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THE ECONOMIC IMPACT OF CLOUD COMPUTING IN SOUTH AFRICA

The study considers changes in the economy that result from cloud computing

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NPO No 020-056-NPO | PBO & Section 18A(1)(a) No 930-017-343

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Executive Summary

Cloud computing has taken the world by storm and is becoming as important a technology in this era as the mainframe, the PC, and the Internet were at different times in the past. At present we may not know the full potential of cloud computing. However, there are at least some issues that are becoming clear in economic terms.

In our economic analysis we conservatively estimate that cloud computing has the potential to foster economic growth by facilitating additional job creation and find that it has the potential to create an additional 1,000 jobs per 80,000 existing jobs in the South African economy for the same amount invested (i.e. R22 billion).

In an economy which has struggled to attract sufficient investment and has only created around 400,000 jobs over the last decade this should make a welcome contribution to job creation.

We also find that one of the major potential economic benefits of cloud computing is the economies of scale derived from the technology, as firms would be able to get more software for a lower amount of capital, lowering fixed costs.

Through cloud computing firms and individuals gain the opportunity to access programs and features that would not previously have been available to them. Such increased accessibility to programs comes about because firms will be renting the software they need for a fixed period of time instead of purchasing it.

Cloud computing has the potential to provide firms and individuals with the benefit of expertise that may be located in different parts of the world. People from different geographic locations can collaborate in using the same programs in real time. In broad terms, new possibilities will arise in business process outsourcing (BPO) as we move into this new technology, so a whole new sub-sector is being created in the BPO arena, which in itself should present job opportunities.

We note that governments stand to benefit from the introduction of cloud computing. Indeed, many of the benefits bestowed upon private entities can be realised by governments that adopt cloud computing, such as lower IT costs, increased efficiency, greater flexibility and generally more effective IT.

However, like most good ideas for improving efficiency, the expansion and effectiveness of the adoption of cloud technology depends to a large extent on the policies adopted by governments. This requires governments to create enabling environments by allowing the market to effectively and efficiently provide broadband at internationally competitive rates.

South Africa may still not have the necessary number of users on broadband to gain its full potential but cloud computing could increase the number of users in the country, provided that the government helps to underpin broadband use by enabling ICT firms to increase their “footprint” of services.

South Africans are good adopters of technology and may in fact become good users of cloud computing, but the country does have work to do in assuring that users will have a better quality and higher quantity of internet connections. Although South Africa has a relatively large number of wireless internet connections, it still may not have a sufficient number and the desired quality required for top level cloud computing.

Overall, cloud computing increases the economic potential of South Africa at basically no additional cost to the country, which in itself, will help economic growth and job creation.

Introduction

Cloud computing has taken the world by storm and is becoming the big technology in this era as the mainframe, the PC, and the Internet were at different times. The economic impact will be positive in general but like all big innovative ideas it will be disruptive to some. Cloud computing will have both consumer and business benefits and many new products and services will become a reality as a result of this step up in the world's computing technology. This study will look closely at the business effects of cloud computing starting with a world view and ending in the South African economy. It will also evaluate the effects of the reduced capital requirements that will result from the new technology.

According to the McKinsey Global Institute, "By 2015, cloud computing could represent a \$70 billion to \$85 billion opportunity, with the market doubling every two years. Some technology watchers forecast that by 2015 cloud computing infrastructure and applications could account for 20 per cent of total spend in these areas. The impact could reach 20 to 30 per cent of the total IT budget for businesses willing to leverage this new technology".¹ Indeed, world-wide trends in usage of the term from Internet searches shows "Cloud Computing" has gained significant momentum since the term was first introduced in 2007.

While the term "Cloud Computing" is not in everyday use in South Africa (SA) yet, many large IT companies are already offering cloud services to a growing customer base. The slow uptake of cloud computing has occurred for a number of reasons, ranging from slow broadband connections to the technology being an unknown quantity to most South Africans. However, given the growth of cloud computing in the rest of the world, coupled with significant investments in this field by major IT companies such as Amazon, Microsoft and Google, as well as numerous other smaller firms, significant progress has been made in making cloud computing more enterprise ready and consumable.² SA has committed itself to installing new connectivity capacity via planned undersea cables, which will significantly increase broadband capacity and facilitate the utilisation of cloud computing.

Moreover, South Africa's citizens have demonstrated a remarkable ability to adopt new technologies relatively quickly (consider the proliferation of cellular telephones and the increased usage of social media networks). Given the offerings by local IT companies in the information and communications technology field, SA is poised to benefit from the up-scaling of this new method of more effectively utilising scarce resources.

SA faces a number of significant challenges. For example, it does not have the capital required to create the millions of jobs that it wishes to generate over the course of the next decade. This report will therefore look at the economics of cloud computing with an emphasis on the change in the capital-worker ratio in the country. The Minister of Finance has stated that SA needs to grow at 7 per cent per annum to enable it to reach the government's target of creating 5 million jobs by 2020 and to reduce the unemployment rate to 15 per cent³ from its current level of 25.7 per cent⁴ of the potential workforce. But given the annual increase in the number of new entrants into the labour market and our current labour absorption capacity, a more realistic growth target would be in the range of 10 per cent per annum in order to achieve the targeted reduction in unemployment. However, for the SA economy to grow at between 7 and 10 per cent per year over the next decade, fixed capital investment would need to increase by 30 to 35 per cent of GDP.

¹ McKinsey & Company (2011) Internet matters: The Net's sweeping impact on growth, jobs, and prosperity, McKinsey Global Institute, May 2011.

² Forbes (2011) *The Cloud Computing Market Grows Up*, July 12, 2011. Available at <http://www.forbes.com/sites/forrester/2011/07/12/the-cloud-computing-market-grows-up/>, accessed: 19/09/2011.

³ International Labour Organisation (2011) South African New Growth Path sets ambitious target to create 5 million jobs by 2020. Available at: http://www.ilo.org/jobspact/news/lang--en/WCMS_151955/index.htm, accessed 19/09/2011.

⁴ Statistics South Africa (2011) Quarterly Labour Force Survey.

This study will first look at what cloud computing is and in a sense what it is not, at the same time considering the obvious advantages of its utilisation, such as economies of scale and making it easier for small and medium enterprises to have access to IT infrastructure that would otherwise be unavailable or prohibitively expensive. It is quite clear that cloud computing has the potential to advance, at a minimal price compared with the relatively large capital outlays that are required to achieve the same objectives in-house, the productivity of those firms that do not have access to the type of infrastructure that becomes accessible with the introduction of cloud computing. The study will also show how government can benefit from using cloud computing.

We believe that one of the main methods by which cloud computing could facilitate the growth of the SA economy would be by reducing the amount of capital required to foster job creation. Lower software and data storage costs that reduce overall IT expenditure will be an additional advantage.

What is cloud computing?

According to the United States National Institute for Standards and Technology cloud computing is defined as, “A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”.⁵ This model does not require end users to have an intricate knowledge of the physical location and configuration of the system. Indeed, IT specialists have described cloud computing by drawing a parallel to the electricity grid whereby end users consume power without requiring the knowledge or understanding of the devices and infrastructure required to provide the service. Moreover, according to IT specialists Eric Knorr and Galen Grumen, “Cloud computing comes into focus only when you think about what IT always needs: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT’s existing capabilities”.⁶

One of the major economic benefits of cloud computing are the economies of scale derived from the technology, which lowers fixed costs for the user. Cloud computing is therefore an attractive proposal for individuals, businesses and government because of the potential positive economic impacts derived by making the best use of limited available resources. Federico Etro, an economics professor at the University of Milan concludes that the adoption of cloud computing solutions in the European market could create a few hundred thousand new small-and medium-sized businesses, which in turn could have a substantial impact on unemployment rates and GDP growth.⁷

For developing economies cloud computing is a particularly attractive proposition because developed countries have already provided a blue print that developing countries can adopt subject to local conditions. More specifically, cloud computing has the potential to raise worldwide revenue through improved efficiencies. Indeed, recent IDC cloud research shows that worldwide revenue from public IT cloud services exceeded \$16 billion in 2009 and is forecast to reach \$55.5 billion in 2014, representing a compound annual growth rate of 27.4 per cent. This rapid growth rate is over five times the projected growth for traditional IT products (5%). The IDC research notes that the economic downturn has amplified cloud services adoption due to the cost-cutting mantra of most organisations across the globe.⁸

Developing countries are in a particularly fortuitous position because they are able to piggyback on technology that has already been developed and fine-tuned in developed countries. In this way it is

⁵ The full NIST definition of cloud computing is available at: http://csrc.nist.gov/publications/drafts/800-145/Draft-SP-800-145_cloud-definition.pdf.

⁶ Gruman, Galen (2008). What cloud computing really means, InfoWorld. Available at: <http://www.infoworld.com/d/cloud-computing/what-cloud-computing-really-means-031>, accessed: 20/09/2011.

⁷ Etro, F. (2009) The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe

⁸ IDC (2011) IDC Cloud Research. Available at: http://www.idc.com/prodserv/idc_cloud.jsp.

possible for developing economies to catch up with developed economies as the cloud allows them to have access to the same IT infrastructure, data centres and applications. For example, cloud computing allows researchers based in developing countries to access data hosted on clouds in developed countries. As noted previously one of the greatest advantages of cloud computing pertains to the reduction of the costs of doing business. Cloud computing translates into higher productivity for all businesses both large and small but for small businesses it can mean a life-changing difference in cases where these businesses were not able to afford the high fixed costs and capital outlays required for their real IT needs.

However, like most good ideas for improving efficiency, the expansion and effectiveness of the adoption of cloud technology depends to a large extent on the policies adopted by government. This requires government to create an enabling environment that will allow the market to effectively and efficiently provide broadband at internationally competitive rates. In addition, government policies ought to incorporate business user's needs as well as consumer needs. The following section briefly discusses some of the major benefits of cloud computing with a view to establishing the focus areas where we envisage that the South African economy will most benefit from the expansion of cloud computing.

Economies of scale

The economies of scale of cloud computing are achieved because individual entities no longer require large facilities on site. In contrast, cloud computing generally allows many users/clients to store their information in one central place, which in turn lowers the fixed costs per user. More specifically, by pooling resource requirements from a large number of individual companies, cloud centres are better able to spread the usage requirements of various companies in a manner that optimises the capacity of the centre. An imprecise but perhaps useful analogy might be to compare the process to the organisation of landing slots and parking facilities at an airport, with higher charges for the most desirable slots and facilities. This means that resources are used more efficiently.

The greater the pool of entities served by the cloud, the greater the economies of scale, which in turn leads to lower costs and higher overall levels of efficiency. Savings are also realised due to lower technical IT staff requirements. Companies will generally require a fraction of the number of IT specialists in-house, since most of the administration will be carried out by the cloud computing host. This will free up in-house IT specialists to engage in other economic activities within the company, such as building new capabilities and focusing on supporting customer requests. Moreover, cloud computing allows companies to adapt to changing market circumstances more quickly. For example, if a company loses market share it is able to adapt by scaling back on some IT operations by cancelling software leases.

Increased accessibility of very expensive software or models

Cloud computing offers firms and individuals the opportunity to access programs and features to which they would not previously have had access. The programs may be very expensive in their packaged form but where the whole package may not be required, renting only the bits needed makes the software more affordable for the firms involved. This is particularly the case with highly specialised software. Productivity is improved as firms that were not previously able to do so can partly automate some of their operations. Many specialised programs may be too expensive for most small and medium sized businesses to consider but the cloud computing economies of scale noted previously make it possible for them to rent such programs at a fraction of the packaged software prices. Access to these specialised programs enables employees to work smarter, which boosts the productivity and earnings of the firms involved.

Cloud computing fosters SMEs

The mechanism behind the positive contribution of cloud computing to increased GDP growth operates through the incentives to create new firms, and in particular small and medium sized enterprises (SMEs). In order to have the greatest positive effect, the technological advance requires complimentary factors, not least of which is a positive regulatory environment regarding the ease of establishing new businesses. Given a regulatory environment that is conducive to doing business one of the main obstacles to entry

into new markets by SMEs is generally the high up-front costs, often associated with physical and IT capital spending.

Cloud computing allows potential entrants to save on the fixed costs associated with hardware/software adoption and with general IT investment, and turns part of these costs into variable costs. In other words SMEs may no longer require relatively large up-front payments to acquire the necessary hardware and software but rather adopt a pay-as-you-go type system when they access the cloud – at least in some high technology sectors. This reduces the constraints on entry into the market and lowers the complexity of entering into a new business venture, which in turn promotes business creation in an economy. Lowering the costs for new business ventures also significantly lowers the risk of failure of new enterprises.

Business process outsourcing would increase in scope

Many developing countries have benefitted from business process outsourcing practices adopted by organisations located in developed countries where labour costs are higher. Business process outsourcing typically involves establishing call centres in developing countries that have a comparative advantage in certain sectors. Cloud computing offers new opportunities to firms that wish to benefit from expertise that may be located in different parts of the world. For example, cloud computing makes it possible for people from different geographic locations to collaborate in using the same programs in real time. It also potentially allows operations to run on a 24 hour basis if collaborators are located in different time zones. This potentially widens the scope of employment opportunities by increasing the size of the market.

Consider, for example, a team of architects collaborating on the same building plans in different time zones working to ensure that the client's plans are completed as expeditiously as possible. This adds an entirely new sub-sector to business process outsourcing, which has the potential to create higher-end jobs in SA. Job categories such as researchers, architects, designers, system designers and a host of others would be able to sell their skills online to a diverse geographic market with the help of cloud computing.

Governments stand to benefit

Governments stand to benefit substantially from the introduction of cloud computing. Many of the benefits, such as lower IT costs, increased efficiency, greater flexibility and generally more effective IT that are bestowed upon private companies can be realised by governments that adopt cloud computing. Integration between government departments is facilitated by cloud computing where all government departments can access a central server, which enhances efficiencies and reduces duplication.

Governments will benefit from increased tax collections from new businesses that are created as a result of the advent of cloud computing as well as the taxes on increased revenues from higher incomes and value added tax (VAT) receipts resulting from increased efficiencies.

Government departments are also likely to benefit individually. For example, in the case of education, learners can access the cloud where there is a central repository of information and piggy-back, in real time, on classes that are occurring in other areas of the country. Citizens have the prospect of benefiting from more efficient government services. Improvements in capacity and efficiency that lead to reductions in wasteful expenditure will allow governments to focus scarce resources on targeted areas. In other words, cloud computing could potentially lower the cost of government operations as well as bring services closer to the citizens of a country. The potential benefits of cloud computing for both private entities and government are thus vast.

The South African perspective

Planned undersea cables are a reliable lead indicator of planned future capacity expansion in the IT sector. The South Atlantic Express (SAex) cable system is the latest multi-billion dollar infrastructural development that aims to boost connectivity between the African continent and the rest of the world. The new SAex cable will possess a 12.8 Tbits/second capacity, making it the largest cable system to land on the African continent, dwarfing the existing EASSy undersea cable that has a capacity of 4.7 Tbits/s and

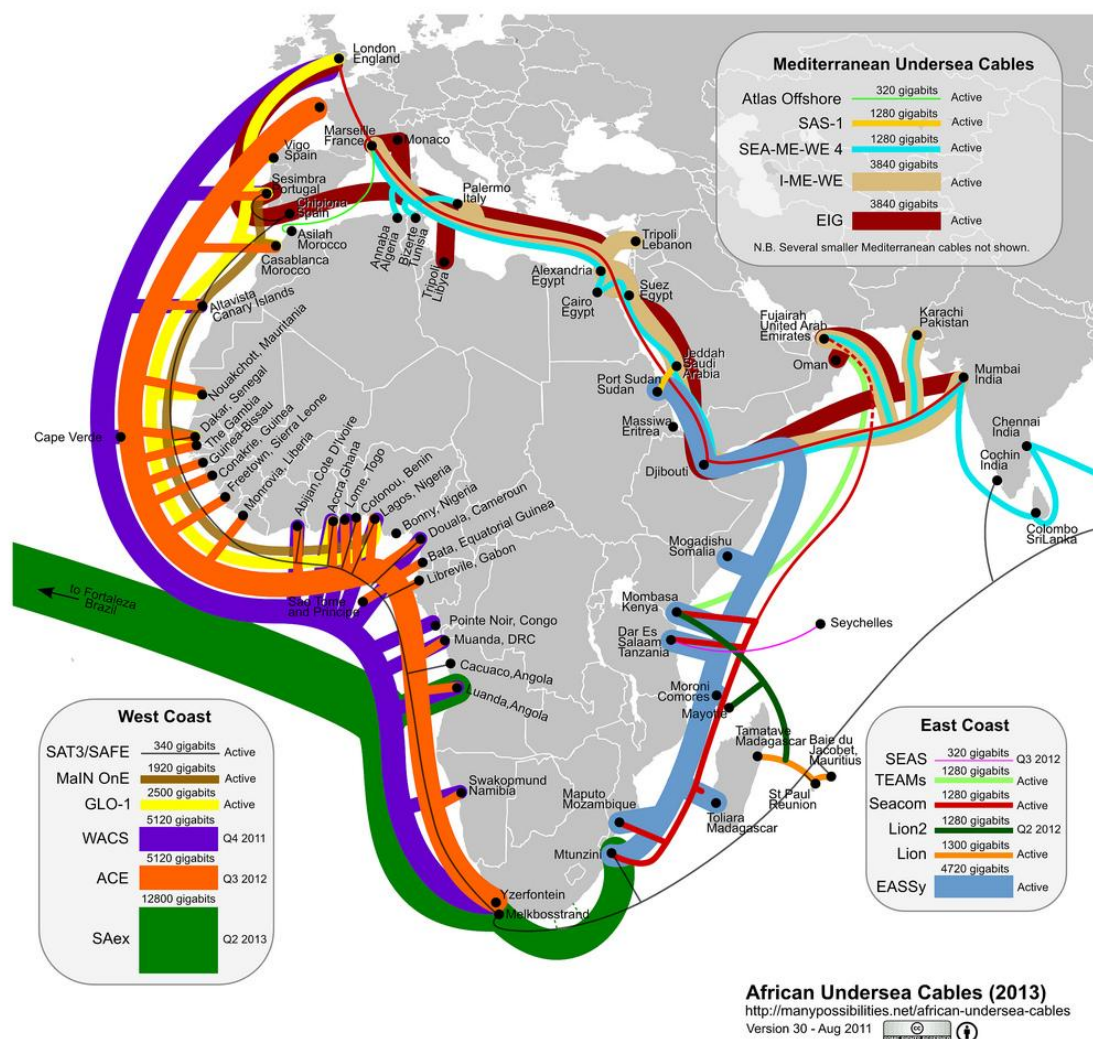
the planned 5.1 Tbit/s WACS and ACE cables, which are due to come on line in the fourth quarter of 2011 and third quarter of 2012 respectively (see graph below).

Another fundamental change that competition in the telecommunications sector has brought about is the lowering of telecommunication price increases in SA. For the period 2003 to 2006 the average telecommunication price increase was in the region of 13 per cent. From 2007 to 2011 the average price increase was closer to 1 per cent. For some years now, we have actually seen price decreases in the telecommunications market and we expect additional competition to bring about further decreases, especially in the cell phone arena.

Broadband in SA, in the main, is not fixed broadband but mobile broadband as we do not have the necessary infrastructure, especially in rural areas, to make use of fixed broadband. Wireless broadband prices have been falling of late and we have seen many of the smaller service providers actually decrease prices quite aggressively, especially the newer market entrants. In real terms communication prices in SA have been dropping at roughly 5 to 6 per cent a year in the last five years.

Although SA does not keep a broadband price index we have more than ample evidence both from Statistics South Africa (Stats SA) data as well as recent price data from specific broadband providers that broadband prices are dropping and more people and firms are making use of the Internet. While SA has been a good early adopter of technology, the level of use of broadband connections is still well below the international average, but we expect that there will be a burst of broadband Internet connections in the next few years.

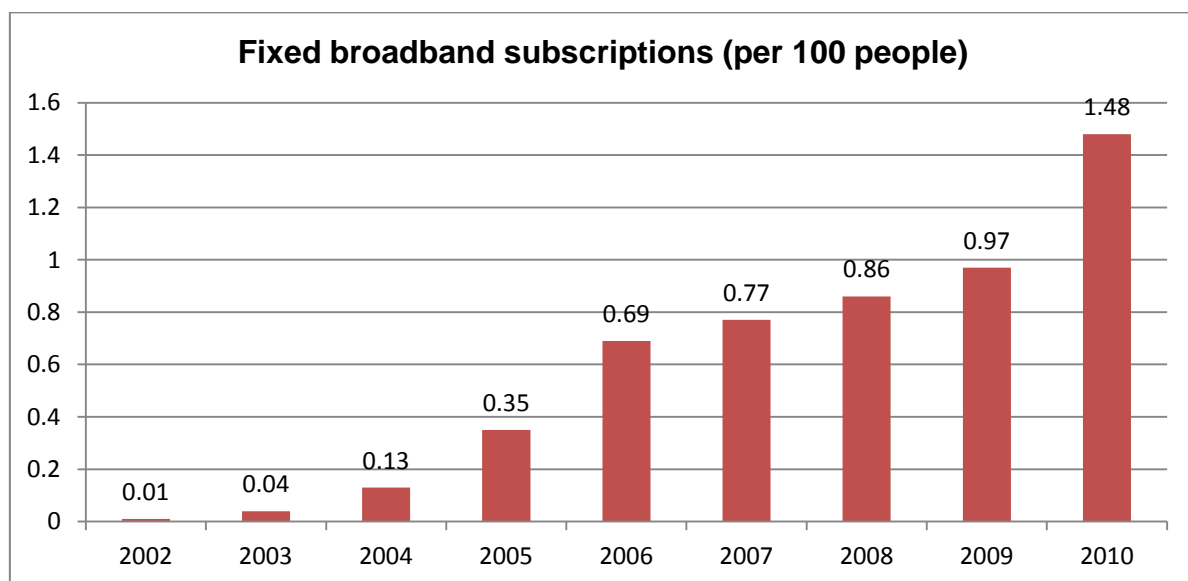
GRAPH 1: African, planned and active, undersea cables



Source: <http://manypossibilities.net/african-undersea-cables/>

Increased broadband capacity alone has the potential to boost economic growth in SA. Indeed, a 2003 Myongji University (South Korea) study examined 207 countries and found Internet penetration has a positive impact on economic growth.⁹ A more recent study by researchers at the University of Munich in 2009 found a clear path from the introduction of broadband and its increased penetration to per capita GDP, concluding that every 10-percentage-point increase in broadband penetration¹⁰ adds 0.9 to 1.5 percentage points to per capita GDP growth.¹¹ Given that the number of fixed broadband Internet subscribers in SA has been increasing at an annual average rate of approximately 11.5 per cent over the previous three years, applying the University of Munich's formula, we conservatively estimate GDP per capita to grow by at least an additional 1.04 per cent (see: Fixed broadband Internet subscribers graph below). Despite the recent increases, SA has a long way to go to bring the number of broadband subscribers up to the same levels as most of the world and especially the developed world and emerging countries.

GRAPH 2: Fixed Broadband subscriptions per 100 citizens



Source: International Telecommunications Union, *World Telecommunication/ICT Development Report and database*

Given the scope of development in the mobile telephony sector, the increased bandwidth possibilities, and the introduction of enhanced computing capabilities such as cloud computing, we are likely to see a marked improvement in the ease of communicating and conducting business in SA. We are also likely to see a general improvement in the well-being of citizens as communication possibilities improve and connectivity increases. Due to their intangible nature, official economic activity statistics are unlikely to capture the true extent of the benefits. Indeed, the number of mobile cellular subscriptions has increased dramatically since 1994 and cellular telephones have become almost ubiquitous. They now play an indispensable role in the lives of the majority of South Africans (see: Mobile cellular subscriptions graph 3 below). Today SA has more cellular phones than citizens, which demonstrates how good SA is at adopting technology.

Many countries have a very high cellular phone uptake but despite huge income inequalities SA, surprisingly, has one of the highest mobile subscription rates in the world. The introduction of the

⁹ Changkyu Choi and Myung Hoon Yi, *The effect of the Internet on economic growth: Evidence from cross-country panel data*, 2003.

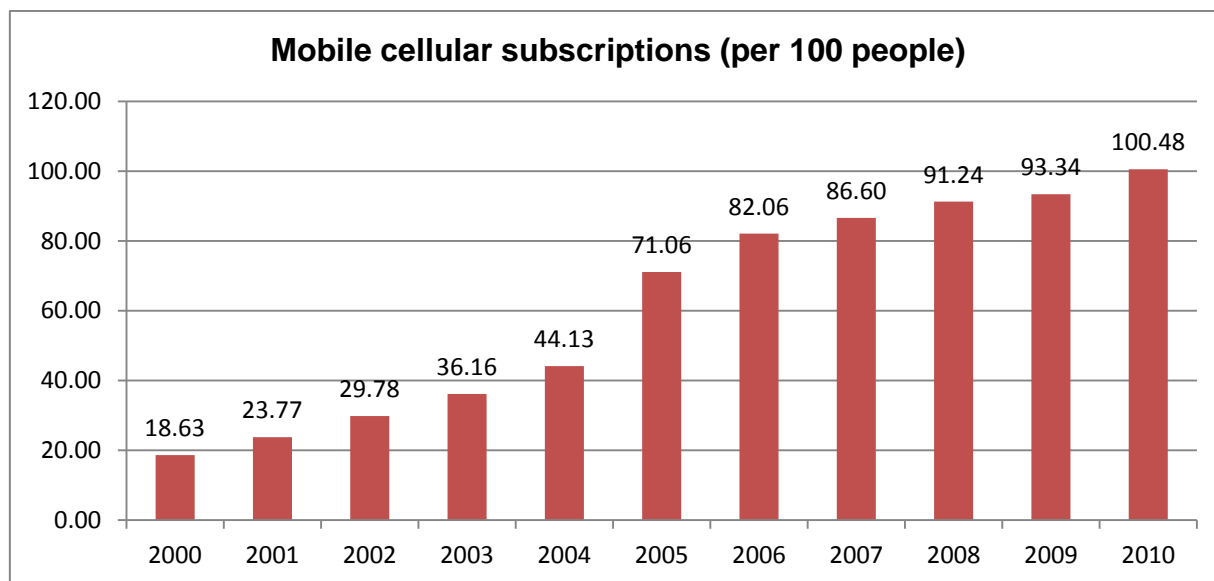
¹⁰ Broadband penetration is measured as the number of broadband subscribers per 100 inhabitants.

¹¹ Nina Czernich, Olivier Falck, Tobias Kretzchmer, and Ludger Woessmann, *Broadband infrastructure and economic growth*, CESIFO working paper, December 2009.

onerous regulatory measures contained in the Regulation of Interception of Communications and Provision of Communication-Related Information Act (RICA) resulted in a short period of mobile subscription decline but subsequent events have shown that SA's citizens cannot live without their mobile phones. Mobile phones are used by many small businesses in advertising their services to customers in all parts of the country, further confirmation of how quickly the country's small businesses will test and employ newer technologies.

While there is no data on the number of people that connect to the Internet wirelessly, Stats SA household data and the All Media Products Survey (AMPS) indicate that between 10 and 20 times more South Africans have wireless Internet than fixed broadband Internet connections.

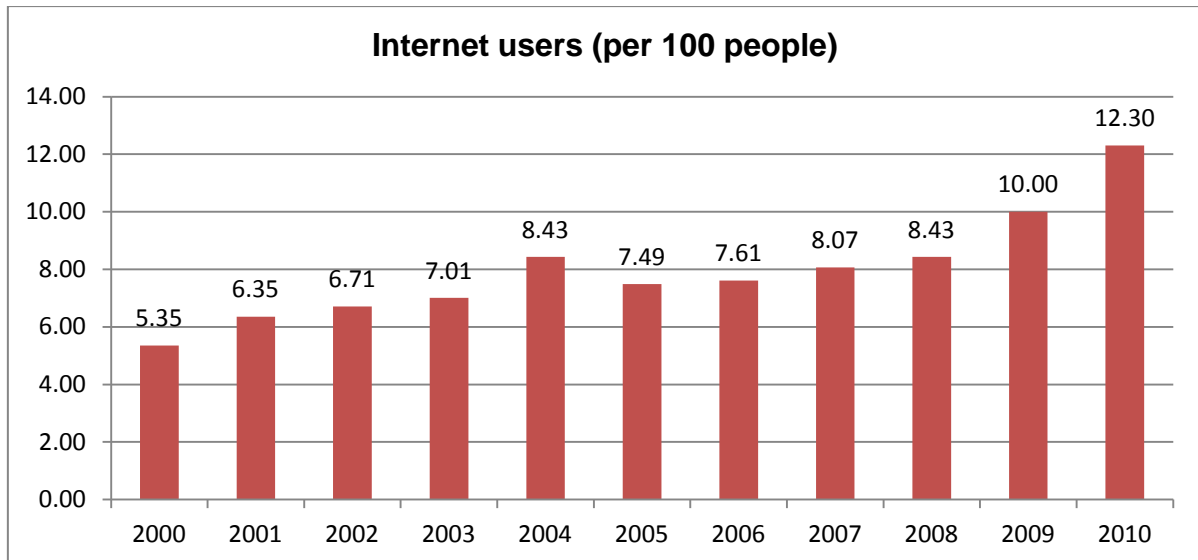
GRAPH 3: Mobile subscriptions per 100 citizens



Source: International Telecommunications Union, World Telecommunication/ICT Development Report and database

Although Internet usage penetration has not occurred to the same degree as cellular telephone subscriptions, largely due to the high capital and variable costs previously associated with Internet usage, we anticipate that the number of users will increase dramatically due to the proliferation of smart phones and reduced costs associated with accessing the Internet (see: Internet users graph below). Higher Internet usage can be expected in the near future as the price of access has declined in real terms and the service has become more reliable. The increased use of wireless services has allowed individuals to access the Internet from virtually anywhere in the country.

GRAPH 4: Internet users per hundred citizens

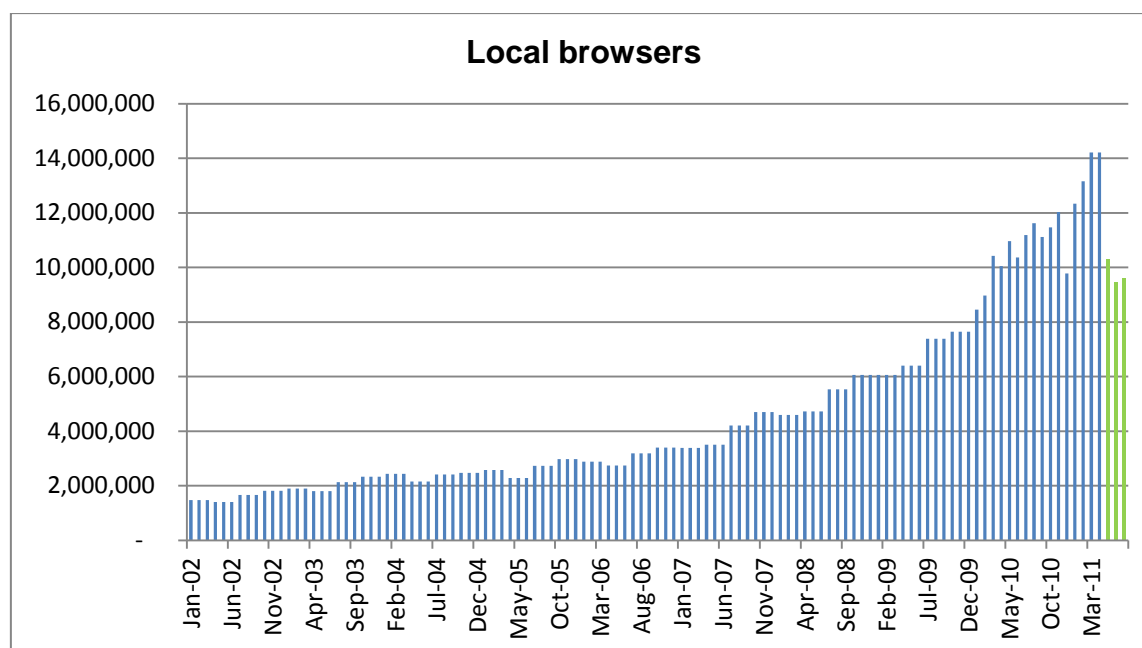


Source: International Telecommunication Union, World Telecommunication/ICT Development Report and database

The future of cloud computing in SA is crucially dependent on a reliable and efficient network of data cables that link not only SA with the rest of the African continent, but more importantly, with the countries in which much of the IT investment has occurred to date. The increased supply and substantial bandwidth of undersea cables that are currently being laid should translate into increased competition in the market and thus lower connection costs. This development will have beneficial consequences for organisations by allowing them to increase the portion of their IT budgets that can be devoted to innovation rather than on the maintenance of existing operations and services.

SA's relatively high telecommunication prices are partly responsible for the low levels of Internet usage and it is clear that broadband prices will have to drop further in order to allow a larger proportion of the population to make use of the Internet. However, over the last three years Internet browsing by South Africans has increased significantly (see Graph 5 below). A new data collection method has been instituted by the Digital Media and Marketing Association (DMMA) that has improved the accuracy of the information collected, which explains the drop-off in Internet browsers over the last three months in the sample depicted below. The decline must be attributed to more accurate data collection rather than a reduced number of people actually browsing the Internet. There is, in fact, a high and rising number of unique local Internet browsers in SA.

GRAPH 5: Local unique Internet browsers as counted by the DMMA



Source: DMMA, 2011

SAARF: AMPS – Internet activity data

According to the latest AMPS figures provided by the South African Advertising Research Foundation (SAARF) in 2010, approximately 18 per cent of the SA adult population accessed the Internet at least once during the year (see Table 1 below).¹² This is a significant increase from the estimated 9.4 per cent of the population who accessed the Internet at least once during the year in 2007.

TABLE 1: AMPS data: Internet usage data (%)

	2007	2008	2009	2010
Past 12 months	9.4	10.7	13.4	18.0
Past 4 weeks	8.1	9.5	11.7	15.6
Past 7 days	6.9	8.1	9.8	13.2
Yesterday	4.6	5.6	6.8	9.0

Source: SAARF: AMPS – Internet trends

Table 2 below shows that of those people who accessed the Internet, the majority have consistently done so at home, increasing from 4.2 per cent in 2007 to 8.5 per cent in 2010. People also tend to access the Internet at their offices but disappointingly the growth of Internet use in offices was limited to around 2.5 per cent over the last year. The AMPS data also indicate that an increasingly large proportion of people claim to access the Internet ‘elsewhere’. Indeed, over the period 2009-2010 the data reveal that those who accessed the Internet ‘elsewhere’ increased by 123 per cent. As noted previously, this is not surprising, particularly when one considers the proliferation of smart phones that allow people to access the Internet from virtually anywhere.

¹² See AMPS internet usage data: <http://www.saarf.co.za/internet.htm>.

TABLE 2: AMPS Data: Place where Internet was accessed (%)

	2007	2008	2009	2010
Educational institution	1.3	1.7	1.9	2.2
Home	4.2	4.8	6.2	8.5
Internet café	1.2	1.5	2.4	2.8
Office	3.7	4.2	4.6	4.7
Elsewhere	0.9	1.1	2.1	4.7

Source: SAARF: AMPS – Internet trends

According to the AMPS data, the primary reason for accessing the Internet was to carry out a “search” (12%). The second most important reason was to “e-mail” (10.7%) and the third most important was to “conduct research or to obtain information” (9.3%). The AMPS data also reveal that South Africans are increasingly accessing the Internet in order to visit social networking sites. In 2009, 4.2 per cent of people accessed the net in order to visit a social networking site and one year later this had increased to 8 per cent (see Table 3 below).

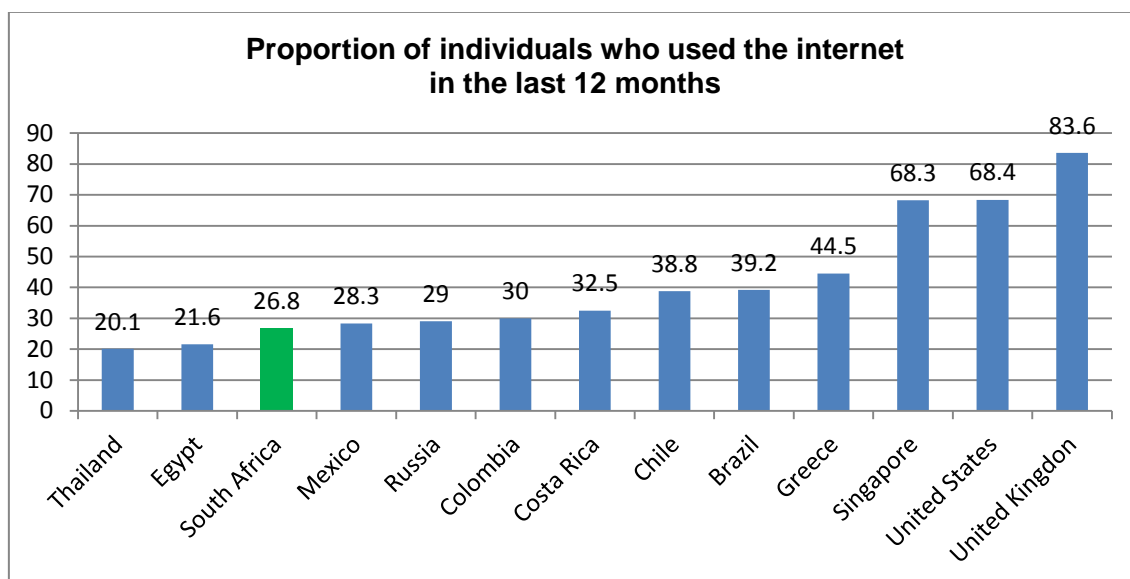
TABLE 3: AMPS Data: Reason for accessing the Internet, 2007-2010 (%)

	2007	2008	2009	2010
Search	7.0	8.0	9.5	12.0
Directory services	1.3	1.3	1.4	1.8
Games	1.4	1.7	2.3	3.2
Gambling	0.1	0.2	0.2	0.3
Dating	0.3	0.4	0.6	0.7
Social networking	—	—	4.2	8.0
E-mail	5.9	6.6	7.9	10.7
Instant messaging	2.2	2.7	1.9	2.8
Chat (excl mail/instant mess)	1.6	2.2	2.6	4.0
Music downloads	1.8	2.1	3.1	4.0
Download a podcast	0.2	0.4	0.3	0.4
Shopping	0.9	0.8	1.2	1.0
Banking	3.1	3.2	3.8	4.1
Share trading	0.3	0.6	0.7	0.6
Research/obtaining info	6.3	7.0	7.3	9.3
Listen radio on-line	0.7	0.8	0.9	0.8
Watch TV on-line	0.3	0.3	0.3	0.3
Read mag/newspaper on-line	1.8	2.0	2.6	2.6
Obtain latest news	1.5	1.8	1.8	1.8

Source: SAARF: AMPS – Internet trends

Graph 6 below shows that compared to other countries, SA has a relatively low level of Internet penetration. According to the International Telecommunications Union 26.8 per cent of South Africans accessed the net in the previous year, this places us significantly higher than Egypt in our sample but substantially lower than Brazil (39.2%), a country that has traditionally been a benchmark against which to compare SAs indicators due to their similar socio-economic conditions.

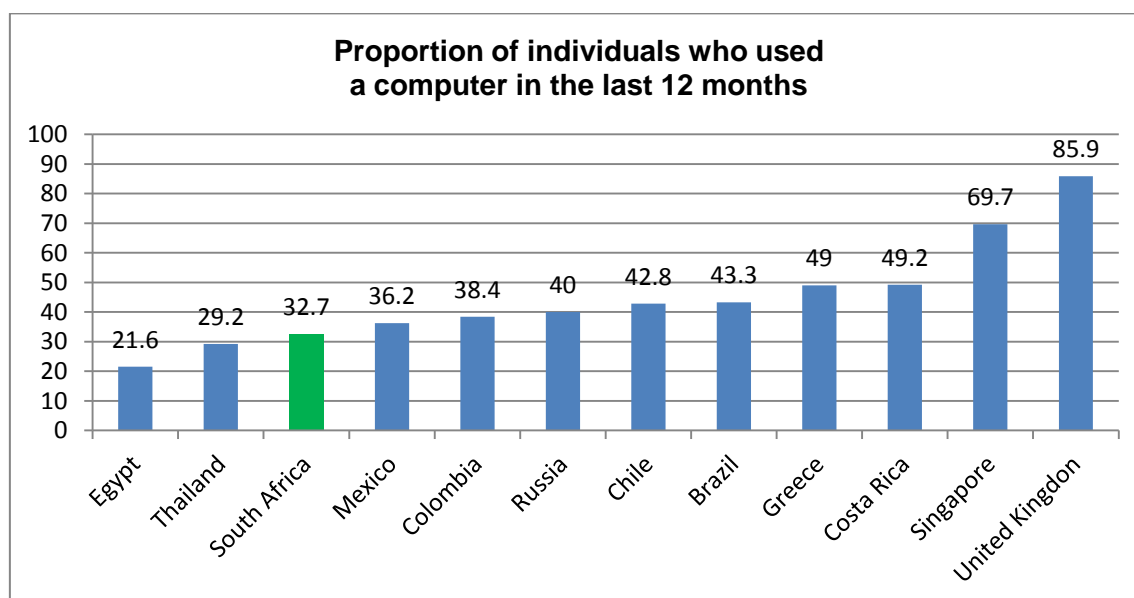
GRAPH 6: Proportion of individuals who accessed the Internet over the last 12 months – selected countries



Source: ITU database and 2010 South African General Household Survey from Stats SA

Apart from the low level of Internet penetration in SA, an additional obstacle to the roll-out of cloud computing amongst ordinary SA citizens is the fact that many of them do not own a computer. According to the general household survey (GHS) conducted by Statistics South Africa, less than two-thirds of South Africans had access to a computer over the last 12 months (see Graph 7 below). In our sample of selected countries, SA once again ranks poorly against other developing economies within the sample in the area of ‘proportion of people who used a computer in the previous 12 months’.

GRAPH 7: Proportion of individuals who had access to a computer over the last 12 months – selected countries



Source: ITU database and 2010 South African General Household Survey from Statistics South Africa. As noted previously, the majority of people use their smart phones to access the Internet (see Table 4 below). ISDN lines and dial-ups have become virtually redundant whilst ADSL lines continue to be the major channel for accessing the Internet at home. There are currently no household survey data indicating the extent to which cloud computing is used by individuals but it would seem that those doing ‘research and obtaining information’ would be the most likely users.

TABLE 4: AMPS Data: Internet connection at home (%)

	2007	2008	2009	2010
Dial-up	2.9	2.9	2.1	1.0
ADSL	1.8	1.6	3.3	2.6
ISDN	0.3	0.5	-	-
Wireless	1.4	1.5	1.5	1.5
Cellphone/GPRS/Edge	0.2	2.5	3.0	5.0

Source: SAARF: AMPS – Internet trends

The Internet has liberated millions of people across the globe by broadening their knowledge base and providing them with new ideas, which has in turn allowed them to introduce cost-cutting measures in their everyday lives and businesses. Because the Internet is an invaluable source of education as well as a means of access to markets it has unleashed the creativity and innovation of millions of people. Much of this increased productivity and trade is not visible in the official numbers and much of the Internet usage that occurs is not likely to be picked up in the official statistics. For example, the stock market indices do not count the profits of bloggers, or the revenue of the entrepreneurs on eBay and Etsy. The official statistics are therefore likely to be conservative estimates of the actual penetration. The AMPS data above show that cell phone connections are at least double that of ADSL connections. Other data from the DMMA suggest that wireless connections may already be at the 4 million subscriber mark, which is far higher than that reported in the AMPS data.

The ICT market and cloud computing

According to BMI-TechKnowledge, a South African based ICT analytics company, revenue in the South African ICT market grew 10.7 per cent in 2010, from R62 billion in 2009 to R68.7 billion in 2010. BMI-TechKnowledge expects the IT market to continue its robust growth and estimates that the market will grow at a compound annual growth rate (CAGR) of 7.6 per cent over the period 2010 to 2015, to reach an estimated R99.1 billion. BMI-T expects the IT market to grow by 8.5 per cent to R75.5 billion in 2011.¹³

Hardware

BMI-TechKnowledge estimates that the hardware market grew by 7.6 per cent in 2010, from R21.2 billion in 2009 to R22.9 billion in 2010. Hardware accounts for approximately one-third of the total IT market and is expected to grow at a real compound annual rate of 3.5 per cent over the period 2010 to 2015.

Software

BMI-TechKnowledge estimates that the packaged software market grew by 9.9 per cent in 2010 to R13 billion, and is expected to show growth of 10 per cent in 2011. Packaged software accounted for 19 per cent of the IT spend in 2010. The packaged software market value is forecast to grow to R20.8 billion by 2015. This reflects a real CAGR of 9.8 per cent over the forecast period.

IT services

The South African IT services market is estimated to have reached R32.8 billion in 2010, showing a year-on-year growth of 13.3 per cent and accounting for 47.7 per cent of the total IT expenditure. The IT services market value is forecast to grow to R49.8 billion by 2015. This reflects a CAGR of 8.7 per cent over the forecast period.

According to BMI TechKnowledge, the following trends are expected to drive the IT Market:

Storage will be a category that should outperform other hardware areas due to continued virtualisation and cloud computing initiatives.

¹³ BMI-TechKnowledge IT: A resilient R68.7 billion market. Accessed 15-08-2011 – available at: <http://www.bmi.co.za/?q=content/it-resilient-r687-billion-market>.

Hosting is the standout category, looking forward, in the IT services arena, considering the drive towards cloud computing.

Adoption of Software as a Service, and collaboration, are areas that will drive growth in the software market as well as in markets in areas such as business process outsourcing.

Finally BMI-TechKnowledge suggests that, “The IT market is maturing in South Africa. This can be seen in the continued consolidation in the industry as well as the convergence that is taking place with the telecoms industry. Cloud computing is on everyone’s lips in the industry and it is expected to move rapidly from an industry push to a market pull”.

TABLE 5: BMI-TechKnowledge: IT profile and forecast for South Africa

Spending (billion Rand)	2009	2010	2015	CAGR: 2010-2015
IT Hardware	21.2	22.9	28.5	3.5%
Software	11.8	13.0	20.8	9.8%
IT Services	28.9	32.8	49.8	8.7%
Total IT	62.0	68.7	99.1	7.6%

Source: BMI-TechKnowledge, 2011

Although BMI TechKnowledge suggests that while there is a lot of potential growth in the South African information market many previous reports were wildly optimistic. Perhaps it would be better to say that lessons have been learned and expectations into the future are now much more realistic.

The make-up of the South African economy

While the South African economy is widely seen as a minerals-and-metals based complex, the biggest sector in the economy is the finance, real estate and business service sector, which makes up more than 21 per cent of the South African economy when measured on a production approach basis.

Manufacturing, at 15 per cent, is the second biggest sector in the economy and ferrous and non-ferrous metal manufacturing is its biggest sub-sector. The government sector, at more than 15 per cent, comprised of both national and local government as well as some non-governmental organisations providing government type services, is the next largest sector.

The government sector is followed by the retail and wholesale trade, motor trade and tourism sector which is just more than 12 per cent of the economy. The transport and communications sector slightly exceeds 9 per cent of the economy on a production approach basis.

In table 6 below we lay out the size of the different sectors in the South African economy and give them a rating for information technology and cloud computing potential. While we do not have much information on cloud computing in SA at present, research from other research houses indicates that information technology makes up around 3 per cent of the total spend in the economy, excluding actual communication spend such as on telephones and cellular phones. Splitting information technology and communications spending can sometimes be problematic but the communications sector probably accounts for about 4.1 per cent and information technology for about 3 per cent of the economy, which means that a combined total of about 7 per cent of value added comes from these sectors.

TABLE 6: Contribution to GDP by industry in 2009 (@ constant 2005 prices)

Industry	Contribution to GDP (%)	ICT usage
Agriculture, forestry and fishing	2.3%	Small but varied
Mining and quarrying	5.3%	Small in engineering and planning
Manufacturing	15.0%	Medium between 10% and 15% of sector
Electricity, gas and water	1.9%	Smart grid could contribute to cloud computing but within sector relatively small
Construction	3.2%	Small
Wholesale, retail, motor trade and accommodation	12.0%	Very big in supply management and customer relationship but rest may be small. 10% to 15% of businesses
Transport, storage and communication	9.1%	In supply management and in communication sector overall; about 15%
Finance, real estate and business services	21.2%	Huge potential – in excess of 20% in some businesses; biggest potential is here
General government services	13.6%	Huge potential as government departments often spread over large distances; 15% plus
Personal services	5.7%	Small
Taxes on products	11.0%	N/A
Less: Subsidies on products	-0.4%	N/A
GDP at market prices	100.0%	ICT spend is about 3% of total economy according to BMI study; communication spend is about 4.1% of economy in real value added terms according to Statistics South Africa

*Sources: Statistics South Africa and Economists.co.za for sector ICT contribution.
See appendix on the banking sector as to the potential ICT spend in banking.*

The South African economy had a reasonably good growth history over the last decade although there was a decline in 2009 due to the global financial crisis.

The primary sectors of the South African economy have had a disappointing decade in general and the economy is relying more and more on its service rather than on its primary sectors. The table below shows that the mining sector has had five declining growth years and five positive growth years while agriculture fared little better and recorded seven growth years compared to three declining years over the last decade.

Manufacturing showed a slight decline, accounting for almost 17 per cent of gross domestic product on a production approach basis in the year 2000 while recently accounting for only about 15 per cent. However, very positive sectors have emerged, including finance, real estate and business services, which have experienced sustained positive growth over the last decade. It is in the latter sectors, as well as in the government sector, that information technology and communication can make a very big difference.

The table below presents a summary of recent growth in the nine major sectors as well as the total growth of the South African economy in the last decade. Most growth forecasts covering the next 2 to 3 years indicate that average growth will be around 3 per cent, while SA waits for the world economy to recover to previous highs.

SA needs an annual average growth rate of at least 7 per cent of GDP in order to bring one of the world's highest unemployment rates down to more acceptable levels. However, the fastest growth rate during the

last decade was 5.6 per cent, whilst the worst decline was in 2009 when the South African economy shrank by 1.7 per cent.

A very basic summary of the performance of the South African economy is presented in Table 7 below. Only the construction sector and the finance, real estate and business services sector have on more than one occasion reached 7 per cent or higher growth. We leave the agricultural sector out of this comparison as it is often dependent on weather patterns rather than economic policy.

TABLE 7: Percentage change in real gross value added per sector, 2001 – 2010

Year	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas and water	Construction	Trade and accommodation	Transport and communication	Finance, real estate and business	Government and personal services	Total
2001	-3.3	-0.1	3.2	-3.7	4.9	1.9	5.9	8.2	0.0	2.9
2002	6.5	1.0	2.8	3.5	5.8	2.3	9.0	6.3	1.2	3.8
2003	0.7	3.4	-1.5	3.0	7.7	2.7	6.3	4.8	3.6	3.0
2004	0.9	1.5	4.9	6.8	9.1	5.4	4.9	7.1	1.9	4.5
2005	2.8	1.0	6.2	5.3	11.9	7.0	5.3	5.7	4.2	5.3
2006	-5.5	-0.6	6.4	3.4	10.4	6.0	5.1	9.6	3.7	5.5
2007	2.7	0.0	5.2	3.4	15.0	5.3	6.6	7.9	4.5	5.6
2008	16.1	-5.6	2.6	-3.1	9.5	0.8	3.4	7.3	4.3	3.7
2009	-3.0	-4.2	-10.4	-1.6	7.4	-2.5	0.6	0.9	2.7	-1.5
2010	0.9	5.8	5.0	2.0	1.5	2.2	2.9	1.9	2.3	2.8
Negative years	3	5	2	3	0	1	0	0	1	1

Source: Statistics South Africa and BMR

The capital-worker ratio in South Africa

TABLE 8: Capital-worker ratio in South Africa – performance over the last decade

Sector	Capital worker ratio 2000 (Rand)	Capital worker ratio 2010 (Rand)	% change: 2000 to 2010
Agriculture	80 343	168 875	110.2
Mining	494 197	972 807	96.8
Manufacturing	214 325	236 213	10.2
Utilities	2 230 886	3 074 892	37.8
Construction	18 324	32 501	77.4
Trade	45 906	63 017	37.3
Transport and communication	655 006	809 769	23.6
Finance	595 463	474 053	-20.4
Government and community	182 077	210 620	15.7
Total	218 514	270 876	24

Source: Bureau of Market Research Unisa

Table 8 shows a major shift away from workers to capital in the production process. In nine of the ten economic sectors the capital-worker ratio increased. For example, in 2000 real capital stock to the value of R80 343 was used in combination with one worker in the agricultural sector. This amount increased by

110 per cent over the next decade to R168 875 in 2010. Real capital stock per worker increased 24 per cent for the total economy.

Interestingly, in all the sectors identified by the government's New Growth Path policy to be labour absorptive, a preference for capital over labour has developed since 2000. In fact, only in the financial sector did the capital-worker ratio decrease, and this was probably due to the huge increase in the private security industry which makes up a bigger slice of this sector today than in 2000. (The private security sector falls under "other business services" and today employs at least 500 000 people)

However, the analysis also shows that the least amount of capital stock per worker (R32 501) is needed in the construction sector, followed by the trade sector (R63 017) whereas a huge jump to R168 875 occurs in the agricultural sector. The manufacturing sector, with R236 213, is next on the list. The manufacturing sector experienced the smallest increase of 10.2 per cent in capital required over the decade.

Judged against this criterion the labour absorption potential is indeed to be found in the majority of the sectors identified in the New Growth Path. However, the other three New Growth Path identified sectors, namely the mining, utilities, and transport and communications sectors, are the most capital intensive.

How many jobs are created from a specific capital spend?

Table 9 shows that compared to the year 2000, fewer workers and less capital stock were needed per R1 million gross value added (GVA) in 2010. This was true for the agricultural, manufacturing, transport and communication, finance and government and community sectors. For example, where 39 workers and R3.1 million in capital stock were needed for R1 million GVA in the agricultural sector in 2000, this changed to 15 workers and R2.6 million worth of capital stock in 2010.

Fewer workers but more capital per R1 million GVA are utilised in the mining, utilities, construction and trade sectors compared to 2000. For the total economy fewer workers and capital are needed compared to 2000. In this sense it can be inferred that the economy has become more productive in the production process.

TABLE 9: Amount of capital needed and number of workers needed for a R1 million gross value added

Year	Agriculture, forestry and fishing: Workers	Agriculture, forestry and fishing: Capital (Rand)	Mining and quarrying: Workers	Mining and quarrying: Capital (Rand)	Manufacturing: Workers	Manufacturing: Capital (Rand)
2000	39.2	3 145 591	4.4	2 150 003	7.9	1 688 957
2001	27.2	3 221 933	4.5	2 179 800	7.8	1 648 266
2002	31.2	3 024 703	4.5	2 204 406	7.8	1 600 513
2003	23.6	2 985 001	4.1	2 179 482	7.7	1 621 138
2004	22.0	2 948 763	3.7	2 144 731	7.5	1 564 167
2005	19.8	2 845 127	3.2	2 097 538	7.2	1 499 361
2006	24.3	3 013 660	3.2	2 157 800	7.0	1 448 425
2007	20.3	2 946 668	3.5	2 268 244	6.8	1 417 952
2008	18.5	2 588 343	3.3	2 550 628	6.6	1 426 737
2009	16.7	2 673 498	3.3	2 811 731	6.9	1 576 237
2010	15.5	2 615 209	3.0	2 945 212	6.2	1 466 058
% change	-60.45	-16.86	-30.41	36.99	-21.24	-13.20

Year	Electricity, gas and water: Workers	Electricity, gas and water: Capital (Rand)	Construc- tion: Workers	Construc- tion: Capital (Rand)	Trade: Workers	Trade: Capital (Rand)
2000	2.8	6 162 835	26.8	491 929	17.9	823 171
2001	2.9	6 233 821	23.4	507 629	18.7	828 014
2002	2.5	5 922 850	21.6	516 933	15.2	820 844
2003	2.6	5 763 222	20.8	518 575	15.5	811 263
2004	2.8	5 471 869	22.7	533 918	15.1	797 168
2005	2.8	5 312 146	24.3	521 656	16.3	776 090
2006	2.8	5 312 575	23.9	510 169	16.7	768 448
2007	2.4	5 382 360	21.5	483 817	15.4	768 689
2008	2.8	6 142 991	21.2	503 206	14.4	804 303
2009	2.8	7 457 500	19.4	538 209	13.8	859 072
2010	2.6	8 088 051	18.1	588 811	13.4	843 831
% change	-4.78	31.24	-32.51	19.69	-25.32	2.51

Year	Transport and communica- tion: Workers	Transport and communica- tion: Capital (Rand)	Finance: Workers	Finance: Capital (Rand)	Government community and personal services: Workers	Government community and personal services: Capital (Rand)
2000	6.6	4 355 056	4.7	2 804 964	12.7	2 317 933
2001	6.1	4 165 230	4.8	2 618 058	12.5	2 340 782
2002	5.7	3 869 287	4.8	2 480 694	12.7	2 343 382
2003	5.2	3 716 962	4.5	2 395 565	12.6	2 306 309
2004	5.1	3 638 960	4.4	2 295 342	12.3	2 317 587
2005	5.1	3 601 122	4.5	2 258 794	12.0	2 275 151
2006	4.7	3 538 630	4.2	2 152 079	12.0	2 260 895
2007	4.6	3 451 100	4.2	2 058 847	11.6	2 252 221
2008	4.7	3 541 559	4.4	1 984 878	11.5	2 255 355
2009	4.6	3 748 301	4.6	2 017 528	11.2	2 278 902
2010	4.6	3 743 904	4.3	2 036 141	11.0	2 307 216
% change	-30.46	-14.03	-8.82	-27.41	-13.95	-0.46

Source: BMR report “A broad review of the new growth path framework with a specific emphasis on the feasibility of its proposed targets”. The gross value added is a yearly figure and gets repeated every year while the capital is an actual figure needed and is not repeated again. (Used with permission.)

However, what is also clear is that the reduction in the number of workers was much larger than the drop in capital stock. The reduction in the number of workers was 25 per cent and that of capital stock only 7 per cent. Of all the sectors where both the number of workers and capital stock declined, it was only in the finance sector where the drop was larger in the capital stock. This means that it takes more capital today to do the same number of jobs than at any time in the history of the South African economy.

The fact of the matter is that creating jobs in SA is a very expensive exercise and the reduction in the cost of creating jobs should be welcomed as this will allow the economy to create more jobs for the same amount of money.

As we will show in the tables below it is quite clear that cloud computing could be one of the saviours of the South African economy as it will lower the capital required to create a job. We attempt to show this in a table format.

Cloud computing helps to decrease the capital costs required to create a job

Many employment opportunities require the spending of a considerable amount of capital. Even agriculture, which is normally seen as a low paying type of employment, requires some form of capital to

be spent before a job can be created. As a simple example: in agriculture creating jobs would probably entail buying land and preparing it by erecting fences, sowing seeds and raising livestock, all requiring capital investment.

Cloud computing would make the creation of jobs easier as a lower cost computer would be required while at the same time software would be “rented” rather than bought. Taking a full office suite with all the bells and whistles as well as all email, data security and the latest in software technology would cost users around R85 per month per user. Specialised software for customer relationship management would cost approximately R120 per month. Both examples would require much less in software spend in the first three years as opposed to buying the software off the shelf.

Using cloud computing would reduce the amount of capital required for the operation of some computers by about half of what it would otherwise have cost as software would be rented. However, adopting cloud computing may increase the broadband costs and that would mean the start-up costs would only be lower by about 25 per cent. The reduced initial outlay would free up capital in many sectors, particularly in the business services and financial sectors.

Below we set out the argument on a very conservative basis and show that even with a very conservative estimate, approximately 0.25 per cent less capital would be needed per job in the South African economy.

While nobody appears to know the exact current uptake of cloud computing in S A, an IDC study found that cloud computing is already making significant inroads in the South African economy. However, overall SA continues to lag other countries in both broadband penetration and most probably the roll-out of cloud computing as well. It must be remembered that cloud computing remains a relatively new concept, even in developed countries, and it would therefore take some time for it to become more widespread.

South Africans have, as previously mentioned, demonstrated a remarkable ability to adopt new technologies relatively quickly as evidenced by the proliferation of cell phone subscriptions. Although computer and Internet penetration has not reached the same order of magnitude as the pervasiveness of cell phone usage, given the projected growth rates we believe that both computer and Internet penetration rates will increase over the next five years to a point where at least half of all households in SA will have a computer and approximately 40 per cent of households will have access to the Internet.

TABLE 10: Conservative estimates of capital saved per job per sector in the South African economy

	Estimates based on BMI total	ICT Capital spend in real 2009 Rands	Conservative estimated cloud computing savings in capital spend	Capital saved per employee per sector
Sector capital	2009	2009	2009	2009
Agriculture, forestry and fishing	1.5%	R 40 102.50	R 2 005.10	R 129.50
Mining and quarrying	2.3%	R 64 669.80	R 3 233.50	R 1 068.00
Manufacturing	4.3%	R 67 778.20	R 5 083.40	R 819.00
Electricity, gas and water	2.1%	R 156 607.50	R 3 915.20	R 1 488.50
Construction	0.5%	R 2 691.00	R 134.60	R 7.40
Trade	2.4%	R 20 617.70	R 1 546.30	R 115.50
Transport and communication	2.9%	R 108 700.70	R 8 152.60	R 1 763.30
Finance	5.4%	R 108 946.50	R 10 894.70	R 2 536.50
Gvt, community and personal services	3.2%	R 72 924.90	R 5 469.40	R 499.30
Total	2.9%	R 61 187.50	R 3 518.30	R 441.60

*Sources: BMI for ICT spend and BMR for Capital per workers spend and ratios.
Economists.co.za for cloud computing estimated savings.*

The adoption rate in the table above is set at levels that are low and assumes that cloud computing would only be adopted by between 20 per cent and 40 per cent of ICT users per sector. This is likely to be the case in the beginning of the roll-out of cloud computing. It is also likely that cloud computing itself would become cheaper over time and the adoption rate would increase as a result.

Under these circumstances it would appear that cloud computing would lower the capital labour ratio by approximately 1 per cent. Considering that fixed capital remains the best indicator of jobs in the South African economy with a relationship close to 90 per cent, this indicates that the adoption of cloud computing would increase the uptake of jobs – assuming that other factors such as skill sets remain at the same ratios.

We estimate that cloud computing currently lowers the cost of creating the average job by approximately R3,500 and we anticipate that as the technology takes hold this estimate may increase to as much as R14,500 in real terms. In other words, we believe that the lower figure is a prudent estimate considering present levels of cloud computing, while the higher estimate provides a predicted forecast of the potential benefits in about five years, as cloud computing is more widely adopted.

At present the South African economy requires R2.2 million for every eight jobs. While using the same capital in real terms this study finds that the amount of jobs that R2.2 million can provide would increase to 8.1. While this is not a significant increase it indicates that for every 80,000 jobs that the South African economy creates on its previous capital to labour ratio – at a cost of R22 billion, cloud computing could potentially add about an extra 1,000 jobs. One must remember that these extra jobs would not cost the economy an extra cent.

Cloud computing therefore has the potential to assist the government in moving closer to its stated target of creating 5 million new jobs by 2020, as laid out in the New Growth Path. Cloud computing also has the

potential to turn around the overall trend of increasing capital spend per job created. Although the aggregate numbers we have presented may not be large, cloud computing has shown a greater potential in assisting to lower the capital costs in certain high capital usage sectors such as banking, insurance and parts of manufacturing.

Conclusion

In conclusion we believe that cloud computing will not only help in the obvious areas such as the economies of scale derived from smoothing the consumption and variability of usage requirements, but will also increase the productivity of individuals by increasing accessibility to new and better services.

Cloud computing has the potential to increase the competitiveness of small and medium sized firms both domestically and internationally as well as improve their ability to compete against larger firms.

Cloud computing has the potential to also create new ways for what is now called business process outsourcing, by reducing geographic disparities and providing organisations with the opportunity to leverage technical expertise in different locations.

We estimate that cloud computing will decrease the capital required for creating jobs in SA and in the process reduce the costs of hiring. This would also enhance the productivity of organisations and contribute positively to overall economic growth. In order to leverage the maximum possibilities of cloud computing, SA will have to increase its Internet accessibility, reliability and capacity to not only link SA with the rest of Africa but more importantly with the rest of the world, where most of the major advances in IT are taking place. Ultimately, cloud computing has a tremendous potential to improve the efficiencies of both private and public sector organisations, as well as simply improve the way individuals conduct their everyday lives. However, the roll-out of cloud computing in SA is crucially dependent on the right policy environment in order for cloud computing to deliver its maximum possible potential.

We end this report with two quotes from two executives in the IT field in SA:

“Vendors are currently marketing the concept of cloud computing in a big way, but it’s really not new – it’s the natural evolution of services from the distributed computing or hosted environments that made an appearance a decade and a half ago, to the Net. What’s different today is that the computing capacity provided ‘out of the cloud’ focuses less on processing and more on services. In South Africa, cloud computing is becoming viable”.

Quote from Spescom executive

“Previously, low bandwidth availability, high cost and variability of throughput reliability made cloud computing a risky venture locally. Today, with more bandwidth available at lower cost, it may well be a more cost effective solution than owning infrastructure and software – especially when you add licences, upgrades, integration and maintenance expenditures to initial purchase and installation costs. However, a hybrid solution may be what is needed at the outset.”

Pieter du Preez, Group Executive: Business Solutions Development

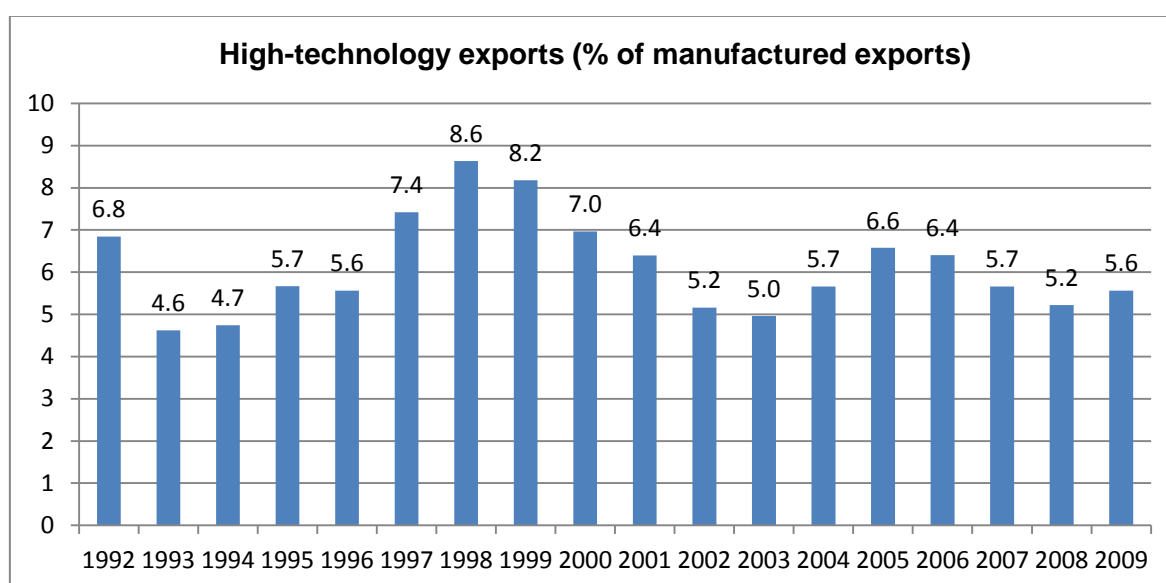
Appendix

List of graphs

High-technology exports (% of manufactured exports)
Research and development expenditure (% of GDP)
Researchers in R&D (per million people)
ICT goods exports (% of total goods exports)
ICT goods imports (% total goods imports)
ICT service exports (% of service exports, BoP)

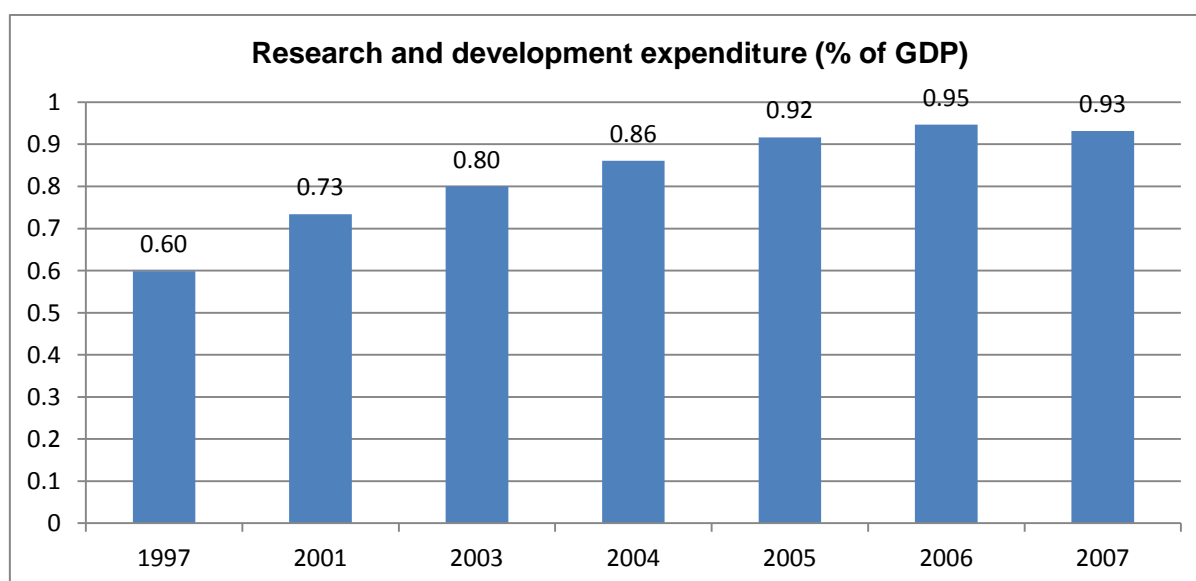
High-technology exports (% of manufactured exports)

GRAPH 1 Appendix: High-technology exports as a percentage of South African manufactured exports



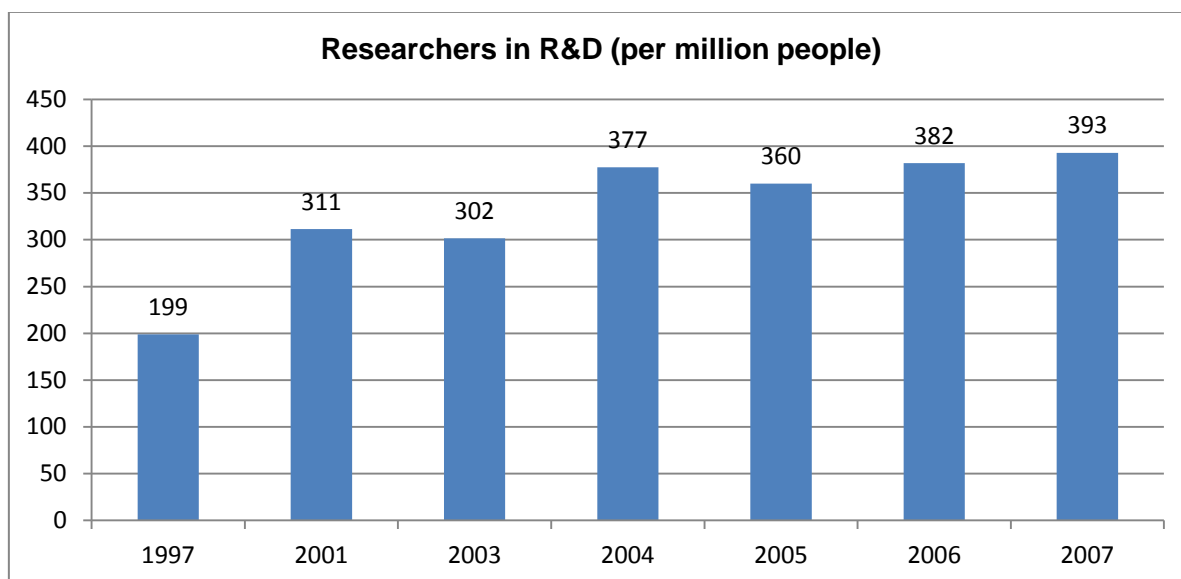
Source: United Nations, Comtrade database

GRAPH 2 Appendix: Research and development expenditure (% of South African GDP)



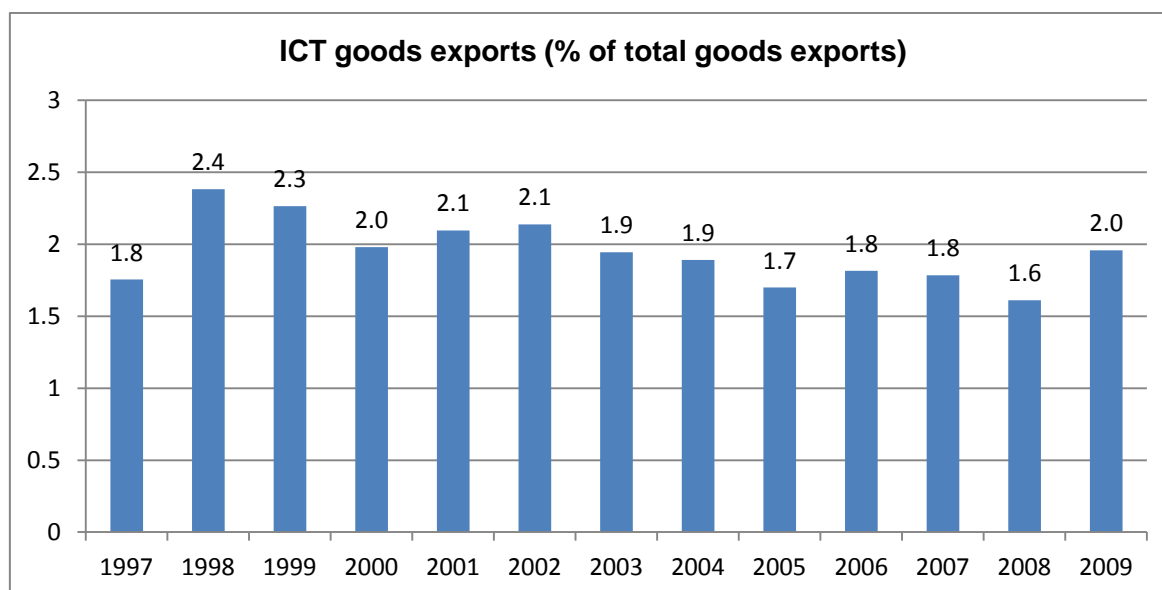
Source: United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics

GRAPH 3 Appendix: South African Researchers in R&D (per million people)



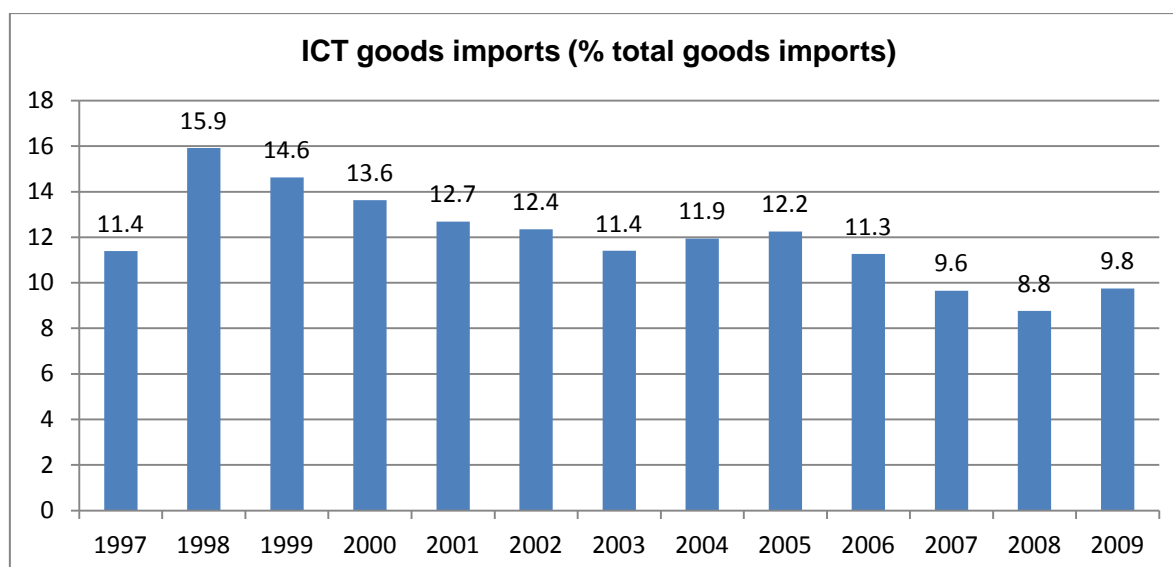
Source: United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics

GRAPH 4 Appendix: South African ICT goods exports (% of total goods exports)



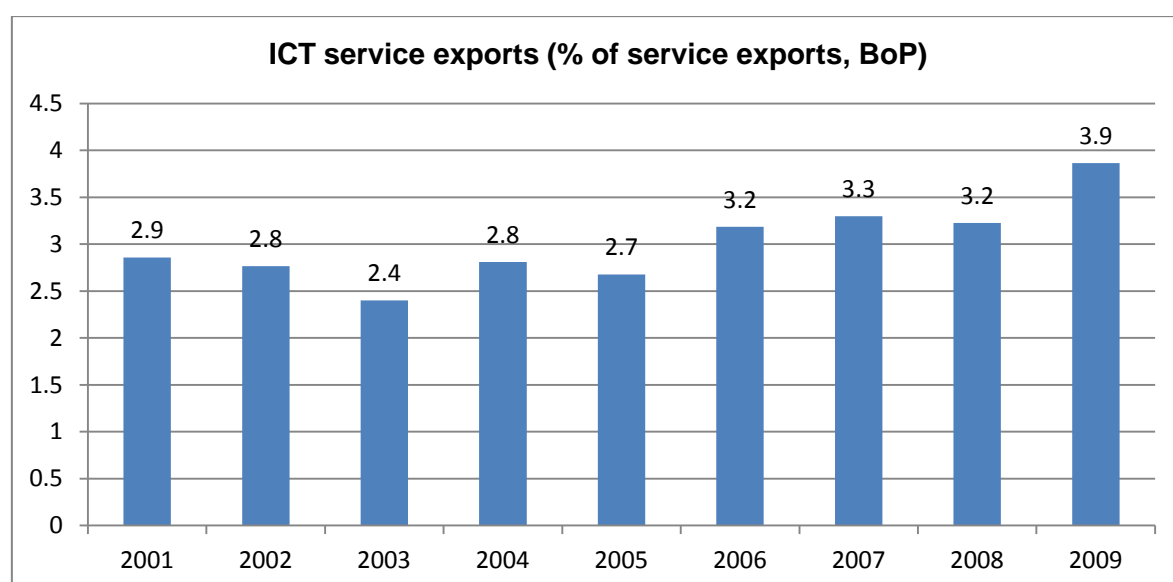
Source: United Nations Statistics Division's Commodity Trade (Comtrade) database

GRAPH 5 Appendix: South African ICT goods imports (% total goods imports)



Source: United Nations Statistics Division's Commodity Trade (Comtrade) database

GRAPH 6 Appendix: South African ICT service exports (% of service exports, BoP)



Source: International Monetary Fund, Balance of Payments Statistics Yearbook and data files

Definitions used

High-technology exports (% of manufactured exports)

High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

Source: United Nations, Comtrade database

Research and development expenditure (% of GDP)

Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development.

Source: United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics

Researchers in R&D (per million people)

Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students engaged in R&D are included.

Source: United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics

ICT goods exports (% of total goods exports)

Information and communication technology goods exports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded.

Source: United Nations Statistics Division's Commodity Trade (Comtrade) database

ICT goods imports (% total goods imports)

Information and communication technology goods imports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded.

Source: United Nations Statistics Division's Commodity Trade (Comtrade) database

ICT service exports (% of service exports, BoP)

Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions).

Source: International Monetary Fund, Balance of Payments Statistics Yearbook and data files

TABLE 1 Appendix: The major banks – IT spend actual as starting point for scope for cloud computing (Financial year ended 31 December 2010)

	ABSA Bank (Rm)	Nedbank (Rm)	Standard Bank Group (Rm)
IT spend	1 969	2 135	2 741
Total operating expenses	20 440	16 598	21 441
IT spending as a % of total operating expenses	9.63%	12.86%	12.78%

TABLE 2 Appendix: Core indicators on access to and use of ICT by households and individuals, latest available data

		Proportion of households with...						Proportion of individuals who used ICTs in the last 12 months		
		Radio	TV	Fixed line telephone	Mobile cellular telephone	Computer	Internet access at home	Computer	Internet	Mobile cellular telephone
Year of latest data										
1	Afghanistan	...	...	...	...	...	...	...	...	...
2	Albania	2008	...	72.1	...	12	8.8	...	...	...
3	Algeria	2009	59.6	98.1	24.8	94.1	18.1	7.2	...	...
4	American Samoa		...	...	...	...	...	...	...	...
5	Andorra		...	...	...	...	...	...	...	...
6	Angola		...	...	...	...	...	...	...	...
7	Anguilla		...	...	...	...	...	...	...	...
8	Antigua & Barbuda	2008	82 ¹	97 ¹	49	78 ¹	47 ¹	36 ¹	60 ²	...
9	Argentina		...	...	...	...	...	...	...	...
10	Armenia	2009	...	96.6	...	...	15.4	9.5	...	...
11	Aruba		...	...	...	...	...	...	...	...
12	Ascension		...	...	...	...	...	...	...	...
13	Australia	2009	...	...	...	78.1	71.8	...	74.2 ³	...
14	Austria	2009	74.1	84.2	27.5	...	74.5	69.8	76.5 ⁴	73.5 ⁴
15	Azerbaijan	2009	99.6	99.9	51.9	60.9	18.2	33.3 ⁵	30.8 ⁶	27.4 ⁶
16	Bahamas		...	...	...	...	...	...	...	69.5 ⁵²
17	Bahrain		...	...	...	...	...	...	...	99 ⁵²
18	Bangladesh		...	...	...	...	...	...	...	...
19	Barbados		...	...	...	...	...	...	...	...
20	Belarus	2009	...	98.8	...	...	38.2	25.1	...	27.4 ⁷
21	Belgium	2009	...	...	...	...	71.1	67.4	77 ⁴	76.2 ⁴
22	Belize		...	...	...	...	...	...	...	88.2 ⁵²
23	Benin		...	...	...	...	...	...	...	...
24	Bermuda	2008	...	...	...	90 ⁸	84 ⁸	90.4 ⁹	82.3 ⁹	...
25	Bhutan	2008	62 ¹⁰	37.7 ¹¹	20.2 ¹¹	39.3 ¹¹	4.7 ¹¹	2.8 ¹¹	...	...
26	Bolivia	2008	85.4	68.7	19.1	56.2	14.7	3.3	...	...
27	Bosnia and Herzegovina	2007	62.8 ¹²	96.8	77.1	64.2	25.2	10.9	...	...
28	Botswana		...	...	...	...	...	...	...	...
29	Brazil	2009	85.5	97.8	39.8	78.4	32.3	23.9	43.3 ¹³	39.2 ¹³
30	British Virgin Islands		...	...	...	...	...	...	...	75 ¹³
31	Brunei Darussalam		...	...	...	...	...	...	...	...
32	Bulgaria	2009	...	98.9	...	...	31.7	29.6	47 ⁴	45 ⁴
33	Burkina Faso	2007	69.5	16.9	2.7	21.6	1.6	0.1	...	78.2 ⁵²
34	Burundi		...	...	...	...	...	...	...	...
35	Cambodia	2008	40.8	58.4	1.1	37.4	3.7	0.2	...	...
36	Cameroon	2007	49.4	30.7	1.2	45	4.1	1.2	...	...
37	Canada	2009	...	98.9	89.3	99.3	81.7	77.8	...	80.3 ⁷
38	Cape Verde		...	...	...	...	...	...	...	...
39	Cayman Islands	2009	...	70.7 ¹⁴	42.3	98.6	71.3	64.5	...	...
40	Central African Republic		...	...	...	...	...	...	...	...
41	Chad		...	...	...	...	...	...	...	...
42	Chile	2009	...	...	45.8	88.9	43.9	31.3	42.8 ¹⁵	38.8 ¹⁵
43	China		...	...	...	...	...	...	...	60.5
44	Cocos Keeling Islands		...	...	...	...	...	...	...	...
45	Colombia	2009	...	87.4 ¹⁶	...	86.1	22.6	15	38.4 ¹⁵	30 ¹⁵
46	Comoros		...	...	...	...	...	...	...	...
47	Congo		...	...	...	...	...	...	...	...
48	Congo (Dem. Republic)		...	...	...	...	...	...	...	...
49	Cook Islands		...	...	...	...	...	...	...	...
50	Costa Rica	2009	77.7 ¹⁷	95.9	65.9	69.5	38 ¹⁷	18.7 ¹⁷	49.2	32.5
51	Côte d'Ivoire	2007	...	...	...	...	1.3	0.5	...	46.3 ⁵²
52	Croatia	2009	...	97.1	...	...	54.7	50	53.3 ⁴	50.6 ⁴
53	Cuba	2008	...	...	...	...	3.3	0.5	...	81.3 ⁵²
54	Cyprus	2009	...	...	...	...	61.2	52.8	54.7 ⁴	49.8 ⁴
55	Czech Republic	2009	...	...	...	...	59.6	54.2	67.5 ⁴	64.4 ⁴
56	D.P.R. Korea		...	...	...	...	...	...	...	92.5 ⁵²
57	Denmark	2009	...	97.9	...	...	86.2	82.5	87.9 ⁴	86.8 ⁴

58	Djibouti	2009	...		...	...	...	12.1	¹⁸	1.7	¹⁸	...	...	...	...	...
59	Dominica		...		...	...	...	...		...		...	...	...	...	...
60	Dominican Rep.	2007	62.3	¹⁹	83	26.5	68.8	12.5	5.7		...	...	...	...	...	...
61	Ecuador	2009	40.3	²⁰	82.7	35.6	73.5	23.4	7.6		25.9	24.6	¹⁵	37.7	⁵²				
62	Egypt	2009	77.2		96.8	54.1	58.7	31	25.3		21.6	²¹	21.6	²¹	68.5	²¹			
63	El Salvador	2009	42.7	²²	83.2	34.2	80.6	12.5	6.4		18.6	12.1	¹³	...					
64	Equatorial Guinea		...		...	...	...	...	...		...	...	...	...	...	...
65	Eritrea		...		...	...	...	...	...		...	...	...	...	...	...
66	Estonia	2009	...		98.9	...	...	65.1	63		72.5	⁴	72.4	⁴	92.6	⁵²	
67	Ethiopia	2007	...		51.2	7.6	...	0.2	0.1		...	...	...	...	...	...
68	Falkland (Malvinas) Islands		...		...	...	...	...	...		...	...	...	...	...	...
69	Faroe Islands		...		...	...	...	...	...		...	...	...	...	...	...
70	Fiji		...		...	...	...	...	...		...	...	...	...	...	...
71	Finland	2009	...		...	...	...	80.1	77.8		85.3	²³	82.5	²³	97.3	⁵²
72	France	2009	...		98.6	...	...	69.2	63		74.3	⁴	71.6	⁴	83.5	⁵²	
73	French Guiana		...		...	...	...	...	...		...	...	...	...	...	...
74	French Polynesia		...		...	...	...	...	...		...	...	...	...	...	...
75	Gabon		...		...	...	...	...	...		...	...	...	...	...	...
76	Gambia		...		...	...	...	...	...		...	...	...	...	...	...
77	Georgia	2009	...		85	41.2	...	12.6	10.8	²⁴	...	...	...	...	...	...
78	Germany	2009	...		95	...	...	84.1	79.1		82.8	⁴	79.3	⁴	86.5	⁵²	
79	Ghana	2007	...		38.8	...	...	5.1	0.3		...	...	...	...	...	...
80	Gibraltar		...		...	...	...	...	...		...	...	...	...	...	...
81	Greece	2009	...		100	...	...	47.3	38.1		49	⁴	44.5	⁴	82	⁵²	
82	Greenland		...		...	...	...	...	...		...	...	...	...	...	...
83	Grenada		...		...	...	...	...	...		...	...	...	...	...	...
84	Guadeloupe		...		...	...	...	...	...		...	...	...	...	...	...
85	Guam		...		...	...	...	...	...		...	...	...	...	...	...
86	Guatemala		...		...	...	...	...	...		...	...	...	...	...	...
87	Guernsey		...		...	...	...	...	...		...	...	...	...	...	...
88	Guinea		...		...	...	...	...	...		...	...	...	...	...	...
89	Guinea-Bissau		...		...	...	...	...	...		...	...	...	...	...	...
90	Guyana		...		...	...	...	...	...		...	...	...	...	...	...
91	Haiti		...		...	...	...	...	...		...	...	...	...	...	...
92	Honduras	2008	81.5	¹⁹	68.1	32.3	69.8	11.1	4.2		...	9.6	²⁵	29.6					
93	Hong Kong, China	2009	...		...	...	...	75.8	73.3		70.2	²⁶	69.4	²⁶	66.5	
94	Hungary	2009	...		99.2	...	...	63	55.1		64.8	⁴	61.8	⁴	93.5	⁵²	
95	Iceland	2009	...		...	...	...	92.5	89.6		94	⁴	93.5	⁴	98	⁵²
96	India		...		...	...	...	...	...		...	...	...	...	...	...
97	Indonesia	2009	81.4		71.6	10.4	61.8	10.2	2.7		...	...	...	27		
98	Iran (I.R.)	2009	...		97.4	85.1	71.3	30.2	18.2		...	11.1	²⁷	...					
99	Iraq	2008	47.5	²⁸	98.1	²⁸	17	²⁸	94.3	²⁸	18.2	²⁸	8.6	²⁸	13.7	²⁹	5.9	²⁹	...
100	Ireland	2009	...		82.1	34.6	84.3	72.8	66.7		69.7	⁴	67.4	⁴	94.6	⁵²			
101	Israel	2009	...		89.8	82.4	91.8	74.5	66.3		67.6	³⁰	63.1	³⁰	...				
102	Italy	2009	...		...	...	...	61.3	53.5		51.4	⁴	48.8	⁴	90.2	⁵²
103	Jamaica	2009	85.8		87.6	15.3	91.5	18.6	9.8		...	...	...	...	...	...
104	Japan	2009	...		...	80.4	94.6	87.2	82.5	³¹	66.2	²¹	78	²¹	74.8	³²
105	Jersey		...		...	...	...	...	...		...	...	...	...	...	...
106	Jordan	2009	...		97.6	...	71.3	43	18		55	¹⁵	26	¹⁵	...				
107	Kazakhstan		...		...	...	...	...	...		...	...	...	...	...	...
108	Kenya	2007	76		69	...	58.3	5.5	2.2		...	...	...	...	...	...
109	Kiribati		...		...	...	...	...	...		...	...	...	...	...	...
110	Korea (Rep.)	2009	87.1		87.1	80.6	95.2	81.4	95.9		82.9	³³	81.6	³³	83.4	³³			
111	Kosovo		...		...	...	...	...	...		...	...	...	...	...	...
112	Kuwait		...		...	...	...	...	...		...	...	...	...	...	...
113	Kyrgyzstan		...		...	...	...	...	...		...	...	...	...	...	...
114	Lao P.D.R.		...		...	...	...	...	...		...	...	...	...	...	...
115	Latvia	2009	...		78.2	...	...	60.1	58		67.5	⁴	66.8	⁴	89.5	⁵²	
116	Lebanon		...		...	...	...	...	...		...	...	...	...	...	...
117	Lesotho		...		...	...	...	...	...		...	...	...	...	...	...
118	Liberia		...		...	...	...	...	...		...	...	...	...	...	...
119	Libya		...		...	...	...	...	...		...	...	...	...	...	...
120	Liechtenstein		...		...	...	...	...	...		...	...	...	...	...	...
121	Lithuania	2009	...		...	...	...	57.3	60		61.5	⁴	59.8	⁴	87.9	⁵²
122	Luxembourg	2009	...		100	...	...	87.9	87.2		88.5	⁴	87.3	⁴	95.1	⁵²	
123	Macao, China	2009	...		...	...	...	78.8	75.4		56.3	³³	54	³³	...	
124	Madagascar		...		...	...	...	...	...		...	...	...	...	...	...
125	Malawi		...		...	...	...	...	...		...	...	...	...	...	...
126	Malaysia	2008	...		...	...	...	38.7	21.1	³⁴	...	...	...	...	...	...
127	Maldives	2009	...		91	...	...	45.9	³⁵	17.6	³⁵	...	...	...	...	...
128	Mali		...		...	...	...	...	...		...	...	...	...	...	...
129	Malta	2009	...		99.3	...	...	67.4	64.4		61	⁴	58.9	⁴	85.9	⁵²	
130	Marshall Islands		...		...	...	...	...	...		...	...	...	...	...	...
131	Martinique		...		...	...	...	...	...		...	...	...	...	...	...

206	TFYR Macedonia	2009	...	...	...	...	...	54.1	41.8	...	57.5	⁴	51.8	⁴	78.7	⁵²
207	Thailand	2009	58	⁵⁰	96.3	⁵⁰	21.3	87.5	20.3	9.5	29.2	²¹	20.1	²¹	56.8	²¹
208	Timor-Leste		...	...	...	...	...	...	...	...	...	...	...	...	...	...
209	Togo		...	...	...	...	...	...	...	...	...	...	...	...	...	...
210	Tokelau		...	...	...	...	...	...	...	...	...	...	...	...	...	...
211	Tonga		...	...	...	...	...	...	...	...	...	...	...	...	...	...
212	Trinidad & Tobago		...	...	...	...	...	...	...	...	...	...	...	...	...	...
213	Tunisia	2008	...	...	77.3	12.6	80.5	13.1	5	...	...	...	...	...	...	...
214	Turkey	2009	...	...	73.7	...	74.1	37.4	30	...	37.9	⁴	36.4	⁴	80.1	...
215	Turkmenistan		...	...	...	...	...	...	...	...	...	...	...	...	...	...
216	Turks & Caicos Is.		...	...	...	...	...	...	...	...	...	...	...	...	...	...
217	Tuvalu		...	...	...	...	...	...	...	...	...	...	...	...	...	...
218	Uganda		...	...	...	...	...	...	...	...	...	...	...	...	...	...
219	Ukraine	2009	...	...	94.8	53.5	83.9	25.2	15.6	...	...	...	15.6	²⁷	...	...
220	United Arab Emirates	2008	43	...	94	...	...	74	66	...	74	...	72	...	...	...
221	United Kingdom	2009	...	...	...	...	...	81.2	76.7	...	85.9	⁴	83.6	⁴	93.2	⁵²
222	United States	2009	...	...	81.2	...	95.8	86.4	68.7	...	...	...	68.4	³³	...	...
223	Uruguay	2009	92.9	...	94.4	64.3	82.8	47.6	27.7	...	48.9	⁴²	41.8	⁴²	67.4	⁴²
224	Uzbekistan		...	...	...	...	...	...	...	...	...	...	...	...	...	...
225	Vanuatu		...	...	...	...	...	...	...	...	...	...	...	...	...	...
226	Vatican		...	...	...	...	...	...	...	...	...	...	...	...	...	...
227	Venezuela	2007	83.8	...	94.8	...	58.4	14.6	5.7	...	...	...	...	...	...	...
228	Viet Nam	2008	...	...	92.1	...	64.2	11.4	4.9	⁵¹	...	...	...	...	...	...
229	Virgin Islands (US)		...	...	...	...	...	...	...	...	...	...	...	...	...	...
230	Wallis and Futuna		...	...	...	...	...	...	...	...	...	...	...	...	...	...
231	Yemen		...	...	...	...	...	...	...	...	...	...	...	...	...	...
232	Zambia	2007	57.5	...	24.4	...	28	2.1	0.6	...	...	...	...	...	...	...
233	Zimbabwe	2008	...	...	52.6	...	31.2	1.5	2.5	...	...	...	...	...	...	...
Note		For data comparability and coverage, see the technical notes. Figures in italics are estimates.														
...		Data not available.														
-		Zero or quantity less than the unit shown.														
Source		ITU World Telecommunication / ICT Indicators Database.														

- 1 National ICT household survey.
- 2 National ICT household survey. Refers only to head of household.
- 3 Population age 15+.
- 4 Population age 16-74.
- 5 Break in comparability. Including Internet access via mobile devices.
- 6 Population age 7+ over the total population.
- 7 Population age 16+.
- 8 Technology Benchmark Survey.
- 9 Population age 18+.
- 10 Source: BLSS.
- 11 Media Impact Study.
- 12 Hi-fi system CD player instead of radio.
- 13 Population age 10+, in the last 3 months.
- 14 Cable TV.
- 15 Population age 5+.
- 16 Colour TV.
- 17 Data correspond to dwellings (not households).
- 18 Country estimate.
- 19 Radio or stereo (not necessarily with a working radio).
- 20 Break in comparability. Refers only to radio device.
- 21 Population age 6+.
- 22 Refers only to radio device.
- 23 Population age 16-74, in the last 3 months.
- 24 Estimate based on the households survey.
- 25 Population age 5+ over the total population.
- 26 Population age 10+.
- 27 All population.
- 28 Excluding Kurdistan region.
- 29 Population age 5+. Excluding Kurdistan region.
- 30 Population age 20+.
- 31 Accessing from personal computers.
- 32 Includes PHS. Population age 6+.
- 33 Population age 3+.
- 34 Does not include dial-up household.
- 35 Estimated based on surveys' results.

- 36 Population age 12+.
- 37 Ministry ICT survey.
- 38 Households in electrified areas.
- 39 Population age 12-65. Living in electrified areas.
- 40 Household with at least one working television.
- 41 Population age 10+.
- 42 Population age 6+, in the last month.
- 43 Population less than 74.
- 44 Population less than 74. The value is 42.55% for population 16-74.
- 45 Household Budget Survey 2006/07.
- 46 Population age 7+.
- 47 Nation-wide survey conducted in early 2009.
- 48 Refers to two urban districts (Paramaribo and Wanica) where 80% of population live.
- 49 The Survey of Family Income and Expenditure.
- 50 Report on Population Characteristics: 2005-2006.
- 51 Only access via computer at home.
- 52 Refers to 2008.
- 53 South Africa is the general household survey and Amps.