The state of e-development in South Africa:

A view from the end of the first decade of the 21st century

LINK Public Policy Paper No 11, July 2010

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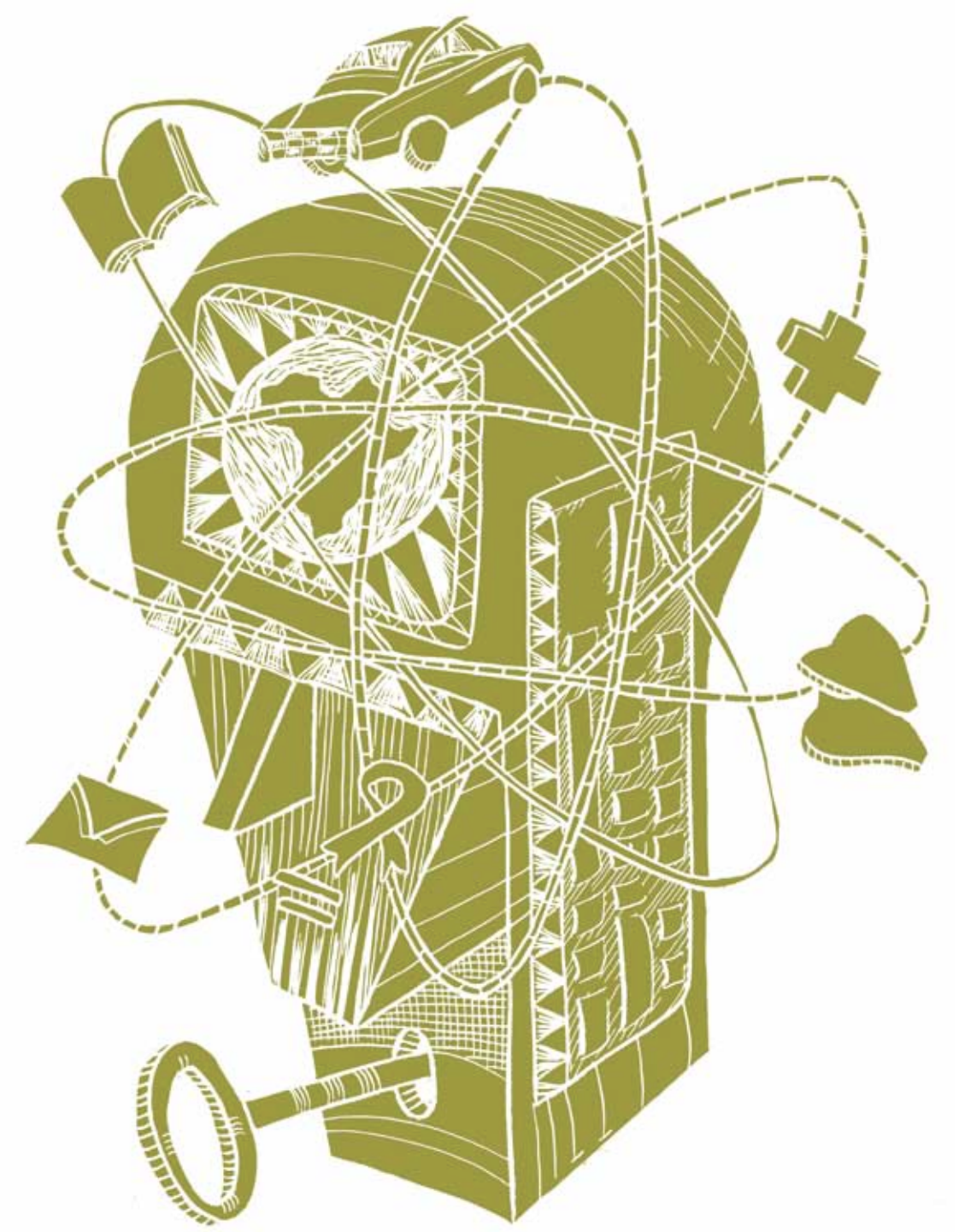
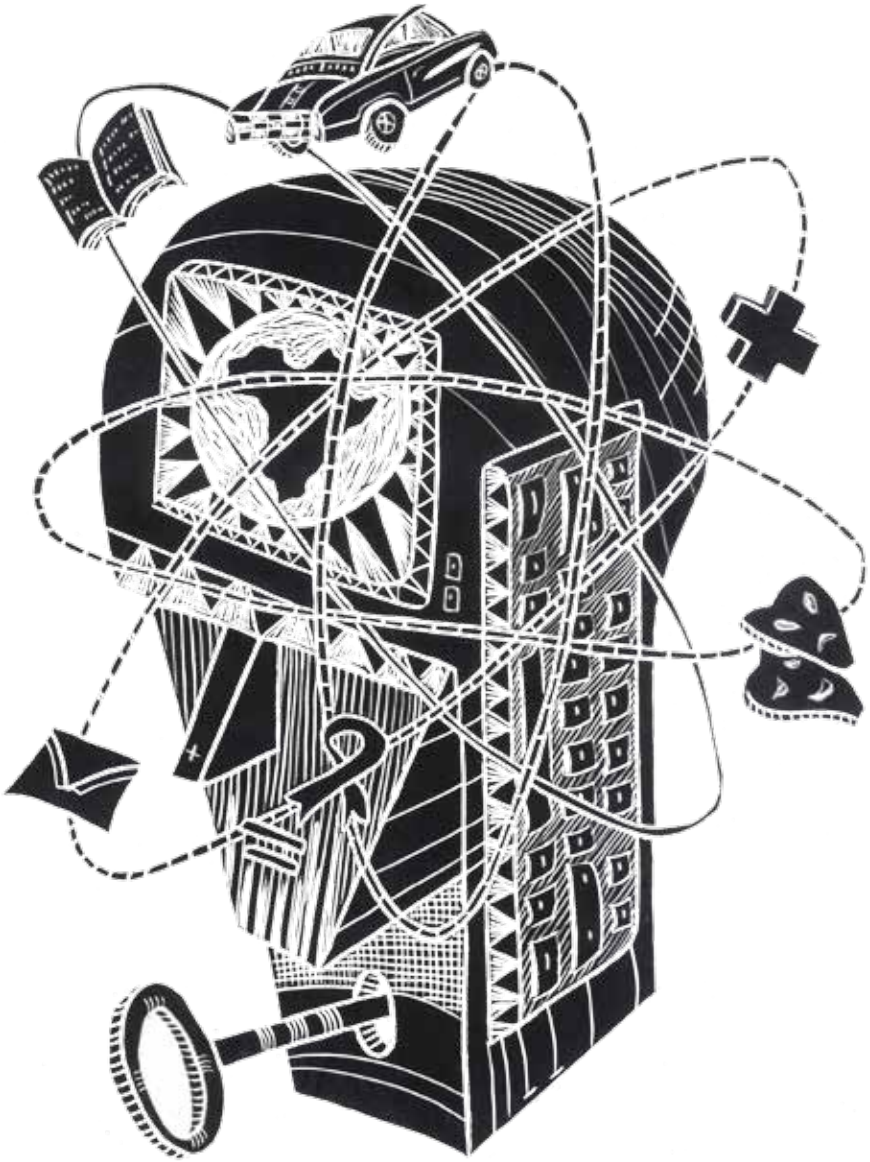


Explanation of image:

21st century human is represented in such a way as to be at the forefront of the developmental processes in a different and technological world. The vision is global, with the thought processes wired to those of education, technology, health and information. The keypad becomes the central nervous system and the giant key slotted into the voice box, the ultimate vehicle for all future communication.



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ICT, The Network Knowledge Economy and Development

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Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ADSL	Asynchronous Digital Subscriber Line
BPO	Business Process Outsourcing
BRIC	Brazil, Russia, India, China
CSIR	Council for Scientific and Industrial Research
DPSA	Department of Public Service and Administration
DSL	Digital Subscriber line
DST	Department of Science and Technology
DStv	Digital Satellite Television
ECNS	Electronic Communications Network Service
FIFA	Federation of International Football Associations
GDP	Gross Domestic Product
GEMS	Gauteng Emergency Medical Services
GERD	Gross Expenditure on Research and Development
GNI	Gross National Income
GPRS	General Packet Radio Service
HIV	Human Immunodeficiency Virus
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technologies
IDI	ICT Development Index
IPTV	Internet Protocol Television
ISAD	Information Society and Development
ISP	Internet Services Provider
IT	Information Technology
ITU	International Telecommunication Union
LAN	Local Area Network
LTE	Long-term Evolution
Mbps	Megabits per second
NACI	National Advisory Council on Innovation
OECD	Organisation for Economic Cooperation and Development
PSTN	Public Switched Telecommunications Network

R&D	Research and Development
RSA	Republic of South Africa
SABC	South African Broadcasting Corporation
SAFE	South Africa – Far East
SANReN	South African National Research Network
SAT3/WASC	Southern Africa – Western Africa submarine cable
StatsSA	Statistics South Africa
TENET	Tertiary Education Network
USAASA	Universal Service and Access Agency of South Africa
USALs	Under Serviced Area Licensees
USD	United States Dollars
VANS	Value Added Network Service
VAS	Value Added Services
WACS	West African Cable System
WEF	World Economic Forum
ZAR	South African Rands

ABSTRACT:

e-Development can be viewed from two perspectives: (1) the diffusion of information and communications technologies in a particular country or geographical region taken together with the degree of sophistication of these technologies and associated services; and (2) the value cycle of production, utilisation and impact of ICTs and new media on economic development and social well-being. Thus an analysis of e-development offers a composite perspective, compared to the often linear views presented in readiness rankings such as the WEF global information technology reports or indicator studies such as the ITU ICT development index[1]. This public policy paper, while exploring a limited set of issues, brings together an examination of South Africa's e-development from the diffusion and value cycle perspectives.

The public policy paper reviews e-development within the knowledge economy ecosystem, by looking at the state of development of the telecoms sector, the IT sector, the content industry, e-business, online media and social networking, e-government, and the broadcast media. It presents a view of the complex set of factors that go together to constitute e-development.

It argues that public policy aimed at encouraging an information society has to date been based largely in an industrial paradigm, where strategic thinking and socio-economic design are exclusively or predominantly influenced by parameters applicable in the industrial age – highly structured, bureaucratised policymaking compared to flexibility in public policy and strategy design; decision makers who make politics-driven rather than evidence-based policy; models of policymaking based on assumptions that changes in the socio-economic environment occur at a decadal rate of change, whereas change in the technology-society-economy continuum occurs at an increasingly rapid pace in cycles which are annual or shorter cycles. Indeed, the world is in a transition from an industrial to an information-knowledge-based paradigm, hence the two paradigms coexist, presenting a set of evolutionary policy challenges to which decision-makers must rise.

Future-oriented policy aimed at development of an information society will need to adopt a paradigm that incorporates and integrates the elements of ever greater and more rapid diffusion and sophistication of information infrastructure, side by side with progression in the ICT value cycle from production to heightened socio-economic impact, in its design.

TWO PERSPECTIVES ON E-DEVELOPMENT: *DIFFUSION AND VALUE CYCLE*

e-Development can be viewed from two perspectives: the diffusion of information and communications technologies in a particular country or geographical region taken together with the degree of sophistication of these technologies and associated services; and the value cycle of production, utilisation and impact of ICTs and new media on economic development and social well-being. Thus an analysis of e-development offers a composite perspective, compared to the often linear views presented in readiness rankings such as the WEF global information technology reports or indicator studies such as the ITU ICT development index.[1] This public policy paper, while exploring a limited set of issues, brings together an examination of South Africa's e-development from the diffusion and value cycle perspectives.

South Africa has demonstrated consistent progress in moving into the electronic age despite limitations in its policy and regulatory environment. Mobile telecommunications networks have spread across the country; sophisticated ICT applications have been adopted by businesses and government; and the Internet provides a foundation for information flows and transactions in banking and financial services, universities and other scientific performing agencies, as well as in shopping and entertainment services. However, this e-development excludes large numbers of the population and large parts of the country, where there is limited or no access to advanced communications at the household or firm level. Thus the digital divide of the early twenty-first century parallels the racial and class divide of the previous three centuries. The majority of the African black population still lives in low-income households with limited access to global communications infrastructure and services, while the minority population (defined as Whites, Coloureds and Indians) has differentiated but nevertheless disproportionate access in relation to the country's demographic profile (StatsSA 2007a).

ICT diffusion for South Africa is generally low, but mobile access is similar to that for OECD countries[2], while the Internet population is similar in size to developing countries (Table 1).

TABLE 1: ICT ACCESS IN SOUTH AFRICA 1990-2007

	Fixed telephone lines per 100 inhabitants			*Mobile subscribers per 100 inhabitants*			*Internet users per 100 inhabitants*			*Fixed broadband subscribers per 100 inhabitants*		*Mobile broadband subscriptions per 100 inhabitants*	
	2002	*2005*	*2007*	*2002*	*2005*	*2007*	*2002*	*2005*	*2007*	*2002*	*2007*	*2002*	*2007*
South Africa	10.4	-	9.6	29.4	-	87.1	6.7	-	8.2	-	0.8	-	2.7
Developing countries	-	13.2	-	-	22.9	-	-	8.6	-	-	-	-	-
OECD countries	-	44.1	38.0	1.0	78.5	96.0	-	44.5	-	4.8	20.0	-	-

These statistics confirm that mobile substitution has taken place in the context of continued high fixed line prices, with South Africa ranked 70 out of 150 countries at an ICT price basket value[3] of

1 For a critique of information society measurement approaches see Jensen & Mahan, 2008.
2 The majority of OECD Internet users use DSL, cable or fibre/LAN
3 The ITU 'ICT price basket value' is a ranking system based on the percentage of GNI per capita combined spend on fixed telephony, mobile cellular telephony and fixed broadband Internet services.

4.2% of GNI[4] per capita, or approximately USD241.92 (ITU, 2009: 56). While mobile connectivity appears favourable, it belies the limited usage of the majority of subscribers (Gillwald & Stork, 2008: 4) and the reality that mobile usage is predominantly business rather than household usage. In 2009, it was reported that 50 million SIM-cards were in circulation, but only about 68% of the population or 33.4 million people had phones (Goldstuck, 2009a). A few million people, perhaps as many as 4.5 million (Gillwald & Stork, 2008: 12) and at least 10% of urban mobile phone users (Goldstuck, 2009a) use multiple SIM-cards to avoid the high costs of interconnection. Though 2008 was reported to be the year of fastest growth since 2001, bringing the Internet user population to 4.6 million people, rising further to 5.3 million in 2009 (Goldstuck, 2010: 136), the continued low Internet penetration and even lower broadband access are indicative of a data divide.

This chapter presents an overview of South Africa's e-development, in relation to the evolution and diffusion of new ICT media; and the value cycle from ICT research and production to its impact across government, commerce and society. It applies this analytical frame with respect to Melody's information society perspective (Figure 1). Melody's framing of the networks for an information society operates at three levels: (a) the deployment of information infrastructure – networks, services, interactivity and content channels; (b) ICT manufacture, utilisation and socio-economic impact; and (c) the policy and regulatory environment governing the above.

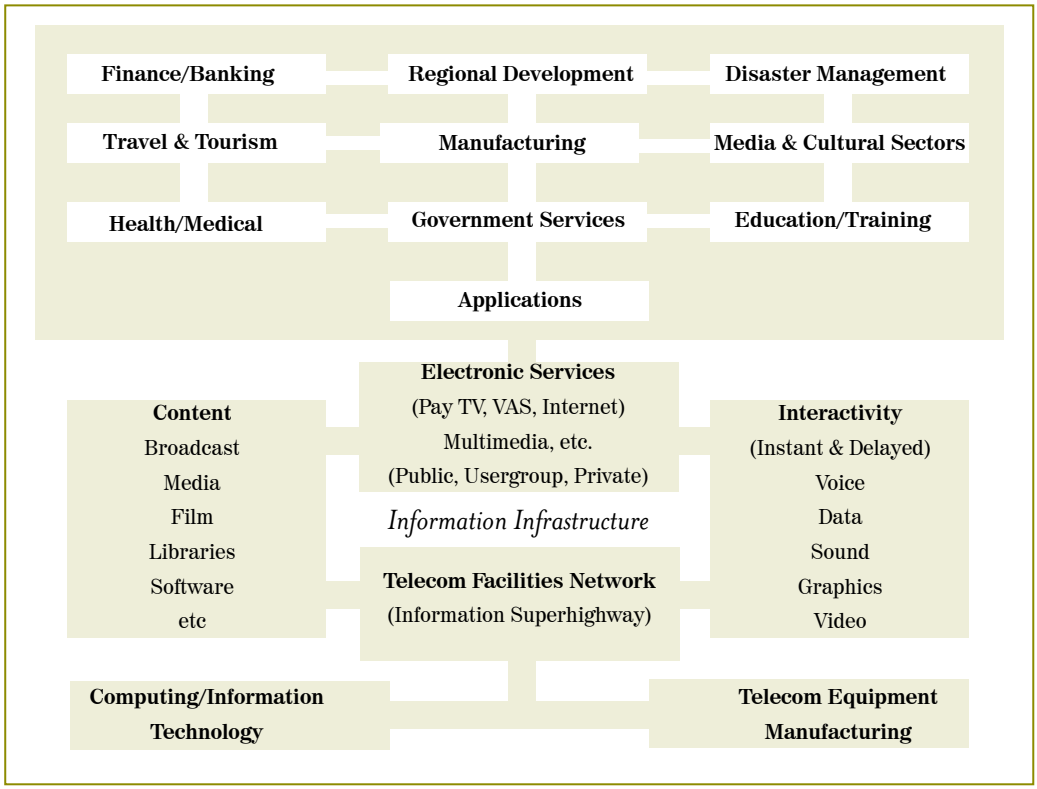

FIGURE 1. CREATING THE NETWORKS FOR AN INFORMATION SOCIETY

Source: Melody (2002a)

4 GNI is gross national income

South Africa's "network knowledge economy" and e-development

A consistently productive economy means that South Africa has seen a decade of strong growth. However, after growing at a rate of between 3.1 and 5.8% per year between 2000 and 2008, the economy contracted by 1.5% in 2009 due to the effects of the global recession (StatsSA, 2010a: 9). The country has a total population of 49.3 million. Fully 10% of the population, or 5.2 million people, are living with AIDS and 43% of deaths are due to AIDS (StatsSA, 2009a: 4, 6 & 8). HIV/AIDS has a negative effect on the working age population of 31.2 million and the labour force of just 17.1 million people (StatsSA 2010b: vi) and is eroding the numbers of teachers, professionals and young people who are important contributors to future economic development. The urban population is estimated at 56% and increasing, with four provinces showing levels of urbanisation greater than 75% and five provinces showing levels of urbanisation between 10% and 45% (StatsSA, 2006: 21-24). There is a growing black and female middle class with the requisite disposable income to purchase electronic goods and to push forward South Africa's e-development (Stephens & Sithole, 2006).
Simultaneously, a significant proportion of the population is excluded from enjoying the benefits of development. The adult literacy rate for ages 20 and above hovers around 74% and poverty levels are high with 22% of the population, or around 10.7 million people, living under the poverty line of USD1.25 per day[5] (RSA, 2009: 48 & 26). Partly because of its advanced industrial base, South Africa's ICT infrastructure and services are relatively well developed in urban centres, but this belies the state of low levels of e-access for most households and small businesses. The Community Survey 2007 reports that 76% of households had a working radio, 73% had mobile phones, 65% had a working TV, 18.6% had a landline telephone, 15% a computer and only 7% had Internet facilities at home (StatsSA, 2007a).

The knowledge factor

Late 20th and early 21st century knowledge economies tend to be characterised by features that include a growing intensity of R&D and innovation, the presence of advanced human capital as a supply side factor in knowledge-intensive production, rapidly increasing levels of penetration of ICT and electronic services, alongside enabling policy and institutional regimes (Houghton & Sheehan, 2002; Melody, 2002b; Smith, 2002), but are often accompanied by social exclusion of poor and low-income households (Castells, 1999). Given the balance of strengths and weaknesses, South Africa exhibits many of these features described as being characteristic of an emerging "network knowledge economy", as compared with the "industrial information economy" (Benkler, 2006).
The country exhibits globally competitive knowledge-intensive production in selected areas, such as the automotive components manufacturing sector, thereby enhancing its competitive economic positioning (Galbraith, 2007). Research and innovation occurs across a "national system of innovation" spanning scientific research councils, national research facilities, research-based universities, and private and public sector research entities. South Africa's gross domestic expenditure on research and development (GERD) in 2007-2008 exceeded USD2.48bn[6] or 0.93% of GDP (DST, 2009: 8-11), low

5 ZAR283 per month converted to USD at 7.5 rands to the dollar
6 ZAR18.6 billion for 2007-08 converted to USD at 7.5:1

by comparison with India and China, which both exceed 1% of GDP. Its technology balance of payments is negative (NACI, 2008), indicating that it is a net importer of technology. ICT R&D has historically been mainly in the software field. New areas of R&D are evolving in cyber infrastructure, mobile technologies and applications (Dwolatsky, 2010; Patel, 2010).

South Africa has a sizeable human resource base of several million tertiary education graduates, with an upward trend in higher education graduations in key sectors such as the engineering sciences, marketing and management sciences and the health sciences (NACI, 2009: 6-18). However, the number of full-time researchers per thousand of the workforce is relatively low at 1.5 (NACI, 2008: 18) and doctoral graduations in the information, computer and communication technology disciplines are very low at only 4% of the total doctoral graduate pool of 1 176 for 2005 (NACI 2009: 18). The size of the ICT workforce, including core workers and end-users[7], is estimated at more than a million (Akoojee, Arends & Roodt, 2007:20-21), not accounting for the large numbers of workers in the telecoms sector. While small in global terms with unmet local demand for ICT skills, the workforce is nevertheless sufficiently large to ensure that the country's ICT infrastructure and services range from the most basic to the most advanced.

The network factor

As regards ICT networks and services, though access to advanced communications such as broadband is limited by lack of effective competition, South Africa has a relatively vibrant private and public ICT sector. The range of new electronic media available provides a reasonably sound foundation for e-business, e-commerce and e-government, including innovations in mobile banking and mobile commerce, as will be discussed below. According to the annual financial statistics for 2008, the transport, storage and communication sector (including postal and telecommunications) contributed more than ZAR500 billion to the country's economic activity (StatsSA 2009b: 7). While data for the communication sector is neither updated nor disaggregated in the report, the estimated total income for the post and telecommunications industry in 2006 was R137.3 billion (about USD17.8 billion[8]) (StatsSA, 2008b: 4-6[9]) or 0.08% of GDP[10], with the largest contribution being from mobile telecommunications, followed by fixed-line, Internet, equipment sales, broadcasting, postal and courier services.

There has been extensive network investment over the last 15 years, in which the main advance has been in mobile networks and fixed line backhaul, with limited growth in fixed line or fixed broadband infrastructure. ICT's contribution to the growth and development of the country has mainly occurred in the private services sector, the greatest progress being in the banking, finance, tourism and hospitality sectors, with more limited diffusion in the manufacturing sector and only minor impact in the mining, agricultural and construction sectors. In new areas of international trade, such as the business process outsourcing (BPO) market, South Africa has so far proved unable to attract

7 According to the definition used in the study, core workers are engaged in the design, assembly and maintenance of computer systems, while end users support ICT business process operations.

8 At a rate of ZAR7.5 to the USD

9 This large sample survey of post and telecommunications is conducted every three to five years, 2006 is the latest survey year.

10 South Africa is listed at 26 with a GDP of USD254.9 billion in a listing of GDP by country for 2006, see http://www.nationmaster.com/graph/eco_gdp-economy-gdp&date=2006 Brazil, Russia, India and China fall in the top 12 countries on this list

expected levels of investment, largely because of the high cost of international bandwidth (dti, 2008). With regard to social communication amongst individuals and households, access to and usage of ICTs are limited to voice communications and text messaging, with only 7% of households (2007) having access to the Internet (StatsSA, 2007a). Using ICT for educational purposes is fairly extensive at tertiary level, though the ratio of student and lecturer access differs across institutions. At secondary level, Internet access is restricted to some fee-paying schools and to public schools in a few provinces where programmes are in place. The fixed network has extensive reach yet limited uptake, while the mobile network reaches to even the most far-flung corners of South Africa, fostered by a combination of tourism development and a rapid decline in the cost of handsets and air-time in recent years.

The ecosystem

In the period 1996 to 2009, public policy and practice have evolved to promote governmental and private sector investment in knowledge-intensive activity focused on economic competitiveness in advanced manufacturing, biotechnology, ICT research and development, and the film and creative industries, with the national Department of Science and Technology and the Western Cape and Gauteng provincial governments placing sizeable public investments in these arenas. However, South Africa does not have a broad ICT policy to promote affordable access to ICT infrastructure and high bandwidth, and to commercial and social content. It has been unable to achieve Benkler's objective (2006: 3) that is to place "the material means of information and cultural production in the hands of a significant fraction" of the country's population. Its e-development path has emerged from a range of initiatives across a wide spectrum of activity, including national and local government policymaking, private sector innovation and non-governmental activism.

The state of e-development

These limitations on e-development are primarily due to over a decade of high prices arising from lack of competition in the network segment of the market, lack of network investment in low income areas and ineffective price regulation. The report on measuring the information society (ITU, 2009: 22) places South Africa at 87 in the ranking table with an ICT development index (IDI) of 2.7. Table 2 illustrates South Africa's IDI ranking compared with that of the BRIC countries, for its neighbour Botswana and for the group of countries with which it is associated in the rankings.

Despite South Africa having a significantly higher GNI per capita than almost all the countries listed in the table, it performs poorly with respect to its ICT price basket value. This value is closer to that of China, which has a GNI per capita less than half that of South Africa, and way less than that for Brazil, which has a similar GNI per capita. Thus, on the ITU IDI index, South Africa fares better overall than Botswana and India with broadly similar ICT price basket values, but significantly worse overall than Russia, Brazil or China. South Africa's GNI per capita places it in the same group with Russia and Brazil, however its information society policies have seen it falter due to failure to promote affordability and access to sophisticated technologies such as broadband Internet. While there has been an increase in the IDI from 2002 (2.11), it has slipped down the rank-

ings and now sits at a similar ranking with Georgia, Libya, Ecuador, Tunisia, Fiji, Albania, Azerbaijan, Mongolia and Syria, countries historically less developed than South Africa.

Broadcasting is notably missing from the ITU ICT development index, perhaps due to the lack of technological advancement in this sphere for over a century. But convergence in digital technologies across services platforms including digital terrestrial TV and IPTV, will see broadcasting making a major contribution to e-development in the next decade. The pace of innovation in television is starting to rival the frenetic rate of development in the computer industry (McLeod, 2009).

TABLE 2: COMPARITIVE ICT DEVELOPMENT INDEX AND PRICE BASKET VALUES

Country & IDI ranking 2008	ICT development index (IDI) 2007	ICT price basket value 2008	GNI per capita (USD)
50 Russia	3.83	1.8	7 560
60 Brazil	3.48	7.7	5 910
73 China	3.11	4.4	2 360
80 Georgia	2.91	12.0	2 120
81 Libya	2.84	-	-
82 Ecuador	2.75	6.5	3 080
83 Tunisia	2.73	2.9	3 200
84 Fiji	2.73	5.2	3 800
85 Albania	2.73	7.1	3 290
86 Azerbaijan	2.71	16.0	2 550
87 South Africa	**2.70**	**4.2**	**5 760**
88 Mongolia	2.67	-	-
89 Syria	2.66	14.0	1 760
109 Botswana	2.10	3.8	5 840
118 India	1.59	4.7	950

Source: ITU, 2009

INFORMATION INFRASTRUCTURE ECOLOGY: DIFFUSION AND SOPHISTICATION

From the perspective of ICT diffusion, we can review the network infrastructure landscape, the IT sector and the content industry.

The ICT market structure incorporates the telecoms and broadcasting markets and the broader ICT sector. The telecoms market is comprised of fixed-line network operators Telkom and Neotel, and mobile network operators Vodacom, MTN, Cell C and Virgin Mobile. Under-serviced area licences (USALs) were awarded to 14 small operators to provide telecommunications services in areas recorded as having less than 5% tele-density and as having limited commercial viability. In 2008, these companies were granted electronic communications network (ECNS) licences under the Electronic Communications Act, 2005, allowing them to build their own network infrastructure, though this may not be cost-effective. In addition, more than 400 firms, including around 250 Internet service providers (ISPs) are licensed to provide telecoms and other value-added network services and to self-provide their own network infrastructure. However, the limitation on available spectrum has meant that these small firms cannot pursue wireless provisioning strategies, a more efficient option compared to building fixed network infrastructure. Thus, competition in the telecoms market is effectively stymied by the high cost of self-provisioning for small players and by the

ineffectiveness of the regulator with respect to spectrum allocation. The broader ICT market includes a very wide range of state and private providers in the realms of hardware and software provisioning, software engineering and applications design, and IT services.

Telecoms market structure

Telkom SA, the incumbent network operator that emerged from the pre-democracy Department of Posts and Telecommunications, has held an effective 18-year monopoly on fixed-line voice infrastructure since incorporation as a public company in 1991, as well as a monopoly on fixed-line data and broadband infrastructure in more recent years. It has harvested increasing profits, while maintaining monopoly prices in relation to consumers and monopoly rents in relation to facilities leasing. Several independent studies have confirmed that a range of Telkom's prices, particularly local call charges and broadband, are far higher than in many other countries (Smit, Neilsen & Roetter, 2008: 111-126). In its 2009 results, Telkom reported a five-year trend of decline in its fixed access lines from 4.7 million in 2005 to 4.4 million in 2009[11] including public payphones (Telkom, 2009: 86). In a declining fixed-line market, Telkom is attempting to expand away from its traditional fixed-line infrastructure and voice business into the broadband, wireless voice and mobile data markets (ibid: 4-5). While it offers high speeds of between 2Mbps and 155Mbps for wide area networks operated by businesses and large organisations, its residential broadband speeds of 4Mbps at the upper end compares unfavourably with 24Mbps in markets like the UK and India. While the company expresses its intentions to rebalance tariffs with respect to both local and international pricing, this is not reflected in prices to the consumer, where average monthly prices increased 11% from August 2008.

Neotel, the second network operator, only launched services to consumers in mid-2008 and so far there has been little impact on prices in the sector from this new market entry. Nevertheless, Neotel has implemented an aggressive marketing campaign, promising a connection within 48 hours, compared with the lengthy waiting period for a Telkom landline. The Neotel customer base developed some depth only from 2009, with deployment of fibre to the desktop, giving a household subscriber base of between 30 000 and 50 000[12]. The company strategy appears to be to focus on building its market share through providing new technologies and added value, rather than engage in full-scale price competition with Telkom.

The South African mobile operators Vodacom and MTN have a continental presence in Africa and the Middle East. Collectively, the two groups have more than 130 million subscribers[13], of whom 44.7+ million are in South Africa, not accounting for multiple and inactive SIM-cards. An exemplar of rapid expansion, MTN's local subscriber base grew from 200 000 in 1996 to 17.1 million in 2009 (Vodacom, 2009; MTN, 2008). While Vodacom and MTN are the dominant players in the market, late entrant and third mobile operator Cell C is estimated to have around seven million subscribers and is set to introduce 4G technology at speeds of 21Mbps. Virtual mobile operator, Virgin Mobile,

11 Year ending March
12 No figures are currently available for business usage
13 Vodacom Group 39.6 million as at 31 March 2009; MTN Group 90.7 million as at 31 December 2009, see respective annual reports

launched in 2006, adds a further 200 000 to the subscriber base (Cell C, 2009; Virgin Mobile, 2009). While high prices remain a strong feature of the South African telecoms market, the two fixed and four mobile operators are intensely focused on keeping abreast of technology advances and convergence in technologies and services, offering an ever wider range of commercial and household voice, data and value-added services.

Internet access is currently experiencing what appears to be a fundamental restructuring of the landscape. Consumers and businesses, who for more than a decade had relied on Telkom for voice, Internet access and international bandwidth, now have a wider market for access through mobile service providers and are likely to have even greater choice resulting from the major market changes pending. VANS providers[14] who have taken a series of cases of uncompetitive behaviour against Telkom to the Competition Commission from 2003 to date, with only limited success, now stand on the cusp of investing in infrastructure development which could push the market towards greater competition and a downward impact on prices. Following the award of ECNS licences in 2009, the sector is awaiting the award of spectrum as one of the last remaining barriers to building new wireless networks. However, the industry regulator, ICASA, has proved slow to deliver on spectrum resource allocation.

Given the slow introduction of broadband by private providers, some provincial and municipal governments have taken an active stance on introducing "municipal broadband". The City of Johannesburg is establishing a public-private partnership with Ericsson to build, operate and maintain a city-wide broadband network, offering affordable services to public entities and low-income communities, with eventual transfer of the asset at an agreed date. But the cost of building the infrastructure and the relative difficulty of designing business models that will show commercial returns, have seen these initiatives get off to a slow start. The metropolitan municipalities have historically invested in telecommunications assets for internal communication, but also own a range of assets that can be utilised for telecommunications purposes, including fibre networks, wireless networks, street light poles, storm water drains and pavements. With the current laying of high bandwidth fibre across many cities by the fixed line operators, municipalities are establishing policy to invite greater penetration of broadband, while at the same time adopting strict guidelines for the remediation of public land.

The technology landscape has developed from the public switched telecommunications network (PSTN) through second generation mobile voice to third generation mobile data technology deployment, both GPRS and 3G. A few mobile companies are likely to introduce fourth generation technologies including long-term evolution (LTE) technologies, as the industry players collectively migrate towards converged digital next generation networks to meet demand for ever greater bandwidth and multi-play services.

The telecoms and broader ICT markets are high-priced markets relative to income, with respect to both voice and data. One of the main cost drivers has been the relatively high interconnection rates charged by operators to terminate calls on each other's networks. In 2009, the Ministry of Communications undertook a major price negotiation on interconnection rates with the sector. Rather

14 Value added network service (VANS)

than await a policy determination from the Ministry, the mobile operators volunteered to reduce interconnection rates commencing 1 March 2010. It is uncertain whether these cuts will be transferred to the consumer.

Broadband pricing changes

The cost of broadband usage began to shift downward with the switch-on of the SEACOM cable on 23 July 2009 (Goldstuck, 2010: 110). The first major changes in pricing strategy came a month later, when Telkom announced that its allocation of 1GB caps would be doubled, and 3GB caps increased to 5GB. MWEB followed quickly with similar changes to bundles. Wireless provider iBurst then launched prepaid pricing, and said it was "revaluating its pricing models".

The next major move in pricing came on 18 March 2010, when MWEB announced a full range of uncapped ADSL packages for consumers and businesses. Several rival ISPs, including AfriHost and Vox Telecom, announced similar deals in the days that followed (Goldstuck, 2010: 103-6).

Academic network, SANReN

There are a number of large-scale projects creating national cyber-infrastructure for science and technology research, a number of which are being managed by the Meraka Institute. In 2009, the academic research network SANReN, consisting of a national backbone with fibre rings in the four largest metropolitan municipalities, Tshwane, Johannesburg, eThekwini and Cape Town, went live. The Johannesburg fibre ring has been completed, connecting the University of the Witwatersrand and the University of Johannesburg to the SANReN backbone. The remaining fibre rings will be completed in 2010. This national network is deployed at 10Gbps and the fibre rings will provide more than 10Gbps speed. An immediate challenge is to connect those institutions that don't conveniently lie in the big metros, such as universities in the North West, Limpopo and Eastern Cape provinces. Meraka and the Tertiary Education Network (TENET) are developing plans to connect these sites. Meraka provides the project management services based on a sound technical understanding of the SANReN requirements, while Dark Fibre Africa lays and maintains the fibre and TENET manages the network. The next objective will be getting scientists and industry R&D to use the available supercomputing power. The proposed average bandwidth utilisation is set at 15%, "so that researchers have a good experience and space to ramp up without living on the edge of the usefulness of the network"(Cloete, 2010).

The Meraka Institute also provides connectivity for the South African Large Telescope (SALT) at Sutherland and is collaborating with the National Research Foundation in connecting the site for the demonstration of the Square Kilometre Array radio-telescope at Carnarvon in the Karoo. The demonstration project will operate at 10Gbps and will be upgraded to 100Gbps if South Africa wins the bid.

International Internet bandwidth

International bandwidth has been one of the perceived bottlenecks in South Africa's e-development value cycle, but shifts are beginning to occur in the undersea cable segment of the market (Figure 2). The SAT3/WASC/SAFE[15] cable systems bringing international bandwidth to South Africa's shores have been operational for the past ten years and have been upgraded from an initial 40Gbit/s aiming for 360Gbit/s. South Africa is linked to the global Internet via the SAT3/WASC cable along the West Coast of Africa to Europe, and by the SAFE cable system across the Indian Ocean to India and Malaysia. Four additional cable systems will have been laid by 2011 including the West African Cable System (WACS), the Africa Coast to Europe (ACE), Eassy[16] and Seacom[17] (Song, 2009). The 17 000Km Seacom cable, offering high capacity bandwidth links between Africa, Europe and Asia, went live in July 2009, with landing sites in South Africa (Mtunzini), Mozambique (Maputo), Kenya (Mombasa) and Tanzania (Dar es Salaam).

SAT3/SAFE was historically managed by Telkom with high access prices charged. With the commercial launch in March 2009, Seacom promises to offer less expensive bandwidth to the African continent and South Africa, serving what is regarded as the "longest underserved coastline in the world", connecting South Africa and countries on the continent to London and Mumbai. This potentially disruptive infrastructure deployment may shift the market for international bandwidth to provide a cheaper alternative to SAT3/SAFE, with significantly greater capacity, at 1.28 Tbps (Goldstuck, 2010: 20). Initiatives are also under way to build undersea cable infrastructure with even greater capacity, the Eassy with 1.4 Tbps capacity and the WACS with a capacity of 3.8 Tbps[18]. The latter project was initiated by the state broadband company, Infraco, and is scheduled for completion in 2011 (Goldstuck, 2008: 32).

This all in theory however, the "Seacom effect" to enable high definition TV, peer to peer networks, IPTV and surging Internet demand" (Seacom, nd) is not yet a reality.

15 Southern Africa – Western Africa Submarine Cable, South Africa – Far East cable
16 East Africa submarine system
17 South Africa – East Africa – South Asia fibre optic cable
18 Terabits per second

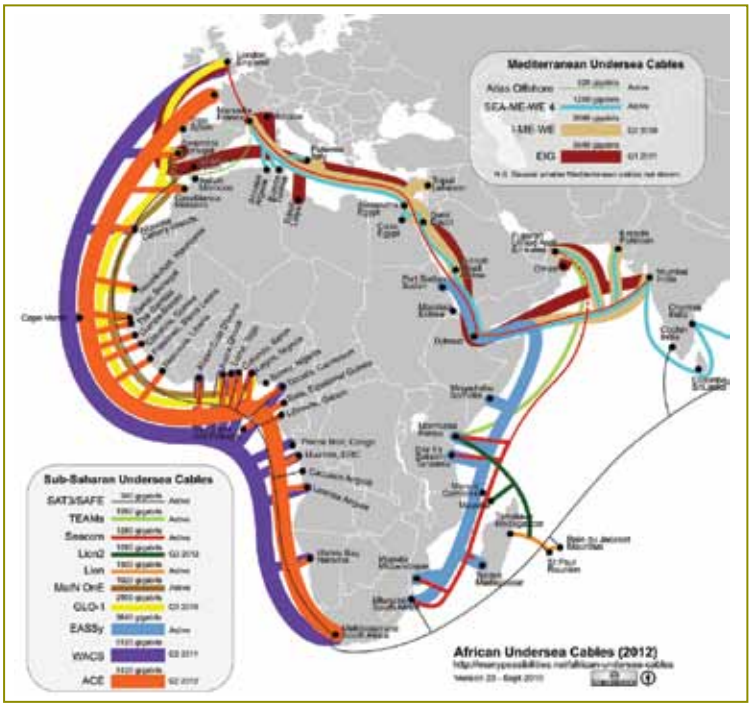

FIGURE 2: EMERGING UNDERSEA CABLE SYSTEM FOR AFRICA (SOUTH AFRICA)

Source: Song, S, 2009 http://manypossibilities.net/african-undersea-cables/

THE INFORMATION TECHNOLOGY SECTOR

South Africa has a sizeable market for IT goods and services, estimated at USD9.5 billion in 2010 (BMI, 2010: 1). It includes the presence of multi-nationals such as IBM, Cisco and Tata[19], and home-grown companies such as Dimension Data and Arivia.Kom. There are reportedly in excess of 2 428 companies operating across the hardware, software and IT services markets, with a combined staff of 141 929 people (Schofield, 2009: 2). These companies offer services that include IT architecture and enterprise resource planning; network evolution and management; hardware and software sales; applications integration; data management; e-commerce; and a range of value-added applications. The sector provides support to the manufacturing and resources sectors, to the broad services sector which includes non-governmental organisations and to academic and research institutions. It enables the increasing utilisation of ICT goods and services as a medium for doing business and for managing operations in all spheres of government.

By international standards, South Africa's large companies show a relatively sophisticated usage of IT both in terms of the continuous upgrading of enterprise-wide systems and the intro-duction of converged services across IT, mobile voice and data platforms. On the other hand, small companies, employing 50 people or fewer are limited in their deployment of IT, except in sectors such as tourism where IT is a core business requirement.

19 Through its indirect subsidiary Financial Network Services Pty Ltd (Africa)

The low levels of household penetration for computers, around 15.6% according to the Community Survey 2007, may begin to shift as large numbers of second-hand laptops come into the marketplace. A similar phenomenon was observed with mobile handsets where, in the period post-2005, the second-hand mobile handset market grew to the extent where the cost of owning a mobile phone was well within reach of most households. However, the cost of operating the mobile phone or computer to conduct electronic or Internet-based transactions is still beyond the budget of most households.

The content industry

The content industry is relatively small and still in the early stages of development. Broadcast and Internet content is generally sourced from foreign providers and websites. The local broadcast market is comprised of a multimedia network operator and broadcast network provider, Sentech; the South African Broadcasting Corporation (SABC) and commercial digital satellite television broadcaster, DStv. Radio and TV broadcasting is a diverse, still largely analogue landscape. The public broadcaster, the SABC, incorporates 15 public broadcast radio stations covering all 11 languages[20] and three commercial radio stations. There are 13 private commercial radio stations and 126 community radio stations licensed to operate across South Africa's nine provinces. The TV market is dominated by the SABC's three multi-language terrestrial television channels, supplemented by the free-to-air e.tv and pay TV offering, DStv. TV and radio offer a programming range from news and current affairs, to drama and reality TV. Four pay-TV channels were licensed in 2007 and the company On Digital Media, branded as TopTV, will introduce 55 channels to the market inMay 2010. It is certain to compete with DSTV in segments such as news, sport and movies, while at the same time aiming for the low- to middle-income market.

The major local producers of Internet content are the media sector (newspapers, radio and TV); financial, tourism and entertainment sectors; and government. The local content industry for the TV, film and advertising sectors is based almost exclusively in Gauteng and the Western Cape, and South Africa also offers facilitation services for international film and advertising crews.

South Africa's broadcast infrastructure is roughly 15 years old, but not yet obsolete. Still using analogue technologies, multi-language television channel SABC 2 has the biggest footprint and covers 80% of the country in terms of its signal, while English-language channel SABC 3 offers a more urban-focused signal. In far rural areas where there is poor TV coverage, satellite is used to convey a broadcast signal, yet there remain areas that are not covered at all. For the FIFA 2010 World Cup™, the International Broadcast Centre at Soccer City in Soweto will broadcast using both analogue and digital technologies.

Digital migration from analogue platforms to digital TV is in process, with signal testing having commenced. Base stations for digital terrestrial television (DTT) will be set up across the country, including in areas that had no previous coverage. However, the initial switch-on date of November 2008 was not met and much remains to be done to ensure that the current high TV coverage for South African households does not decline due to the lack of affordability of set-top boxes. It is

20 The most spoken languages are Afrikaans, English, Pedi, Sotho, Tsonga, Tswana, Xhosa and Zulu

argued that new channels are needed to attract people to buy the set-top boxes required for accessing the digital signal (Ngcobo, 2010), presenting a particular challenge for the cash-strapped public broadcaster. Estimates indicate that government will need to subsidise approximately 4.5 million set-top boxes for low-income households. There is now speculation that the switchover for most viewers will only take place in 2014, skirting dangerously close to the 2015 deadline for withdrawal of global protection for analogue signals.

Value cycle of ICT production, utilisation and socio-economic impact

The value cycle perspective on e-development reviews the level of technological advancement with respect to the electronics and telecoms/ICT components manufacturing sector, advances in consumer services and the related effects on society and the economy.

South Africa is a net importer of telecoms equipment, as well as the information and computing technologies that go to make up the facilities network. While the South African government adopted an ICT Research and Development Strategy in 2007, the ICT sector is probably several decades away from making a significant contribution to local needs or to making the country a significant player in the global ICT R&D sector. A few universities conduct R&D in the field, giving rise to the emergence of new institutions in the past five years, namely The Joburg Centre for Software Engineering (JCSE), established with support from metropolitan government[21] and the ICT industry; and the Meraka Institute[22], established in 2007 with resources from the state fiscus. Meraka emerges from a long history of ICT R&D at the CSIR[23] and conducts research and experimental development in four broad fields, namely cyber-infrastructure, imaging and networks, systems engineering and applications. Its current major project is building the South African National Research Network (SANReN), a dedicated high-speed network for academic and research institutions, connecting up to 108 sites and more than 3 000 researchers across local-international research networks (Meraka, no date). SANReN's national backbone was completed in December 2009. Future plans include raising investment levels and preparing a 10-year research roadmap.

The more developed parts of the R&D ecosystem include the local electronics industry which produces vehicle tracking systems and satellite TV decoding systems for export and for local markets. Other areas of innovation include wireless technologies and mesh networking, as well as voice recognition systems for local languages, translation engines such as translate.org.za and software design and standardisation (Majozi, Mbuli, Ferguson & De Vaal, 2009: 271-272). As regards ICT priorities for the productive sector, the top three priorities for innovation in 2009 were applications development, network infrastructure with due attention to broadband access, and business intelligence (Schofield, 2009: 2-3).

The Internet landscape has evolved slowly since the 1990s, but is beginning to show signs of more rapid development, with increasing access and usage. The number of Internet services and Internet access providers, ISPs and IAPs, increased from seven in 1994 to 603 in 2008 and 726 in 2009, of which the majority were internal corporate providers serving staff and clients of the particular

21 The City of Johannesburg
22 www.meraka.org.za
23 Centre for Scientific Industrial Research, one of several scientific performing agencies

company (Goldstuck, 2010: 13), and a small proportion were independent ISPs (ISPA, nd). By December 2009, Internet access had passed the five million mark and is heading for six million by the end of 2010.

As Internet access grows, demand for bandwidth is increasing, in particular from business and the academic community. There are currently five broadband providers in South Africa (previously six), namely Telkom, Neotel, Vodacom, MTN and Wireless Business Solutions (WBS) operating as iBurst. The 2008 Internet survey, (Goldstuck, 2008: 46) argues that the premium offerings may be expensive, but for the ordinary user with average Internet needs, there is a price to suit the pockets of most working people who have computers and phones at home.

Pricing of ADSL broadband showed a downward trend between 2004 and 2007 and South Africa witnessed a shift from dial-up to ADSL over the period 2005 to 2009. Of the estimated 630 000 ADSL connections, 355 000 were SMEs connecting an estimated 1.1 million users via SMEs. Wireless broadband subscribers were reaching towards the 1.5 million mark by December 2009, giving a total population of broadband connections of just over 1 million (Goldstuck, 2010).

It is noted that these shifts come as a result of a concerted response to constraints in the telecoms policy environment and attempts to push aside the existing policy paradigm of "managed liberalisation" rather than as a result of well-designed policy or regulation.

Electronic business and commerce

The services sector is both the largest contributor to GDP and the sector in which the greatest usage of electronic media occurs. In the period since 1996, banking and financial services, tourism and entertainment have become powerful exponents and power users of online media.

The small and medium enterprise (SME) sector predominantly uses ADSL (73%), with dial-up a thing of the past (4%) and wireless broadband not yet gaining ground (8%) (Goldstuck, 2009: 97). There are a number of possible explanations for the retreat from wireless broadband, including the higher cost and performance in relation to the relatively basic needs of SMEs; and the current low levels of mobility of SME staff when compared with people working in large corporate organsations, government or academia. Of the various types of SMEs, wireless broadband is a popular form of access in the wholesale trade, in advertising, mining and construction (11-13%), while there is limited usage in financial services, health services and the retail trade (2-6%). This reflects the attractiveness of wireless broadband for business-to-business services, as compared with business-to-citizen services. The level of SME Internet usage per business is also relatively low – 70% of SMEs have 10 or fewer employees accessing the Internet, while only 3% of SMEs have 50 or more staff who access the Internet (ibid: 101 & 108).

The manufacturing sector has been slow to adopt e-business, with limited B2B e-commerce for major activities such as supply cycle management, but few studies are available to track developments in this important economic sector.

Banking and financial transactions

The four largest banks, FNB, ABSA, Nedbank and Standard Bank offer Internet, telephone and mobile phone banking. The number of South Africans banking online at the end of 2009 reached 4.6 million, tracking the number of Internet users of a year earlier (Goldstuck, Rabelani & Gillowey, 2010). Transactions use simple but heightened security measures, including SMS pass-words for Internet banking and instantaneous SMS notifications for credit card usage. Wizzit, a division of the South African Bank of Athens Limited, is designing a service for the 12 million economically active people who are unbanked, recruiting retailers to take deposits and pay out cash, though this business model requires generating large numbers of transactions at low cost. Small emerging banks such as Capitec, that have opened for trading in the last 12 years, are building their businesses around mobile data and Internet-based transactions as this presents a more cost-effective financial model for their operations, but are finding that a branch network is essential for servicing the mass market. The tipping point appears to have been reached. Regulators have defined their legislative structure; cellphone operators have come to terms with operating in the stricter banking environment; consumers have learnt to trust transactions by phone; and banks are devising business models to make money from this service. (Claasen, 2010).

South Africa is awash with point-of-sale devices that enable transactions against either credit or debit cards, at restaurants, automotive service centres and most retail outlets, creating the basis for a local innovation in access to cash – the mini-Automatic Teller Machine (ATM). Mini-ATMs use the same network as the already-installed point-of-sale devices. The customer transacts a withdrawal and is issued with a receipt, which is then converted to cash by the retailer. Since the retailer uses the existing cash taken in by the business, electronic transactions between the retailer and the banking system take the place of large physical cash transfers.

Online media and social networking

New electronic media, in particular the Internet and mobile media technologies, have taken root in the first decade of the 21st century. Most newspapers and radio stations have an online presence, with 107 online newspapers and 152 online magazines reported (MDDA, 2009: 109-112), but the Internet is used to access a much broader range of social media. Trends indicate an increase in the number of unique Internet browsers, the number of page impressions, the number of sessions, time per session and total time spent online in 2008 (Nielsen, 2009). Of the estimated 4.7 million unique browsers, the audience demographics are predominantly male and English-speaking, with nearly 50% older than 35 years (ibid). Unsurprisingly, employment websites such as careerjunction.co.za and Careers24, personals and dating sites, real estate and automotive sites were in the top five sectors by average time per session in 2008, reflecting the main lifestyle components of users. Education and healthcare do feature in the top ten most engaging sectors by average time per session, but email, messaging and chat still attract the largest number of unique browsers (Nielsen, 2008). Popular online brands include News24.com, yellow pages.co.za, Autotrader.co.za, supersport.co.za and Junkmail.co.za, revealing that there is growing Internet substitution for news and advertising print media (Nielsen, 2007). This broad interest has held steady for several years now:

… brands in the top twenty are indicative of the increasing penetration of the Internet into daily South African life. Whether it's for news, health, jobs, cars, classifieds, sport or lifestyle, South Africans are turning more and more to the Internet to meet their needs (ibid).

This is confirmed by a local report on online media (Goldstuck, 2009b: 4-5) which points to the strength of online advertising and the attractiveness of social media and social networking tools for the media, automotive and telecommunications sectors. Online advertising grew by 27% in 2007, by 32% in 2008 and by 35% in 2009, bringing the total online advertising spend in 2009 to R419 million. This robust growth rate reflects growing confidence in the medium, despite the challenges of the global economic crisis and illustrates "the growing ability of online publishers to execute online strategies" *(ibid)*.

Social networking sites Facebook and Twitter gained popularity in 2009, with their potential role in strengthening democracy, attracting attention of users and government alike. Blogging is big with large media owners setting up blogspots like www.mydigitallife.co.za and The Times Planet Blog. More importantly, individuals and communities of interest, in school, business and academia, are blogging on every topic imaginable.

Media companies have started offering online content using mobile Internet technologies, and mobile Internet penetration looks set to grow, with popular sites including entertainmentafrica.mobi. Mobile websites or mobisites include online newspaper and radio content, sport, and wireless applications such as ring tones, music downloads, games, graphics and animations (MDDA, 2009: 124-127).

The print media appear to have been much more successful than the public broadcaster at repurposing their content for the online environment. This flexibility bodes well for ensuring the continued, possibly increased socio-economic value of text as a medium of communication. The challenge for online content is access for the more than 90% of the population, aged 15 years and above, who are not connected to the Internet. While mobile content provides a partial solution, it cannot provide the full solution, because only limited content will be retrieved via a mobile phone.

Electronic government

e-Development in the three spheres of government – national, provincial and local – has had mixed fortunes. The national Batho Pele[24] Gateway citizens' information portal www.gov.za and electronic filing of tax returns to the South African Revenue Services are two of the more successful applications of electronic government. But the absence of effective e-government is strongly felt in services such as the preparation and delivery of passports and identity documents, which is dogged by inefficiency and long waiting times.

At the level of South Africa's nine provinces, the Gauteng government has focused on three large-scale programmes, namely the Gautengonline schools programme, the e-Government programme (including Gauteng Emergency Medical Services and SAPS[25] Gauteng) and the G-Link broadband infrastructure project, amongst a wide range of departmental and cross-governmental initiatives. The provincial government of the Western Cape has pioneered online procurement and offers the

24 People First
25 South African Police Services

cape-gateway[26] "easy access to government information and services" and an online educational resource repository, Edumedia Online. The remaining seven provincial governments have not developed any significant online presence, though all have websites offering information about the province and the activities of provincial departments. The KwaZulu-Natal provincial government website channels visitors to the South African Government Information and Services portals, but offers no provincial-specific e-services, though department-specific information is available on the site. This latter province is also keen on introducing high-speed broadband access for local residents, though this is likely to be a long-term venture as much of the province is rural.

A brief review of e-government in a single province (Gauteng)[27] will need to suffice here as a perspective on electronic government, noting that provincial and municipal level governments are the main providers of public services to their respective populations. The Gauteng Online schools programme, started in 2002, has seen the computerisation of approximately 1 100 schools for the benefit of learners. However, a major weakness has been the lack of development of relevant local educational content. The website provides links to other sites hosting educational material, but there has been no development of an overarching e-learning programme; no learner- or teacher-focused website design; and no move to put textbooks, supporting learner materials or age-specific general knowledge online. This limits the value of the school computerisation programme to the learning process, as teachers and students need a comprehensive e-learning programme that explores all existing content areas of the curriculum, introduces new ICT-enabled teaching methodologies and adds new interactive content, such as exploring virtual 3D maps for geography lessons, or using virtual 3D graphics of animal and human anatomy to teach biology, or downloading short film documentaries on local history in history lessons.

The Gauteng emergency services command and control centre uses the GEMS electronic system to respond to calls and dispatch emergency vehicles, to track vehicles using GIS[28] technology, and to refer calls to the South African Police Services (Gauteng) when necessary. The electronic system improves on the historical use of telephone and radio, as it creates the foundation for a high quality of service with respect to the rapid identification of vehicles closest to the emergency scene and electronic tracking of patient progress. The SAPS Operations Centre (Gauteng), established in 2000, is perhaps one of the most advanced e-government operations nationally. It regularly upgrades its digital information management system and deploys high-bandwidth networks, enabling easy processing of high data volumes. The availability of comprehensive crime intelligence supports decision-making and improves responsiveness.

Advances in interactive electronic government are limited by, amongst other things, the low levels of Internet penetration with respect to households and small business. At the local government level, metropolitan municipalities such as the City of Joburg and the City of Cape Town have a well developed web presence, but this has limited value for poor communities who do not have Internet access. Projects such as SmartCape[29], offering free Internet access and local content at community

26 http://www.capegateway.gov.za/
27 Based on 2009 study by Abrahams and Newton-Reid
28 Geographic information systems
29 www.smartcape.org.za

libraries across Cape Town, are therefore very important initiatives that require long-term government and industry funding and should be extended to other provinces. Only a few municipalities in smaller towns make use of electronic government, typically those with a high tax base due to being retirement and/or tourist towns.

Hence, if the middle- to high-income population uses a greater proportion of private, rather than public, services, and the poor use a greater proportion of public, when compared with private, services, then poor households experience the burden of the digital divide through the relative absence of electronic government services as compared to the increasing pervasiveness of electronic commerce.

Broadcast media and digital content

Radio and TV have a wide reach, covering around 76% of radio households and 65% of TV households, compared to 72% mobile phone households (StatsSA, 2007b). However, this degree of coverage still leaves several million people outside the realm of daily media reporting. News and drama programming is offered in all eleven languages, though the bulk of TV programming is in four language groups – Nguni, Sesotho, English and Afrikaans. TV sound and picture quality is generally good and local content quotas deliver a reasonable level of local content compared with other African countries, but do not compare favourably with the huge local content industries that have evolved in, for example, India or China. Community radio and television stations, operating as non-profit organisations, offer a neighbourhood perspective on South African life. Of the four community TV stations, Soweto Community TV launched in 2006 offers both local and national coverage and is a font of hip, cultural information. The public broadcaster, the SABC, will broadcast all 64 games in the FIFA 2010 Soccer World Cup™ live on South African radio and TV, ensuring a high percentage participation in this nation-building six weeks.

The public broadcaster's role in promoting democracy through offering programming that covers news, current events and the cultural diversity of the country has, however, been diminished by its often weak governance and the parlous state of its finances. These weaknesses have led to attempts at political intervention in the appointment of the Board, which should be publicly accountable and independent of the government of the day. It has prompted the rise of the civil society "save our SABC coalition", an advocacy group for public accountability of the public service broadcaster. The new Board appointed in 2009 will need a firm yet clever strategy to achieve the delicate balance between promoting increased volumes of local content, digitising existing content and archived materials for availability in new converged formats such as DTT[30] and IPTV[31] , while ensuring effective governance and a trusted public broadcasting model.

30 DTT is digital terrestrial television
31 IPTV is Internet protocol television

Open access to knowledge

The Internet has made it possible for academics and the broader knowledge sector to promote access to research and scholarly works through their "free availability on the public Internet" (Budapest Declaration, Open Access Initiative, 2002), based on the rationale that access to knowledge in an Internet age should be at the lowest possible cost and not enclosed by the publishing industry. This is a fundamental departure from the proprietary approach to intellectual property rights, operating in a paradigm that recognises the value to be gained from enabling future generations to build on existing research, technology and design through open access to the source material for knowledge production.

Only a few South African universities, notably the University of Pretoria, are pioneering such open access approaches. The Association of South African Scientists (Assaf) argues strongly in favour of open access to scholarly works. The Human Sciences Research Council, a statutory social science research agency, makes its publications available online for free download or by request to the data repository, and has seen sales of its publications increase manifold, because the work has high visibility through the Internet. Creative Commons licensing is not yet a strong feature of research publications, but appears to be attracting interest amongst academics.

Skills, gender and ICT

The limited availability of skills is a constraint to growth of the sector. The problem is less in the services sector where these tools are used, than in the productive sector where the tools are developed. South Africa had no skills base in mobile communications and its convergence with computing 15 years ago; now large companies employ a range of skills, from technical to content skills. In the technical equipment sector, a few companies like UEC in Durban have developed a niche market with roughly 900 staff producing Multichoice digital satellite decoders for sale in the Far East, South America, Australia and on the African continent. The large banks employ many thousands of people for information systems development and maintenance, mainly in-house. This latter is a thriving sector, but there are major shortages of software project managers, systems integration and architecture specialists, information security developers, as well as database administration and other high-level developers. These skills are crucial as they form the apex of the skills pyramid needed to design new large-scale IT projects (Dwolatsky, 2010).

There is a scarcity of useful statistics on ICT skills, but a few recent studies offer a perspective. The ICT workforce, incorporating both core workers[32] and end-users, has been measured at various points as being around 1.1 million in 2003 with core ICT workers at around 182 800 (Akoojee, Arends & Roodt, 2007: 21). By 2009, core workers had increased to around 430 000 (Schofield, 2009). Nevertheless, a 2008 survey (Schofield, 2008: 15) argues that around 70 000 core ICT workers are needed to provide the various economic sectors with the skills necessary to ensure effective utilisation of these new technologies.

Gender participation in the ICT workforce is skewed towards women (James, 2006), with a greater percentage of the total workforce (64.4% in 2005) being women. However, men dominated the

32 Workers whose main productive activity is the design, deployment, maintenance and support of computer systems

workforce in the core workers component, while women were in the majority in the end-users component, "performing administrative support and secondary ICT work activities" (*ibid*, 2006: 40-41). The lower level of women's participation in science and technology is often attributed to women's lack of technical capability. This study found that, contrary to this view, the many barriers that remain to women's greater participation in the ICT workforce include the lack of role models, salary inequities and work-family conflicts.

The broadcast industry has two major centres for production – Cape Town for shooting commercials and facilitation for international crews working in both features and commercials, and Johannesburg for the local TV-content industry. Commercials from all over the world are shot in South Africa using local crews and expertise, indicating the high level of technical skills available. However, at the level of film, documentary and series, skills development is less advanced (Ngcobo, 2010).

Policy Formation and Regulatory Environment 1996-2009

The slow pace of e-development raises questions regarding the efficacy and value of telecoms policy choices to date, and points to a vacuum with respect to broader policy for building an "information society" or "network economy". Policy and regulatory design in relation to infra-structure competition, technology and services innovation, access pricing, quality of service, stimulating investment in next generation networks, encouraging universal connectivity and service, and promoting a local content industry, are key issues that still require the attention of policymakers and regulators in South Africa today.

This slow pace of e-development in practice can be tracked against the equally slow shaping up of the policy environment in the 16 - year period since the first democratic elections in 1994. Extensive investment in network readiness may at first appear to be at an acceptable level, but this belies the demand-side reality of limited infrastructure usage as found in several studies, including the household survey on ICT access and usage (Gillwald, Esselaar, Burton & Stavrou, 2005) and the annual Internet surveys (Goldstuck, 2005-2010).

Information society policy has been dominated by the Department of Communications, which holds an infrastructure mandate, while departments that could offer policy or strategy interventions such as Trade and Industry (e-development for business and SMEs), Public Service and Administration (e-government), Health (telemedicine) and Education (online educational content and scholarly publications) have made little input in terms of creating the conditions for e-development.

As previously stated, e-development has been fostered largely through the introduction of services innovations such as mobile pre-paid services, the subsequent offering of small units of airtime and SMS bundles, as well as the availability of cheap new and second-hand handsets. Hence, South Africa is a country with a large mobile-user base, typically using small units of air-time for voice communications, and a limited market for broadband Internet access at current market prices.

Information society and development 1996

In one of its first international information society policy initiatives, the South African government hosted the Information Society and Development (ISAD) conference in Johannesburg in 1996. The South African position paper presented an "information community perspective" highlighting the following issues: inclusive participation of developing countries as producers in the information society, not merely as ICT consumers with continued technological dependence on the developed world; fostering IT innovation capacity in the developing world as one means to address global political power imbalances and their further entrenchment in the 21st century; and the desire for the information revolution to benefit "society as a whole" (RSA, 1996a: 12-20). The future that was not precisely captured, but was envisaged in this document, was of an almost unimaginable array of wireline, wireless and mobile technologies and the Internet, little understood in 1996.

The ISAD conference was a precious moment in history, coming just two years after the first democratic elections in South Africa. However, there was no naïvety with respect to how difficult it would be to address the technology requirements of the African continent and developing countries. The chairperson's conclusions to the ministerial meetings argued that the technology gap was increasing between the highly-industrialised and less-industrialised countries, while developing countries had their own particular needs and should mobilise investments for information infrastructure, multi-media industries and skills development. Based on this thinking, the post-ISAD review paper "Towards the information society in South Africa" (NITF, no date: 8-10) motivated for national IT policy to complement existing policy on telecommunications and science and technology in order to set the frame for complementary actions in government and civil society. A case was made that the three factors necessary to move into the information society were flexibility (to embrace and advance change and avoid "creating a newly privileged information technology elite"), infrastructure and people (Blake, 1996: 3). However, no strategic action was taken and it would be 10 years before South Africa would set out its ISAD plan. The focus for the period 1996-2006 would be telecommunications and many poor public policy choices would be made along the way. The telecommunications operators and IT service providers would reap large revenues, but much of South Africa would remain under-developed and excluded from the benefits of the information society.

Telecommunications reform: exclusivity versus competition

South Africa's telecommunications reform and electronic communications development have seen three successive periods of legislative reform, the "exclusivity" period from 1996-2001 based on the Telecommunications Act 1996, the "managed liberalisation" period from 2001-2006 based on the Telecommunications Amendment Act 2001 and the "information society" period from 2006 onwards based on the Electronic Communications Act, 2005 (Esselaar & Gillwald, 2007: 10-11). These reforms have widely failed to meet the growing demand for affordable voice communications and fast Internet-based data communications and have therefore been paralleled by other state and private initiatives that have sought to remedy the failures. These proposed remedies include establishment of a state-owned enterprise, Infraco, to provide alternative international bandwidth for

affordable broadband services and municipal broadband provisioning by the mainly metropolitan municipalities. These approaches too, have thus far borne little fruit.

The "exclusivity" period, introduced and overseen by the Ministry of Communications, extended the monopoly status of the incumbent operator Telkom for six years from the date of inception of the Telecommunications Act, 1996. It established the Independent Communications Authority of South Africa (ICASA), the telecommunications and broadcasting regulator and the Universal Service Agency, now USAASA[33], whose mandate was to promote universal access and service. Therefore, during the first five-year period of telecommunications policy, competition in voice services only existed in the mobile segment of the market, in the form of a duopoly between Vodacom and MTN.

In the second reform phase, South Africa introduced the Telecommunications Amendment Act 2001 that provided for, inter alia, the licensing of a second network operator. In 2004, government introduced policy directives that were broadly interpreted as enabling VANS to self-provide their own facilities, but then immediately argued that this had not been the intention and VANS would have to continue leasing facilities from Telkom. This was the policy of "managed liberalisation" for the telecommunications sector, an excruciatingly slow process for opening up the market to competition in the fixed-line and mobile sectors. Government often intervened directly in the award of licences to telecoms companies, holding back new market entrants, first Cell C in the mobile market, then Neotel in the fixed-line market. Delays of several years in each case have resulted in these late entrants battling to gain a foothold in a fast-changing market characterised by disruptive technologies. Government policy had the effect of stifling competition at the level of fixed and mobile voice services, while at the same time limiting opportunities for competition in the infrastructure segment of the market, thus the market remained restricted and consequently consumer prices remained high. Despite a requirement in the Electronic Communications and Transactions Act of 2003 that a policy be drafted for SME access, no specific policy to support better access to ICTs for SMEs was developed until the Information Society and Development (ISAD) Plan was finally released in late 2007. The Plan included SMEs as one of the priority focus areas, but did not volunteer any practical supply-side measures to reduce prices for this or other key economic sectors.

The introduction of the Electronic Communications Act, 2005, set the foundation for greater market liberalisation and convergence in networks and services, providing for electronic communications network service (ECNS) and electronic communications service (ECS) licences which would enable ICASA to license nearly 500 industry players. Notably, ICASA did not proceed with this licensing initiative immediately following promulgation of the Act. It took a High Court challenge from the company Altech, an ICT products and services company, to make this change. In September-October 2008, South Africa's e-development experienced an unexpected shift. After more than a decade of telecommunications policy limiting the opportunities for e-development, a court ruling prevented the Minister of Communications from appealing against an earlier High Court decision that value added network services providers (VANS) could build their own networks. This decision unlocked

33 Universal Service and Access Agency of South Africa

the opportunity for several hundred voice and data carriers to be licensed to build their own facilities networks (Stones, 2008; ICASA, 2009) and thus avoid the very expensive facilities leasing and interconnection costs that have been a feature of the South African telecoms market.

Looking back, this might have been something of a turning point for South Africa. But, as previously argued, the costs of building network facilities on the one hand and the slowness in spectrum allocation on the other, have seen the legislation provide little comfort to either providers or consumers. Under this current regime, the mobile and Internet markets have grown, less because of government policy than despite it.

South Africa's policy uncertainty whether it is "to be or not to be" an information society, is reflected in successive years of poor Internet access from 2000 to 2006 (Paul Budde Communication, 2006), but has experienced a renewed surge since 2008 to around 5.3 million users in 2010, largely due to easier availability and price reductions in ADSL and mobile broadband (Goldstuck, 2010: 137). However, high computer hardware and bandwidth prices relative to the income of the majority of households have not brought affordable Internet access or widespread usage of advanced ICT services such as banking, shopping, education and entertainment within reach. Despite an exponential increase in mobile telecommunications access, with figures reaching about 34 million subscriptions in 2009, continued high mobile data prices may limit demand for accessing Internet services from a mobile phone.

ISAD and e-government 2006

Late in 2006, government released the national information society and development (ISAD) plan. Ten years had elapsed from the heady days of the ISAD conference and the information society still seemed as distant as it had in 1996. There is little in the text that was not contained in the South African government 1996 ISAD position paper, except for the fact that there is a dumbing down of the issues in the 2006 plan. The statement is made that the South African ICT policy and regulatory environment is globally recognised as being amongst the best in the world (The PNC on ISAD, c2006: 3). However, in reality, South Africa's policy and regulatory dispensation has been roundly criticised from several quarters both at home and abroad (Horwitz & Currie, 2007), with few if any complimentary views expressed.

TABLE 3: OVERVIEW OF ISAD PLAN

Ten pillars for the information society	Imperatives
Pillar 1: Policy and regulatory environment	A "predictable, investor friendly … enabling policy and regulatory environment" and a strong regulator.
Pillar 2: ICT infrastructure and universal access	"… ubiquitous access to ICT infrastructure and services at affordable prices …"
Pillar 3: Local content	"… a national content strategy … building a national identity based on … the diverse culture and multilingualism of the … society …"
Pillar 4: Digital inclusion and e-awareness	"… increase awareness of the benefits of ICT to all …"
Pillar 5: Human capital	"… restructure education curriculum to address the needs of the knowledge economy … develop the skills necessary for a vibrant … ICT sector …"
Pillar 6: ICT capacity development and R&D	"… develop a sustainable science, technology and research sector and increase employment in vibrant and growing knowledge-intensive industries …"
Pillar 7: Co-ordination and integration	"… harness efforts across government structures in all three spheres of government …"
Pillar 8: Funding	"… ensure that investments by both governments and the private sector are made so that basic infrastructure is financed adequately …"
Pillar 9: Institutional mechanisms	"… ensure that ISAD policies, programmes and initiatives are … driven … through a series of institutional arrangements that enable planning, alignment and co-ordination across government".
Pillar 10: Measurement of the information society development	"… an indicator system that supports monitoring, evaluation and impact assessment, development planning, budgeting, forecasting and decision making processes..."

Source: The PNC on ISAD, 2006: 3-5

The rhetorical nature of these statements must have made it impossible for even the most professional public servant to seriously pursue any particular course of action. The ISAD plan fell down on numerous fronts: (a) lack of strategy – there were just too many imperatives, objectives, pillars, principles and targets to give any clarity to the mission and purpose of government; (b) the actions of government were contrary to the stated intentions as regards a "predictable, investor friendly, enabling policy and regulatory environment"; (c) some of the statements were beyond the ambit of ISAD, such as the requirement to develop "a sustainable science, technology and research sector". As regards the latter point, a simple statement on ICT R&D would have sufficed. The expansive statement on R&D in the ISAD plan suggests a lack of awareness on the part of the drafters regarding the already substantial work done by other government agencies to foster a 21st century system of innovation, explaining their inability to craft an appropriate positioning for ICT R&D. Finally (d) there are some incomprehensible confusions such as the confusion of broadband and broadcasting, possibly due to a typographical error (*ibid*: 29).

The ISAD plan and e-government policy presented opportunities to build information society capacities on the foundations laid by infrastructure legislation and regulation. Granted that the legislative base of the early 21st century had distinct weaknesses (discouraging competitive pricing, absence of a frame to encourage the emergence of broadband infrastructure necessary for converged services, a weak sector regulator, other), information society policy could, in theory, set the challenge for change. However, information society policy fell under the same ministry as infrastructure policy and legislation, hence infrastructure policy was always going to lead. The telecoms sector stakeholders were few in number and had (and still have) sizeable, unique interests in growing the size and profitability of the fixed line and mobile voice markets. They are in a powerful position *vis-à-vis* the ministry due to their positioning as infrastructure providers in South Africa and on the African continent, infrastructure which governments rely on as the basis for valued added communications and transactions services. The information society stakeholders, on the other hand, were many (undersea cable consortia, ISPs, VANs, WASPs, higher education bandwidth consortia, public and community advocacy groups), with diffuse interests and still embryonic Internet-based service offerings. Thus the former stakeholder grouping could exert strong influence on ICT policy, while the latter grouping did not yet have the muscle to shift the telecoms monolith of industry and government.

It is curious that other very powerful industry stakeholders, such as the major banking and financial institutions, who are high volume users of voice and Internet services, did not lobby for more competitive pricing as a means to encourage the growth of e-commerce and e-business.

But there were other reasons for the lack of traction in information society development. Responsibility for the information society focus and the e-government focus fell under two separate ministries; communications, and public service and administration, respectively. The Minister for the Public Service and Administration (1999-2008) posed some difficult questions for government:

A review of e-government policy points to a number of weaknesses. While the Presidential Review Commission report (1998) highlights the need for alignment between information technology infrastructure on the one hand and modernised electronic government on the other hand (PRC, 1998: Chapter 6), the first e-government policy entitled Electronic Government: The Digital Future (DPSA, 2001) takes a technology and e-administration angle, neglecting the potential of online media (Internet and mobile media) to create value for communication between government, citizens and communities. There are only six references to the Internet, two references to websites and one reference to cellphones in the entire document, all generic statements with little policy direction: … *means of communication: desktop and handheld computers, telephones and cellphones, self-service kiosks and ATMs* …(*DPSA, 2001: 4*); … *cheap and fast access to the Internet* … (ibid: 5)*; South Africa is counted among the countries that lack laws governing Internet crime* … (ibid: 12)*; e-Government is premised … on the availability of the Internet, and if Websites are compromised, then government data can be read or modified* … (ibid: 20)*; Political statements, industrial espionage, and thievery are all reasons for cyber-terrorists to attack Web sites* …(ibid: 20).

The overwhelming concern of the policy is IT and information security. While this was a valid concern in the early days of the 21st century, the emphasis on securing information, rather than on making information readily available through these new media, must have played some role in

holding back progress of e-government. There are several (17) references to access (to the Internet, to government services, to IT infrastructure for previously disadvantaged communities), however, they are so vague as to render them meaningless. There is a single reference to "health consulting and telemedicine" and no references to e-learning or education utilising electronic media, this at a time when e-health applications, services and technologies were already being introduced in public services across the world. It would seem that the policy had not done enough to create the basis for electronic media to impact on the lives of millions of people.

The ISAD Plan raises the e-health and e-education objectives and a later document, South Africa's e-government journey (DPSA, 2008), prioritises six pro-poor services including registration of births and deaths, and social grant applications. However, slow progress is reported. Limited content is available for e-education and there is no programmatic work on content development and management for the public education sector; while telemedicine is practised in only a few locations (Patel, 2010) and the collaborative intergovernmental platforms required for e-enabling the six pro-poor services were not yet established (Williams, 2009).

Conclusion

This review of the elements of ICT diffusion and sophistication with respect to information infrastructure, and evolution of the ICT value cycle with respect to production, utilisation and socio-economic impact, argues that the reality of South Africa as a "connected, information society" remains futuristic. There is only a very small ICT and electronics manufacturing sector, continued low levels of Internet and broadband penetration, and ICT penetration is much higher in the large cities than in small towns or rural areas. Policy and regulation have not closed the digital divide and may rather have contributed to its widening.

Why the failure to move towards an inclusive information society? e-Development was hemmed in by government policy in the period 1996 to 2008 as a result of government's protection of the powerful interests of the telecoms and mobile operators. Then, a confluence of events, namely the court judgement on VANS self-providing their own facilities and the award of more than 450 ECNS licences, a slight reduction in broadband prices and the introduction of innovative broadband packages, the gradual opening up of the undersea cable environment, the possible reduction of interconnection rates, sets the scene for burgeoning e-development post-2010. Internet usage moved slightly ahead of the curve as evidenced in the 2010 Internet survey figures of five million users, or roughly 10% of population. Unfortunately this still limits e-development to the relatively highly-industrialised Gauteng province, and to three other metropoles, namely the City of Cape Town, eThekwini Metro and Nelson Mandela Metropolitan Municipality.

In the early stage development of the South African information society, government and industry players saw South Africa as a low middle-income country and assumptions were made that the market for value-added services and online media was small in comparison to the voice market. Thus high telecoms prices aimed at maximising profit from the voice market have been at the heart of the country's limited progress in household connectivity and low levels of Internet-based activity. These high prices were driven by a number of factors, of which two are prominent. In the first instance, from 1997 to 2008 telecommunications policy favoured the incumbent operator, Telkom, by creating a monopolistic environment. It required mobile service providers and VANS to lease their facilities from the fixed-line operator and set the context for a skewed interconnection pricing regime to emerge, with high call termination rates on the Telkom-owned backbone network. Secondly, restricted ownership of the undersea cable for international voice and data traffic encouraged monopoly pricing on international bandwidth.

Then, in 2008 the Altech High Court judgement enabling new operators and ISPs to build their own facilities networks broke the government stranglehold on the telecoms sector. It forespelt a confluence of activity, including the Neotel deployment of fixed mobile infrastructure in metropolitan and urban centres, public debate on interconnection rates leading to the lowering of peak and off-peak mobile call rates, growth in the undersea cable environment introducing cheaper rates for Internet connectivity. This massive programme of infrastructure building alongside a strong push to reduce the price of fixed-mobile and mobile-mobile voice calls and international bandwidth for Internet access is creating a new landscape in which the availability and affordability of infrastructure is encouraging adoption of Internet-based services and online media.

Connected cities, disconnected regions

It is possible that e-development will push through the barriers of bad policy, regulation and national governance in those parts of the country where the infrastructure and services have become a necessity to the operation of firms and the lifestyles of households, making for perhaps six "connected cities" – Johannesburg, Tshwane, Ekurhuleni, Cape Town, Nelson Mandela Metro and eThekwini. Other smaller cities such as Bloemfontein and Nelspruit, and small towns in locations where populations are highly dispersed, as is the case in the KwaZulu-Natal and Eastern Cape provinces, will remain largely disconnected from the highly urbanised hubs where e-development is taking place. Diffusion of advanced ICTs is limited to six cities and sophistication of ICT and Internet-based services is limited to high- and some middle-income households.

Even within the six cities, there are disconnected segments where households situated far from the urban centres may be living without access to electronic goods and services, except for intermittent SMS messaging on a cheap mobile phone with little capacity for enhanced applications.

Moving beyond disconnected policy

These disconnected regions mirror the disconnectedness of policy thinking. Policy weaknesses are visible with respect to information society strategy design, with respect to overly bureaucratised approaches to government's responsibilities for policy design and information society leadership, with respect to the limited utilisation of available policy research, and not least with respect to policy flexibility in a highly contested domain for development.

This disconnected policy may be due to the cognitive dissonance experienced by policy-makers, who have spent most of their careers in decision-making operating from an industrial paradigm, where strategic thinking and socio-economic design are exclusively or predominantly influenced by parameters applicable in the industrial age – highly structured, bureaucratised policymaking compared to flexibility in public policy and strategy design; decision-makers appointed to make politics-driven rather than evidence-based policy; models of policymaking based on assumptions that changes in the socio-economic environment occur at a decadal rate of change, whereas change in the technology-society-economy continuum occurs at an increasingly rapid pace in cycles which are yearly or shorter cycles. Indeed, the world is in a transition from an industrial to an information-knowledge-based paradigm, hence the two paradigms co-exist, presenting a set of evolutionary policy challenges to which decision-makers must rise.

Future-oriented policy aimed at development of an information society will need to adopt a paradigm that incorporates and integrates the elements of ever greater and more rapid diffusion and sophistication of information infrastructure, side by side with progression in the ICT value cycle from production to heightened socio-economic impact, in its design, as represented in Figure 3, below.

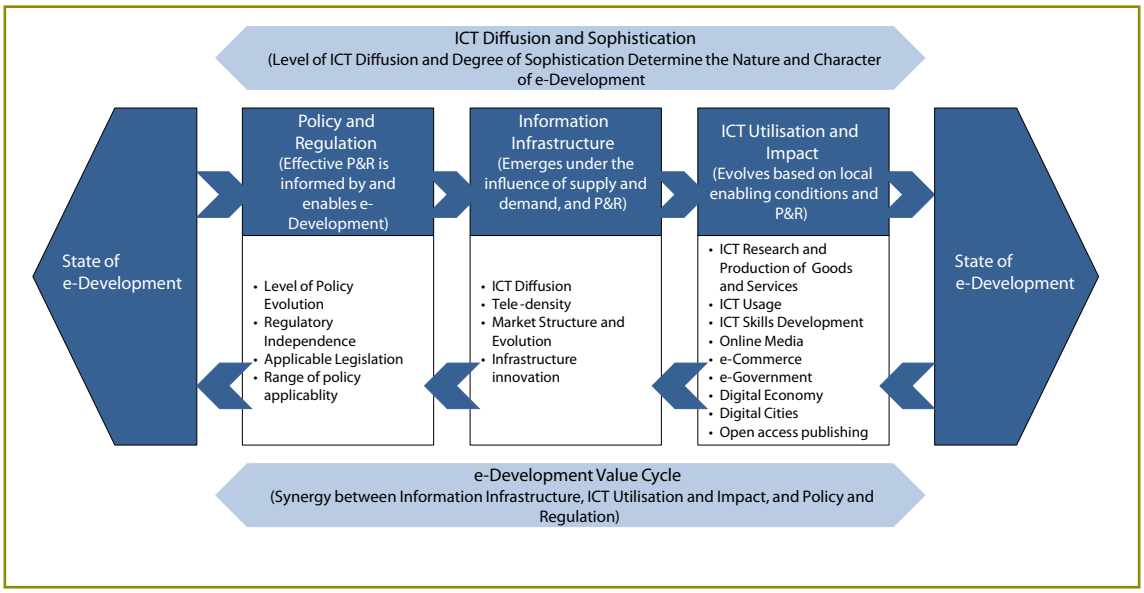

FIGURE 3: PERCPECTIVES ON E-DEVELOPMENT

Design: Abrahams, L. & Burke. M. 2010

This 2010 review of e-development commenced with a view of Melody's conceptual framework: Creating networks for the information society. It concludes with a conceptual perspective on e-development. The state of e-development in any country, in this case South Africa, is considered to be affected by (a) the levels of ICT diffusion and sophistication and (b) the value cycle created by the synergies between information infrastructure, ICT utilisation, innovation and impact, and policy and regulation. Hence it is necessary to track the evolution of these factors in order to understand the state of e-development at a given socio-economic conjuncture. Analysis of the state of e-development can provide valuable evidence and insights for future policy and regulation.

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