmental objectives. Many developing country policy-makers have fallen into the trap of articulating where they would like to be in 20 years time, whilst forgetting the reality of where they are now. Any attempt at maximising the potential of information and communication technologies must first involve an assessment of existing indigenous capacity in terms of strengths and weaknesses, priorities and threats as outlined above. In order to facilitate this process there is need to undertake a consultative exercise on information infrastructure development, at which the views of key stakeholders can be expressed. Key stakeholders will vary from country to country but provisionally should include representatives from:

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<sup>127</sup> Adeya, N. and Yahaya, F. (1999) *Africa and the Information Economy*, paper prepared at UNU/Intech on, 8 July 1999, Maastricht, Holland, unpublished.

<sup>128</sup> See Table A1 in Appendix A.

- the government;
- the national telecom regulator;
- internet service providers (ISPs);
- other ICT service providers;
- telecom service providers;
- computer vendors;
- user groups;
- parastatals;
- educational authorities;
- the civil service;
- development agencies; and
- non-government agencies.

This consultative exercise should seek to fulfil at least three objectives:

- sensitisation of stakeholders as to the importance of information infrastructure;
- eliciting support for information infrastructure activities; and
- identification of needs and key objectives of a proposed national policy.

#### **9.2.4 Strategy formulation**

Policy-makers in Sub-Saharan Africa are justifiably apprehensive about adopting a form of technology that requires training and knowledge that may lead them into greater technological dependencies. However, the reality is that countries need a mix of advanced, intermediate and generic technologies to meet different needs effectively. Therefore, alternative efforts are needed to transfer and acquire technological capabilities and the technology itself in order to produce indigenously according to a country's resources (Odedra, 1990b). Thus, it is envisaged that each country will have a hierarchy of needs based on cost-benefit analysis and internally generated criteria.

A key element in strategy formulation must be the need for realism. African countries are being urged to develop world class infrastructures by numerous actors, not least of

all the development agencies and the manufacturers of these technologies themselves. The incitement of developing countries to "leapfrog" older, less efficient legacy information and communication technologies to modern, faster and less expensive infrastructures is far too enticing. The concept of "leapfrogging" was first mooted in the telecommunications industry when it was argued that developing countries had:

...a remarkable opportunity to completely leapfrog the electromechanical technology, avoiding the expense of replacing obsolete capital stock and problems of technological cumulativity, and start their telecommunications infrastructure from scratch (Antonelli, 1990, p. 71).

The concept rests on a number of assumptions:

- the ability of countries to buy off-the-shelf technology that can be easily unpackaged and understood;
- the static nature of technology: that at any one time it is possible to have the latest technology that would remain static enough to allow rapid learning; and
- That all countries begin the "leapfrogging" race at the same starting line.

In reality not all developing countries are equally placed to benefit from the putative benefits of leapfrogging. Empirical evidence reveals that the most rapid rates of assimilation tended to take place in the first and second-tier newly industrialised countries within the Asia region (Hanna, Boyson and Gunaratne, 1996, p. 190). Moreover, the ability of these countries to leapfrog was contingent upon their high rates of economic growth and investment, a relative abundance of skilled labour and their exposure to international trade. There are inherent difficulties involved in technology transfer and transplantation, which seem to point to serious fallacies in the concept of "leapfrogging" (Singh, 1999; Adeya and Yahaya, 1999). As Davison et al. (1999) point out:

While leapfrogging may appear as an attractive option for the late adopters, it may not provide the intended results in all circumstances. The greatest danger is that a new "cargo cult" may arise, where the developing economies observe the

benefits which later and succeeding generations of IT bring to the industrialised nations. Hurrying to acquire the same technology, developing countries rely on the blind belief that similar benefits will quickly accrue to themselves (Davison et al., 1999, p. 3)

At the same time, African countries are being urged to imitate the success of new information economy industries in areas such as Bangalore and Jamaica. Such a strategy is myopic in that the speed at which these industries innovate often precludes participation by "late-comers" (Heeks, 1998). If the putative goal of countries in Sub-Saharan Africa is to attempt industrial catch-up and ape the success of their faster-growing developing counterparts, rather than chasing shadows, African countries must innovate rather than imitate. Developing countries can no longer rely on low-cost labour; greater emphasis will have to be given to improving the speed, effectiveness and quality of technological acquisition. Highly skilled personnel are required to absorb, adopt and apply these imported technologies. In addition, a well-trained workforce is required to assimilate and diffuse the new technologies and operate the systems.

Any talk about serious reduction in existing ICT disparities between advanced industrialised and developing countries is misguided, at least for the foreseeable future. It is an illusion to think that ICT-poor countries can "catch up" or keep pace with advances in the most technologically advanced societies. In the advanced industrialised countries the rate of technological development is very high and is supported by enormous research and development resources (Mansell and Wehn, 1998). This is certainly not to say that poor countries should not try to upgrade their ICT systems. But they should not do so in the unrealistic expectation that those who are ahead will wait for them. The situation may improve for poorer countries, but the present disparities are unlikely to go away. Having outlined the importance of applications and strategy formulation, the next stage in the process is focuses on policy formulation.

### **9.2.5 Policy formulation: the three dimensions of information infrastructure policy**

National information infrastructure policies may take a number of forms; more generally they may be seen as explicit or implicit. According to Forsythe (1997)

explicit policy instruments are intended to have a direct impact on technology variables and related activities. Implicit policies, on the other hand, are intended to affect targets other than technology-related ones, but can also impact unintentionally on technology. Policy instruments may be utilised to affect demand for technology by industry and other national actors. Here the intention is to ensure the appropriateness of the technology to be utilised, the source of the technology (local or imported), and the preferred form in which it is to be sourced, for example, licences and local research and development. Information infrastructure policies evidently must involve supply side policies as well. Likely policy instruments would include an analysis of the flow of innovation, the provision of information and communication technology services, and the creation and availability of indigenous capabilities in these technologies.

The three critical dimensions of information infrastructure policy are: demand, supply and government. The demand side of information infrastructure policy is represented by the user. Policy in this field focuses on facilitating access to information infrastructure services, and maximising user benefit. The supply side of information infrastructure policy is concerned with those who supply the component to the information infrastructure and the applications that run on it. Focus here is on improving the telecommunications and information technology environments and encouraging suppliers to these sectors to create appropriate applications and infrastructure. The third key element focuses on government itself. Government looms large in Sub-Saharan Africa as typically the number one employer and as the institutional mechanism that facilitates a fair and effective interaction between demand and supply, and dictates the environment within which this takes place. In addition the public sector in Sub-Saharan Africa is likely to be the largest user of, and supplier to, the information infrastructure. At the same time, the information infrastructure policy process is multilayered with multiple objectives determined by differential timescales. It is envisaged that governments in Sub-Saharan Africa will have short-term, medium-term and long-term goals. The strategy formulation process outlined below proposes a three-stage model comprised of:



1. The foundational level: immediate priorities for public policy with a time horizon of between one and three years. Examples include telecommunications reform and the reduction of import tariffs on ICT-related goods.
2. The intermediate level: these priorities are envisaged to encompass medium-term goals and build on the foundational level. Here the time scale of implementation is between four and six years. Examples may include the creation of research institutes to foster the production of appropriate indigenous applications and information and communication technologies.
3. The advanced level: longer-term goals which may represent the achievement of objectives set at the vision-setting stage. These longer-term goals are envisaged to build on earlier developments and may be implemented over seven years or more. Examples could include the achievement of universal service objectives or the transformation of government business process and service delivery.

These levels are evidently not exclusive and represent progressive steps towards the achievement of the national vision. At each of these levels, policy is envisioned in terms of its impact within the dimensions of demand, supply and government. Given the state of information infrastructure in Sub-Saharan Africa as revealed by Chapter Four and the case studies of Nigeria and Ethiopia, the most pressing need is for the establishment of an effective information infrastructure foundation on which to build future capabilities. Appropriately, therefore, the emphasis is placed on the pivotal foundational level, which will determine a country's ability to achieve medium and longer-term objectives. For example, without the immediate commencement of educational policies designed to increase national basic computer literacy it is unlikely that the majority will be able to benefit from information technology products in the future. Without devoting greater government resources to creating indigenous applications and content in the short-term it is doubtful whether information and communication technologies will have much of an impact on the local populace. The criticality of implementing a planned and targeted information infrastructure strategy in the short-term must not be lost on African policy-makers. At the same time, attempts to tackle the serious bottlenecks in information infrastructure development in the short-term must not blind policy-makers to the need for long-term planning.

### **9.3 The foundational level**

Public policy at the foundational level should be focused on removing the constraints to information infrastructure development, and beginning the enhancement of national competencies. Though each country will have its own set of priorities, the findings of the previous chapters have revealed that there are four areas, warranting immediate attention in the short-term, that encompass the main constraints and challenges for information infrastructure development in Sub-Saharan Africa:

1. Infrastructure.
2. Human resources.
3. Applications and Content.
4. Environment.

Cross-cutting these issues is the need for awareness raising. This cross-cutting issue determines the extent of technology uptake within all three of the key dimensions: demand, supply and government. At the level of the user there should be awareness raising programmes to improve public understanding of the application of information and communication technologies, with co-operation from the public and private media. The case study of Ethiopia in Chapter Seven, for example, revealed the need for an improved culture of information exchange and sharing. At the government level there should be, first and foremost, sufficient awareness of the necessity of, and requirements for, infrastructure development among policy and decision-makers. Even in some advanced industrialised nations concern has been expressed at the lack of awareness of information and communication technologies by policy-makers and the private sector (OECD, 1998). To overcome this lack of awareness, special efforts must be made to sensitise heads of state and chief executives of the private and public sector to the broad policy goals and the importance of the information infrastructure to other sectors.

Specific awareness-raising programmes and pilot projects on the potential of developing public shared access facilities (e.g. smart payphones, telecentres, community information centres) should also be arranged to help overcome the high cost of access in rural areas and help to address universal access goals. Without awareness

of ICT-related issues and their importance at all levels, it is unlikely that information infrastructure development activities will be accorded the status they deserve. In this area development agencies have already begun to hold workshops to sensitise high-level decision-makers and some grassroots organisations; however, there is still a critical lack of knowledge about information and communication technologies in rural areas, government and even the private sector (Wangwe, 1996). The government has a responsibility to publicise its information infrastructure vision and to raise user awareness through the educational system and national media.

### **9.3.1 Infrastructure development**

At the foundational level the central focus will undoubtedly be on upgrading the existing physical infrastructure. Building on earlier needs assessment exercises, policy-makers must prioritise the development of both the telecommunications and information technology sectors. Chapter Four highlighted that supply side constraints continue to hinder the ability of carriers to meet the burgeoning demand for telecommunications services in the region. These constraints include the state monopoly of telecommunications and the existence of regulations that restrict private sector participation. In addition, the two case studies revealed that whilst these operational considerations go a long way to explaining the poor rate of growth of telecommunications in Sub-Saharan Africa, the volatile political economy of the region continues to be a factor in accounting for the lack of development in telecommunications infrastructure. These generic problems were borne out by the case studies in Chapter Seven and Eight which analysed two vastly different countries at different stages of their telecommunications development, yet which both suffered from operational difficulties that were representative of the whole region. Both case studies also revealed that similar solutions were necessary in the short-term, namely:

- the reform of the telecommunications sector to increase operational efficiency;
- the extension of services to rural areas;
- the "digitalisation" of current networks;
- consistent policy-making;
- greater deregulation in the telecommunications sector;
- investment in new value-added services;

- the establishment of standards for interoperability; and
- the analysis and deployment of appropriate new technologies.

At the demand level policy-makers must ensure low cost and easy access to a reliable communications network. Deregulation of the sector will also allow and encourage the indigenous private sector to provide value-added services. The role of government must be to regulate the sector to ensure first efforts towards longer term universal service objectives are being met. In addition there should be an immediate assessment of new technological options which may offer low cost solutions to extend rural access. Chapter Five found that new connectivity options such as satellite and cable telecommunications delivery mechanisms offer low cost and complementary options to countries wishing to extend their communications network. In the short-term the stark reality is that investment and operational improvement is required if the telecommunications sector is to act as an enabler rather than a constraint on information infrastructure development in the Sub-Saharan Africa region. In a similar vein there is an urgent and perhaps more pressing need to improve the level of information technology development in the region. Similarly, the major problems facing the expansion of information technology in Sub-Saharan Africa remain:

- the policy vacuum in the sphere of national information technology policy;
- import restrictions and outdated government policies towards the sector;
- inadequate maintenance of hardware;
- the scarcity of experienced and skilled software and management personnel trained in information technology;
- the macroeconomic environment which has resulted in a small and weak middle class with very low purchasing power for such items as computers and information goods;
- infrastructural deficiencies, namely a weak and expensive telecommunication infrastructure, which has hampered the growth of information networks, and an erratic electricity supply;
- the lack of an information culture;
- no well-established centres dedicated to developing software; and
- poor or non-existent procedures for equipment procurement.

### **(a) The supply level**

In the short-term, a national information technology policy must be articulated that is applied consistently to the sector. It should be enabling rather than restrictive. There is an urgent need to reform the existing policy environment affecting the supply of information technology products. Obvious targets would be an immediate reduction in import tariffs or restrictions on the importation of information technology products. Positive fiscal measures must also be put in place including: tax allowances on capital goods, grants on capital expenditure, subsidies on leasing of technologies, and incentives to foreign investors. Though this may lead to the increased use of foreign technology, it would allow a greater degree of technology transfer and also facilitate the local assembly of information technology products. This would in turn provide a foundation for the development of indigenous information technology industries. Reducing the pace at which technology advances accentuate the experiential losses arising from any restriction on the free movement of technology. Countries in Sub-Saharan Africa will find it increasingly impossible to play technological catch-up in the absence of unrestricted access to foreign technologies.

Straddling both the information and communication technology sector are new value-added services such as the Internet. In general, Internet access costs will still need to come down significantly before a wider spread of the population can make use of it. Generally it can be seen that service levels have improved and costs have come down where there is competitive Internet service provision and ISPs are free to establish their own independent links to the Internet, rather than being forced to go through the local telecommunication operator's network (ITU, 1998b). At the same time, telecom operators can reduce service costs by providing national local call tariff rates for Internet traffic irrespective of location. There is an immediate need for African governments to provide a policy response in the short-term to improve the environment in which the physical infrastructure, namely telecommunications and information technology, is to be developed. In the telecommunications arena immediate policies should focus on:

- regulatory reforms to guarantee fair competition in telecommunication services;

- subsidy or exclusivity policies to foster private investment in rural telecommunications;
- licensing policies to facilitate the take-up of the services that will be provided over new infrastructures such as submarine cable, GMPCS, and VSAT technologies;
- ensuring interoperability with the existing networks of new infrastructures such as cellular and other wireless systems, including roaming, directory services and sufficient data speeds for internet;
- ensuring transparent policies and corruption free licensing and procurement procedures;
- the development of responses to the global changes in accounting rate agreements, GATS and WTO agreements. This would include developing strategies for telecom operators to cope with the impacts of the changing accounting rate regime, Internet telephony and by-pass and examining the effect of these developments on the profitability of new capital investment; and
- the formulation of policies on restrictions on foreign ownership and cross ownership.

The policy response in the information technology sector should focus on:

- incentives for the adoption of technology and for the supply of technical consulting services and the establishment of professional accreditation in the information technology sector;
- creating an effective and consistent public sector procurement policy that builds the foundation for greater interoperability between departments and effective technology use; and
- the need for new legislation covering areas such as: intellectual property legislation; public information and contracting policies.

#### **(b) The demand level**

At the demand level, users can be encouraged to use information and telecommunications technology by lowering prices and improving ease of access.

Access to information and communications technologies is critical for effective participation in the global information economy. Government policy should focus on reducing the cost of information technology to the end user as rapidly as possible. Import duties and sales taxes could, for example, be removed from computer hardware and software (this is already the case in some countries, such as Mauritius). Special corporate and personal income tax deductions should be introduced to allow individuals and companies to offset the purchase of computer equipment. Soft loans should also be made available to individuals to purchase computer equipment. Governments can also fuel demand for information and communication technologies by being a visible user of the technology (Petersen, 1994). This can lead to increased government efficiency and have a powerful demonstration effect for those reluctant to invest in the requisite infrastructure. Further, liberalisation and privatisation in the telecommunications industry in Africa should be accomplished as rapidly as possible. Liberalisation and privatisation are not the end goals, but are the means to achieve the lowest possible prices, most advanced services, and network expansion to meet universal access objectives (ITU, 1998a). At the same time governments must formulate universal access obligations in concrete terms to ensure that deregulation does not further disenfranchise rural areas.

Evidently, in the short-term the highest priority will be attached to addressing the severe deficiencies in the underlying telecommunications networks and high costs for its use in the Sub-Saharan African region. Given that the majority of Africans live in rural areas there is a compelling case for listing the extension of information and communication technology services to rural areas as a priority for information infrastructure policy. Since the mid-1990s there have been increasing calls for the development of delivery mechanisms which are sustainable and effective (Chambers, 1997; UNDP 1993). One of the most popular of these methodologies continues to be the multipurpose telecentre concept. Though there is no agreed definition of a telecentre<sup>129</sup>, it is generally agreed that each centre has a physical space and provides some information technology for public use. The telecentre concept is designed to

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<sup>129</sup> Community technology centres, networked learning centres, cabinas públicas, espaces numérisés, telestugen, learning access places and telecottages are just some of the names that are being employed for places that provide a range of activities and services in often isolated areas that attempt to increase access to ICTs.

bypass the usual obstacles to extending access to rural and dispersed populations by providing community-based access to information and communication technologies. International development agencies and organisations such as UNESCO and the ITU have, in the past two years, stepped up their activities to establish telecentres in developing countries.

Telecentres provide a cheap and potentially sustainable means of increasing access to information and communication technologies and sensitising rural or displaced communities to their benefits. There are many telecentre support service models, ranging from the publicly funded village kiosks to small private sector centres that are entirely market driven and highly profitable. The choice of "which model" is dependent upon a range of factors, financial affordability being one of many considerations. For example, policy-makers may wish to use these centres to achieve their visions of empowering people to access and use information to their advantage. In reality it may be better to think of points of access strategies to increase the communications capabilities of the population (Hodge and Miller, 1996). A points-of-access approach argues the need for a variety of sustainable points of access to telecommunications and information services for the populace. It deconstructs the "universal access" issue and separates it out into questions of the construction of points of access in the form of telecentres, phonestops and Internet kiosks and cybercafés, and affordability of access. It also raised questions about how value-added services and content are developed and delivered through these access points.

Individual points of access, by definition, offer access to local markets with varied needs that both vary over time and dynamically. It is thus unlikely that a single access point will be able to provide the full range of competencies likely to be needed to develop and supply a varying mix of services to meet local market needs. Attention must also be paid to how rural populations will access the information infrastructure. For Ethiopia, for example, a key factor in promoting information sharing and democratising access to information infrastructure will be the ability to communicate in the Gi'iz alphabet. For most people, English is a second or third language and for ease of communication, the ability to send e-mail or download information in Amharic or Tigrigna is vital. Though Ethiopia's National Computer and Information Centre has managed to create indigenous keyboards based on Amharic script and some basic



software, there is an urgent need for national research efforts to develop country-specific software and on-line interfaces both for e-mail and for information retrieval. The development of a user-friendly Amharic interface for on-line connectivity is therefore an important priority which will greatly assist the promotion of electronic communication in the country and ensure sustainability.

Governments may also pursue a mixed strategy of constructing basic points of access in less profitable locations, while subsidising or deregulating telecentres provided by the private sector, which are likely to more closely mirror local needs. In this way points of access will emerge, where needed, that are sustainable and do not exhibit the classic suboptimal return on public investment that is typical of the Sub-Saharan Africa region. Despite some criticism of the sustainability of the telecentre concept during the first few years of its introduction to Sub-Saharan Africa, the consensus is that they represent an effective mechanism for expanding information and communication technology access (Opoku-Mensah, 1998).

The key issues, sustainability and affordability, can be addressed by the government targeting the most marginalised communities whilst allowing the private sector to respond to local needs. This will release scarce public and donor funds from the burden of funding a potentially huge number of points of access. In order to effectively place points of access policy-makers should use information and communication technologies to target populations. For example, census data and geographical information systems (GIS) can play an important role in planning telecentre projects as part of an integrated rural development strategy (Brodnig and Mayer-Schönberger, 1999). Major national mapping and household surveys can be employed to aid in the planning and selection of potential locations, to pinpoint areas where the level of demand and ability to pay make such services viable (Bekele, 1999).

### **(c) The government level**

The main deficiency in the information technology sector in many Sub-Saharan African countries is that there is no single institution specifically charged with information infrastructure policy formulation, implementation and review. As a result there is no national programme to enable the country to develop information technology and

utilise its potential. There is a desperate need for institutional responsibility to integrate information and communications technologies into the development process. In addition there is an urgent need for the development of what Woherem (1995) has called a culture of management and maintenance. In resource-scarce countries the effective leverage of existing national resources is imperative. Woherem cogently argues for a mechanism to be put in place to check the 'impulsive or unwarranted buying of new systems due to ignorance, ulterior motives, the sales-pitch of the vendors or the technical and graphical attractiveness of new systems' (Woherem, 1995, p. 14). A national procurement policy for the public sector can go some way to alleviating the *ad hoc* purchasing of incompatible or inappropriate technologies.

A second key goal for high-level decision-makers in the short-term is to increase their capacity to make informed decisions. Decision-makers in Africa often suffer from severe information deficiencies and have access to far fewer intelligence sources than their industrialised nation counterparts (Jequier and Dedijer, 1987). This lack of "intelligence for development" results in decision-making based on often outdated and perhaps irrelevant information. Given the new opportunities for rapid and timely intelligence gathering offered by the Internet amongst other services, African policy-makers cannot justify claims of ignorance. In the short-term a strategic development intelligence bureau should be set up with state of the art links to the Internet and global commercial databases. This bureau should be charged with the task of providing constantly updated information, filtered for relevance, to each government ministry. Examples of such information include:

- critical assessments and information on the expanding range of technology options available;
- international legislation that affects information infrastructure and national development;
- development of online information resources for use by entrepreneurs to identify sources of investment and development funds; and

- developing guidelines and identifying sources for the production of the information required by investors including financial reporting of existing operations, market analysis and general economic investment and risk analysis.

This strategic intelligence resource is vital if countries are to benefit from rather than be disadvantaged by the rapid pace of technological change. It would allow greater scrutiny of foreign assistance and more coordinated state procurement policies. In turn, strengthening the local bargaining position through an improvement in the capacity to identify and negotiate for technology.

### **9.3.2 Human resource development**

Human capital is increasingly being recognised as the engine of the global information economy (UNDP, 1998b). Effective technology transfer can only take place if it also incorporates a transfer of knowledge. Without a thorough understanding of imported technologies, countries in the Sub-Saharan African region cannot hope to determine their information infrastructure futures. Rather, they will remain trapped in a cycle of dependence upon foreign manufacturers.

With the decline in the macroeconomic fortunes of all but a few Sub-Saharan African countries there has been a concomitant fall in the level of educational spending (ADB, 1998). Restricted by structural adjustment programmes and blighted by falling commodity prices the majority of governments in the region have significantly reduced public expenditure on education at precisely the time it is being deemed critical (OECD, 1998). Within the framework of national information infrastructure, human capital plays a key role and it is imperative that policy-makers assign it the requisite status. In the short-term policy should focus on achieving a basic level of national information and communication technology literacy.

A national information infrastructure policy must also ensure the ability to benefit from these technologies for all stakeholders. Mitter (1998) argues that rather than being gender neutral, the benefits that can arise from technological change may bypass the

female population. Looking specifically at telecommunications technologies, she asserts that for socio-cultural reasons – including limited mobility, low incomes, lower educational levels and the urban-rural bias – women will not be the first in accessing, using and experimenting with these new technologies nor in benefiting from their potential. Mat Zin et al. (2000) corroborate this assertion, in a study of gender differences in computer literacy levels in Malaysia. They found a significant difference in computer literacy levels between male and female students among undergraduate students in Malaysia. In order to address the critical issue of human resource development policies may include:

- making basic information technology courses compulsory throughout the educational chain;
- increasing the number of information technology teachers;
- ensuring every school has access to the Internet and is networked to a country-wide "SchoolNet";
- providing free information technology education classes for adults;
- upgrading national technological capabilities through the establishment of information-intensive institutions that can provide extensive extension services on a wide scale and deliver comprehensive packages of assistance comprising technical know-how, finance, management skills, training and sales information;
- creating professional programmes to train a large cadre of experts in advanced information technology; and
- redressing the gender bias in technology uptake.

Another important element is the promotion of science and technology, which is increasingly being seen as a cornerstone of economic progress (Cassiolato, 1997). Recent biotechnological advances and genetic engineering must alert African policy-makers to the importance of indigenous research and development, and also the threats that may arise from commodity substitution. Africa's share in the world's scientific output fell from 0.5 per cent to 0.3 per cent between 1985 and 1995; Africa as a whole accounts for only 0.36 per cent of the world's total number of scientists (UNESCO, 1998). The continent unwittingly continues to encourage a steady stream of intellectual exportation, by ensuring the lack of adequate research facilities and disincentivising

advanced education. Intelligent public policies are critical to effecting the shift from simple agriculture and simple manufacturing to information-based economies that employ innovation and technologically advanced applications.

### **9.3.3 Applications and content development**

African policy-makers will also need to assess how information and communications technologies are applied nationally, what applications are needed and the content that is available. How information and communications technology is applied, and whose interests it serves, is central to whether this is an enabling technology, or a sophisticated way of keeping people and communities disempowered (Bourgault, 1995). At various stages in the development and use of applications, it is necessary to ensure that the needs of end users are paramount, and not those of intermediaries.

Given the scarcity of resources available to Sub-Saharan African countries, policy-makers must formulate a national information infrastructure strategy that prioritises those applications which can give its citizens the most benefit in the medium and long-term. In the Sub-Saharan African region, given the preponderance of the state, a top-down strategy is the most appropriate. This strategic model emphasises that the key responsibility for information infrastructure development lies with the government itself. At the same time, developing indigenous capacity is fundamental if countries want to avoid the asymmetrical dependencies inherent in playing technological catch-up. This thesis views information and communications technologies in a utilitarian light: how they can best be applied as an enabling technology, rather than as an end in themselves. The potential number of applications that can be facilitated by the information infrastructure is so great that it has tended to obscure some practical considerations. While the Internet has already shown that there is a widespread demand for electronic content and services, the utility of many innovations is unclear to many potential users and policy-makers. Possible application areas should dovetail with development goals and criteria, and be prioritised. The most pressing area for public policy is to tackle some of Sub-Saharan Africa's endemic problems. From a review of the development literature (UNDP, 1998b; UNECA, 1998; OAU, 1989) these are commonly adjudged to be:

- alleviating poverty and fulfilling basic needs;
- improving agricultural efficiency and rural development;
- improved macroeconomic and environmental management; and
- diversifying the economy by strengthening the private sector and reforming public enterprises.

Countries will need to assess their own hierarchy of needs and prioritise the development of applications appropriately. The case study of Ethiopia in Chapter Seven, for example, pointed to three target areas for applications development: meeting basic needs, developing human resources and diversifying the economy. In terms of meeting basic needs, environmental and resource management is of paramount importance in a largely rural country. Given Ethiopia's dependence on agricultural products, the sustainable exploitation of Ethiopia's natural resources is critical to national development. In the area of disaster prevention and preparedness the ability to prevent or minimise the impact of natural disasters is a priority in Ethiopia. Information is critical to the success of disaster prevention and a national network can play a vital role in empowering policy-makers through the more effective information gathering and processing capabilities that can be achieved through modern geographic information systems technologies.<sup>130</sup> A functioning telecommunications service can itself be seen as a basic need (ITU, 1998b). Thus, a priority must be the development of a modern and integrated telecommunications and information technology system that is capable of enhancing and facilitating education, health care, business information, public administration and rural development.

An allied strategy in fulfilling basic needs is the development of human resources. Applications such as distance learning technologies can improve the educational delivery mechanism to previously marginalised areas in the rural hinterlands. The Ethiopian government is also embarking on intense efforts to diversify its economy away from agricultural dependence. A national information infrastructure policy would support these efforts through the use of information and communication technologies to

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<sup>130</sup> Cisler, S. (1999) "GIS in Africa", posting to the Global Knowledge for Development listserv, 16 November 1999. Available from [gkd@phoenix.edc.org](mailto:gkd@phoenix.edc.org).

facilitate the development of agriculture, manufacturing, and tourism and perhaps the creation of new export opportunities. India, for example, has managed to create a domestic IT industry that is forecast to be valued at US\$58 billion by 2008<sup>131</sup>, within the space of twenty years. The Ethiopian government would also benefit from improved local government service delivery, and eradicating outdated and ineffective tax and fiscal mechanisms. An effective government information infrastructure can improve tax collection and aid in the accumulation of accurate and timely data for more effective macroeconomic decision-making.

Basic needs and poverty alleviation can be supported by a number of applications. For example, health care and education systems can be strengthened through tools that will provide data for self-diagnosis and self-care. The education of rural people in health issues can be implemented by using information and communication technologies and distance learning. Remote healthcare via health informatics systems can make public health policy more effective by storing and providing information on disease and patients. Modern electronic communications can facilitate access to libraries, laboratories, and public archives. Distance education employing information technology such as multimedia and video-conferencing can become a vehicle to provide continuing education to people who are out of school. This would facilitate the educational process and reduce the likelihood of African researchers in advanced fields being marginalised because of their lack of access to germane information.

Rural development and the improvement of agricultural efficiency can be achieved through the systematic and reliable collection of data. Economic policies that are geared towards an equitable distribution of resources between the urban and rural sectors require reliable demographic, production, market, weather and other critical data. A systematic approach based on accurate statistical data is required to map out a realistic strategy to alleviate poverty. National experts and scientists in the field also need accurate meteorological information, harvest data, market reports and population counts at the local and regional level to facilitate their task of realising sustainable rural economic growth. Many countries have skilfully employed information technology to their advantage. Indian researchers, for example, have become among the leaders in

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<sup>131</sup> Knipe, M. (2000) "Lonely cabbies spearhead the IT revolution", *The Times*, 9 March 2000, p. 19.

meteorological sciences using information technologies of meteorological data gathering, analysis and forecasting (Kupkes, 1996).

Another common development objective within the Sub-Saharan Africa region is a reduction of the macroeconomic dependence on the agricultural and extractive sectors. To this end, the region must look to strengthening the private sector. In many industrialised countries the private sector has been the major driver of the diffusion of information and communication technologies (OECD, 1998). These technologies have made existing business more efficient and profitable while at the same time enabling the creation of new profitable value-added services. Though the so-called "productivity paradox" has yet to be fully resolved, new technologies are now all-pervasive in the private sector of practically all industrialised countries (Kelly, 1998). Previously seen as a key, mission-critical support tool information and communication technologies are increasingly becoming a commercial medium in their own right. Electronic data interchange and business-to-business electronic commerce are just two examples of applications that are forecast to become essential for firms who wish to compete globally (Kelly, 1998). Evidently those developing countries that wish to attract foreign investment may find themselves bypassed in favour of countries with more developed communications infrastructures.

Emphasis must be placed on the application of these technologies to achieve specific objectives. Further examples of possible application areas include:

- improving the effectiveness of public information and judicial administration;
- enabling the functioning of financial markets and the development of the private sector through applications for: property, land, and business registry systems; payment clearance and settlement systems;
- improving infrastructure service provision: air transport control, vehicle registration, utility management systems;
- strengthening trade and global competitiveness: trade facilitation systems, electronic data interchange systems;



- managing the macro-economy and government: national and monetary statistics, debt management, tax administration, expenditure management, municipal planning systems; and
- preserving the environment: natural resource inventories, environmental monitoring, licensing and inspection, regional planning.

A central concern needs to be the building of capacity so that the people with the needs have the skills to understand and shape the applications, rather than continually depending on external experts. This is true both at the level of communities, and at the national level, where it is essential that Sub-Saharan African countries build the necessary skills to address their own needs. Currently, the majority of software applications originate from the developed world. Many of these are excellent, and it would be a waste of resources to duplicate them. However, there are other areas where the needs of the developing world are so different that completely new applications could be developed. An example of the former would be word-processing where the needs of document production are largely similar throughout the world; whereas health care would be an example of the latter, where the experience of developing countries differs greatly from that of the developed world. At the same time, the most useful applications are not necessarily the most sophisticated (Schumacher, 1993). Installing basic word-processing and electronic mail will greatly assist in many situations in the developing world. When considering pilot projects, attention should be paid to whether they are reproducible on a large scale. For example, broadband tele-medicine is an application with enormous potential, but the cost makes it unrealistic as a means of addressing widespread health problems. Whereas placing a basic personal computer with a dial-up connection in most rural health centres would make a significant contribution to health-care workers.

There are evidently strategic choices for each developing country. Prioritisation directed by the overall developmental and economic needs of the country is central to a coherent information infrastructure policy. First and foremost, appropriate applications should fulfil local needs and promote local industries. Application examples that fulfil these criteria include:

- virtual agricultural trading markets;
- agricultural extension information services;
- local tourism promotion;
- government information access;
- banking and e-commerce facilities; and
- census registration.

A country's assessment of its own hierarchy of needs is critical to leveraging information and communication technologies in support of development objectives. Countries cannot just concoct a "wish list" of desirable applications and hope to transplant them into the local environment. Rather, the needs assessment described above must be placed in the context of local needs and within a clearly articulated strategic framework.

### **9.3.4 Environment**

One of the biggest constraints to information infrastructure development in countries in the Sub-Saharan African region is the environment in which physical and human capital must operate. The Sub-Saharan Africa region exhibits the highest concentration of low-income countries in the world and records correspondingly low scores in terms of annual human development indicators (UNDP, 1999). Though the focus of this research is not on economic development policies, there is an explicit acknowledgement that policy implementation and design does not take place in a vacuum, and is constrained by the national environment in which it is formulated. Political instability and a lack of good governance appear to be endemic in large areas of the continent and do not augur well for consistent policy-making.

One of the lessons that can be drawn from the success of the South-East Asian economies in upgrading their information infrastructures is that the presence of a stable policy regime helped ensure that long-term plans reached fruition (Amsden, 1989). It is important that membership of the national institution/body or committee charged with directing and implementing information infrastructure policy be based on merit rather than political expediency. Moreover, providing they are effective within their roles, committee members should be viewed as long-term appointees, immune to the political

waves that invariably buffet the national polity. The information infrastructure development process is based on incremental progress towards long-term objectives. If the process becomes an extension of national politics then it will suffer from the same deficiencies that so typify African policy-making.

Allied to the need for policy consistency and macroeconomic and political stability is the need to address the linkages that affect national development. The state of public utilities in Sub-Saharan Africa represents another constraint on national development. The case study of Nigeria, for example, highlighted the additional costs to potential users of information technology as a result of the need to provide backup energy supplies (Lee, 1996). Information and communication technologies are energy intensive and incorporate in-built design assumptions of uninterrupted power and neutral climatic conditions. A generalisation can be made with regard to the limited extent of national grids in Sub-Saharan Africa, especially in rural areas (de Olivera, 1991). Therefore a national information infrastructure strategy will also have to look at integrating the use of information and communication technologies and the host of infrastructural services they rely on. A critical segment of public infrastructure is the transportation network, which continues to hamper trade in Sub-Saharan Africa. The neglect of major transportation routes and the lack of national rail networks in Nigeria, for example, increases transaction costs and curbs economic growth (Lee, 1996).

Much has been made by development agencies of the opportunities offered to Africa by electronic commerce (Cogburn and Adeya, 1999). However, this patently disregards the obstacles to transacting electronically in the region. In Ethiopia, for example, as of August 1999, credit card facilities were only available in a handful of international hotels in the capital Addis Ababa and local banks had yet to be networked with their outlying branches. Even in countries with relatively well-developed banking systems, environmental factors such as the high rate of fraud and the lack of credit reference agencies and accurate national records represent serious constraints to the development of electronic transactions. Even if these were to be overcome, internal transport networks may nullify the time gains from transacting electronically. The government must ensure that it takes a holistic approach to information infrastructure development. It must ensure that secondary linkages to the information infrastructure do not impinge upon overall policy efficacy. Government policy in this area may include:

- maintaining macroeconomic and political stability to encourage investment;
- investing or deregulating the public utilities sector to ensure a more reliable service; and
- encouraging innovation in the banking sector to facilitate electronic payments systems.

Governments must provide an enabling environment to foster the growth of technology and technology-related industries in the economies of Africa. It is clear that there is no universal solution to the problems facing African countries. National policy formulation must be specifically tailored to meet clearly defined national objectives, based upon local realities, constraints and needs. Nevertheless, there are some identifiable common principles, and African decision-makers should actively pursue the vigorous debate around these principles at all levels. Any efforts to prepare the continent for an era of accelerated structural change must encompass policies to address basic needs and ensure an environment that is conducive to creating the necessary conditions for the information economy to flourish. These conditions include good governance, respect for human rights and the rule of law, and ensuring transparency and accountability in public administration. The short-term measures outlined above point to the kinds of policies governments in the Sub-Saharan African region should be focusing on in order to build a foundation that expedites the achievement of medium and longer-term objectives. This foundational period of one to three years will lay the groundwork for much of what is to come and will determine the pace at which countries can progress toward their goals.

#### **9.4 The intermediate level**

Public policy at the intermediate level should focus on leveraging the information infrastructure to pursue national development objectives. In the medium term information infrastructure policy should concentrate on consolidating the foundation created by the previous two or three years' policies; strengthening, deepening and entrenching the national information infrastructure. Again, policy should focus on the four areas of: physical information infrastructure and human resource development,

applications and content development and the environment. Typically centring on:

- information and communications technology industry development;
- research and development;
- leveraging information and communication technology applications to facilitate public sector service delivery;
- the implementation of large-scale demonstration projects: networking the educational system, electronic customs systems, national identification systems, and the creation of an electronic census; and
- the codification of indigenous knowledge.

Information technology should be utilised to improve productivity, quality of products and/or services, labour productivity in the workplace and competitiveness in the international marketplace. The links between information technology and the different sectors of the economy must be analysed and understood in the planning process. Such factors as user requirements and infrastructural support, should be included in assessing the impact of information technology on the various sectors. Lastly, information technology should be considered as an economic sector in its own right. This sector can be categorised into sub-sectors such as research, human resources development, hardware, software, consultancy and database/networks. Each of these subsectors can be analysed to assess its impact on national development programmes.

For most Sub-Saharan African countries there is no realistic opportunity to break into the international information technology market. However, indigenous skills in information technology must be nurtured and the relationships between international suppliers of hardware must be better managed to ensure a more effective transfer of knowledge. Software should hold a special place in public policy (Heeks, 1999a). Policy aspects of information technology therefore need to be addressed in terms of formulation, dissemination, and implementation. In the absence of clear and enforceable policy, the African information industry is likely to evolve in a haphazard manner in reaction to uncoordinated external motives, thus allowing improper practices that would impair the growth of enthusiasm for information and communications technologies.

In the long-term there is a critical need for research and development in order to develop appropriate new products for the domestic and international markets, and also for keeping abreast of international technological developments. At present, countries in the Sub-Saharan African region are almost entirely dependent on the foreign private sector for information technology products. As a result, they must adapt to products designed for use where there is a reliable energy source and stable climatic conditions, and where the English language is standard and literacy taken for granted. Few African countries if any, exhibit these characteristics, hence the urgent need for indigenous research and development to create products appropriate to the local environment and market. In the medium term there is a desperate need for the local production of information technology products. The simple assembly of computers is growing in countries such as Nigeria and Kenya, and should be encouraged to foster the development of local information technology industries. This can help prevent a widening technological gulf between developing countries and industrial nations and form the basis of product adaptations for the local market.

The direction of research and development is as important as the level of funding and the underlying capabilities. As much of the research into information technologies has been dominated by industrial countries, the focus is on sophisticated entertainment products such video-on-demand, interactive television and virtual reality, products which are clearly not a priority in Sub-Saharan Africa. Local research and development technologies should address customer requirements in developing countries, such as voice-text conversion for illiterate people or cheap cellular networks for rural areas or interface design.

In view of the fact that African countries are opening up their economies to both external investment and market competition, policy formulation should take into account the impact of the national and the external environment on the development of information infrastructure. Issues such as international data networks, technology compatibility, intellectual property rights, transborder data flows, technology transfer, and economic conditions, should all be explicitly considered by policy-makers. Once the main impediments to information and communication technology use, such as poor telecommunications networks, the lack of Internet service providers and restrictions on

the supply of information and communications technology have been overcome, attention should be given to leveraging these technologies to expedite national development goals. It is hoped that the achievement of the objectives at the foundational and intermediate levels will allow a maturation of a national information infrastructure, and hence the reduction in government participation. Advanced applications which should be prioritised include:

- digitising public records to facilitate public service delivery, taxation and anti-fraud measures;
- developing an electronic clearing-house mechanism, for use by operators and entrepreneurs seeking investment, to make widely available the information needed by prospective investors;
- developing innovative methods for reducing the cost of equipment in new investments in infrastructure, such as making use of the technology with the best price/performance ratios; and
- creating government information networks.

## **9.5 The advanced level**

The advanced level of information infrastructure planning can represent the fulfilment of some of the long-term objectives set out in the national vision. Policies will be specific to the aspirations of and contingent on the effectiveness of public policy at the foundational and intermediate levels. The timeframe for the achievement of these advanced and long-term goals is envisioned as being over seven years, but countries may well have longer-term ambitions which require correspondingly lengthier horizons. Potential long-term policies might focus on:

- national ICT applications utilising the latest technological innovations;
- broadening the industrial base by the creation of new information and communication technology based industries;
- advanced research into biotechnology and genetic modification; and
- regional electronic trade networks.

It is important that these longer-term aspirations are realisable and that policy-makers assess what local skills competencies are required for their fulfilment in, for example, 15 years. It is likely that the technology possibility frontiers will shift dramatically over such a long period of time, hence policy-makers need to be visionary in their estimation of what can be achieved locally by a certain deadline.

## **9.6 Roles and responsibilities**

It is explicitly acknowledged throughout this research that NII development is an inherently complex process. This is evidenced by the fact that industrialised country policymakers continue to struggle to create information infrastructures that are conducive to their local environments. Nor have many countries successfully managed to articulate and delineate the necessary stages in the infrastructure development process. The contention of this thesis is that the lack of indigenous social, political and economic capacity within the Sub-Saharan Africa region warrants an approach to strategy formulation that is broad-based and participatory. Chapter 3 highlighted the often overlooked issue of state failure, and it is this weakness of the African state and local actors that necessitates a broad coalition of internal and external actors. The following groups need to be represented in formulating the strategy, for the reasons given:

- the government usually needs to mobilise other stakeholders to participate, organise and often lead the preparatory work, and of course plays the central role in actual formulation of the strategy, as a policy maker and regulator;
- the demand side of the NII, including the productive and service sectors, as well as sectoral ministries of government. After all, the NII's impact on development will be determined primarily by the way it is used in society;
- the private sector, both supply and demand sides, will need to provide the bulk of the investment and of the technical expertise needed to deploy the NII;
- local non-governmental organisations have increasingly important roles as providers of services in society, particularly to the poor; and
- the scientific and academic community for the provision of knowledge and expertise in their fields. International experts from the private sector or from international financial organisations can contribute a world perspective and an



objective, non-political point of view. They can also facilitate financing of follow-up investments.

There is also a critical need for coordination and strategic alliances with external actors.

### **9.6.1 The Regional level**

Given the low level of competencies exhibited by the vast majority of countries in the Sub-Saharan African region, and the dependence of these countries on the foreign private sector for the production of information and communication technologies, there is a critical need for regional cooperation. Regional and sub-regional collaboration are necessary to optimise the use of scarce resources. Chapter Five, for example, highlighted the economic benefits that can accrue to African countries from the economies of scale that arise from pooling satellite capacity. Moreover new connectivity options such as pan-African submarine cable systems rely to an extent on cooperation between countries to ensure interconnection. The fact that the majority of countries in the regions are facing common challenges in their efforts to develop their infrastructures means that there is much to be gained from learning from the experience of other countries in the region. Historically, the lack of regional and subregional collaboration has led to poor telecommunications interconnection between countries and wide variations in the deployment of information and communication technologies (Akwule, 1992). Countries in the Sub-Saharan African region can vastly improve their negotiating position by combining their buying power and actively pursuing collective bargaining for purchasing information and communication technologies.

Firstly, there is an urgent need for organisational rationalisation. There are a number of organisations on the continent with overlapping briefs, namely: the Pan African telecommunications organisations, PATU, PANAFTTEL and RASCOM, the regional satellite coordinating body. Efforts should be made to harmonise and reduce duplication among existing and envisioned regional and sub-regional organisations. Existing regional organisations, such as PATU should either be strengthened or disbanded if they continue to be ineffective. In the area of infrastructure development

concerted efforts should be made to share information and experiences on best practice. There are likely to be divergent approaches to information infrastructure development within the region; however, there may be valuable generalisable lessons that can be learnt by late starters. All countries within the region can benefit greatly from improved information exchanges between countries regarding best practice, restructuring models and regulation. There should also be benchmarking mechanisms for comparing operational and network performance, such as the achievement of universal service objectives. There should also be collaboration on procurement strategies where applicable, as this would facilitate interoperability and reduce costs. Regional cooperation on interconnection may also go a long way to reducing the domestic costs of calls within the region. Sub-regional telecommunications hubs can provide telecom services to other African countries at the lowest possible cost by sharing inter-continental links.

In terms of telecommunications development countries should strive to improve interoperability between telecommunications networks. The inefficiencies of routing calls to neighbouring states through distant third parties must be tackled. This could be achieved by the appointment of a regional telecommunications advisory board to oversee the development of international connections in the region and, for example, the adoption of common standards for the use of new technologies and in procurement procedures. By the same token national Internet development can be greatly facilitated by regional cooperation. The creation of regional hubs can improve the speed at which countries can connect to the wider Internet. At the same time, Africa must lobby for an African regional Internet registry to allocate Internet Protocol address space, autonomous system numbers, and maintain databases of registry information. This organisation will assist in the development and growth of the Internet in the African region and assist the African community in the development of procedures, mechanisms, and standards to efficiently allocate Internet resources as a service to the community as a whole. It could also serve as an advisory body to aid in the development of public policies and public positions on Internet development.

There is also scope for regional cooperation to reduce the impact of the limited human resource base, by creating, for example, regional centres of research on information and

communication technology. In this way, smaller countries that lacked the resources to fund domestic research development would still be capable of benefiting from advanced research. The development of a regional research network amongst African universities to carry out research and development would facilitate this endeavour and could provide policy-makers in the region with valuable input. This regional network could be bolstered by establishing centres of excellence or specialisation, to train policy-makers, network operators and users in government and the private sector. Regional applications development may be another area for consideration. Given that many countries in the regions suffer from similar resource management problems, there may be scope for regional applications and content development. Disaster preparedness and prevention applications could be created and coordinated at the regional level to increase national efforts. Regional cooperation can also foster economic integration. By adopting measures for the regional development of transport, communications and tourism networks, countries can encourage trade and growth.

In terms of financing infrastructure in the region the creation of an African telecommunications fund, long mooted, should be a priority. At present there are a significant number of countries that are unattractive to foreign investment and who fail to qualify for development assistance. The creation of an African fund could target such countries that fall through the financing net and aid them in their telecommunications development efforts. Though mechanisms such as WorldTel, the ITU's developing country telecommunications fund, have been set up for this purpose, the stringency of the requirements for funding qualification precludes many countries that are not prepared to fully privatise their telecommunications operators.

### **9.6.2 The International level**

National information infrastructure planning cannot be expected to take place within an international vacuum. Rather, the global nature of the deployment and production information and communication technologies necessitates a strategy that recognises the importance of the international arena. Sub-Saharan African countries are dependent on the foreign private sector for the supply, maintenance and knowledge of information and communication technologies. This dependency dictates the formulation of an

international dimension within the information infrastructure development process. International actors impact on the domestic creation of information infrastructure in a number of fundamental ways, namely as:

- suppliers of technology;
- suppliers of information and expertise;
- global regulators and standard setters;
- an international marketplace;
- a source of finance; and
- the source of development assistance through the international development community.

The dependency of Africa on the foreign private sector for the supply of technology has been a recurrent theme throughout this thesis. In the long-term it is hoped that this dependency can be ameliorated by greater indigenous production. The reality is that in the short-term, the development of African information infrastructure will be predicated on the ability of countries to access, transfer and transplant foreign technologies into their local environment (Bhatnagar et al., 1992). Chapter Five investigated the role of the foreign private sector in providing new connectivity options, which included satellite delivery mechanisms and submarine intercontinental cable systems. It was argued that these represented alternative options to African policy-makers seeking to widen access to their public telecommunications operators, but that each scheme warranted in-depth analysis to assess appropriateness. It is likely that research will accelerate the development of new, lower cost telecommunications and information delivery mechanisms. Therefore it is imperative that information infrastructure policy planners have access to the latest information regarding their development.

Access to the latest information is critical for effective planning in Sub-Saharan Africa, especially in the field of technological development. Sub-Saharan Africa has for too long been the repository for outdated technology. At a recent communications conference in Nigeria one of the founders of one of the first American Internet service providers, Prodigy Inc., highlighted the fact that the majority of vendors were selling Internet technologies that had been discontinued in the United States three years before

in 1996.<sup>132</sup> The region cannot continue to accept the technological cast-offs of industrialised nations, whilst at the same time striving for technological parity. It is essential that policy-makers are suitably knowledgeable and sufficiently technologically literate to ensure informed procurement. Hence the need, as stated earlier, for strategic intelligence bureaux that scan and filter the relevant information for the perusal of decision-makers.

In addition there may be a need for strategic alliances with information and communication technology producers. Global competition in these industries ensures that it is very much a buyer's market and African countries should leverage their collective buying power to dictate the terms upon which technology is transferred. Large populous countries with relatively substantial resources and significant domestic markets, such as Nigeria, could for example tender an international offer to suppliers for a large consignment of information technology products, specially modified to incorporate surge protectors for the local market. Even smaller countries, such as Ethiopia, could enter into agreement with Indian software houses in Bangalore to produce bespoke products in the local language.

One of the biggest constraints to rapid information infrastructure development in Sub-Saharan Africa is the lack of local expertise and experience with information and communication technology products. The global phenomenon of skill shortages in these industries is particularly acute in Africa and will remain so long as governments fail to prioritise education and provide an environment that encourages its most talented resources to contribute to the brain drain. In the industrialised nations the solution to shortage of skills has been to induce people to transfer their knowledge assets from other countries through the promise of higher financial remuneration. It is unlikely that Africa can offer the same level of remuneration; however, policy-makers should think laterally as to how they can exploit the global brain drain. The deterioration in African living standards has seen a concomitant rise in the size of the African diaspora. Though there has been few attempts to quantify its size, it is generally agreed that within this disparate group a significant proportion are employed within many of the leading

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<sup>132</sup> Eric Sung, formerly a technology executive, Prodigy Inc., in a personal communication to the author commenting on the NICOMM exhibition, held in Lagos, Nigeria, 8-9 November 1999.

information and communication technology sectors in the industrialised nations. Policy-makers should investigate mechanisms for exploiting this hidden reservoir of expatriate talent. Mechanisms could include:

- a database of expatriate nationals who work in these key industries;
- the establishment of foreign working groups who would provide industry intelligence and expertise on the latest developments within their industries;
- networking to facilitate employment exchanges;
- expatriate input into local software and hardware design; and
- representation and informed participation at international conferences.

Alice Amsden (1989), in her seminal book on the newly industrialised economies of South-East Asia, highlights how South Korea boosted indigenous knowledge by sponsoring the graduate education of thousands of engineering and science students in Western universities. By leveraging the collective experience of their expatriate populations African governments may be able to achieve similar success in increasing their domestic human capital and ensure that they stay informed and are represented at the international level.

Another important factor that affects national information infrastructure development is the role of the international governance regime. National efforts to develop the information infrastructure are conditioned to a degree by international regulations on the trade of information and communication technologies. For example, the World Trade Organisation's General Agreement on Trade in Services (GATS) commits signatories to deregulating their telecommunications markets. Specifically GATS stipulates that the telecommunications sector must be competitive and incorporate an independent regulator. Though the majority of African countries signed this agreement, by 1998 only seven countries, including Ghana, South Africa, Senegal, Côte d'Ivoire and Mauritius, had made commitments in the area. However, GATS will affect almost all African countries through their membership of the WTO. Though a Coordinated African Programme of Assistance Services (CAPAS) was set up to strengthen African power at the international negotiating table, there is a lack of coordination between the various national ministries concerned. In particular, the Ministries of Trade and

Commerce and the Telecommunication ministries appeared to have little or no dealing with each other on the issue (Cogburn and Adeya, 1999).

Whilst there have been efforts to ensure an effective African presence at international fora, the fact remains that despite its size and importance Sub-Saharan Africa remains marginalised. The continent's inability to create a united front at the international level arises from a number of factors. Firstly, the struggle for resources and geopolitical influence is a familiar tale in Africa. The abiding legacy of the arbitrary division of the continent according to the whims of the colonial powers has left enduring pockets of instability. For example, some 11 countries have been involved in the ongoing civil war that swept through the Congo in 1998. Also it seems that old colonial ties continue to linger as countries such as France continue to maintain a key stake in practically all the telecommunications sectors of its former colonies. These divisions, along colonial or ethnic lines, limit the effectiveness of Africa's positions in global fora and reduces the potential for regional and sub-regional activities. African countries must attempt to put these barriers to international cooperation behind them and create effective institutional mechanisms to ensure that the African voice is heard and respected rather than merely tolerated at the international negotiating table.

With the advent of services such as electronic commerce and the success of developing countries, such as India, in creating successful export industries, there has been talk of African countries exploiting the economic opportunities of a global marketplace underpinned by information and communication technologies. Though there are many barriers to this happening on a major scale there may well be opportunities in the medium to long-term for countries to export on a significant scale to the global marketplace. Should this be the case policy-makers must ensure that its entrepreneurs have access to information on foreign markets and are encouraged to export by a welcoming fiscal environment. Tax incentives should foster entrepreneurship and a "start-up" culture amongst the domestic private sector. Policy-makers can also facilitate the export process by sponsoring foreign trade fairs and expositions.

From a financial viewpoint, the prohibitive costs of information infrastructure development may mean that revenue-scarce Sub-Saharan African countries need to

enter into alliances with the foreign private sector. As the pressures to place public infrastructure on more commercial principles have increased, financing sources have become more diversified. Initially this has involved privatisation of existing providers and a significant number of public telecommunications operators have already had a significant proportion of ownership transferred to foreign multinational telecommunications companies. The financing requirements for building new communication infrastructures are substantial. Raising these large sums will not be easy given the indebtedness of African countries and their poor credit ratings which restrict the types of commercial lending. For some countries this may imply that funding is limited to multilateral institutions such as the World Bank and regional development banks. However, receiving funding from these institutions may, for the foreseeable future, take some time due to the complexity of disbursement procedures and the stringency of conditions. This often means that by the time funding is agreed, the technological landscape may have changed and needs to be renegotiated. Allied to this issue is the fact that those countries which fail to qualify for such funding find, due to a high level of external debt, that private commercial lending and equity markets are not accessible.

In order to be successful, innovative financing techniques will need to be applied to meet the large capital investment requirements associated with building new national information infrastructures. This suggests the importance of strategic alliances between national and foreign financiers, equipment suppliers, governments and local companies in order to attract foreign investment. Investment capital is an essential element of the partnerships that have to be formed to successfully develop the national information infrastructures required for sustainable development. However, the process of procuring funds will in itself require prior mobilisation of partners to provide the specific construction, operational and financing expertise that a particular project needs. Increasingly, financing has to be viewed as an integral component of each development project rather than something that can be added at the end.

The international community of development agencies also has a responsibility to leverage information and communication technologies to improve the assistance they provide to developing countries. The Internet has proved to be an effective tool for facilitating collaborative partnerships. Virtual fora and online resources can allow



greater dissemination of knowledge and can improve coordination of development assistance. There is a need for interagency knowledge partnerships that share information, experiences and resources to promote broad access to, and effective use of, knowledge and information as tools of sustainable and equitable development. Specifically, there should be efforts to:

- encourage the international development community to assist efforts to improve infrastructure;
- encourage support for capacity building, awareness raising and human resource development; and
- support the development of electronic information sharing and distance training resources to facilitate financing and investment in African information infrastructure and policy and regulation.

Countries in the Sub-Saharan African region must also exploit the knowledge of other developing regions. There should be exchanges of experience and practices on information infrastructure development in Latin America and Asia. It is likely that there will be some common ground and room for south-to-south collaboration on infrastructure services and procurement strategies. The weakness of the African state in Sub-Saharan Africa, and its inexperience with information infrastructure development policy calls for a web of interactions between actors at the national, regional and international level. What is required is a new institutionalist approach that takes into account the new realities of globalisation and the need for intranational, regional and international cooperation. Institutions are seen in the broad sense as comprised of representative collectives ranging from grass roots organisations to multilateral agencies whose key roles could be coordinated by the state. Within this schema NGOs, for example, could help African policymakers assess the appropriateness of incoming technologies, local grass root organisations could sensitise local communities to the advantages of using ICTs and international development agencies could provide financial and technical assistance at the micro and macro level.

## **9.7 Evaluation, reappraisal and research**

A final aspect of the multilevel strategic framework involves a constant evaluation and reappraisal of the information infrastructure planning process. The rapid pace of technological change necessitates a close monitoring of public policy in this area. The advent of fresh innovations may well offer more efficient solutions to old problems and need to be assessed in this light. Periodic working groups based around the key areas mentioned above must assess the efficacy of public policy and whether it is meeting objectives and benchmarks. In close alliance to this should be research in line with the principles of constructive technology assessment. This understanding will allow policy-makers to anticipate social consequences better and to construct those institutional arrangements that orient technological change towards socially desirable ends. Here one must look at relationships among variables affecting technological development, be they socio-economic, political, cultural or gender variables, geographical locations or market forces. Too little is known about how these factors interact at the micro, meso and macro levels. It is hoped that in the long-term strategies can be formulated that allow a more appropriate and equitable development of socially beneficial technologies.

## CHAPTER 10

### Conclusion

#### 10.1 Research findings and discussion

It is only since 1995 that the majority of industrialised nations began to articulate a policy response to the dynamics of information infrastructure development. It is therefore unsurprising that their developing country counterparts, which have more pressing concerns such as the fulfilment of basic needs occupying their agendas, have been somewhat slower in their response. In 1999, with more than half of the countries in the region engaged in military action at home or abroad, endemic macroeconomic and political instability and some countries on the edge of human disaster, it would be understandable if information infrastructure policy was viewed as a luxury. Such government myopia is dangerously negligent. Chapter One of the research highlighted the confusion surrounding the perceived impact of techno-economic change. It highlighted that despite this constant, the *leitmotif* of the literature was of fundamental transformation.

Chapter Two presented evidence for the importance of information infrastructure and, pointing specifically to the economic gains arising from more efficient communications networks, the importance of accurate and timely information for decision-making. Chapter Two stressed that the Sub-Saharan Africa region faced a set of challenges that could be ameliorated by leveraging information and communication tools; such as improving resource management. At the same time, information and communication technologies are accelerating the pace of scientific and technological change and posing questions about the sustainability of African agriculture in the face of commodity substitution through genetic engineering. It was concluded that countries that fail to adapt or to shape this transformational process may find themselves marginalised to the global periphery. Finally, the chapter argued that the outcome of this process of transformation for Sub-Saharan African countries was predicated on the pivotal role of public policy.

Chapter Three presented a conceptual framework outlining how African governments can constructively steer the information infrastructure development process to suit their national development objectives. It was firstly argued that African policy-makers must understand the complexity of the issues at hand. This understanding could allow policy-makers to anticipate social consequences better and to construct those institutional arrangements that orient technological change towards socially desirable ends. The conceptual framework, drawing on a number of theories, including constructive technology assessment theory, provides an empowering analytical perspective from which to view the development of information infrastructure. This perspective looks at relationships among variables affecting technological development, be they socio-economic, demographic, political, or cultural. The framework is seen as a policy matrix for integrated information infrastructure planning at the national, regional and international levels. The final objective being to give policy-makers the ability to prioritise the use of scarce resources according to their national hierarchy of needs.

Chapter Four revealed the lack of national information infrastructure policy-making in the region and pointed to the overall weaknesses in the provision of telecommunications and information technology use and diffusion. While Africa's communications and information infrastructure has improved dramatically since 1995, access to, or the means to exploit a reliable, widespread communications infrastructure is still a dream for the majority of Africans. Since the early 1990s there has been a belated recognition of these failings. In the wake of concerted efforts by external actors such as development agencies, African policy-makers have been sensitised to the importance of information and communication technologies to national competitiveness, and as a means of supporting national development. However, the strategic policy responses to this issue have on the whole been disappointing. Though characterised by immense diversity countries in the Sub-Saharan Africa region remain remarkably uniform in their lack of an effective public policy response in this area.

Chapter Four also revealed that the majority of countries in the Sub-Saharan Africa region have begun to restructure the telecommunication sector. This has typically involved the separation of the postal service from the national telecommunication operator and the institution of a separate regulatory authority. International capital and strategic partners have been obtained by some of the national telecommunications

operators but few second operators have been established as yet. Early liberalisation of the market for value added services in some countries has also resulted in a large number of alternate data, paging and mobile telecommunications service providers. There have also been some noteworthy efforts to expand telecommunications services to rural areas through the institution of universal access obligations and funds for rural communications development, and in setting targets for provision of services and the quality and extent of national connectivity (Cogburn and Adeya, 1999).

However, the institution of these reforms in the telecommunications sector represents only the first faltering steps in the information infrastructure development process. The analysis of the Sub-Saharan African region in Chapter Four revealed a public policy vacuum in this area and the continuing existence of explicit fiscal barriers to information infrastructure development. This suboptimal development of information infrastructure was borne out by the case studies conducted in Ethiopia and Nigeria in Chapters Seven and Eight respectively. Both the case studies revealed a similar lack of policy in the field and fundamental weaknesses in their information infrastructures. These weaknesses, which appear to be typical of countries within the Sub-Saharan Africa region, were found to be:

- underdeveloped information infrastructures, in terms of the telecommunications and information technology sectors;
- low utilisation of information and communication technologies;
- weak, non-existent, or ineffectual public policy in this area;
- underdeveloped human resource capabilities in the utilisation and production of information and communication technologies; and
- political and economic constraints which have deterred private investment.

Chapter Four also revealed that there was a widening gap between the developed and developing countries as well as an intranational gap within countries. This divide was between urban dwellers with relatively good access to communications networks and the majority of the population who are rurally located and often unconnected. Chapter Four also highlighted the existence of a number of external actors – namely

development agencies and the foreign private sector – who appear to be heavily influencing the development of information infrastructure in the region.

Chapter Five began the first of two chapters analysing in greater depth the role of external actors in the area of information infrastructure development, looking specifically at the role of the foreign private sector in terms of their development of 'offshore' information infrastructure. The proxy variables of satellite and submarine cable projects were taken as an indication of the importance of the foreign private sector in information infrastructure development and the need for public policy to regulate and coordinate their actions. In a similar vein Chapter Six examined the role of development agencies. It was found that while development agencies are bringing much needed capacity to the region in terms of network development and training, there is a lack of coordination and effective evaluation of their assistance. A survey of development agency projects revealed that there were over 100 organisations engaged in over 300 projects involving information and communication technology activities in Sub-Saharan Africa in 1998. Of these, 273 were devoted to the Sub-Saharan African region.

Qualitative analysis of the project abstracts of these 273 projects within the Sub-Saharan Africa region, that were completed or ongoing between January 1 1996 and May 31 1999, revealed a high degree of homogeneity in the stated justifications and rationales behind these projects. A case study of one such initiative, the United Nations Development Program's Internet Initiative for Africa in Ethiopia, was conducted to test some of the assumptions underpinning the use of ICTs in development assistance projects and to illustrate some of the issues raised in the of sample projects. The project was found to be undermined by issues deriving from project design and conceptualisation and the unique problems associated with the technology itself and the African context. Despite these problems it was acknowledged that development agencies have played and will continue to play a key role in agenda setting, consensus and capacity building. Thus, though there is an explicit recognition of the importance of the development community, there is also an acknowledgement of the need for a more coherent framework for planning and implementing information infrastructure-related projects. Finally, the last two chapters, national case studies of Ethiopia and Nigeria,

have shown the common and specific problems facing countries in the Sub-Saharan African region.

Chapter Seven's case study of Ethiopia revealed a country emerging slowly from a prolonged period of political and economic instability, with a correspondingly low level of information infrastructure sophistication. With over 80 per cent of the country living in rural, often inaccessible areas, the vast majority of Ethiopians were found to be reliant on the traditional forms of communication, and national usage of information technology, even in government, is limited. In terms of physical infrastructure Ethiopia continues to suffer from the high costs involved in reconstruction and development in the wake of its ongoing war with Eritrea. This has destroyed significant segments of basic infrastructure in the hinterlands and restricts government efforts to extend services to outlying regions.

Ethiopia is also unique in that it is home to a large number of non-governmental organisations and the United Nations Economic Commission for Africa (UNECA). This is an important distinction because the country has benefited from the activism and funding of these organisations. For example, the single most important development agency project for information infrastructure development in Sub-Saharan Africa, the Africa Information Society Initiative, has been designed by UNECA. This has meant that policy-makers in Ethiopia were sensitised to the importance of information and communication technologies as early as 1993 and Ethiopia had one of the earliest African experiences with the Internet in 1995. Yet, the country has failed to capitalise on these advantages. As in the majority of Sub-Saharan African countries, the national telecommunications operator is a government-owned monopoly that has failed to effectively develop an extensive public telecommunications network. However, the public telecommunications operator is widely acknowledged as a relatively well-run parastatal and the government has publicly stated that it has no intention of privatising it (Adam, 1995). Nor will the government allow competition in the provision of Internet services. Again, like the majority of Sub-Saharan African countries the government has yet to articulate a national information infrastructure policy and appears content to wait and see. Chapter Seven concluded that, given the structural problems facing the country it is vital that the indigenous information infrastructure is upgraded. The long-term solution to Ethiopia's seemingly intractable problems may lie

in the creation of an effective information infrastructure that furnishes policy-makers with timely and accurate information. This information in turn will improve the capacity of government to manage such information-intensive issues as environmental deterioration and demographic management.

The case study of Nigeria in Chapter Eight investigated the development of information infrastructure in Sub-Saharan Africa's most populous country. The obvious demographic differences between Nigeria and Ethiopia – Nigeria's lucrative supply of natural resources, its higher standard of living and the fact that English is the official language – would seemingly favour it over Ethiopia in the race for information infrastructure. However, despite the abundance of resources and relative prosperity of the country, Nigeria was found to be suffering from the same deficiencies in information infrastructure that were affecting its smaller and less resourceful neighbours. The coverage of the telecommunications network was clearly inadequate and the population subsisted with an unreliable and expensive service that functioned sporadically.

The main cause of these problems could be divined from two sources: operational and political economic issues. Like Ethiopia the public telecommunications operator, NITEL, suffers from poor maintenance management, effective management, low revenue generation and a non-commercial *modus operandi*. However, unlike Ethiopia, NITEL is widely acknowledged as a poorly run parastatal, which has resulted in a sub-optimal public switched network. At the same time, it was found that political economic considerations continue to exert a negative impact on the development of the sector. Political instability had militated against consistent policy-making, and had resulted in a state-owned monopoly which straddled the divide between its national responsibility and commercial sensibilities rather uncomfortably. Nor have the country's macroeconomic frailties encouraged the information infrastructure development process. An examination of information technology development in Nigeria found an industry bereft of government support and restricted by a negative fiscal environment of high tariffs on ICT goods. Chapter Eight did find evidence of a vibrant private sector that managed to circumvent government restrictions, and engage in the local assembly of personal computers comprising smuggled components. However, value added services such as Internet provision were seriously constrained by



the public monopoly of telecommunications, the poor provision of public utilities and the lack of domestic buying power. Coupled with this were the typical problems of inadequate skilled human resources and the lack of indigenous content, applications and maintenance capabilities.

An investigation of Nigerian public policy in the field of information infrastructure development revealed a familiar level of inaction at the government level. It was found that while successive regimes had vaguely acknowledged the importance of information and communication technologies there had been no consistent and comprehensive policy in this area. The government of General Sani Abacha had attempted to create a comprehensive policy blueprint, which was designed to articulate a vision of where Nigeria would be by 2010. However, despite the lengthy consultative period and the expertise of those who participated in the project, the "Vision 2010" document paid only lip-service to the importance of information infrastructure. The subsequent death of General Abacha and the election of a civilian government in May 1999 saw the repudiation of this exercise in political posturing. As is customary in Nigeria, in October 1999 the newly-incumbent civilian government announced a poorly drafted and vague telecommunications policy, that essentially disowned the policies of the previous regime, and has only served to obfuscate the telecommunications reform process.

Overall this thesis has highlighted the fact that the global shift in the importance of information and communication technologies and information infrastructure has caught Sub-Saharan African policy-makers unawares. Whilst these global shifts represent challenges to policy-makers on a global scale, they represent unique challenges for African policy-makers.

## **10.2 Further research**

The literature review in Chapter One revealed that information infrastructure policy development straddles a number of dimensions ranging from the economic to the technological. Yet there has been little academic research into how the shift towards a new techno-economic paradigm, wherein knowledge is deemed the key resource, will

affect and is affecting developing countries. The U.S. economist Thorstein Veblen argued that the 'outcome of any serious research can only be to make two questions grow where only one grew before'<sup>133</sup>. In the same spirit, this thesis has raised more questions that it can answer and has pointed to an urgent need for further research. Suggestions for further research include:

- **National case studies of the effectiveness of national information infrastructure policies.**

The critical success factors in information infrastructure planning are as yet undetermined, but it is hoped that with time researchers will be able to point to effective and ineffective information infrastructure policy regimes. This will enable policy-makers to better understand the information infrastructure development process from other national experiences and avoid a sub-optimal return on public investment. The conduct of comparative case studies could give insights into the effectiveness of policy-making.

- **The need for better metric methodologies**

At this critical time, when both countries and companies are restructuring to take advantage of new technologies and services, both government and industry need better tools to measure impact and efficacy. They must reach beyond traditional measurements of infrastructure and look at who is constructing information infrastructure, and how and why. Traditional methods are failing to accurately capture the extent of information and communication technology usage in developing countries. Further research should look to the development of more accurate metric methodologies that take into account dispersed communities and communal societies.

- **The impact of greater access to information**

An important area for further research is an analysis of the content that will flow on and through an information infrastructure. In the Sub-Saharan African context research

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<sup>133</sup> Veblen, T. (1919) *The Place of Science in Modern Civilization*, London: Thoemmes Press, p. 23.

could focus on the impact of information garnered from improved information infrastructure access. Content analysis will provide much needed information on how the information infrastructure is being utilised and whether alternative access methodologies are warranted.

- **The impact of information and communication technologies on developing countries**

It is hoped that policy-makers in Sub-Saharan Africa will begin in earnest to create information infrastructures, yet it is likely that a significant proportion will fail to promote this critical resource. With information and communication technologies increasingly becoming ubiquitous in industrialised countries, there is an urgent need for an assessment of the implications of this for Sub-Saharan. Areas may include the economic impact on countries in an era of genetic modification and commodity substitution and employment, and the competitiveness of the African private sector in an era of electronic commerce. In addition, further research in this area might look at the effect of informational deficiencies on decision-making in public policy. Little if any research has been conducted on the effect of informational deficit on the development process. There has been no substantive research on the effect of planning without adequate statistics, which is so common in Sub-Saharan Africa. Nor have attempts been made to assess the use of information sources in public policy.

- **Design of rural information infrastructure access methodologies.**

Researchers in information infrastructure development in Sub-Saharan Africa must keep in mind the demography of the region; namely, the rural population bias. There is an urgent need for practical research into the design of effective information and communications technology delivery mechanisms to facilitate relevant and timely local information to rural communities. Research areas might include, for example, the use of interface and interactive design to overcome literacy and language issues.

### 10.3 Conclusion

Technological innovation in such diverse domains as information and communication technologies, material science (alloys, ceramics, fibre optics, composites) and biotechnology are fundamentally restructuring the global economy. Underpinning all these advances are a host of ICTs that are helping to unleash the potential of other technologies and creating fundamental transformations in other areas. In this new global economic environment, information and the knowledge it provides has become a key factor in determining national economic competitiveness and underpinning national development objectives. This thesis has justified the importance of information infrastructure for Sub-Saharan African countries. It has been argued that information infrastructure represents a new foundational infrastructure that can offer a number of benefits and help African policy-makers in their endeavours against the challenges they face now and they will face as a result of technological change. Whether African countries benefit or lose out from the structural shift to an information economy is predicated on the effectiveness of public policy in creating a host of competencies. These range from designing and implementing information infrastructure to the creation of a conducive environment by government.

The research has looked at the role of external actors, in particular the foreign private sector and development agencies and argued that they represent an important dimension in national information infrastructure planning. Finally, this last chapter has enlivened the conceptual multilevel strategic national information infrastructure framework, articulated in Chapter Three, by presenting specific policy recommendations for the region. It has been argued that information infrastructure represents an increasingly critical resource that can support Sub-Saharan Africa's development efforts. However, it is recognised that whilst the African state is likely to play a critical role in this process, its historic weakness in policymaking necessitates a broad coalition of internal and external actors ranging from grass roots organisations to international development agencies. This is best achieved through strategic policy planning and implementation that involves public, private and voluntary sector participation and partnerships, at the national, regional and international levels.

## **APPENDICES**

## APPENDIX A

**Table A1: National Information Infrastructure Planning in Sub-Saharan Africa, June 1999**

Country	National information infrastructure agency	NII Policy	Comments
Angola	No	No	The majority funds earmarked for information infrastructure is being spent on reconstruction and development of war-affected areas. Rebels still hold key parts of the country, thus an NII are difficult to implement.
Benin	The Ministère de la Culture et de la Communication	No	
Botswana	Government Computer Bureau (GCB)	No	
Burkina Faso	Délégation générale à l'informatique (DELGI)	Yes	
Burundi	No	No	
Cameroon	The Centre National de Développement de l'Informatique (CENADI)	No	
Cape Verde	No	No	
C.A.R	Office National d'Informatique (ONI)	No	
Chad	No	No	No formal national policy for ICTs but there is a high level of awareness at top levels of government, partly fostered by the Centre National d'Appui à la Recherche (CNAR) which is the UNDP's national SDNP partner.
Comoros	Ministère de l'Éducation nationale, de la Formation professionnelle et technique	No	
Congo	Ministère de la Culture, des Arts et de la Recherche scientifique, the Ministère de l'Information and the Ministère du Développement	No	As of November 1999, the ongoing civil war had resulted in the destruction of key elements of the national telecommunications infrastructure. Until a negotiated settlement is reached it is unlikely that any information infrastructure strategy will be mapped out.
Côte d'Ivoire	Commission Nationale pour l'Informatique, (CNI), the Secretariat General l'Informatique, (SGI) and the Commissions Ministerielles de l'Informatique, (CMI).	Yes	Côte d'Ivoire has a relatively long history of national information technology policy development. In the late 70's the Government established the Commission Nationale pour l'Informatique, (CNI), the Secretariat General l'Informatique, (SGI) and the Commissions Ministerielles de l'Informatique, (CMI). It also set up the Commission Nationale pour le Traitement de l'Information (CNTI) in 1980.
Djibouti	The Centre d'information de la Direction du Plan	No	
Equatorial Guinea	No		
Eritrea	Eritrean Information Systems Agency (EISA)	Yes	Despite the ongoing border conflict with neighbouring Ethiopia the government is keen to improve the practically non-existent information infrastructure. In 1999 it signed a contract with a US firm to supply the countries first GSM mobile network

Country	National information infrastructure agency	NII Policy	Comments
			and has recently licenced its first ISP.
Ethiopia	The Ethiopian Science and Technology Commission (ESTC) National Computer and Information Centre (NCIC)	No	A broadly constituted cross-sectoral national Internet working group, Bringing Internet to Ethiopia (BITE), drew up a detailed and well thought out proposal which was among the most comprehensive national information infrastructure in Africa plans to date.
Gabon	No		
Gambia	No		
Ghana	Ghanaian National Information and Communications Committee (GNICC)	Yes	A draft national communications policy has been developed by the Ghanaian National Information and Communications Committee (GNICC) which comprises representatives from the academic, research, government and private sectors and coordinated by the University of Ghana
Guinea Bissau	The Instituto nacional de estudos e pesquisa (INEP)	No	
Kenya	No	No	In general there has been little in the way of leadership emerging from the academic, research and public sectors in the area of national networking and use of ICTs. This is partly explained by the political climate, the lack of broad institutional support from government for the academic sector (which has had a history of opposing the Moi regime), and the tight controls the state puts on public sector communications.
Lesotho	No	No	
Liberia	No	No	Most of the information infrastructure has been destroyed during the war.
Madagascar	Centre d'information et de documentation Scientifique et technique (CIDST)	No	There is no formal national ICT policy process but the Ministère de la Recherche scientifique et technologique pour le développement is planning a number of studies in this area, most likely to be carried out by CIDST.
Malawi	No	No	There is no national process for the development of information infrastructure plans.
Mali	No	No	
Mauritania	No	No	
Mauritius	National Computer Board (NCB)	Yes	The Government has put into place a National Information Technology Strategy Plan (NITSP) a strong commitment to ICTs and has already made a number of efforts in addressing the regulatory and legal framework for ICTs.
Mozambique	No	No	Although an active rebuilding process is taking place in Mozambique with support from a broad spread of the international community, the 20 years of civil strife have reduced the economy to very low levels and left few remaining functional public institutions outside the capital city.
Namibia	Ministry of Information and Broadcasting	Yes	The Ministry of Information and Broadcasting convened a conference on Building Namibia's National Information Infrastructure in Windhoek, May 11th-14th '98. This was expected to assist with the government's decision to establish a national information network linking all the regions in Namibia which will provide public

Country	National information infrastructure agency	NII Policy	Comments
			access to government information and support the development of Namibia's Information Society
Niger	Delegue General a l'Informatique (DELGI)	No	National information infrastructure planning started with a UNDP SDNP mission in May 1997. However, since then there have been no public declarations of intent.
Nigeria	No	No	
Reunion	No	No	
Rwanda	Ministère de l'Enseignement Supérieur, de la Recherche scientifique et de la Culture	No	
Sao Tome And Principe	No	No	
Senegal	Delegue General de l'Informatique	No	The country has advanced information infrastructure organisations , and has announced a variety of initiatives to improve the local information infrastructure.
Seychelles	Technical Support Services Division (TSSD) of the Department of Industry is responsible for national science and technology information policy.	No	The national information infrastructure is designed to underpin the country's key sectors: tourism and fishing. Though no formal plan has been announced the government has declared its intention to turn the island into an information technology hub for the region.
Sierra Leone	No	No	This war torn country has had much of its public infrastructure destroyed.
Somalia	No	No	There is no recognisable national government in the country and virtually no public institutions are operational.
Sudan	No	No	
Swaziland	No	No	
Tanzania	No	No	
Togo	No	No	
Uganda	No	No	
Zambia	No	No	
Zimbabwe	No	No	



**Table A2: Main telephone lines, Africa, 1996**

Country	Population 1996	Total (000s)	Per 100 inhabitants	Growth over previous year
Algeria	29,168	1,278.1	4.38	8.7%
Angola	11,185	52.4	0.47	-12.6%
Ascension	1	0.4	38.35	2.6%
Benin	5,514	32.7	0.59	15.9%
Botswana	1,490	72.2	4.84	21.0%
Burkina Faso	10,780	34.1	0.32	13.4%
Burundi	6,088	14.8	0.24	-13.7%
Cameroon	13,560	70.6	0.52	7.6%
Cape Verde	396	25.2	6.37	17.3%
Central African Rep.	3,344	9.0	0.27	15.2%
Chad	6,515	6.0	0.09	12.6%
Comoros	632	5.0	0.79	10.4%
Congo	2,668	21.4*	0.81	4.2%
Côte d'Ivoire	14,781	130.0	0.88	12.3%
D.R. Congo	46,812	36.0*	0.08	—
Djibouti	617	7.6*	1.31	0.5%
Egypt	60,603	3,024.9	4.99	11.4%
Equatorial Guinea	410	3.7	0.89	45.8%
Eritrea	3,280	18.8	0.57	9.5%
Ethiopia	58,506	148.7	0.25	4.4%
Gabon	1,106	35.0	3.16	9.4%
Gambia	1,141	19.2*	1.73	4.9%
Ghana	17,832	112.9	0.63	88.2%
Guinea	7,518	16.2	0.22	49.3%
Guinea-Bissau	1,091	7.9	0.73	7.6%
Kenya	31,806	261.4	0.82	9.1%
Lesotho	2,078	17.8*	0.90	13.2%
Liberia	2,820	4.5*	0.16	—
Libya	5,593	318.0*	5.88	20.5%
Madagascar	15,353	39.4	0.26	20.9%
Malawi	10,114	35.5	0.35	3.3%
Mali	11,134	21.3	0.19	24.1%
Mauritania	2,351	10.2	0.43	10.3%
Mauritius	1,134	185.9	16.39	25.4%
Morocco	27,623	1,251.0	4.53	8.0%
Mozambique	17,796	61.2	0.34	2.3%
Namibia	1,575	85.5	5.43	9.0%
Niger	9,465	15.4	0.16	11.7%
Nigeria	115,020	405.1*	0.36	9.9%
Réunion	664	225.9	34.01	3.3%
Rwanda	5,397	15.0*	0.19	—
Sao Tomé & Príncipe	135	2.5*	1.91	1.7%
Senegal	8,572	95.1	1.11	16.0%
Seychelles	76	15.2	20.00	12.4%
Sierra Leone	4,297	16.6*	0.37	5.5%
Somalia	9,822	15.0*	0.17	—
South Africa	42,393	4,258.6	10.05	8.5%
St. Helena	6	1.7*	34.26	9.5%
Sudan	27,291	73.8	0.27	-1.6%
Swaziland	938	20.5	2.19	3.8%
Tanzania	30,799	90.3*	0.30	2.2%
Togo	4,201	24.1	0.57	10.8%
Tunisia	9,156	584.9	6.39	12.1%
Uganda	20,256	47.9	0.24	10.8%
Zambia	8,275	77.9	0.94	1.5%
Zimbabwe	11,908	175.0	1.47	14.8%
AFRICA	743,195	13,642	1.84	9.9%

Note: \* 1995 data. Figures in italics are estimates.

Source: International Telecommunications Union, World Telecommunications Indicator database.

**Table A3: Sub-Saharan Africa country summary of Internet connectivity, August 1999**

Country	No. of ISPs	Users	International Bandwidth (Kbps)	Local Call Cost* (US\$)	Internet Density (Population / User)	Speed (Users / Int* Bandwidth Kbps)
Total (Excl.) South Africa	192	67985	16011	2.8	9,395	5.0
Angola	5	1,500	192	6.00	7,978	8
Benin	7	2,000	128	4.80	2,941	16
Botswana	6	1,000	640	0.60	1,551	2
Burkina Faso	3	700	256	1.10	16,289	3
Burundi	1	75	19.2	0.75	87,853	4
Cameroon	4	2,000	256	1.55	7,162	8
Cape Verde	1	50	19.2	n/a	8,340	3
CAR	1	200	64	6.90	17,445	3
Chad	3	200	64	10.50	34,460	3
Comoros	1	50	64	0.20	13,440	1
Congo	0	0	0	n/a	n/a	n/a
Guinea	5	300	128	2.00	48,557	2
Djibouti	1	400	128	1.00	1,628	3
Equatorial Guinea	1	200	64	n/a	2,150	3
Eritrea	4	300	28.8	0.60	11,827	10
Ethiopia	4	2,400	512	2.60	25,880	5
Gabon	2	1,000	512	13.90	1,171	2
Gambia	4	150	128	1.20	7,960	1
Ghana	9	4,500	640	1.34	4,190	7
Guinea Bissau	1	150	64	n/a	51,153	2
Ivory Coast	3	2,000	256	4.80	568	8
Kenya	16	15,000	2000	1.36	1,935	8
Lesotho	1	200	9.6	n/a	10,920	21
Liberia	1	50	64	n/a	54,960	1
Madagascar	5	700	256	0.43	23,354	3
Malawi	3	400	128	1.56	25,943	3
Mali	5	400	128	2.80	29,578	3
Mauritania	2	100	128	6.60	24,540	1
Mauritius	6	960	896	1.00	1,202	1
Mozambique	6	3,500	384	0.80	5,340	9
Namibia	6	2,000	1000	1.00	827	2
Niger	2	200	192	1.31	50,595	1
Nigeria	15	1,000	1152	0.40	121,773	1
Reunion	1	500	64	n/a	n/a	8
Rwanda	1	100	128	n/a	65,270	1
Senegal	9	2,500	1000	1.90	3,600	3
Seychelles	1	1,000	128	n/a	76	8
Sierra Leone	1	100	128	1.50	45,760	1
Somalia	0	0	0	n/a	n/a	0
Sudan	1	300	128	n/a	95,090	2
Swaziland	3	900	64	0.95	1,036	14
Togo	2	300	196	1.60	14,780	2
Uganda	4	3,000	256	8.40	7,106	12
Tanzania	4	2500	1098	1.94	12,876	2
Zambia	3	3,000	256	1.60	2,897	12
Zimbabwe	17	10,000	2000	4.00	1,195	5

\*Converted to US\$/hour. \*The number of Internet users per 1 kbps of available international bandwidth.

Source: Compiled from www.apc.org and e-mail postings on Global Knowledge for Development listserv postings.

## APPENDIX B

**Table B1: Foreign private sector involvement in the ICT sector in Sub-Saharan Africa**

Country	Company(s)	Industry
Angola	n/a	n/a
Benin	n/a	n/a
Botswana	Sprint/France-Telecom/Deutsche-Telecom alliance – Global-One. France Cable & Radio (FCR).	Telecommunications and Internet provision
Burkina Faso	Teleglobe (Canada). OMNES, (a subsidiary of Cable & Wireless)	Public telecommunications and Internet provision
Burundi	n/a	n/a
Cameroon	n/a	n/a
Cape Verde	Portugal Telecom International (PTI) has a 40 per cent share of CVT the PTO	Public telecommunications and Internet provision
Central African Republic	A subsidiary of France Telecom, SOFRECOM holds a 40 per cent stake in the PTO	Public telecommunications provision
Chad	Full Internet services using an X.25 link to Paris were established by the PTO, TIT, in October 97 in co-operation with France Cable & Radio (FCR).	Internet provision
Comoros	n/a	n/a
Congo	n/a	n/a
Côte d'Ivoire	Second largest ISP is Globe Access, a joint venture with French company Omnes, with 35 per cent of its shares being retained by the state and 51 per cent being bought by France Cable and Radio (FCR).	Internet service provision
Democratic Rep Congo	n/a	n/a
Equatorial Guinea	GETESA, the PTO, is partially privatised with 40 per cent being owned by France Cable and Radio (FCR).	Public telecommunications provision
Eritrea	n/a	n/a
Ethiopia	Ericsson holds the sole license for mobile telephony provision	Mobile telephony
Gabon	n/a	n/a
Gambia	n/a	n/a
Ghana	The UK based Africa Online provides Internet services. GNPC (US) is working with the Israeli company Gilat to deploy a VSAT-based telephone network around the country. Both GT and GNPC each have 20-year exclusivity licenses. Celltel (a joint venture between local investors and AT&T) and – Millicom Ghana, of the UK, operates a GSM cellular network.	Public telecommunications provision
Guinea Bissau	Guinea Telecom (GT) is the sole telecom operator in the country is 51 per cent owned by Portugal Telecom International (PTI).	Public telecommunications provision. Mobile telephony

Country	Company(s)	Industry
Kenya	AfricaOnline offers Internet access	n/a
Lesotho	n/a	n/a
Liberia	n/a	n/a
Madagascar	Data Telecom Services (DTS), a joint venture of the PTO, Telma, with 49 per cent ownership by France Cable and Radio (FCR) operates the public telecommunications network. The national telecom operator, Telecom Malagasy (Telma), has a 10 year exclusivity period which began in 1994. Telma is 66 per cent owned by the state and 34 per cent owned by France Cable & Radio (FCR).	Public telecommunications provision
Malawi	Full Internet services have been supplied since mid-1997 by MalawiNet, a joint venture between the PTO, (MPTC) and American company USCOMNET Inc. A joint venture between Telekom Malaysia and MPTC (which owns 40 per cent) called Telekom Network provides cellular services in limited areas.	Public telecommunications provision. Mobile telephony
Mali	n/a	n/a
Mauritania	Supplied as a turnkey solution by France Cable & Radio (FCR)., Mauritel, was the first in Africa to provide Internet services, via its joint venture with FCR, Telecom-Plus. It is still the sole provider of public telecommunications	Internet provision
Mauritius	Similar to those in other francophone countries, the PTO is a joint venture with France Cable & Radio (FCR) which owns 30 per cent. Mauritius will be connected by fibre optic cable to the global backbone in 1999 when South Africa's Far-East (SAFE) project links to the country	Public telecommunications provision. Mobile telephony
Mozambique	One of the major providers of connectivity in Mozambique has been Teledata, a joint venture company between TDM and Marconi Portugal (Telecom de Portugal). There is one GSM cellular mobile operator, M-Cell that is owned by Telecomunicacoes Moveis de Mocambique, a subsidiary of TDM (76 per cent) with Detecon (24 per cent), the consultancy arm of Deutsche Telekom.	Public telecommunications provision. Mobile telephony
Namibia	n/a	n/a
Niger	Full Internet services have been available from SONITEL since November '96. The international Internet link is provided by France Cable and Radio (FCR)	
Nigeria	n/a	n/a
Reunion	n/a	n/a
Rwanda	In 1998 a GSM cellular service was established by Rwandacell with investment from South African cellular operator MTN. An X.25 data service is also available (Rwanda Pac).	Mobile telephony
Sao Tome And Principe	The Companhia Santomense de Telecomunicações (CST) is the sole telecommunications operator, 51 per cent owned by Portugal Telecoms International (PTI). Full Internet services are being developed by the PTO, CST, as a joint venture with Portugal Telecommunications International (PTI)	Public telecommunications provision. Mobile telephony
Senegal	The sole telecommunications operator is the Société nationale des télécommunications du Sénégal (SONATEL) which was privatised in 1998 been privatised, with France Cable & Radio (FCR) purchasing 33.3 per cent. Togo Telecom and the West Africa Growth Fund has also invested in Sonatel.	Public telecommunications provision

<b>Country</b>	<b>Company(s)</b>	<b>Industry</b>
Seychelles	In 1998 Cable & Wireless Seychelles PLC, a subsidiary of the British C&W group was the sole telecommunications operator, although plans are being made to end its monopoly.	Public telecommunications provision. Mobile telephony
Sierra Leone	n/a	n/a
Somalia	n/a	n/a
Sudan	n/a	n/a
Swaziland	UUNET Swaziland provides an Internet dial-up service	Internet service provision
Tanzania	n/a	n/a
Togo	n/a	n/a
Uganda	UK owned AfricaOnline has been the most recent entrant, setting up service in November 1998.	Internet service provision
Zambia	The public Telecommunications operator awarded a \$17m contract to Motorola to provide a wireless local loop facility in 1998.	Public telecommunications provision
Zimbabwe	Full Internet access is provided by three locally registered companies with international ownership – SITA, Wilken/afsat and Datel	Internet service provision

Source: GKD List serv, Bellanet, and UNDP/RBA

## APPENDIX C

**Table C1: Main ICT-related projects by development agency, January 1999**

Development Agency	No. of projects
International Development Research Centre (IDRC)	97
World Bank	73
<b>United Nations System</b>	
• International Telecommunication Union (ITU)	23
• UN Development Programme (UNDP)	19
• UN Population Fund (UNFPA)	7
• UN Educational Scientific and Cultural Organisation (UNESCO)	4
Bellanet International Secretariat	16
US Agency for International Development (USAID)	15
Swedish International Development Cooperation Agency (SIDA)	14
Agence de la Francophonie (ACCT)	4
International Institute for Communication and Development	3
Council for Scientific and Industrial Research (CSIR) of South Africa	3

*Source:* Global Knowledge database. Available at <http://gkaims.globalknowledge.org>. Accessed 2 January 1999.

**Table C2: Major ICT-related Development Projects in Africa, 1999**

<b>Initiative</b>	<b>Executing agency</b>	<b>Cost</b>	<b>Countries</b>
Leland Initiative	USAID	US\$15 million	Benin, Botswana, Côte d'Ivoire, Ethiopia, Eritrea, Ghana, Guinea, Guinea-Bissau, Kenya, Mali, Madagascar, Malawi, Mozambique, Namibia, Rwanda, Senegal, South Africa, Tanzania, Uganda, Zambia and Zimbabwe
Acacia	IDRC	CAN\$60m	South Africa, Mozambique, Senegal, Uganda
TradePoint	UNCTAD	ECU 30 million	Pan-African
SDNP	UNDP		Angola, Cameroon, Benin, Mauritania, Morocco, Mozambique and Chad.
Internet Initiative for Africa (IIA).	UNDP Africa Bureau	US\$6m	Angola, Burkina Faso, Cap-Verde, Gambia, Mauritania, Namibia, Nigeria, Ethiopia, Sao Tome et Principe, Swaziland, Chad and Togo.
Africa Information Society Initiative (AIS)	UNECA UNESCO UNCTAD UNIDO	n/a	Pan African
African Networking Initiative	IDRC ITU UNECA UNESCO	n/a	Pan African
African Virtual University Project	InfoDev (World bank)	US\$1.2m	Pan African

Source: UN agencies, Infodev, Bellanet database.

**Figure C1: List of organisations with ongoing information and communication technology projects**

<b>Regional Agencies:</b>	Standing Conference of African National & University Libraries (SCANUL)	United Nations University (UNU)	<b>Germany</b>	<b>Italy</b>	<b>US</b>
African Development Bank (ADB)		World Bank	Fredrich Ebert Stufting (FES)	Italian Government Co-operation	USAID
Commonwealth of Learning (COL)	<b>International Agencies:</b>	World Health Organisation (WHO)	Carl Duisberg Gesellschaft (CDG)	<b>Japan</b>	<b>Zambia</b>
COMNET-IT		World Trade Organisation (WTO)	Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ)	Japan International Co-operation Agency (JICA)	Council for Scientific and Industrial Research (CSIR)
CTA	CAB International	<b>National/Local Agencies:</b>	<b>Denmark</b>	<b>Netherlands</b>	<b>Private Sector &amp; Foundations</b>
European Community	InfoDev (World Bank)		Danish Agency for International Development Assistance	International Institute for Communication and Development IICD	BellaNet
European Space Agency	International Council of Museums (ICOM)	<b>Belgium</b>		Ministry for Co-operation (DGIS)	Eutelsat
Forum of African Ministers of Communications	International Documentation Network on Great Lakes	Belgian Administration for Development Cooperation (BADC)	<b>Ireland</b>	<b>Norway</b>	Microsoft
La Francophonie (ACCT)	International Federation of Library Associations IFLA	Vrije Universiteit of Brussels (VU)	Irish Ministry of Foreign Affairs	Norwegian Agency for Development Cooperation (NORAD)	MWeb
Organisation for African Unity (OAU)	International Telecommunications Union (ITU)	<b>Canada</b>	<b>Finland</b>	<b>New Zealand</b>	Pan African News Agency (PANA)
Pan African Telecommunications Union (PATU)	United Nations Development Programme (UNDP)	Canadian International Development Agency (CIDA)	Finish Ministry of Foreign Affairs	New Zealand Ministry of Foreign Affairs	2B1 Foundation
Regional African Satellite Organisation (RASCOM)	United Nations Education, Science and Cultural Organisation (UNESCO)	Canadian Ministry of Foreign Affairs (CVCEN)	<b>France</b>		Carnegie Mellon Corporation
UN Economic Commission for Africa (UNECA)	UN Environment Programme (UNEP)	International Development Research Centre (IDRC)	Caisse Française de developpement Centre Int. Développement de l'Inforoute (CIDIF)		Ford Foundation
<b>Sub-Regional Agencies:</b>	UN-Food & Agriculture Organisation of the UN (FAO)	Provincial government of Quebec	Ministère de la Co-opération Français		Global Information Infrastructure Commission (GIIC)
African Agricultural Association (ASARECA)	UN Industrial Development Organisation (UNIDO)	<b>Switzerland</b>	Reseau electronique francophone (REFER)		Intelsat
Common Market for East and Southern Africa (COMESA)	UN Office for Outer Space Affairs	Fondation de Devenir (FDD)	ORSTOM		US-Internet Society
East African Co-operation Intergovernmental Authority on Drought and Desertification (IGAD)	UN Operations Support (UNOPS)	Swiss International Co-operation			Kellogg Foundation
Southern African Development Community (SADC)	UNITAR				PanamSat

Source: Bellanet Donors database, Jensen@apc.org, UNDP IT for development department, InfoDev Database, January, 1999.



## **APPENDIX D**

### **Research process and data analysis**

Personal interviews were deemed an important part of the research. A total of 21 interviews were undertaken in order to establish the opinions, issues and constraints to the effective implementation of the UNDP project. Interviewees were selected from the IT community; and personnel in agencies that were overseeing procurement and implementation strategies.

Interviews took approximately one hour each and began with an introduction to the project, its objectives and strategy for implementation. It was also explained to the participants that their answers would form part of the data of the research project. Next, interviewees were asked questions relating to their educational background and role within their respective organisations. The time allotted was sufficient in that it allowed a thorough examination of the project and also adequate time to receive data on interviewees' recommendations for information infrastructure development in Ethiopia. The interviewing process was semi-structured in the sense that specific question areas were explained to the interview at the beginning of the interview in order to maximise the receipt of the requisite data. Interviewees were also encouraged to comment on general issues such as the state of the information technology industry in Ethiopia and the governments attitude towards information sharing. Due to the reluctance of interviewees, respondents were not tape recorded, however, to ensure accurate data collection, notes were taken during each interview. Other data collected included e-mails, notes from planning meetings, and project documents.

### **Structure of semi-structured interviewing**

Participants were asked to comment on six areas based around the UNDP's Internet Initiative for Africa in Ethiopia. These areas interview themes were collated from the existing literature of development project evaluation as well as the Internet Initiative for Africa project document it self. It was felt necessary to give some structure to the

interview process to ensure the collection of data relevant to an evaluation of the initiative itself.

### **Semi-structured interviewing themes**

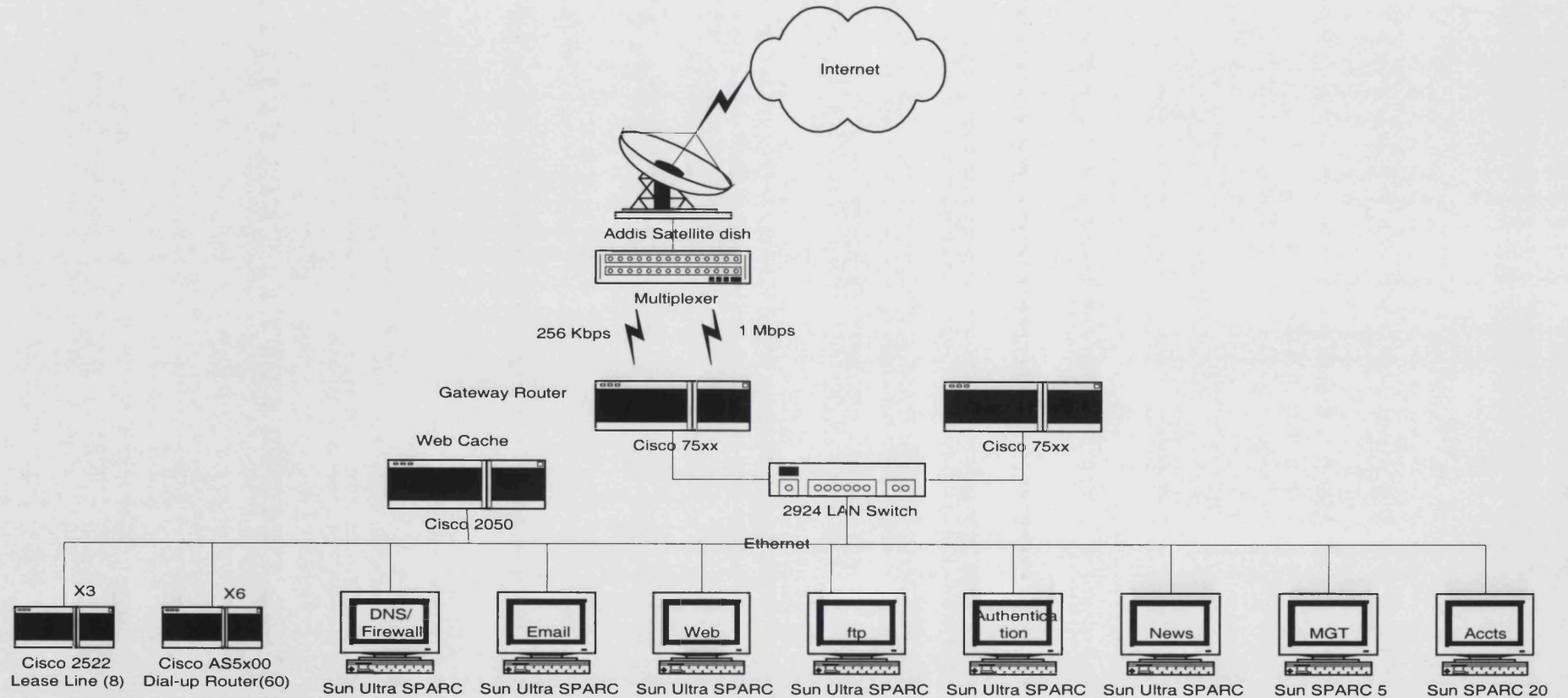
Interviewees, as well as being asked their general impressions of information infrastructure development in Ethiopia, were also asked to respond to the following themes:

- Initial impression of the project
- Strengths of the project
- Weaknesses of the project
- Who they felt would benefit the most from the initiative
- What they felt the constraints might be
- Recommendations

**Table D1: List of individuals and organisations interviewed as part of the case study of  
the Internet Initiative for Africa: Ethiopia**

NAME	TITLE	ORGANIZATION / COMPANY	DATE
MARK BIDDER	INFORMATION MANAGER	EMERGENCY UNIT FOR ETHIOPIA, UNDP, ETHIOPIA	10/07/98
NEWAY BEYENE	CUSTOMER ENGINEERING AND SERVICE MANAGER	AFCOR (ETHIOPIA) PLC	10/07/98
MICHEAL ASFAHA	SECRETARY GENERAL	ADDIS ABABA CHAMBER OF COMMERCE	12/07/98
HUSSEIN HIBESHI	HEAD, TRADE INFORMATION DEPT.	ADDIS ABABA CHAMBER OF COMMERCE	12/07/98
ESHETU ALEMU	DEPUTY DIRECTOR	NATIONAL COMPUTER & INFORMATION CENTRE, ETHIOPIAN SCIENCE & TECHNOLOGY COMMISSION	10/07/98
SOPHIA BEKELE	MANAGING DIRECTOR	CITY BUSINESS SERVICES	10/07/98
HAILU AYELE	VICE CHANCELLOR	UNIVERSITY OF ADDIS ABABA	17/07/98
MUHGETA BAYEH	COMMUNICATIONS OFFICER	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
ABEBE KEBEDE	HEAD OF PROGRAMME DEPT	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
ASRAT GAMD	HEAD OF ADMINISTRATION	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
GIRMA SHIFERAW	HEAD OF FINANCE DEPT	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
DEJERE BALCHA	HEAD OF COMMUNICATIONS UNIT	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
AKALEWOLD BANTIRGU	STRATEGIC PLANNING COORDINATOR	CHRISTIAN RELIEF & DEVELOPMENT ASSOCIATION	11/07/98
TEWODROS DEMISSIE	HEAD, MANAGEMENT INFORMATION SYSTEM	CARE ETHIOPIA	15/07/98
RAHEL KEBEDE	COMMUNICATIONS OFFICER	ACTION AID	15/07/98
JEMAL YUSUF	LOGISTICS/ PROCUREMENT OFFICER	AFRICARE	16/07/98
SOLOMON YEWONDWO SSEN	MANAGER OF INFORMATION SYSTEMS.	COMMERCIAL BANK OF ETHIOPIA	16/07/98
GETACHEN TESFAYE	HEAD OF INFORMATION DEPT	NATIONAL BANK OF ETHIOPIA	16/07/98
ALEMAYEHU TESFAYE	DIVISION MANAGER COMPUTER NETWORK & COMMUNICATIONS	ETHIOPIAN AIRLINES	16/07/98
MKANE FAYE	DIRECTOR	DISD, UNECA	10/07/98
ABEBE CHEKOL	DEVELOPMENT INFORMATION OFFICER	THE BRITISH COUNCIL	15/07/98

Figure D1: Proposed Internet Initiative for Africa Ethiopian Internet Gateway Architecture



ETHIOPIA INTERNET NODE

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