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Innovation in Sub-Saharan Africa: Competitiveness, Capability and Achievements in South Africa, Nigeria and Uganda

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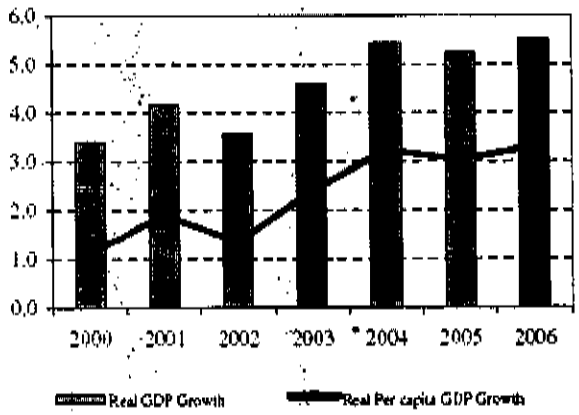
Africa has shown fairly consistent economic growth since the turn of the millennium, reaching a 4.9 percent average annual growth in gross domestic product (GDP) between 2001 and 2006 (Blanke 2007). In 2006, Africa's average growth in GDP exceeded 5.0 percent for the third consecutive year reaching 5.5 percent, the highest in two decades; with the average growth in sub-Saharan Africa reaching 5.7 percent (see Figure 1 and Appendix 1). The challenge put to Africa is to now concentrate efforts on sustaining growth. Africa would have to increase its average annual growth rate to seven percent in order to meet its Millennium Development Goal (MDG) of eradicating extreme poverty and hunger by 2015 (AfDB press release May 2007).

Figure 1. Africa: Growth in GDP (%), 2000 – 2006



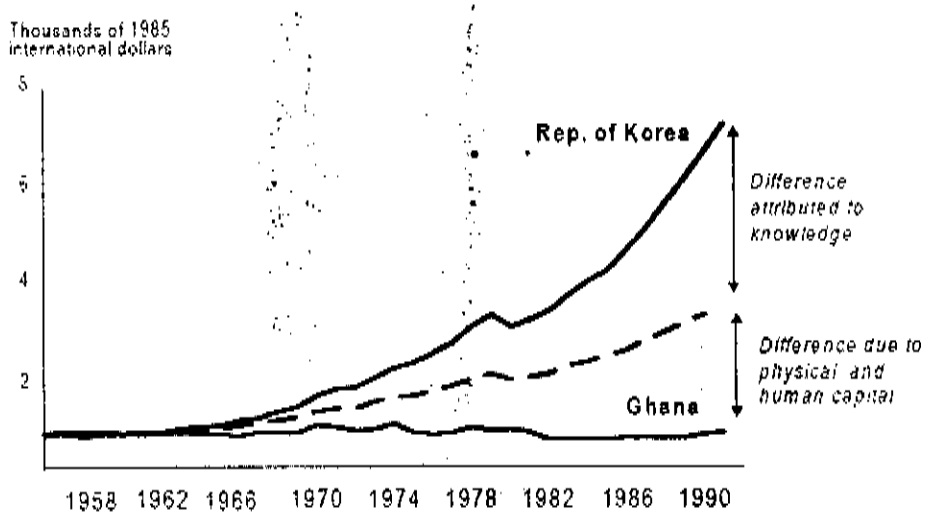
Source: AfDB Selected Statistics Report 2007 (p. 43)

According to Blanke (2007), Africa's impressive economic growth over the past few years was partly due to increased macro-economic stability in many African countries – including South Africa, Nigeria and Uganda – but mainly fueled by exogenous circumstances and interventions such as a more favourable international economic environment and debt relief. Instead of the benefits of the growth in globalization trickling down and contributing to poverty reduction in sub-Saharan Africa, the region actually shows an increase in income inequality, which has adverse effects on income growth, contributing to poverty escalation (Habiyaremye 2005). And the poor performance in this region has not significantly impacted on economic growth in advanced economies, indicating the disconnection or marginalization of sub-Saharan Africa from the world economy.

It is now well-recognised that investment in science and technology and innovation is essential for sustainable economic growth and social development in the global knowledge economy (NEPAD 2007; UNDP 2005). As Toffler (1990, p. 9 as cited in St.

George 2006) puts it, "The most important economic development of our lifetime has been the rise of a new system for creating wealth, based no longer on muscle but on mind". Evidence from research on developed countries, and more recently also on some developing countries, indicate the correlation between a country's scientific and technological capabilities and its economic performance (NEPAD 2007). This is aptly illustrated by the example of the economic development of Korea and Ghana, two developing countries that had the same per capita income five decades ago. Figure 2 shows that Korea surpassed Ghana in economic growth, increasing its per capita income by a factor of 8.9 in real terms, mainly as a result of more effective policy and use of technical knowledge (Utz 2006).

Figure 2. Knowledge Makes the Difference between Poverty and Wealth



Source: Aubert (2007)

Thus it is indicated that the challenges of sustaining economic growth in Africa are to integrate into the world economy and are embedded in growing a knowledge-based economy that is driven by innovation, science and technology (Kamara, Bousrih and Nyende 2007).

The concept of innovation differs according to a country's level of economic development (Mathews and Hu 2007). For developed or lead countries, the primary goal is to maintain lead position by introducing "new-to-the-world" innovations through products, processes and/or abstract knowledge (Mathews and Hu 2007, p. 1005). For developing or latecomer countries - such as South Africa, Nigeria and Uganda – the primary goal is to catch-up and not necessarily to produce at the technological frontier. Key in the catch-up process is the adaptation and diffusion of knowledge and technologies developed elsewhere; and this adaptation and diffusion of technologies has to occur faster than the rate at which the advanced economies innovate.

Necessary skills are required to adapt and use the 'new' technologies. Thus the basic enabler of a country's transition to a knowledge economy is an education system that encourages learning, exploration, creation and sharing of knowledge (Utz 2006). The key role that higher education institutions play in growing the knowledge economy has only recently been recognised. Previously, international development agencies viewed higher education as institutions for the elite and thus placed emphasis on primary and - later on - secondary education in developing countries. Late-comer countries are now encouraged to invest in developing their higher education systems. A United Nations Millennium Project report (UNDP 2005, p. 93) states that,

> A new view that places universities at the center for the development process is starting to emerge...Universities and research institutes (including polytechnics) are now deeply integrated into the productive sector as well as society at large. Universities are starting to be viewed as a valuable resource for business and industry; universities can undertake entrepreneurial activities with the objective of improving regional or national economic and social performance.

Mwamila and Diyamett (2006, p. 7) indicate three main functions of universities:

i) To transmit advanced knowledge from one generation to the next so that it can serve either as a basis of action, or a springboard to future research;
ii) To provide a centre for the attempt to advance the frontiers of knowledge; and
iii)To provide, through its teaching, for the high level manpower needs of the society.

The university thus plays a critical role in the knowledge-based economy not only by providing the human capital necessary for adapting and utilising knowledge adopted from more technologically-advanced countries, but also in providing knowledge for advancing knowledge frontiers. Although the key developmental role of the university in the knowledge economy is well-established, there is still much to be understood about the developmental role of the university in developing countries.

This paper is one of a series of papers on the developmental role of the university, with particular focus on university-industry interactions in the national systems of innovation (NSI's), in three sub-Saharan countries at different levels of economic development: South Africa, Nigeria and Uganda. The main objective of this paper is to describe the socio-economic context, and the scientific and technological climate of each of the three countries. Describing the national context of the university and firm is an essential first step considering that the interaction between the multiple actors of countries' national systems of innovation are embedded in the particular national context and are unique to that context. The description of the national context also enables us to situate each country, and facilitates comparison between the three countries in order to determine whether the state of UILs in each country is a reflection of the general level of development of the country. It is noted that the countries' policy framework and relevant state-steering mechanisms are critical for harnessing science and technology – this will be the focus of another paper of the project.

This paper is organized as follows: The first section presents an overview of South Africa, Nigeria and Uganda's innovative competitiveness, capabilities and achievements in relation to the world, relevant geographic and economic regions, and each other. The section benchmarks the three countries with the use of the best-known composite indicators or indices for assessing countries' (including latecomers') innovation potential and sophistication. The second section focuses on each of the countries separately, describing the country's socio-economic development, and level of scientific and technological sophistication and progress over time. We make use of common composite indices, such as the UNDP's Human Development Index (HDI), and indicators at the disaggregated level with particular focus on indicators of capabilities to adopt, adapt and diffuse knowledge and technology. We also provide an assessment of the countries' environmental context considering that historically, Africa's economic development has hinged on its natural resources and raw materials (see Juma 2006).

1. Benchmarking South Africa, Nigeria and Uganda's Competitiveness and Technological Sophistication in the Knowledge-Economy

In this section we utilize leading indices for assessing South Africa, Nigeria and Uganda's levels of competitiveness and technological capabilities and sophistication in relation to relevant regions and each other. These indices have often been deemed inappropriate for the developing country context. Lall (2001), for example, presents an insightful critique of the leading indices of the World Economic Forum's, *The Global Competitiveness Report*, which is used by policy-makers worldwide. Nonetheless, as various authors show – for example Utz (2006), and Oyelaran-Oyeyinka and Sampath (2007) – these indices are useful for answering the question, *"Where do these countries stand- in terms of technological sophistication and readiness - in relation to the world, its geographic and economic regions, and in relation to each other?"* The indices that appear in this section are: The World Economic Forum's competitiveness indices, the *Global Competitiveness Index (GCI)* and the *Business Competitiveness Index (BCI)*; three indices by the United Nations, *UNIDO's Competitive Industrial Performance (CIP) Index, UNDP's Technological Achievement Index (TAI) and UNCTAD's Innovation Capability Index (UNICI);* and a recent innovation of the World Bank, the *Knowledge Economy Index (KEI)*. This section will firstly report the countries' performance on each of the indices and secondly, discuss the usefulness of the indices for the purposes of this paper.

The World Economic Forum's (WEF) competitiveness indices

The Africa Competitiveness Report: trends for 2001, 2004 and 2007

The World Economic Forum's, *The Africa Competitiveness Report*, first published in 1998, is the first systematic benchmarking index developed for Africa (Cook and Sachs 2000-2001). It combines qualitative and quantitative measures in their analyses and benchmarking of the macro- and micro-economic competitiveness of countries. The qualitative data, such as corruption and quality of overall infrastructure, are obtained from the WEF's Executive Opinion Survey conducted among top executives in the countries ranked for the Global Competitiveness Index (GCI); and the quantitative data include indicators such as government debt and patent data. The goal of the report series is to highlight prospects for and obstacles to growth and competitiveness in the region. A hundred and twenty eight countries are included in the GCI. Each country is ranked according to its performance on the nine pillars of the GCI identified as critical for productivity and competitiveness: institutions (public and private), infrastructure, the macro-economy, health and primary education, higher education and training, market efficiency (goods, labor, financial), technological readiness, business sophistication, and innovation. These pillars are organized into three sub-indexes – the basic requirements sub-index, the efficiency enhancers sub-index, and the innovation and sophistication

factors sub-index – with each sub-index being weighted according to the country's stage of development [see Blanke (2007) for a more detailed description of the GCI].

Table 1.1 Africa Competitiveness Report Top 10

	2000 - 2001	2003 - 2004			2007		
Africa Rank	Country	GCI Rank	Country	Index value	GCI Rank	Country	Index value
1	Tunisia	36	Botswana	4.56	29	Tunisia	4.72
2	Mauritius	38	Tunisia	4.49	46	**South Africa**	**4.42**
3	Botswana	**42**	**South Africa**	**4.37**	58	Mauritius	4.22
4	Namibia	46	Mauritius	4.12	65	Egypt	4.09
5	Morocco	52	Namibia	3.99	72	Morocco	4.02
6	Egypt	55	Gambia	3.93	73	Libya	4.00
7	**South Africa**	58	Egypt	3.84	76	Algeria	3.98
8	Senegal	61	Morocco	3.77	83	Botswana	3.83
9	Ghana	69	Tanzania	3.49	88	Namibia	3.76
10	Swaziland	71	Ghana	3.46	97	Kenya	3.61
11	Ethiopia	74	Algeria	3.39	**102**	**Nigeria**	**3.49**
14	Tanzania	**80**	**Uganda**	**3.25**	108	Tanzania	3.40
16	Cameroon	**87**	**Nigeria**	**3.10**	113	Madagascar	3.29
17	**Uganda**	88	Zambia	3.10	115	Lesotho	3.24
18	Mozambique	91	Cameroon	2.98	**116**	**Uganda**	**3.21**
20	**Nigeria**	93	Mozambique	2.91	118	Mauritania	3.18

Data source: [a] http://www.afronets.org/archive/200010/msg00104.php; and
The World Economic Forum, *The Africa Competitiveness Report 2000-2001, 2004, 2007*

The report advises against comparison over time because each edition includes slight differences from previous years. Nonetheless, comparison over time will be used in this paper simply to get a sense of where each of the three countries rank in terms of order (top, middle or bottom) over the three years. The composition of the top seven countries in Africa remains largely unchanged in the 2000-2001, 2003-2004 and 2007 reports with some variation in position. The star performers on the GCI are Tunisia, South Africa, Mauritius and Botswana which were each ranked in the top three for two periods (except for Tunisia who ranked in the top two over the three periods). In 2007 five of the top ten were North African countries with Tunisia leading the region ranking number one in Africa and 29 in international comparison, and Libya being included in the report for the first time. South Africa leads sub-Saharan Africa coming in after Tunisia to rank second in Africa and 46 in international comparison.

Table 1.2. The Global Competitiveness Index 2007: Africa comparators

Country/Region	Average score
Southeast Asia	4.25
North Africa	4.09
Latin America and Caribbean	4.07
Sub-Saharan Africa	**3.29**

Note: All averages are weighted by population

Data source: The World Economic Forum, *The Africa Competitiveness Report 2007*

In 2007 South Africa also achieved an index value (GCI = 4.42) well-above the averages for all of the relevant regions: Southeast Asia (4.25), North Africa (4.09), Latin America and Caribbean (4.07), and sub-Saharan Africa (3.29). Sub-Saharan showed the lowest levels of competitiveness of all of the regions for the overall GCI and the nine pillars; performing particularly poorly on the pillars of the basic requirements sub-index, infrastructure and health and primary education, and the pillars of higher education and training and technological readiness of the efficiency enhancers sub-index. All of the regions showed poor performance on the innovation factors sub-index. South Africa ranked in the top three for competitiveness with regard to all of the pillars except three: infrastructure, the macro-economy, and health and primary education. South Africa's performance on the nine pillars mirrors that of sub-Saharan Africa, although the country ranked in the top three in Africa for technological readiness.

Nigeria and Uganda have, however, not performed as well with regard to competitiveness. Nigeria and Uganda remained in the top 20 African countries in the 2000-2001, 2003-2004 and 2007 reports, but were on the lower rungs in international comparison. In 2007, Nigeria ranked 11th in Africa, whereas Uganda ranked 18th. In 2007, Nigeria achieved a GCI value (3.49) slightly above the average for sub-Saharan Africa (3.29), whereas Uganda's GCI value was slightly below the average (3.21). Both countries achieved overall index values well-below the averages for the other relevant regions (see Table 1.1 and Table 1.2). Like South Africa, Nigeria and Uganda's performance on the nine pillars mirrors that of sub-Saharan Africa. South Africa outperformed Uganda and Nigeria on all nine pillars, and Uganda performed the worst. Uganda performed at the bottom six ranks in relation to the rest of Africa for competitiveness in the quality of institutions, infrastructure and health and primary education.

In sum, the key pillars of competitiveness critical for increasing productivity and improving competitiveness in countries at the early stages of development – the quality of infrastructure, health and primary education, higher education and training, and technological readiness - present obstacles to improvement in competitiveness in South Africa, Uganda and Nigeria, and sub-Saharan Africa generally. The three sub-Saharan African countries, however, show strength in macro-economic development.

The Business Competitiveness Index (BCI): Trends for 2001 and 2007

The complement to the GCI is the BCI, which assesses the micro-economic conditions presenting propensity for and obstacles to a country's competitiveness. The BCI includes two sub-indexes: Quality of the national business environment and company operations and strategy. In the 2007-2008 edition of The Global Competitiveness Report, 127 countries are ranked with Tunisia and South Africa leading the African region in international comparison, ranking 25th and 34th respectively outperforming China (57th) and Brazil (59th). South Africa dropped six positions since 2001 when it was ranked 28th. This was mainly due to the country's decline in the quality of the national business environment. Nigeria ranked 84th, 12 positions above Uganda in the 96th position outperforming Algeria (97th). Nigeria dropped 18 positions since 2001 when it ranked 66th. Nigeria declined dramatically in the quality of the national business environment dropping 20 positions from 68th in 2001 to 88th in 2007. (Uganda's ranking for 2001 was not available.)

The United Nation's industrial competitiveness, technological achievement and innovation capability indices

UNIDO's Competitive Industrial Performance (CIP) Index

The Competitive Industrial Performance (CIP) index assesses a country's ability to produce manufactures competitively. The index focuses on two years, 1985 and 1998, that is, prior to Africa's economic growth spurt at the turn of the millenium (see UNIDO's Industrial Development Report 2002-2003). The CIP index posits that industrial performance is a result of slow and incremental processes. The index was constructed from four indicators of industrial performance: Manufacturing value added (MVA) per capita, manufactured exports per capita, share of medium- and high-tech activities in MVA, and share of medium- and high-tech products in manufactured exports.

Rank			Country/Region	Index value		
1985	1998			1985	1998	
6	1	↑	Singapore	0.587	0.883	↑
1	2	↓	Switzerland	0.808	0.751	↓
27	33	↓	Brazil	0.140	0.149	↑
61	37	↑	China	0.053	0.129	↑
32	39	↓	South Africa	0.096	0.108	↑
40	45	↓	Tunisia	0.064	0.068	↑
67	57	↑	Egypt	0.012	0.038	↑
64	62	↑	Kenya	0.013	0.025	↑
75	78	↓	Nigeria	0.006	0.006	-
70	80	↓	Tanzania	0.009	0.005	↓
80	84	↓	Uganda	0.001	0.003	↑

Data source: UNIDO 2002/2003.

East Asia was the lead among the developing regions in both years with Singapore ranking first in the world in 1998. Sub-Saharan Africa faired the worst among the developing regions with 12 of the 20 lowest ranking countries in international comparison coming from the region, indicating low levels of industrial performance. South Africa was the lead country among the 16 sub-Saharan African countries included, ranking 32nd in 1985 and dropping to the 39th position in 1998. South Africa, along with Brazil, China, India and Saudi Arabia, forms part of cluster of countries with medium to low MVA per capita. Kenya was the only country in the region to improve in industrial competitiveness in 1998, climbing two positions from 64 to 62. Nigeria and Uganda are ranked near the bottom with Uganda performing the worst of three countries.

UNDP's Technological Achievement Index (TAI)

The Technological Achievement Index (TAI) was introduced in the UNDP's Human Development Report in 2001. The TAI provides an overall assessment of a country's technological progress and capacity to participate in technological innovations reflected in how well it creates and diffuses technology and builds a human skill base. The TAI aims to assess technological achievement (as opposed to potential, effort or input) and consists of four components: Creation of technology, diffusion of recent innovations, diffusion of old innovations, and human skills. Although the TAI is now somewhat dated, the index provides a useful classification of countries at different stages of development with regard to disparities, diversity and dynamism in technological achievement (Utz 2006). Seventy two countries are assessed and are grouped into four categories according to level of technological achievement: Leaders (TAI above 0.5), potential leaders (TAI

0.35-0.49), dynamic adopters (TAI 0.20-0.34), and marginalized (TAI below 0.20). [See Desai, Fukuda-Parr, Johansson and Sagasti (2002) for a detailed description of the TAI.]

	1995 – 2001			1995 - 2001	
Country/Region	**Rank**	**Index value**	**Country/Region**	**Rank**	**Index value**
Leaders			**Marginalised**		
Finland	1	0.744	Senegal	66	0.158
United States	2	0.733	Ghana	67	0.139
Potential Leaders			Kenya	68	0.129
Malaysia	30	0.396	Tanzania	70	0.080
Mexico	32	0.389	Sudan	71	0.071
Dynamic Adopters			Mozambique	72	0.066
South Africa	39	0.340	**Others**		
Brazil	43	0.311	[redacted]		
China	45	0.299			
Tunisia	51	0.255			
Egypt	57	0.236			
Algeria	58	0.221			
Zimbabwe	59	0.220			

Note: This table includes all of the African countries ranked on the TAI.

Data source: UNDP 2001 and
http://humandevelopment.bu.edu/dev_indicators/start.cfm?header_id=14

Topping the list as 'leaders' in terms of technological achievement are Finland (in first place) and the United States (in second place) (see Table 1.4). South Africa, which leads in the African region with regard to technological achievement (in 2001), was ranked 39th and classified as a 'dynamic adaptor'. 'Dynamic adaptors' mainly include developing countries that are dynamic in using new technology, have significantly higher human skills than 'marginalized' countries, are likely to have some high technology industries and technology hubs, but have slow diffusion of old innovations (i.e. telephones and electricity). TAI values were not calculated for Uganda and Nigeria due to a lack of data.

UNCTAD's Innovation Capability Index (UNICI)

The Innovation Capability Index (UNICI), introduced in UNCTAD's World Investment Report 2005, uses proxies to assess innovative activity (the Technological Activity Index) and the availability of skills for such activity (the Human Capital Index). The UNICI is composed of quantitative data (such as USPTO patents data) and is calculated for 117

countries for 1995 and 2001. The countries are divided into three groups: High, medium and low levels of innovation capability.

	1995		2001		
Country/Region	**Rank**	**Score**	**Rank**	**Score**	
High					
Sweden	1	0.957	1	0.979	↑
Finland	2	0.947	2	0.977	↑
Medium					
South Africa	45	0.5	48	0.548	↓
Egypt	61	0.449	56	0.474	↑
Tunisia	80	0.302	72	0.365	↑
Low					
Nigeria	99	0.1	96	0.157	↑
Uganda	107	0.0	99	0.140	↑
Developed Countries (excl. new EU members)		0.876		0.869	↓
The new EU members		0.665		0.707	↑
South-East and East Asia		0.492		0.518	↑
West Asia and North Africa		0.348		0.361	↑
Latin America and the Caribbean		0.375		0.360	↓
South Asia		0.223		0.215	↓
Sub-Saharan Africa		0		0.160	↑

Data source: UNCTAD 2005.

South Africa and Mauritius are the only sub-Saharan countries, together with other newly-industrialising South-East European countries and countries in the CIS region and China, are classified as having 'medium' innovative capabilities. South Africa did however decline in innovative capability falling three positions from 45 in 1995 to 48 in 2001. The other sub-Saharan African countries, together with some Latin American and West Asia and North African countries, are included in the 'low' capability group. Although sub-Saharan Africa marginally increased in average innovative capability, the region still lags behind the other regions. Nigeria and Uganda are near the bottom end. Both countries climbed ranks in 2001, ranking at 96 and 99 respectively.

In comparison to the best-known indices benchmarking national competiveness and innovation, the UNICI compares best with the knowledge index introduced by the World Bank with regard to the indicators used (UNCTAD 2005). The two indices however differ in that the one assesses innovation capacities whereas the other assesses knowledge

capacities respectively. This paper will now report on performance on the World Bank's Knowledge Economy Index, the index introduced most recently.

The World Bank's Knowledge Assessment Methodology (KAM) index

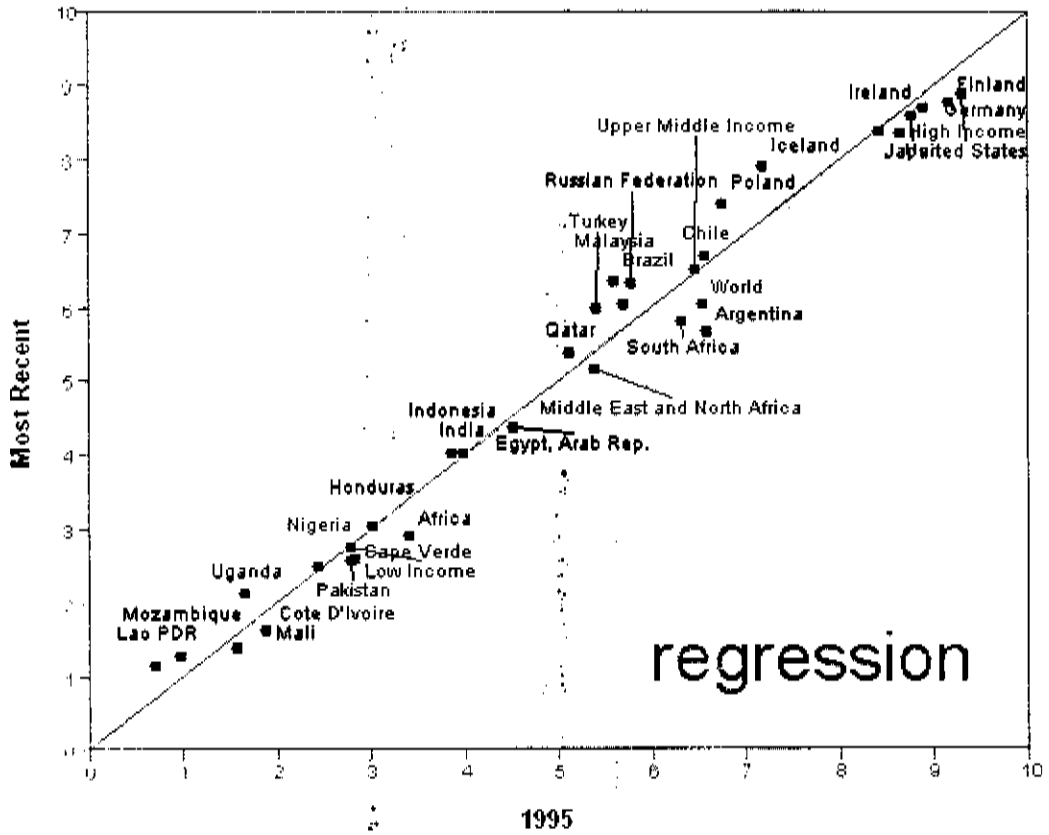
The Knowledge Assessment Methodology (KAM) was developed by the World Bank Institute's Knowledge for Development Program in 1999. The KAM was designed as an interactive Internet-based tool for benchmarking countries' and regions' overall level of development in the knowledge economy. The KAM 2007 includes 140 countries assessed on the basis of 80 quantitative and qualitative variables, such as GDP and administrative burden for start-ups respectively.

The KAM Knowledge Economy Index (KEI) is a composite index that is an average of the normalized values of 12 of the 80 indictors of the four pillars considered critical for the knowledge economy:

i) an economic and institutional regime that provides incentives for efficient use of existing and new knowledge, with a view to flourishing entrepreneurship;
ii) an educated and skilled population, which creates, shares and uses knowledge to innovate and create economic value;
iii) a dynamic information infrastructure to facilitate effective communication, dissemination, and processing of information; and
iv) an efficient innovative system of firms, research centers, universities, and other organizations capable of tapping into the growing stock of global knowledge, and assimilating and adapting it to local needs (Kamara et al. 2007, p. 6).

The Knowledge Economy framework "asserts that investments in education and training, innovation and technological adoption, the information infrastructure, and a conducive economic incentive and institutional regime are necessary for sustained creation, adoption, adaptation and use of knowledge in domestic economic production, which will consequently result in higher value added goods and services" important for economic development (Chen and Dahlman 2005, p. 15). The KEI assesses knowledge development potential and whether the economic environment and institutions are conducive for the effective use of knowledge for economic development. [See Chen and Dahlman (2005) for a more detailed description of the KEI and the complete KAM tool.]

Figure 1.1. Global Knowledge Economy Comparisons – Knowledge Economy Index (KEI) (unweighted)

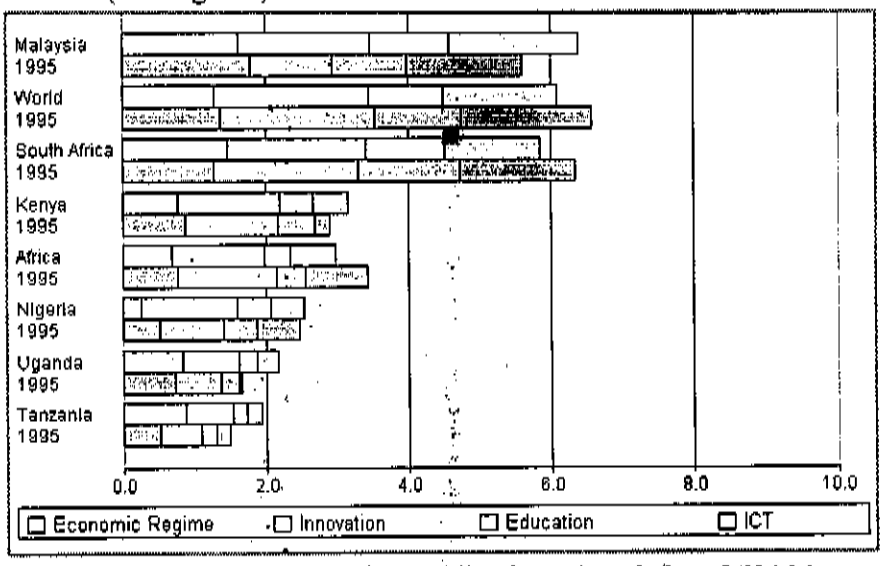


Source: KAM (2007) (http://info.worldbank.org/etools/kam2/KAM_page7.asp)

Figure 1.1 and 1.2 illustrate South Africa, Nigeria and Uganda's readiness for the knowledge economy in relation to relevant comparators and each other for 1995 and the most recent year available. It can be seen that low income countries, mainly African countries (including Nigeria and Uganda), are clustered at the bottom third of the distribution. Middle-income countries, including South Africa, are clustered in the middle and high-income countries in the top third. South Africa's performance on the knowledge economy index is lower but similar to the world average. Its performance is considerably lower than the average for upper middle-income countries, indicating that the country is not keeping pace with the rest of the world and the relevant income region. While, on average, upper middle-income countries improved somewhat since 1995, South Africa appears below the 45-degree line indicating that its recent KEI performance declined relative to its performance in 1995. Uganda and Nigeria appear above the 45-degree line indicating improvement in their performance on the KEI since 1995. Although Nigeria had a score similar to the low income countries' average, both Nigeria and Uganda showed lower levels of readiness for the knowledge economy in relation to other low income countries (on average). These countries also scored less than the average for the African region - which declined since 1995. Nigeria and Uganda have not kept pace with

the rest of the world or their geographic and relevant income regions. However, these countries seem to be improving.
Figure 1.2 provides a picture of the three countries' performance on the four pillars that comprise the KEI. For each country or region, the bars depict performance for the most recent year available and performance in 1995.

Figure 1.2. KEI cross-country comparison, 1995 and the most recent period for which data are available (unweighted)



Source: KAM (2007) (http://info.worldbank.org/etools/kam2/KAM_page9.asp)

South Africa and Uganda improved their economic and institutional regime relative to 1995. South Africa did not show improvement in any of the other pillars, whereas Uganda improved in performance on all of the other pillars with a marginal improvement in education (proxy indicators include adult literacy rate, and secondary and tertiary enrolment). Nigeria improved in performance on the innovation pillar and achieved the same score held in 1995 for the education pillar. Nigeria declined in performance for the economic and institutional regime pillar and the ICT pillar. Considering the low average performance among countries in the African region, it is evident that many countries in Africa have not placed enough emphasis on improving adult literacy levels and enrolment in secondary and tertiary education (one possible reason may be that, until recently, many African countries have been encouraged by international development agencies to focus mainly on the development of primary level education to the detriment of secondary and tertiary level education).

In sum, considering the countries' overall performance on the most common and influential indices assessing competitiveness, and technological capabilities and sophistication, a common trend is apparent even though some of the indices are somewhat dated. Generally, South Africa leads the three countries with regard to innovative capability, followed by Nigeria and then Uganda. However, South Africa showed a decline on most of the indices whereas the other two countries seem to be

making progress in developing their innovative capability with Uganda showing the greatest progress.

As stated previously, these indices are useful for answering the question, *"Where do these countries stand- in terms of technological sophistication and readiness - in relation to the world, its geographic and economic regions, and in relation to each other?"* The utility of these indices for assessing areas of technological capability and progress over time is however debatable, and the development of appropriate and useful indices has been a constant challenge, which is evident from the number of indices being introduced. The World Banks' Global Economic Prospects 2008 (p. 59) – which introduces new indices of its own - indicates that indices always fall short because "technology is embodied in products, intermediate inputs, and processes", and thus cannot be measured directly. Indices thus use proxy indicators in their assessments. The indices included in this report have various indicators in common with some emphasizing inputs to technological advancement (such as education and R&D expenditures and personnel), and others assessing the diffusion of 'old' (such as electricity and transport) and 'new' technologies (ICT), and innovation at the frontier (such as patents).

In this paper we argue that absorptive capacity is essential for fostering the NSI in developing countries. According to Habiyaremye (2005, p.?), absorptive capacity refers to "the ability to recognize the value of new, external knowledge, assimilate it and apply it to commercial ends", and "is a necessary condition for developing countries to successfully exploit external sources of knowledge and generate own innovations." The basis of absorptive capacity is an appropriately skilled human capital base and the focus is on learning. In addition to a human capital base, basic infrastructure (such as an adequate transport system) and dynamic information and communication infrastructure are necessary for the diffusion of technologies in order to sustain levels of technological development. The TAI recognizes and emphasises the importance of absorptive capacity as defined here, while the KEI excludes indicators of basic infrastructure (which is important for the developing-country context), whereas the UNICI only includes indicators of human capacity.

Neither of the indices – besides UNIDO's Competitive Industrial Performance index, which focuses on exports – includes measures of openness and exposure to technology developed elsewhere and international innovation networks, which enables countries to acquire technologies and knowledge from elsewhere. Acquiring technology and knowledge is the essential first step in the catch-up process. This deficiency is also noted in the World Banks' Global Economic Prospects 2008 report, and the importance of indicators of openness to acquire technology is also emphasized by the literature focusing on innovation in the developing world and the role of technological development in poverty reduction (see Habiyaremye 2005).

Habiyaremye (2005) provides a useful description of the foundations of technological development in the developing-country context, with a focus on sub-Saharan Africa. Before technologies developed elsewhere can be adopted, adapted and utilized in the developing-country context, technology transfer has to occur. Key mechanisms for

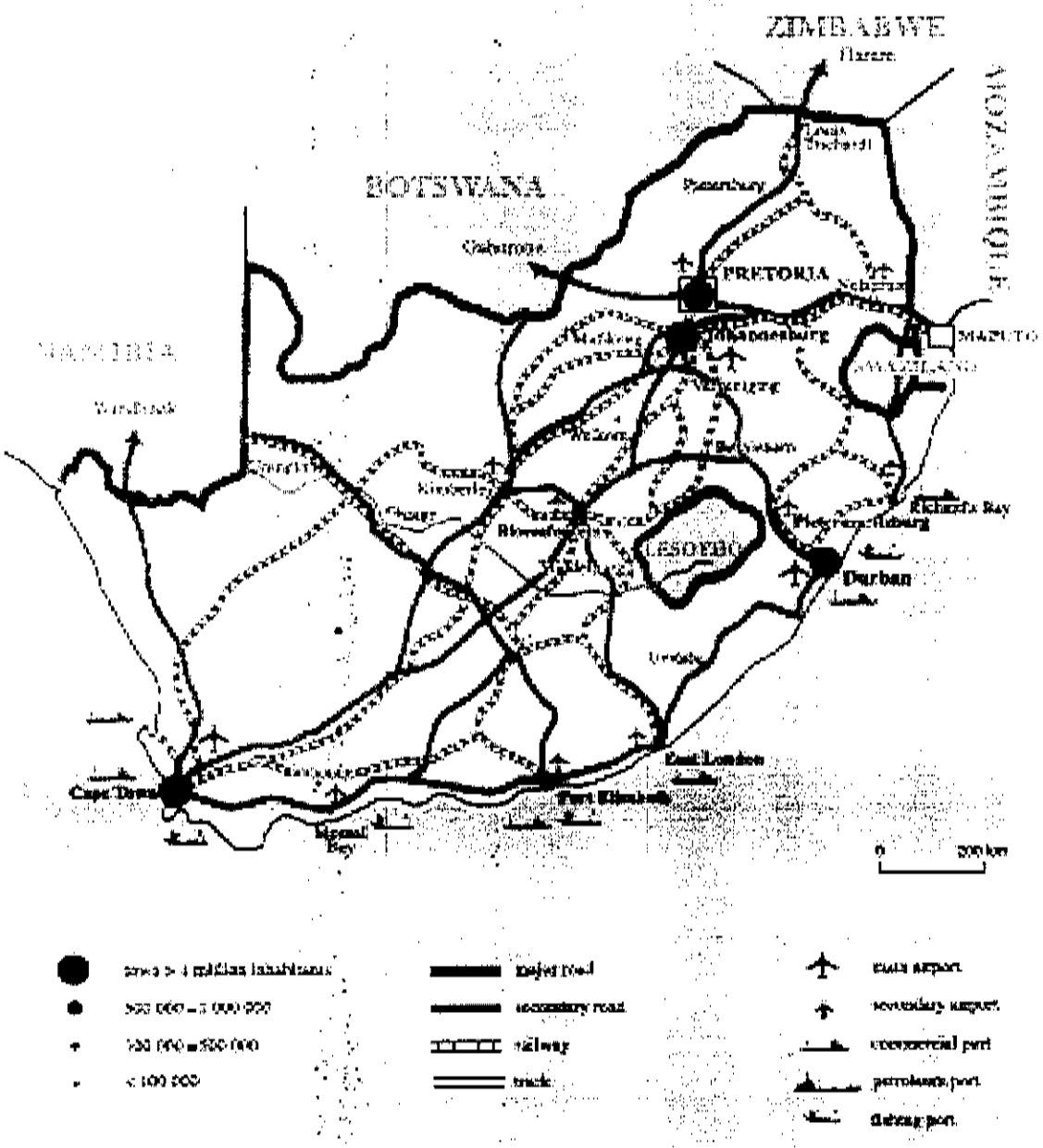
technology transfer in developing countries are trade (particularly the imports of capital goods), foreign direct investment (FDI) and the royalties and license fees payments and receipts. Although the easiest way to gain new technology is through the import of capital goods, FDI inward inflows are more important for catch-up as it involves the transfer of not only technologies, but the know-how and capacity for adopting, improving and utilising the technologies and innovative processes. It is important to note at this point that technology transfer does not happen automatically and without cost, and technologies cannot simply be acquired off-the-shelf. The technology transfer occurs in specific ways and at cost. The technologies also do not necessarily come in a form that is readily useable with easy-to-follow instructions. Knowledge for using technologies is often codified and/or tacit, thus requiring appropriately skilled persons providing the absorptive capacity for efficient and sustainable technology diffusion.

Thus the basic blocks for catch-up are: Firstly, openness and exposure to international innovation networks for technology transfer, and secondly, the absorptive capacity for adapting and using this technology, and adequate basic infrastructure and a dynamic ICT infrastructure. But it should not be taken that developing countries should not attempt to innovate at the frontier as this is important for developing innovations specific to the African context that are also new-to-the-world (e.g. vaccines for tropical diseases found in Africa, location-specific technologies for harnessing agricultural capabilities, etc.).

In addition to the weaknesses described above, composite indices, by nature, do not provide the detail necessary to gain a full picture of technological capability in developing countries and progress over time, in pin-pointing obstacles and facilitators of scientific and technological development in developing countries. Thus, for the purposes of this paper, it is necessary to describe the countries' scientific and technological performance, as well as the socio-economic factors impacting on scientific and technological performance, at the disaggregated level and also describe performance over time.

The second section of this paper focuses on the socio-economic environment, and attempts to provide an assessment of the scientific and technological capabilities and achievements of the three sub-Saharan African countries. An adaption of the four pillar-framework of the KAM is used as the framework for organizing the indicators included in the paper: Macro-economic environment (Pillar 1); an educated and skilled population (Pillar 2); adequate basic infrastructure and a dynamic information infrastructure (Pillar 3); and scientific and technological capabilities (Pillar 4). South Africa's social development and performance on the various indicators included in the four pillars will firstly be reported followed by Nigeria's performance and lastly, Uganda's.

Disaggregating performance in South Africa



Source: African Economic Outlook 2007

2. Disaggregating Performance in South Africa

South Africa: The Socio-Economic Context

In 2005, South Africa had a population of 46.89 million; accounting for 6.31 percent of the total population in sub-Saharan Africa, about 7.82 percent of the total population in upper-middle income economies and 0.73 percent of the world population. South Africa's population, in 2005, was a third of Nigeria's total population and nearly double that of Uganda. In the same year, more than half (63.15 percent) of the population fell in the age group 15 to 64 years, and less than half (40.70 percent) lived in rural areas, which is less than the world average of 51.23 percent. Although the size of South Africa's rural population is much smaller than the world average and that of sub-Saharan Africa (64.77%), its rural population is about 13 percent larger than the average for upper-middle income economies. Urbanization in South Africa declined in 2005 (1.94%) from 1996 when it had an annual growth rate of 3.10 percent; but this was the general trend as lower growth rates in 2005 in comparison to 1996 were shown in upper-middle economies, sub-Saharan Africa and the world. South Africa's population growth also declined in 2005 in comparison to 1996 (1.14% and 2.23% respectively), and again this was the trend for its comparators as well (see Table 2.1 below). The country's annual population growth was however higher than that of upper-middle economies, but lower than sub-Saharan Africa and the world's annual growth.

Table 2.1: Population indicators - South Africa and selected regions, 1996 and 2005

	South Africa		Upper-middle income		Sub-Saharan Africa		World	
Indicators	1996	2005	1996	2005	1996	2005	1996	2005
Population (total in millions)	40.00	46.89	562.25	599.85	599.77	743.06	5747.02	6437.68
Population growth (annual %)	2.23	1.14	0.87	0.59	2.63	2.25	1.41	1.19
Population ages 15-64 (% total pop.)	61.54	63.15	63.84	66.71	52.12	53.39	62.11	64.48
Rural population (% of total pop.)	46.02	40.70	30.20	28.00	69.03	64.77	54.76	51.23
Urban population (% of total pop.)	54.98	59.30	69.80	72.00	30.97	35.23	45.24	48.77
Urban population growth (% annual)	3.10	1.94	1.22	0.94	4.22	3.64	2.27	2.04
Life expectancy at birth (total years)*	54.72	47.66	69.48	69.80	46.91	46.65	66.28	67.56
Life expectancy at birth (female years)*	58.10	48.68	73.42	73.60	48.20	47.25	68.36	69.61

Note: * data for 1997 and 2005 as data was not available for 1996.

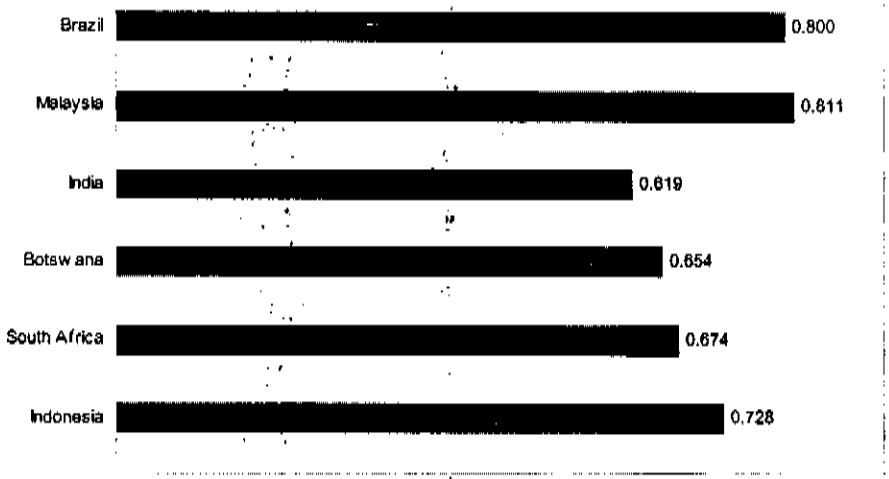
Data source: Word Bank online database 2007

Life expectancy at birth was a low of around 48 years for the total population (and females) in 2005, lower than the country's averages in 1996 and that of sub-Saharan Africa (around 47 years) (see Table 2.1 above). The country's life expectancy is however considerably lower than that for upper-middle income economies and the world averages (both around 70 years).

Low life expectancy affected the country's performance on the Human Development Index (HDI) in 2005, reported in the United Nations Development Programme's *Human*

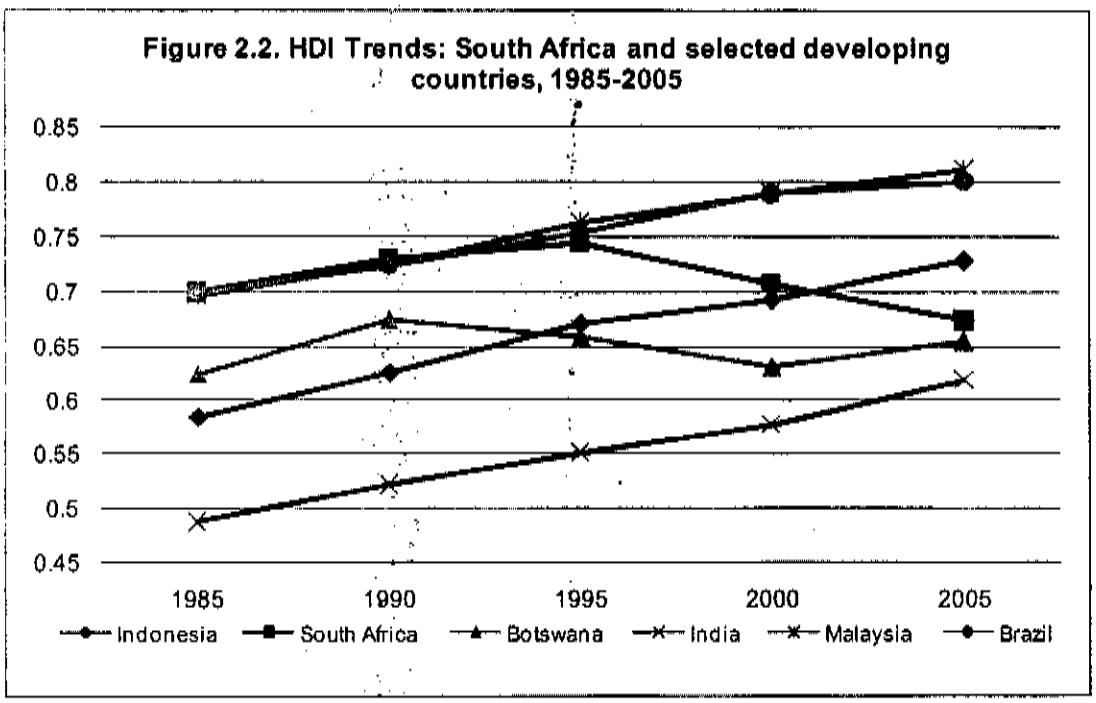
Development Report 2007/2008. South Africa is classified as a country of medium human development and is ranked at 121 out of the 177 countries included in the report. The HDI is a composite of three sub-indexes (South Africa's scores are reported in parenthesis): life expectancy index (0.430), education index (0.806), and the GDP index (0.786).

Figure 2.1. HDI, South Africa and selected developing countries, 2005



Data source: UNDP Human Development Report 2007/2008

Figure 2.2. HDI Trends: South Africa and selected developing countries, 1985-2005



Data source: UNDP Human Development Report 2007/2008

As depicted in Figure 2.1 and Figure 2.2 above, according to the Human Development Report 2007/2008, in 2005, South Africa had higher levels of human development than India and Botswana; but lower than other developing countries, Brazil, Malaysia and Indonesia. Although the country showed a gradual improvement in the period 1985 to 1995, from a HDI value of 0.699 in 1985 to 0.745 in 1995, it declined in human development during the next ten years to 0.674 in 2005. This trend in HDI could be attributed to the high HIV prevalence in the country.

In 2005, the country's HIV prevalence rate was 18.8 percent for the population aged 15 to 49 years, which is 18 times higher than the world average of one percent and three times higher than the average for sub-Saharan Africa (5.8%). The number of people living with HIV/AIDS in South Africa at the end of 2005 was the second highest in the world and the highest on the African continent (The Henry J. Kaiser Family Foundation 2007). As the strongest economy in Africa, the future course of the epidemic in South Africa will have implications for the continent overall (The Henry J. Kaiser Family Foundation 2007).

The South African government, together with various international aid agencies, is focusing efforts on combating the spread of the epidemic in the country and prevalence rates are beginning to stabilise (The Henry J. Kaiser Family Foundation 2007). The country has reported a gradual decline in HIV prevalence in the age group 15 to 24 years during the period 2004 to 2006, which is suggestive of a decline in the incidence of new infections (UNGASS South African report 2008).

Table 2.2. Percentage of young people aged 15-24 who are HIV-infected (2004-2006)

Age Group (Yrs)	HIV Prevalence (CI 95%) 2004	HIV Prevalence (CI 95%) 2005	HIV Prevalence (CI 95%) 2006
<20	16.1 (14.7 – 17.5)	15.9 (14.6 -17.2)	13.7 (12.8 – 14.6)
20 – 24	30.8 (29.3 – 32.3)	30.6 (29.0 – 32.2)	28.0 (26.9 – 29.1)

Source: UNGASS South African report, Progress Report on Declaration of Commitment on HIV and AIDS 2008 (p. 32)

South Africa also faces challenges in combating the emergence of a drug-resistant type of tuberculosis (TB) and high rates of HIV/TB co-infection (The Henry J. Kaiser Family Foundation 2007). Prevalence of TB was also astonishingly high at 600 per 100,000 people in 2005, an increase of one and a half times the rate in 1995 (see Table 2.4 below).

Poverty levels in South Africa

Poverty levels in South Africa are considerably lower than that of many low and middle income economies and sub-Saharan Africa, but are still high with more than a third (34.07%) of the total population living on less than two dollars a day in 2000, a level slightly higher than in 1995 (32.22%) (see Table 2.3 below). The country's GINI index

value also increased from 56.59 in 1995 to 57.78 in 2000, indicating an increase in inequality.

Table 2.3: Poverty in South Africa and selected [illegible]

Indicators	South Africa		Low & middle income		Sub-Saharan Africa	
	Year	%/value	Year	%/value	Year	%/value
GINI index	1995	56.59	..	..	..	..
	2000	57.78	..	..	..	..
Poverty headcount ratio	1995	6.28	1996	22.66	1996	47.72
at $1 a day (PPP) (% of population)	2000	10.71	2002	20.13	2002	42.63
Poverty headcount ratio	1995	32.22	1996	55.52	1996	76.42
at $2 a day (PPP) (% of population)	2000	34.07	2002	50.69	2002	73.81

Data source: World Bank online database 2007

The country also reported lower prevalence rates of undernourishment (2.5% of the total population) in 2004 than many countries in sub-Saharan Africa (30.0%), upper-middle economies (4.2%) and the world (13.9%).

Table 2.4: Health and poverty: South Africa and [illegible] regions

Country/Regions	Health Expenditure Total (% GDP)		Health Expenditure Per capita (PPP US$)		Physicians (per 1,000 people)		Births attended by skilled health staff (% of total)		Prevalence of undernourishment (% of total population)		HIV Prevalence (% aged 15-49)	Tuberculosis Prevalence (per 100,000 people)	
	2000	2004	2000	2004	Year	Number	Year	%	1997	2004	2005	1995	2005
South Africa	8.1	8.6	235.6	390.2	2004	0.77	2003	92.0	2.5	2.5	18.8	392.4	599.9
Upper-middle income countries	6.3	6.6	245.3	342.0	2003	2.65	2005	91.6	..	4.2	2.2	85.7	103.9
Sub-Saharan Africa	5.9	6.3	30.3	45.0	..	..	2005	44.7	30.0	30.0	5.8	242.4	348.4
World	9.3	10.1	477.8	648.8	1998	1.60	2005	62.9	14.7	13.9	1.0	128.7	136.4

Data source: World Bank online database 2007

In 2004, South Africa spent only 8.6 percent of its GDP on health, that is, 390.2 US dollars per capita. Although, this expenditure is slightly higher than the average of upper-middle income countries (6.6% of GDP and 342.0 US$ per capita), South Africa's expenditure per capita is about three fifths of the world's average per capita. The country increased its expenditure on health slightly from expenditure in 2000 (8.1% of GDP and 235.6 US$ per capita).

In 2003, South Africa did not reach the world average of one to two physicians per 1,000 people, but a relatively high rate (i.e. 92.0%) of the total number of births were reported to have been attended by skilled staff, that is, more than double the average in sub-Saharan Africa in 2005 (44.7%). This rate is also higher than the world average of 62.9 percent. The low number of physicians may have been affected by 'brain drain'.

Bhargava and Docquier (2007) reported a total stock of 11,705 South African physicians living abroad in 2003, increasing to 15,136 in 2004. And according to Clemens and Pettersson (2006 cited in the World Bank's Migration and Remittances Factbook 2007), 4,844 or 5.1 percent of nurses trained in the country were living abroad in 2000.

The indicators reported above show that South Africa, which accounts for about 6.3 percent of the population in sub-Saharan Africa, shows relatively low poverty levels, in keeping with its status as an upper-middle economy. The country does however seem to be struggling with high prevalence of communicable diseases, HIV and TB, adversely affecting average life expectancy in the country. This has resulted in a decline in overall human development in the country as indicated by its performance on the HDI. Inequality, as measured by the GINI index, has also widened in recent years.

South Africa is however the strongest economy in sub-Saharan Africa, forming part of the SANE economies (consisting of South Africa, Algeria, Nigeria and Egypt). Pillar 1 of the four pillars critical for the knowledge economy, that is, the country's macro-economic environment will now be reported.

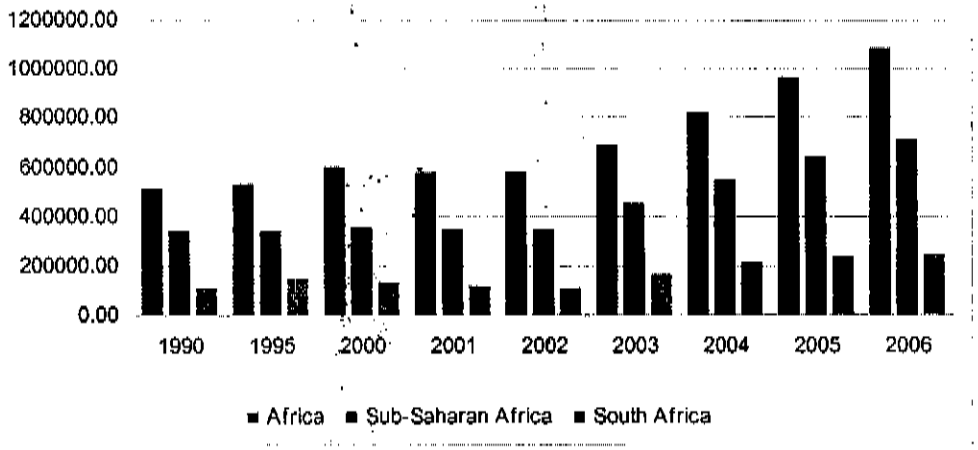
Pillar 1: An economic climate conducive to the exposure to, and use and creation of knowledge technologies...

The macro-economic environment

South Africa together with Algeria, Egypt and Nigeria are the four largest economies in Africa – which consists of 53 countries – forming the SANE economies. The SANE economies compare relatively well with the emerging economies that make up the BRIC economies (Brazil, Russia, India and China), and in 2005 the group's average GDP per capita (US$ 1,841) was higher than that of the BRIC economies (US$ 1,669) (Kasekende, Oshikoya, Ondiege and Dasah 2007). The SANE economies represent almost a fifth of Africa's land mass and about a third of its population, and account for slightly more than half of its total GDP (Kasekende et al. 2007).

South Africa is the largest economy in Africa (Kasekende et al. 2007). In 2006, South Africa accounted for 22.71 percent of the total nominal GDP for Africa and 34.48 percent of sub-Saharan Africa (see Table A1 in the appendix).

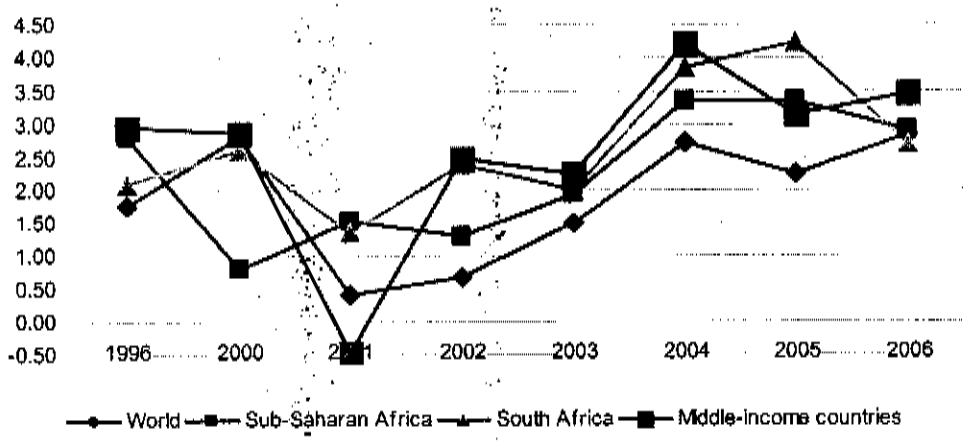
Figure 2.3. GDP, US dollars at current prices in millions, South Africa and sub-Saharan Africa and Africa, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

The country achieved a higher average annual growth in GDP in the period 2000 to 2005 (3.86%) than it had in the period 1995 to 2000 (2.48%) with the highest annual growth rate, of 5.10 percent, achieved in 2005. The growth rate in 2005 was the country's highest since apartheid (Kasekende et al. 2007). Kasekende et al. (2007) attributes South Africa's improved performance to a favourable international climate and the implementation of the Growth and Employment and Redistribution (GEAR) strategy in the mid-1990s. The high rate of 2005 however fell to 3.44 percent the following year in 2006. Figure 2.4 below illustrates South Africa's buoyant GDP growth trend between 1995 and 2007.

Figure 2.4 GDP per capita, annual average growth rates, South Africa and selected regions, 1996-2006

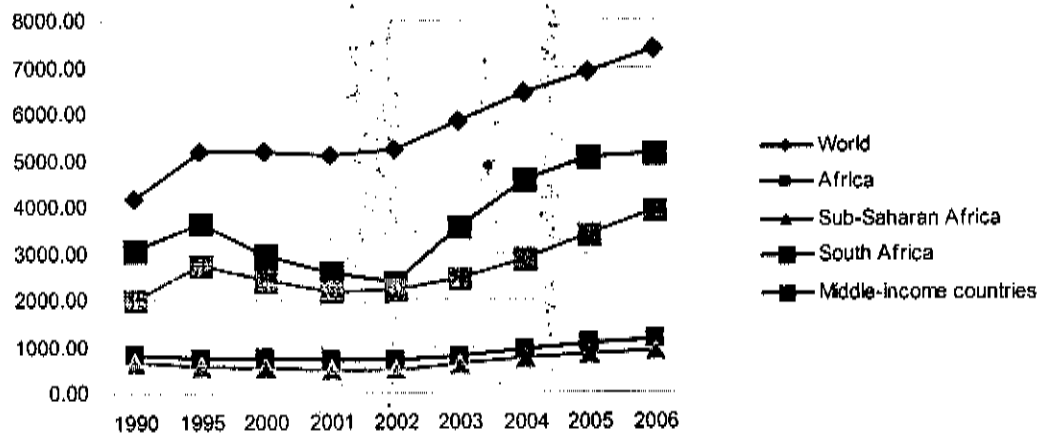


Data source: UNCTAD Handbook of Statistics 2007 online

South Africa has shown relatively high growth rates in GDP per capita since 2001, a general global trend also shown by sub-Saharan Africa. However, while most countries in the world continued growth in 2006, GDP per capita growth in South Africa and sub-Saharan Africa dropped, with South Africa dropping 1.5 percentage points.

South Africa has, however, consistently shown nominal GDP per capita significantly higher than that of the averages for the Africa region and slightly higher than middle-income economies over the 16-year period, 1990 to 2006. Its GDP per capita is however lower than the world average and growth in absolute value slowed after 2004.

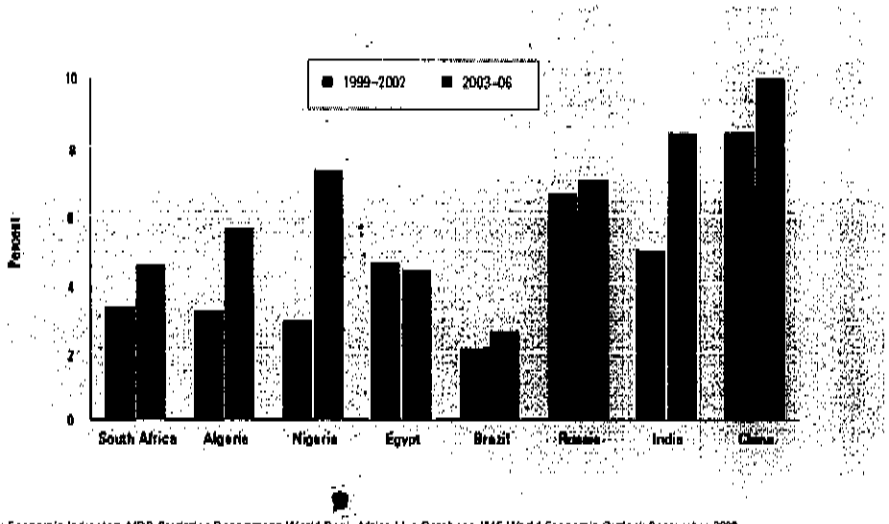
Figure 2.5. Nominal GDP per capita (US$ at current prices) - South Africa and selected regions, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

In comparison to the other SANE and the BRIC economies, although the country achieved higher growth rates in the period 2003 to 2006 (4.5%) than it did in the 1999 to 2002 period (3.25%), its growth was slower than that of the SANE countries and most of the BRIC countries (as illustrated in Figure 2.6 below).

Figure 2.6. South Africa's average real GDP growth rates (1999–2002 and 2003–06) in comparison to the other SANE economies



Source: Economic Indicator: AfDB Statistics Department; World Bank, *Africa Live Database*; IMF *World Economic Outlook* September 2006.
Note: For the BRIC economies, the average of real GDP growth is calculated for the period 2003–05

Source: Kasekende et al. (2007, p. 53)

Table 2.5. Selected macro-economic indicators, South Africa

	1995	2000	2005	2007	2008
GDP, constant prices (billion, national currency)	803.713	922.148	1,115.82	1,226.55	1,277.82
GDP, current prices (billion, US $)	151.117	132.964	241.889	274.501	299.6
GDP, constant prices (annual % change)	3.1	4.2	5.1	4.7	4.2
GDP per capita, current prices (US$)	3,684.84	2,986.45	5,158.84	5,723.93	6,185.43
GDP based on PPP (% share of world total)	0.975	0.927	0.923	0.909	0.903
Current Account Balance (% GDP)	-1.7	-0.1	-4	-6.7	-6.4
Inflation, average consumer prices (annual % change)	8.7	5.4	3.4	6.6	6.2

Data source: IMF World Economic Outlook Database October 2007

Table 2.5 presents selected macro-economic indicators, including forecast data for 2007 and 2008, provided by the International Monetary Fund (IMF) (there are slight discrepancies between the IMF data and that provided by UNCTAD reported above). It is forecast that South Africa's annual growth in GDP will decline slightly whereas real GDP and GDP per capita is expected to increase. South Africa's share in the world GDP output has remained slightly under one percent at purchasing power parity, and shows a gradual decline between 1994 and 2006 and is expected to continue to decline in 2008.

	1990	2000	2002	2005	2006
World					
Gross National Income	22,644,691	31,874,724	32,813,530	44,664,187	48,290,612
Gross capital formation	5,233,919	7,119,261	6,832,953	9,956,231	10,968,066
Gross Fixed capital formation	5,038,329	6,904,770	6,739,880	9,715,788	10,726,170
Exports of goods and services	4,416,844	8,018,553	8,137,642	12,924,248	14,936,923
Imports of goods and services	4,473,221	7,978,734	8,078,063	12,801,579	14,699,058
Sub-Saharan Africa					
Gross National Income	311,479	340,587	332,354	601,947	671,573
Gross capital formation	51,815	55,576	53,586	114,467	132,571
Gross Fixed capital formation	52,474	53,985	53,610	110,287	130,174
Exports of goods and services	114,939	124,120	108,943	210,626	249,946
Imports of goods and services	101,399	101,998	107,858	199,866	231,115
South Africa					
Gross National Income	107,746	129,704	108,085	237,105	241,634
Gross capital formation	19,863	21,145	17,802	44,174	46,472
Gross Fixed capital formation	21,445	20,123	16,659	41,267	44,974
Exports of goods and services	27,149	37,034	36,578	66,520	70,393
Imports of goods and services	21,016	33,107	32,316	68,750	77,112
Developing economies					
Gross National Income	3,764,651	6,671,277	6,739,412	10,110,322	11,729,358
Gross capital formation	985,237	1,690,098	1,721,831	2,843,501	3,272,019
Gross Fixed capital formation	877,592	1,598,413	1,640,175	2,703,083	3,183,333
Exports of goods and services	1,045,647	2,443,203	2,471,716	4,400,522	5,261,183
Imports of goods and services	996,524	2,255,186	2,283,688	3,910,922	4,598,423

Data source: UNCTAD Handbook of Statistics 2007 online

The country showed strong overall GDP performance in the period 1990 to 2006, as shown in Table 2.6 above, which presents the country's economic activity and selected comparators. Growth in GDP also lead to an increase in imports and a widening current account deficit of four percent in 2005 that is expected to increase to around six percent in 2008 according to the IMF forecast (see Table 2.5 above). A current account deficit of six percent would be the highest level since the demise of apartheid in 1994 (African Economic Outlook 2007).

The total value of imports in 2006 was more than three times the value in 1990, an increase in the country's share of the global total from 0.47 to 0.52. Although the country's total exports of goods and services in 2006 was double that of 1990, its share in the world's exports dropped from 0.61 percent to 0.47 percent. Similarly, it dropped in its share in the total exports of developing economies from 2.6 percent in 1990 to 1.34 percent. In contrast to its share in the world, South Africa accounts for a large 28.16

percent of total exports in sub-Saharan Africa in 2006, an increase from its share of 23.62 percent in 1990. It also has an (increasingly) large share of the total imports in sub-Saharan Africa (33.37% up from 20.73% in 1990).

Figures 2.7 to 2.12 below present trade by sector indicators for South Africa and its comparators. South Africa has a trade structure more similar to that of the world and middle income countries than the African region. Notably, the country's agricultural sector (as a share of GDP) is much smaller than that in Africa as a whole and the sub-Saharan African sub-region, and the share of the services sector is much larger.

Figure 2.7. Total value added by sector - South Africa, 1990-2006

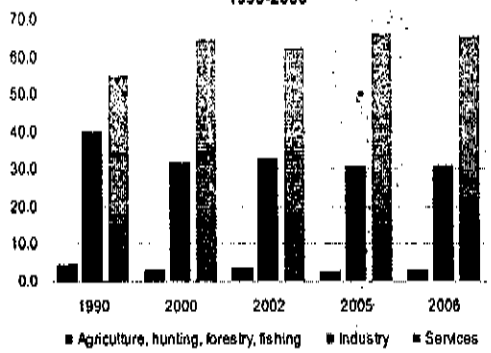


Figure 2.8. Total value added by sector-Africa, 1990-2006

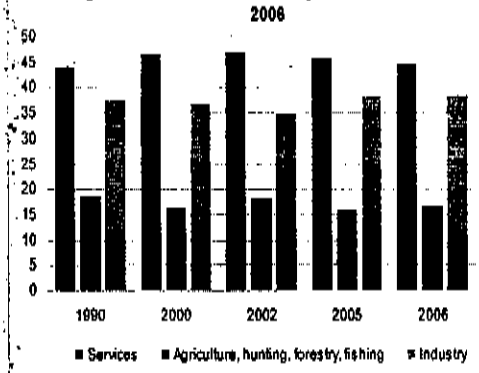


Figure 2.9. Total value added by sector - Sub-Saharan Africa, 1990-2006

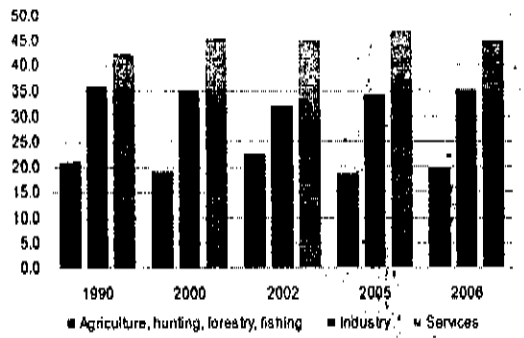


Figure 2.10. Total value added by sector - Sub-Saharan Africa excluding South Africa, 1990-2006

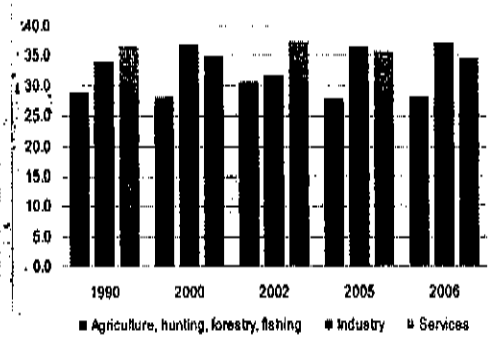


Figure 2.11. Total value added by sector - Middle-income countries, 1990-2006

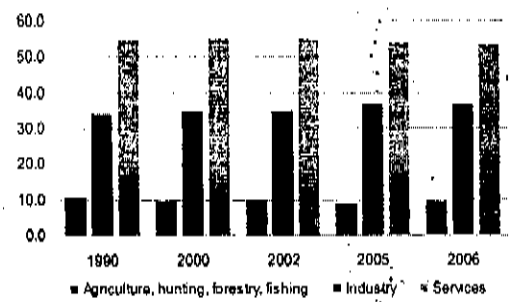
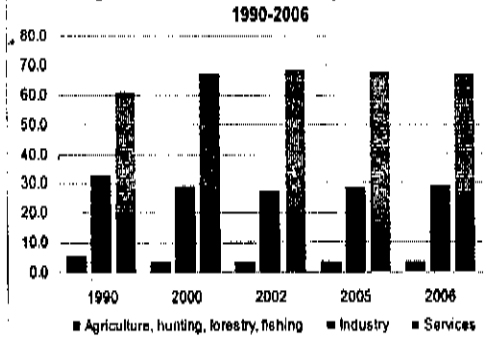
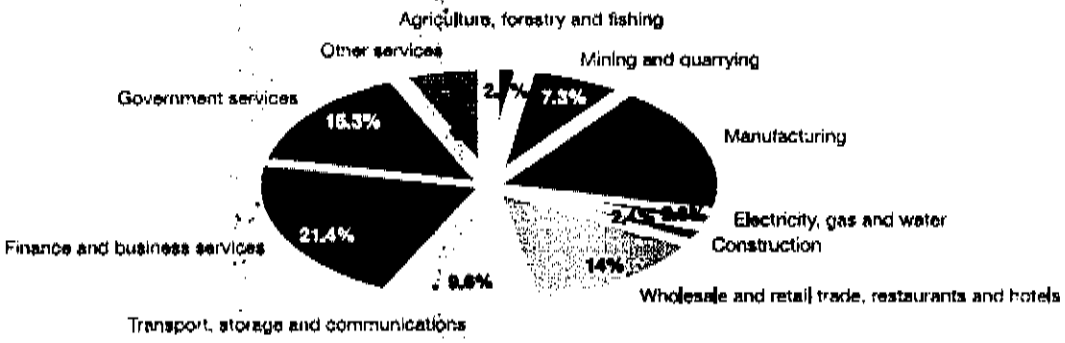


Figure 2.12. Total value added by sector - World, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007

Figure 2.13. GDP by sector (%) – South Africa, 2005



Source: Authors' estimates based on National Institute of Statistics data.

http://dx.doi.org/10.1787/247765010430

Source: African Economic Outlook 2007 (p. 489).

In the figure above, which presents a breakdown of the economy in 2005, it can be seen that the South African economy is relatively diverse in structure. In 2005, finance and business services and manufacturing accounted for about a fifth of GDP – the former slightly larger than the latter. The third and fourth largest sectors are government services, and wholesale and retail trade, restaurants and hotels. Primary commodities, agriculture and mining, were considerable smaller in size. As the OECD (2007, p. 27) indicates, even though South Africa's economy has become more diversified in recent years, the country's "exports continue to be dominated by "mineral-based" items".

Table 2.7. Development aid and [illegible] South Africa [illegible] Sahara Africa

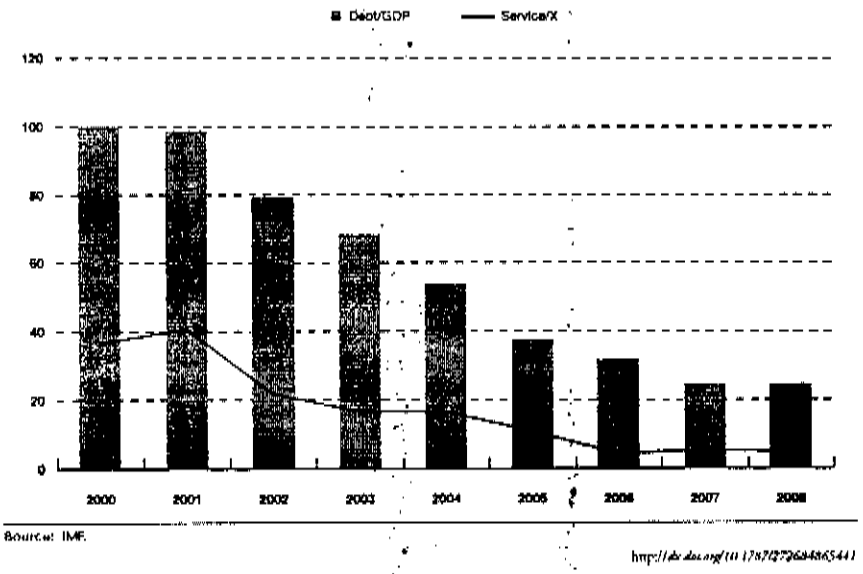
	South Afri ca				Sub-Saharan Africa			
Indicators	1995	2000	2002	2005	1995	2000	2002	2005
Aid (% of GNI)	0.26	0.38	0.47	0.30	6.08	4.09	5.71	5.54
Aid per capita (current US Dollars)	9.87	11.08	11.13	14.93	32.02	19.90	27.25	43.90
Official development assistance and official aid (current US Dollars) ('000)	385,170	487,310	504,570	700,000	18,715,950	13,194,050	18,924,730	32,620,150
*Aid % of world average	0.57	0.84	0.76	0.66	27.76	22.84	28.34	30.67
External debt, total (DOD, current US Dollars)	25,357,999	24,860,978	25,040,513	30,631,649	235,283,374	211,212,562	211,670,464	214,840,699

Note: *Author's calculations based on World Bank 2007 online data.

Data source: World Bank online database 2007

South Africa's total external debt also increased in absolute value from 25,357,999 US dollars in 1995 to 30,631,649 US dollars in 2005, increasing its share in the total external debt in sub-Saharan Africa from 10.78 percent in 1995 to 14.26 percent in 2005 (see Table 2.7 above). The figure below however shows that the country's stock of external debt as a share of its GDP shows a downward trend in recent years. South Africa's receipt of aid is low in comparison to other countries in sub-Saharan Africa, accounting for 2.15 percent of the total aid in the region in 2005, and 0.66 percent of the world total (see Table 2.7 above).

Figure 2.14. Stock of total external debt (% of GDP) and debt service (% of exports of goods and services)



Source: African Economic Outlook (2007, p. 494)

Openness: Trade

South Africa is the most industrialized country in the sub-Saharan African region (Pietrobelli 2001). South Africa accounted for a high 24.97 percent of the total merchandise exports in sub-Saharan Africa in 2006, a gradual decline from its share of 31.61 percent in 2000, slowing down the average annual growth in the region by more than one percent for the period 2000 to 2005. South Africa's share of the world's total exports remained small, under 0.5 percent (see Table 2.8 below). The country's share in sub-Saharan Africa's total imports however increased by about one percent from its share of 35.53 percent in 2000 to 36.62 percent in 2006, and the country's merchandise imports (18.6%) grew at faster rate than its exports (13.0%) for the period 2000 to 2005. Its share in the world's total merchandise imports was less than 0.60 percent.

Table 2.8 Openness: Merchandise trade - South Africa and other regions, value (millions of dollars) and share in world total (%)

	Annual avg. growth rate		1990		2000		2002		2005		2006	
Exports	1990-2000	2000-2005	Value	%	Value	%	Value	%	Value	%	Value	%
World	6.8	11.3	3,478,571	100.00	6,444,106	100.00	6,472,603	100.00	10,440,760	100.00	11,982,932	100.00
Developing economies	9.0	14.1	842,883	24.23	2,044,590	31.73	2,052,444	31.71	3,750,526	35.92	4,408,951	36.79
Africa	3.3	16.3	106,993	3.08	147,173	2.28	146,432	2.26	298,026	2.85	332,801	2.78
Sub-Saharan Africa	4.0	16.2	66,312	1.91	94,867	1.47	96,580	1.49	190,889	1.83	212,937	1.78
Sub-Saharan Africa (excluding South Africa)	4.8	17.6	42,744	1.23	64,884	1.01	66,856	1.03	139,264	1.33	159,767	1.33
Middle Income	7.5	13.5	202,273	5.81	413,028	6.41	417,647	6.46	741,991	7.11	841,746	7.02
South Africa	**(a)2.5**	**13.0**	**(a)23,568**	**0.68**	**29983**	**0.47**	**29,723**	**0.46**	**51,626**	**0.49**	**53,170**	**0.44**
Imports												
World	6.7	11.2	3,590,163	100.00	6,642,126	100.00	6,640,572	100.00	10,712,215	100.00	12,203,386	100.00
Developing economies	8.5	13.3	800,081	22.29	1,904,395	28.67	1,911,101	28.78	3,359,059	31.36	3,915,401	32.09
Africa	4.4	14.3	97,037	2.70	130,973	1.97	142,179	2.14	246,931	2.31	278,432	2.28
Sub-Saharan Africa	5.7	15.7	52,704	1.47	83,581	1.26	91,354	1.38	165,865	1.55	188,930	1.55
Sub-Saharan Africa (excluding South Africa)	5.5	14.1	34,305	0.96	53,886	0.81	62,087	0.93	103,360	0.96	119,745	0.98
Middle Income	7.2	12.0	223,828	6.23	430,440	6.48	429,952	6.47	721,587	6.74	834,284	6.84
South Africa	**(a)5.8**	**18.6**	**(a)18,399**	**0.51**	**29,695**	**0.45**	**29,267**	**0.44**	**62,304**	**0.58**	**69,185**	**0.57**

Note: (a) Before 1998, data refers to South Africa Customs Union (Botswana, Lesotho, Namibia, South Africa and Swaziland).

Data source: UNCTAD Handbook of Statistics 2006-7

As shown in Table 2.9, the share of trade in services in South Africa and its small share in the world total are growing steadily. The country accounts for more than a third (36.05%) of the total services exports in sub-Saharan Africa, and nearly a quarter (24.19%) of its services imports in 2006; from its share of 30.44 percent and 17.65 percent respectively in 1990. South Africa accounts for around seven percent of the share in the total services exports and eight percent of the total services imports in middle-income countries.

Table 2.9: Openness: Trade in [illegible] South Afri[illegible] sele[illegible] d regions
value (millions of dollars) and share in wo[illegible]l (%

	1990		2000		2002		2005		2006	
Exports	Value	%	Value	%	Value	%	Value	%	Value	%
World	830,805	100.0	1,529,340	100.0	1,640,038	100.0	2,494,520	100.0	2,735,658	100.0
Developing economies	154,347	18.6	353,258	23.1	366,925	22.4	593,426	23.8	669,748	24.5
Africa	21,474	2.6	32,910	2.2	36,149	2.2	59,931	2.4	65,203	2.4
Sub-Saharan Africa	11,192	1.3	16,207	1.1	18,195	1.1	30,981	1.2	33,346	1.2
Sub-Saharan Africa (excluding South Africa)	7,785	0.9	11,161	0.7	13,210	0.8	19,824	0.8	21,713	0.8
Middle income	49,006	5.9	105,720	6.9	105,961	6.5	164,950	6.6	179,770	6.6
South Africa	**3,407**	**0.4**	**5,046**	**0.3**	**4,985**	**0.3**	**11,157**	**0.4**	**12,022**	**0.4**
Imports										
World	860,477	100.00	1,518,794	100.0	1,624,975	100.0	2,404,156	100.0	2,616,583	100.0
Developing economies	184,114	21.40	397,846	26.2	414,326	25.5	641,835	26.7	718,693	27.5
Africa	29,960	3.48	39,866	2.6	44,051	2.7	74,407	3.1	82,153	3.1
Sub-Saharan Africa	21,176	2.46	26,936	1.8	30,503	1.9	53,241	2.2	59,074	2.3
Sub-Saharan Africa (excluding South Africa)	17,438	2.03	21,114	1.4	24,999	1.5	41,087	1.7	44,991	1.7
Middle income	50,845	5.91	101,058	6.7	100,162	6.2	163,011	6.8	178,536	6.8
South Africa	**3,738**	**0.43**	**5,823**	**0.4**	**5,504**	**0.3**	**12,155**	**0.5**	**14,291**	**0.5**

Note: (a) Before 1998, data refers to South Africa Customs Union (Botswana, Lesotho, Namibia, South Africa and Swaziland).

Data source: UNCTAD Handbook of Statistics 2007 online

In 1990 and 2006, the largest share of South Africa's exports to developed countries went to Europe with this share decreasing by 7.5 percent in 2005 from 1990, and the exports to USA and Japan increasing by 2.1 percent and 3.2 percent respectively. The largest share of South Africa's imports in 2005 came from Europe, USA and Japan with shares of imports to these countries decreasing by 7.0, 4.6 and 2.9 percent respectively from shares in 1990.

Figure 2.15. Destination of exports to developed countries - South Africa, 2005

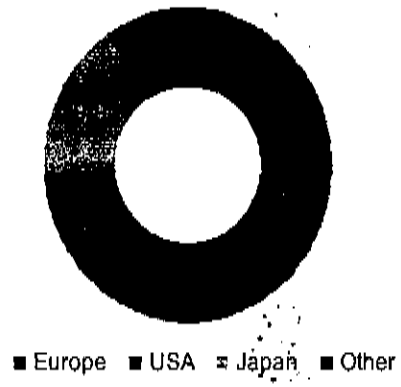
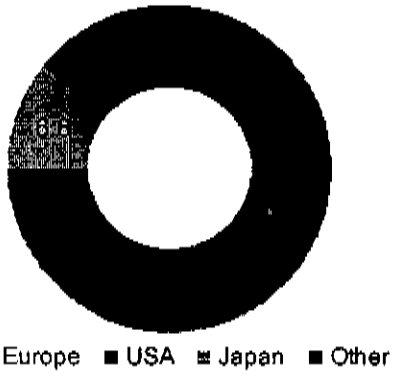


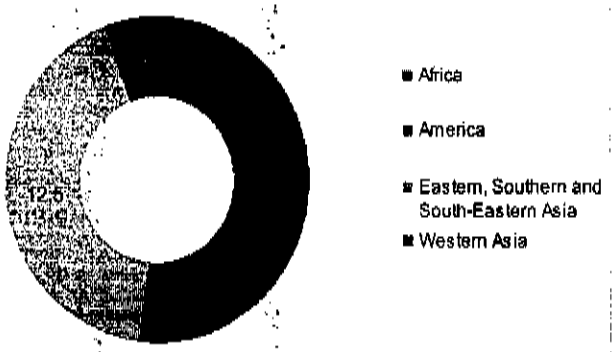
Figure 2.16. Origin of imports from developed countries - South Africa, 2005



Data source: UNCTAD Handbook of Statistics 2006-7

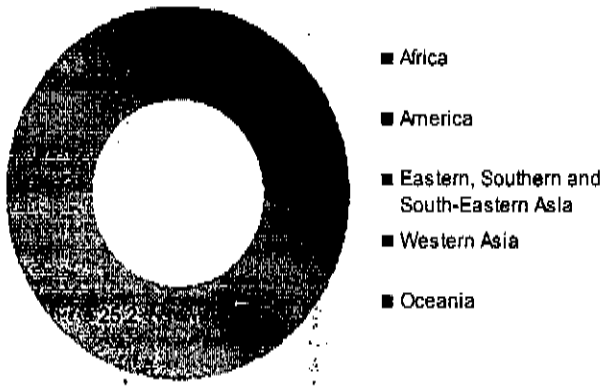
And the largest share of exports to the developing world went to Africa with this share increasing by 12.2 percent in 2005 from its share in 1990, and exports to Eastern and Southern and South-Eastern Asia increasing by 10.3 percent. In 2005, most of South Africa's imports came from Eastern and Southern and South-Eastern Asia and imports from this region increased by 22.7 percent from 1990, whereas imports from other African countries only increased by 3.4 percent. Most of South Africa's imports came from developed countries and most of its exports went to developed countries. In this way, - considering that the country is less dependent on trade in primary commodities than other sub-Saharan countries - exposing the country to technologies in the advanced countries.

Figure 2.17. Destination of exports to developing countries - South Africa, 2005



Data source: UNCTAD Handbook of Statistics 2006-7

Figure 2.18. Origin of imports from developing countries - South Africa, 2005



Data source: UNCTAD Handbook of Statistics 2006-7

South Africa's industrial performance:
Table 2.10 shows the country's performance of manufacturing value added. South Africa performs favourably in comparison to most other developing economies. In 2005, the country's MVA per capita (US$ 834) was slightly lower than Brazil's (US$ 941), but considerably higher than China (US$ 479), India (US$ 92) and Indonesia (US$ 328).

A fifth (20.4%) of South Africa's exports were machinery and transport equipment, up from a low 8.8 percent in 1995; and more than a third (39.4%) of its imports of machinery and transport equipment, down from 44.9 percent in 1995 (UNCTAD Handbook of Statistics 2006-07).

Table 2.10. South Africa - International comparison of industrial performance, 1995-2005

Indicator	Year/Period	South Africa	Developing countries
MVA, average annual real growth rate (in %)	1995-2000	2	2.8
	2000-2005	2.2	1.4
Non-manufacturing GDP,average annual real growth rate (in %)	1995-2000	2.6	3
	2000-2005	3.8	2
MVA per capita, in constant 1995 US$	1995	715	5089
	2000	751	5693
	2005	834	5870
MVA as percentage of GDP at constant 1995 prices	1995	19.4	19.4
	2000	19	19.4
	2005	18.4	18.8

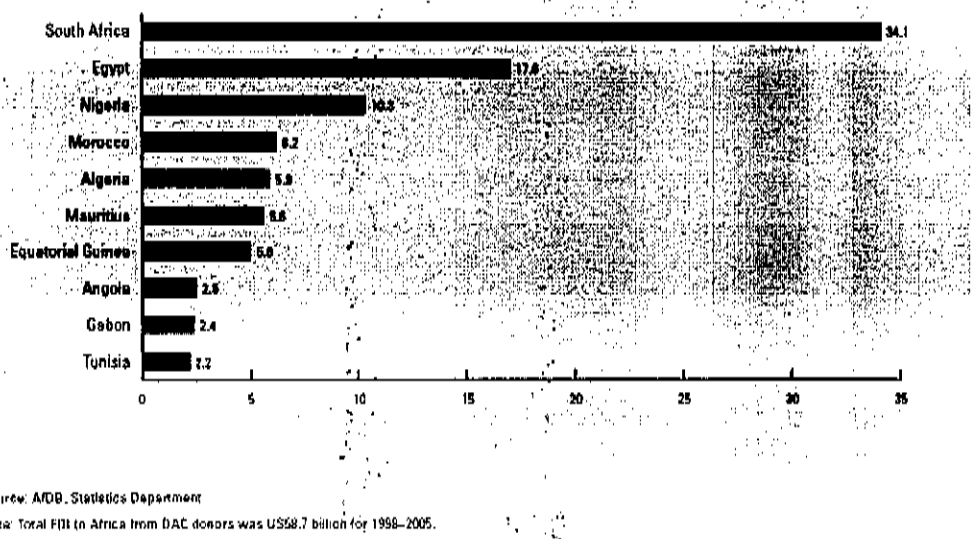
Source: UNIDO 2007 (http://www.unido.org)

Openness: Foreign Direct Investment (FDI)

Since 1994, the end of apartheid, South Africa has become a significant destination of FDI inflows within the southern African region (Mlambo 2005, p. 558). Kasekende et al.

(2007) provides determinants of FDI in South Africa: Natural resources (especially minerals), as the largest economy in Africa it is pivotal for production and trade in the region, and its physical and financial infrastructure is superior to other countries in the region.

Figure 2.19. The 10 largest recipients of FDI from DAC donors, as percent of net total to Africa (1998–2005)



Source: AfDB, Statistics Department
Note: Total FDI to Africa from DAC donors was US$8.7 billion for 1998–2005.

Source: Kasekende et al. (2007, p. 49)

On the whole however, FDI in South Africa has not kept standard with other developing countries with inward FDI declining dramatically in 2006 from 2005 and 2003 (see Figure 2.21). As Mlambo (2005) indicates, FDI performance in South Africa is unstable, and is often driven by a few large transactions. The negative inflow in 2006 was a result of the sale of a foreign stake in a domestic gold-mining company to a local firm (UNCTAD, World Investment Report 2007).

Outward FDI rose significantly in 2006 (see Table 2.20 and Table 2.21). South Africa showed a significant decline leading to negative FDI inflows in 2006, contrasting with inflows in 2005. According to the World Investment Report (2007), in 2006 South Africa accounted for four fifths of the total FDI outflows in Africa, which had FDI outflows of nearly four times higher than those of 2005 and more than twice the previous peak in 1997, a record high for the region (World Investment Report 2007). According to UNCTAD's World Investment Report 2007, a large proportion of the FDI outflows by South Africa transnational companies (TNCs) in 2006 was in natural resource exploration and exploitation, and many of the African TNCs in services expanding into Europe in 2006 were from South Africa (e.g. MTN).

Table 2.20. Africa – distribution of FDI flows among economies, by range, 2006

Range	Inflows	Outflows
Over $3.0 billion	Egypt, Nigeria, Sudan and Tunisia	South Africa
$2-2.9 billion	Morocco	..
$1-1.9 billion	Algeria, Libyan Arab Jamahiriya and Equatorial Guinea	..
$0.5-0.9 billion	Chad	..
$0.2-0.4 billion	Ghana, United Republic of Tanzania, Ethiopia, Zambia, Congo, Namibia, Cameroon, Uganda, Burundi, Botswana, Gabon, Côte d' Ivoire and Madagascar	Morocco, Liberia and Nigeria
Less than $0.1 billion	Mali, Democratic Republic of the Congo, Mozambique, Seychelles, Cape Verde, Djibouti, Guinea, Mauritius, Somalia, Gambia, Benin, Senegal, Lesotho, Togo, Kenya, Sierra Leone, Guinea-Bissau, Zimbabwe, Swaziland, Malawi, Burkina Faso, Central African Republic, Niger, Rwanda, Eritrea, Comoros, São Tomé and Principe, Mauritania, Liberia, South Africa and Angola	Egypt, Libyan Arab Jamahiriya, Angola, Algeria, Tunisia, Kenya, Botswana, Mauritius, Sudan, Seychelles, Senegal, Congo, Sierra Leone, Swaziland, Niger, Malawi, Mali, Mozambique, Cape Verde, Zimbabwe, United Republic of Tanzania, Benin, Burkina Faso, Guinea-Bissau, Côte d' Ivoire, Namibia, Togo and Gabon

Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics) and annex table B.1.

[a] Countries are listed according to the magnitude of FDI.

Source: UNCTAD, World Investment Report 2007 (p. 37)

As shown in Table 2.20 above, South Africa was the only country in Africa to have FDI outflows over three billion US dollars in 2006.

Table 2.21. Openness: FDI flows [illegible] (millions of dollars and percentages)

Country/region	FDI flows					FDI flows (% gross fixed capital formation)			
	1990-2000 Annual Avg.	2003	2004	2005	2006	1990-2000 Annual Avg.	2004	2005	2006
South Africa									
Inward	854	734	799	6 251	- 323	4.1	2.3	15.4	- 0.7
Outward	1 203	565	1 352	930	6 674	5.4	3.9	2.3	14.1
Southern Africa									
Inward	1 999	5 307	3 629	6 202	- 195	7.4	8.3	11.9	0.3
Outward	1 240	801	1 337	1 171	6 779	4.3	3.2	2.4	12.0
Africa									
Inward	6 903	18 677	18 018	29 648	35 544	7.3	12.6	17.8	19.6
Outward	1 917	1 286	2 059	2 272	8 186	2.2	1.7	1.6	5.1
Developing economies									
Inward	130 722	178 699	283 030	314 316	379 070	9.3	12.9	12.6	13.8
Outward	52 836	45 372	117 336	115 860	174 389	3.8	5.5	4.7	6.4
World									
Inward	495 399	564 078	742 143	945 795	1 305 852	7.8	8.5	10.4	12.6
Outward	492 622	560 087	877 301	837 194	1 215 789	7.9	10.1	9.2	11.8

Source: UNCTAD, World Investment Report 2007

Cross-border sales decreased in 2006 in comparison to 2005, whereas purchases increased. It can be seen in Table 2.22 that the majority of the cross-border sales and

purchases in Southern Africa were in South Africa, and South Africa's cross-border sales accounted for 31.74 percent of the total in Africa in 2006 and its purchases accounted for 45.84 percent.

Table 2.22. South Africa – Cross-border merger and acquisition overview (millions of dollars), 1990-2005

	Sales				Purchases			
	1990-2000 (Annual average)	2004	2005	2006	1990-2000 (Annual average)	2004	2005	2006
South Africa	511	1 935	7 001	5 582	1 154	2 320	528	5 138
Memorandum								
Angola	..	-	-	1	..	..	..	..
Nigeria	..	10	43	2 838	2	-	-	21
Southern Africa	457	2 108	7 031	5 863	1 167	2 334	557	5 139
Africa	851	4 595	10 509	17 569	1 266	2 718	15 505	11 208
Developing economies	22 277	53 120	94 101	127 372	8 954	37 925	82 426	122 941
World	57 869	380 598	716 302	880 457	117 889	380 598	716 302	880 457

Source: UNCTAD, World Investment Report 2007

Ten of South Africa's TNCs form part of the top 100 non-financial TNCs from developing countries in 2005.

Table 2.23. Presence in the top 100 non-financial TNCs from developing countries, ranked by foreign assets (millions of dollars and number of employees), 2005

Ranking by:				Foreign				
Foreign assets	TNI [b]	II [c]	Corporation	Assets	Sales	Employment	No. of affiliates	II [c]
21	67	40	Sasol Limited	5 368	5 351	5 267	16	51.6
36	48	41	MTN Group Limited	3 896	1 787	4 594	16	61.5
38	31	18	Sappi Limited	3 671	3 697	8 717	34	59.2
41	49	44	Steinhoff International holdings	3 220	2 262	18 000	6	60.0
46	66	77	Gold Fields Limited	2 672	900	6 156	2	25.0
56	58	93	Barloworld Ltd	2 079	2 594	9 135	3	10.0
66	75	94	Naspers Limited	1 421	587	2 050	1	9.1
69	91	59	Imperial Holdings	1 208	1 745	6 434	35	42.3
85	77	91	Bidvest Group Limited	1 134	3 582	13 891	60	46.5
90	1	20	Datatec Limited	1 084	2 897	2 530	47	53.9

Source: UNCTAD/Erasmus University database.

For details, see annex table A.I.11 in WIR07.

[a] All data are based on the companies' annual reports unless otherwise stated. Data of affiliates are from D&B Who Owns Whom database.

[b] TNI is calculated as the average of the following three ratios: foreign assets to total assets, foreign sales to total sales and foreign employment to total employment.

[c] II is calculated as the number of foreign affiliates divided by number of all affiliates (Note: Affiliates counted in this table refer to only majority-owned affiliates).

Note: The list covers non-financial TNCs only. In some companies, foreign investors may hold a minority share of more than 10 per cent.

Source: UNCTAD, World Investment Report 2007

South Africa, the strongest economy in sub-Saharan Africa, showed improvement and resilience in overall GDP performance since the 1990s, notably growth in GDP and exports. However, as the African Economic Outlook 2007 (p. 490) states, South Africa's economic performance "is still below the level needed to make a major dent in poverty and unemployment". As reported earlier, the country still has high poverty levels and high levels of communicable diseases bringing down its overall level of human development.

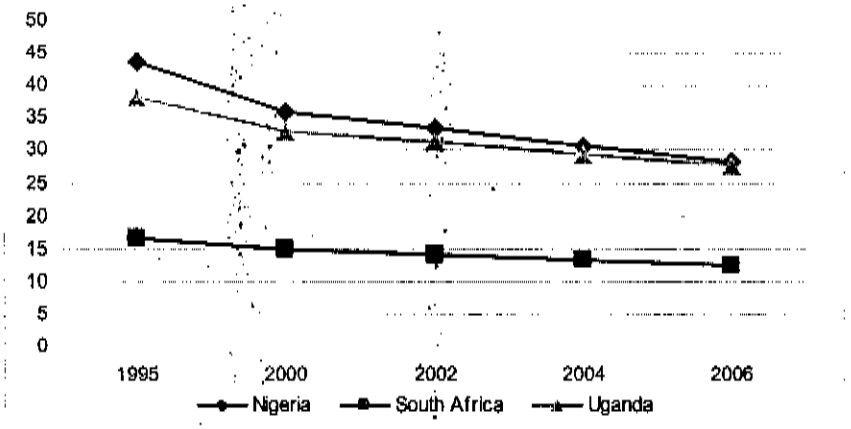
In the following section, indicators of education and human resource capacity in South Africa will be reported.

Pillar 2: An educated and skilled population to use, share and create knowledge and technologies...

Education

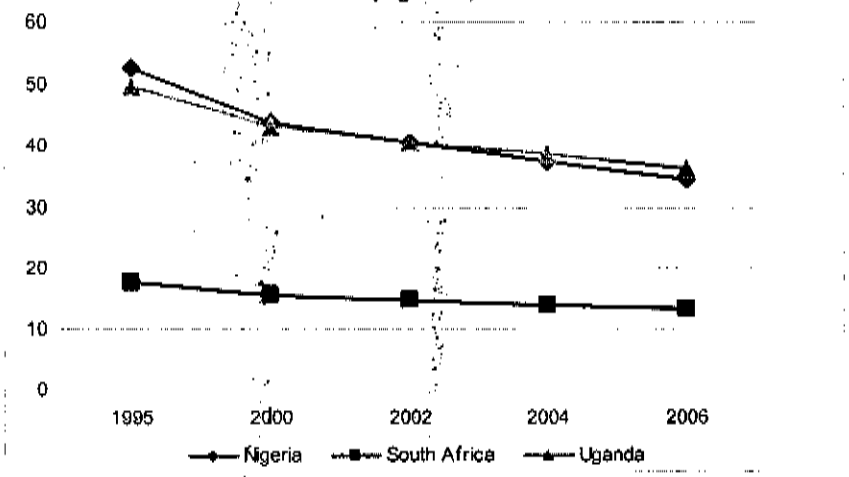
In the developing-country context the ability to identify, adapt, improve and utilize technologies developed elsewhere is of utmost importance for innovation, - that is innovation by doing, using and interacting – perhaps more so than creating at the frontier. Indicators of basic education are thus important to consider, especially in the context of sub-Saharan Africa which has poor levels of educational development and high illiteracy rates.

Figure 2.20. Illiteracy rates (%) in Nigeria, South Africa and Uganda, 1995-2006



Data source: AfDB Selected Statistics on African Countries 2007 Volume XXVI

Figure 2.21. Illiteracy rates (% female) in Nigeria, South Africa and Uganda, 1995-2006



Data source: AfDB Selected Statistics on African Countries 2007 Volume XXVI

South Africa's illiteracy rate is low relative to other sub-Saharan African countries, and is gradually decreasing. The downward trend is also seen among females (see Figures 2.20 and 2.21). The country's illiteracy rate in 2006 dropped by 4.2 percent from a rate of 16.7 percent in 1995 and illiteracy among females dropped by 4.4 percent, with 13.1 percent of the female population illiterate. South Africa's illiteracy rate in 2006 was about half that of Uganda and Nigeria in the same year, with decline slower in South Africa than in the other two countries.

Table 2.24. Commitment to education: Public spending, Nigeria, South Africa and Uganda and selected regions, 1999-2005

Country/ region	Total public expenditure on education as % of GNP		Total public expenditure on education as % of total government expenditure		Public current expenditure on primary education as % of public current expenditure on education		Public current expenditure on primary education as % of GNP		Public current expenditure on secondary education as % of public current expenditure on education		Public current expenditure on secondary education as % of GNP	
	1999	2005	1999	2005	1999	2005	1999	2005	1999	2005	1999	2005
Nigeria	...	...	...	...	...	...	...	...	...	...	...	...
South Africa	6.2	5.5	22.2	17.9	45.2	42.5	2.74	2.3	33.7	33.2	2.0	1.8
Uganda	...	5.3 **,z	...	18.3 **,z	...	61.9 **,z	...	2.5	...	19.9 **,z	...	0.8 z
World[1]	4.5	4.9	...	14.4	...	34.3	...	1.5	...	35.0	...	1.7
Developing countries	4.4	4.7	...	...	...	...	...	1.8	...	...	...	1.5
Sub-Saharan Africa	3.7	5.0	...	...	...	49.5	...	2.1	...	27.2	...	1.1

1. All regional values shown are medians.
(z) Data are for 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

The country's total expenditure on education as a percentage of its gross national income and government expenditure in 1999, dropped by 0.7 and 4.3 percent respectively in 2005. In 1999 and 2005, expenditure on education as a share of gross national income was however higher than the average expenditure on education in developing countries, sub-Saharan Africa and the world. The South African government shows greater commitment to primary education than secondary education having allocated almost half of its expenditure on education on primary education and more than 10 percent less on secondary education (i.e. about a third of the total expenditure on education). This is the general trend in sub-Saharan Africa as well with expenditure on primary education almost double that for secondary education. Expenditure for primary and secondary levels of education in most countries in the world, however, is almost equal.

Table 2.25. Primary education: South Africa, Nigeria and Uganda, and selected regions (age group 6-12 years)

Country/territory	School-age population (000) 2004	Enrolment in primary education: School year ending in 1999 Total (000)	% F	Enrolment in primary education: School year ending in 2005 Total (000)	% F	Out-of-school children (000): School year ending in 1999 Total	Male	Female	Out-of-school children (000): School year ending in 2005 Total	Male	Female	Pupil/teacher ratio: School year ending in 1999	Pupil/teacher ratio: School year ending in 2005
Nigeria	21,645	17,907	44	22,267	45	7,189 **	3,158 **	4,031 **	6584 **	2923 **	3661 **	41 **	37
South Africa	7,176	7,935	49	7,444 z	49 z	171	139	32	569 z	321 z	248 z	35	36 z
Uganda	6,086	6,266	47	7,224	50	...	...	...	...	...	...	...	52
	Sum	**Sum**	**% F**	**Sum**	**% F**	**Sum**			**Sum**			**Weighted average**	
World	641,843	646,731	47	688,285	47	96,459	39,820	56,639	72,124	31,163	40,962	25	25
Developing countries	563,298	560,453	46	607,524	47	92,534	37,859	54,675	68,825	29,386	39,439	27	28
Sub-Saharan Africa	113,594	80,825	46	109,663	47	42,423	19,854	22,569	32,774	14,984	17,789	41	45

Note: (z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Table 2.26. Enrolment in secondary education: South Africa, Nigeria and Uganda, and selected regions

Country/ region	School-age population (000) 2004	Total enrolment: School year ending in 1999 Total (000)	% F	Total enrolment: School year ending in 2005 Total (000)	% F	Enrolment in technical and vocational education: School year ending in 1999 Total (000)	% F	Enrolment in technical and vocational education: School year ending in 2005 Total (000)	% F
Nigeria	18,681	3,845	47	6,398	45	-	-	-	-
South Africa	4,932	4,239	53	4,593 z	52 z	160	44	276 z	40 z
Uganda	4,074	318 **	40 **	760 **	44 **	40 **	30 **	32 **	32 **
	Sum	**Sum**	**% F**	**Sum**	**% F**	**Sum**	**% F**	**Sum**	**% F**
World	775,474	438,570	47	511,936	47	46,955	45	51,100	45
Developing countries	660,691	321,911	46	398,529	47	29,062	46	33,419	46
Sub-Saharan Africa	104,741	21,381	45	33,190	44	1,153	36	2,063	40

Notes: (z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

In 2004, females accounted for about half of the total enrolments at both levels in 1999 and 2005. The proportion of out-of-school children at the primary level in 2005 was 7.9 percent of the share of the population at school-age in 2004. The pupil-teacher ratio in 1999 and 2005 was much the same, 35 and 36 pupils to one teacher respectively; which is much higher than the world average and that for developing countries, but much lower than the average for sub-Saharan Africa.

Although South Africa shows relatively positive enrolment rates at both the primary and secondary levels, quality of education in the country is relatively poor. The Global Campaign for Education 2008 (as cited in the South African Institute of Race Relations' *Fast Facts*, February 2008) ranked South Africa at 50 for quality of schooling out of the 156 developing countries included in the report. The Global Campaign for Education 2008 ranks countries according to their achievement of universal basic education, political will, growth in enrolments, quality inputs, equal opportunities, and transparency and accountability. South Africa ranks below Brazil (ranked 16th) and Botswana (ranked 47th), but higher than India (ranked 60th). The country's average fourth-grade reading literacy score was 302 in 2006, which is below that of Indonesia (ranked 405th) and Singapore (ranked 558th).

Table 2.27. Enrolment in tertiary education: South Africa, Nigeria and Uganda, and selected regions

Country or territory	Total students enrolled (000) School year ending in 1999						Total students enrolled (000) School year ending in 2005					
	Total		Male		Female		Total		Male		Female	
Nigeria	699		397		302		1,290	z	844	z	446	z
South Africa	633		292		341		735		334		401	
Uganda	41		27	**	14	**	88	z	54	z	34	z
		Sum						Sum				
World	92,863		48,345		44,517	48	137,769		68,732		69,037	
Developing countries	47,225		27,096		20,129	43	80,150		42,899		37,251	
Sub-Saharan Africa	2,133		1,274		859	40	3,540		2,197		1,343	

Note: (z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

In 2005, South Africa's tertiary enrolments accounted for a fifth (20.8%) of the total tertiary enrolments in sub-Saharan Africa and less than one percent of the total in developing countries and the world (0.9% and 0.5% respectively). The proportion of enrolments in sub-Saharan Africa, the group of developing countries and the world was slightly lower than in 1999 with enrolments in South Africa accounting for 29.7, 1.3 and 0.7 percent respectively. The total tertiary enrolments in the country in 2005 were higher than that in 1999 in absolute terms. Females accounted for more than half of the enrolments in both 1999 and 2005 (i.e. 53.9% and 54.6% respectively).

Table 2.28. Tertiary education: Distribution of students by field of study and female share in each field, 2005

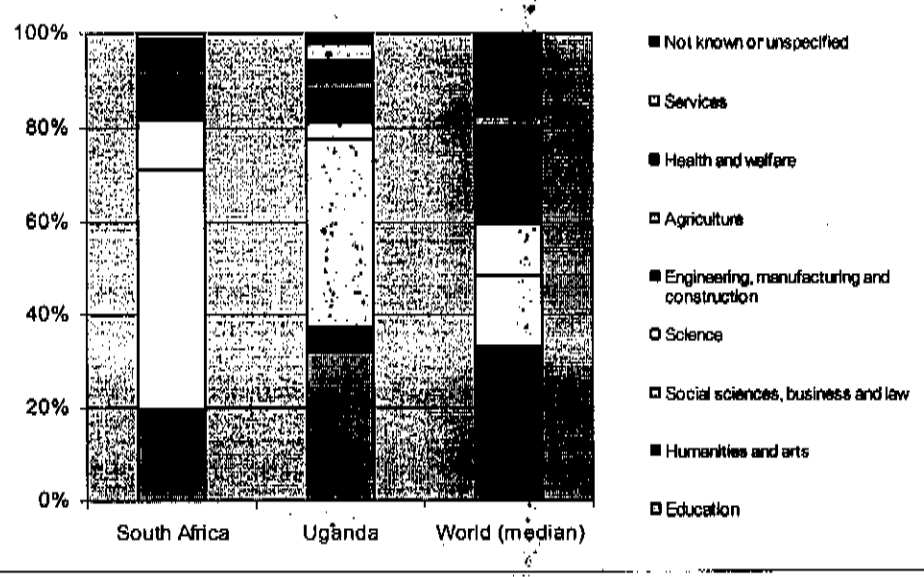
	Percentage distribution by field of study in selected countries and the world in 2005									
	South Africa		Nigeria		Uganda				World (median)	
Study field	Total %	% F	Total %		Total %		% F		Total %	% F
Education	14	71	..	..	32	z	39	z	12	71
Humanities and arts	5	60	..	..	5	z	41	z	22	56
Social sciences, business and law	51	56	..	..	40	z	41	z	15	35
Science	11	44	..	..	3	z	24	z	11	30
Engineering, manufacturing and construction	9	24	..	..	7	z	19	z	13	16
Agriculture	2	42	..	..	2	z	22	z	4	32
Health and welfare	6	68	..	..	4	z	40	z	5	63
Services	1	65	..	..	4	z	53	z	2	31
Not known or unspecified	-	.	..	..	2	z	55	z	17	.

Note: (z) Data are for the school year ending in 2004.

Source: UNESCO Education for All Global Monitoring Report 2008

The distribution of enrolment by study field in South Africa in 2005 was similar to the distribution in most countries in the world in the same year. The major differences were in the humanities and arts, and the social sciences, business and law with South Africa showing a greater concentration in the latter and most countries in the world showing a higher concentration in the former.

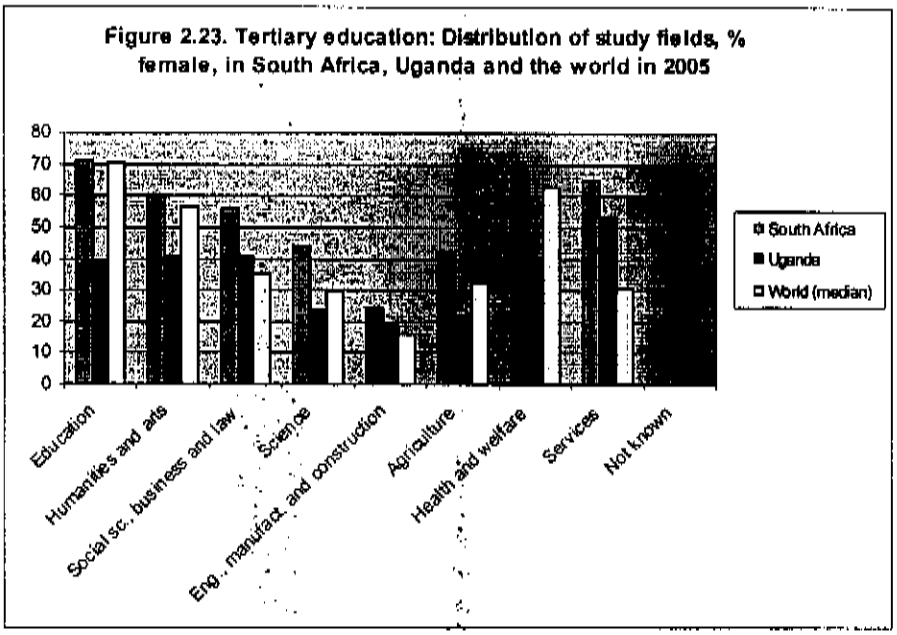
Figure 2.22. Tertiary education: Percentage distribution across fields of study in South Africa, Uganda and the world in 2005



Data source: UNESCO Education for All Global Monitoring Report 2008

South Africa shows a larger proportion of females in all study fields in comparison to the proportion in the world and Uganda (see Table 2.28 above and Figure 2.22 below). South

Africa, like most countries in the world, had greater numbers of females enrolled in the more traditionally female study fields, accounting for more than half of the enrolments in education and health and welfare. In South Africa, services was also dominated by females. In contrast, females account for a significantly smaller proportion of the more traditionally male study fields, engineering and science, with the difference more pronounced in the former.



Data source: UNESCO Education for All Global Monitoring Report 2008

Labour force participation

In South Africa, like most other upper-middle income countries, about 65 percent of the population in the age group 15 to 64 years was employed in 2005. Labour force participation in this age group was however 9.08 percent higher in sub-Saharan Africa. The higher labour force participation in sub-Saharan Africa can be attributed to the higher percentage of females in employment.

Around 40 percent of the total labour force in South Africa and its comparators – sub-Saharan Africa, upper-middle income countries and the world – were female (see Table 2.29 below). About half of the female population in the age group 15-64 years, was in employment in South Africa in 1995 and 2005, whereas more than 80 percent of the male population in the same age group was in employment in 1995 and 2005.

Table 2.29: Labour force participation, South Africa, 1995 and 2005

	South Africa		Upper-middle income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005
Labor force participation rate, total (% of total population ages 15-64)	68.38	65.28	65.97	65.05	75.98	74.36	71.79	70.95
Labor force participation rate, female (% of female population ages 15-64)	54.10	49.31	52.19	52.57	64.40	62.56	58.24	57.85
Labor force participation rate, male (% of male population ages 15-64)	83.13	81.85	80.10	77.92	87.84	86.29	85.01	83.77
Labor force, female (% of total labor force)	40.03	38.22	40.00	40.89	42.76	42.14	39.81	40.08

Data source: World Bank online database 2007

Agriculture labour force

The proportion of employment in agriculture was significantly smaller than the proportion in sub-Saharan Africa where 65 percent of the labour force is in agriculture, middle-income countries where about a quarter of the labour force is in agriculture. Nearly half of the world's labour force was in agriculture in 1995 and 2005. In 2005, females made up a quarter of the agriculture labour force in South Africa; whereas, in the same year, nearly half of the agriculture labour force in sub-Saharan Africa was female. The percentage of the labour force in agriculture in South Africa and its comparators shows a downward trend (see Table 2.30 and Figures 2.24 to 2.26 below).

Table 2.30: Labour force, Agriculture total and female, 1995 and 2005, South Africa

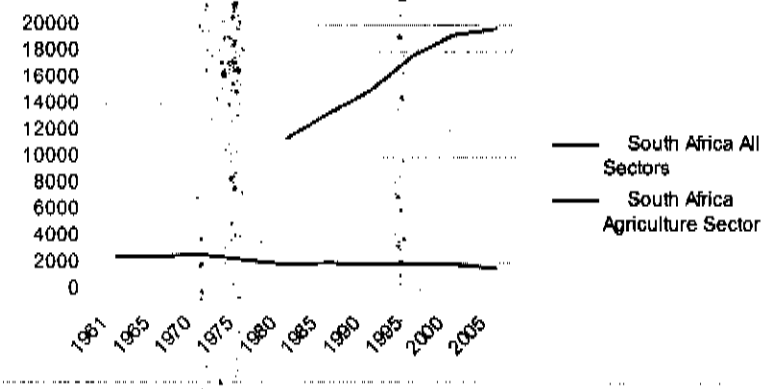
	South Africa		Middle income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005
Labour force (total in thousands)	17,671	19,786	275,291	348,906	242,702	309,471	2,604,869	3,050,342
Agriculture labour force (total in thousands)	1,924	1,598	91,466	92,573	170,455	201,546	1,274,611	1,359,910
Agriculture labour force (% of total labour force)	10.89	8.08	33.23	26.53	70.23	65.13	48.93	44.58
Agriculture labour force (total female in thousands)	521	403	34,675	38,501	80,314	95,759	550,442	598,417
Agriculture labour force (% female)	27.08	25.22	37.91	41.59	47.12	47.51	43.19	44.00

Note: *Author's calculations

Data source: UNCTAD Handbook of Statistics 2007 online

While the South African labour force has been growing steadily since the 1980s, employment in agriculture is low and shows a gradual decline.

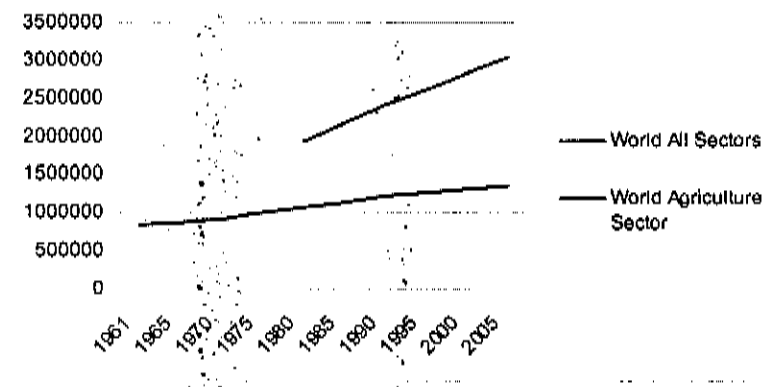
Figure 2.24. Growth in total and agriculture labour at 5-year intervals - South Africa, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007 online

As shown in Figure 2.25 below, growth in the size of the labour force in agriculture globally is slow. Table 2.30 shows that, globally, the size of the agriculture labour force was smaller in 2005 than it was in 1995.

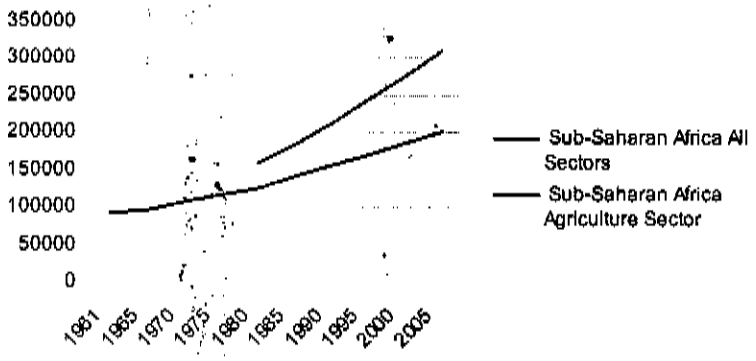
Figure 2.25. Growth in total and agriculture labour at 5-year intervals - World, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007 online

Even though labour in agriculture in sub-Saharan Africa in 1995 declined by 5.11 percent in 2005, the agriculture labour force was 57.05 percent larger than that of South Africa. In other words, South Africa's agriculture labour force was about an eighth of the agriculture labour force in sub-Saharan Africa in 2005.

Figure 2.26. Growth in total and agriculture labour at 5-year intervals - Sub-Saharan Africa, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007 online

Researchers in South Africa

The number of researchers in South Africa increased between 2000 and 2005, with the number of researchers in 2001 increasing by 20.84 percent in 2004. The number of researchers per million inhabitants between 2000 and 2005 was similar to that in Brazil but significantly less than that in Singapore. Most of the researchers in South Africa worked in higher education, with the number of researchers employed by the sector double the number in business and five times the number employed in government in 2004. In 2001, the number of researchers employed in the higher education sector was three times that in business and about four times the number of researchers employed in government. This trend was similar to that of Brazil where researchers are mostly employed in the higher education sector, followed by business and then government. The trend is different in Singapore where most of the researchers in the country are employed by the business sector followed by employment in higher education and then government.

Table 2.11: Number of researchers – South Africa and [redacted] countries, 2001-2004

Country	Year	Researchers: Full-time equivalent (FTE)				Researchers: HC				Researchers: by sector of employment (HC)			
		Total	Female	% Female	Per million inhabitants	Head count	Female	% Female	Per million inhabitants	Business enterprise	Government	Higher education	Private non-profit
Brazil	2001 k	67,785	...	...	384	116,539	52,326	44.9%	661	20,674	4,652	41,876	583
Brazil	2003 k	79,301	...	...	437	135,080	62,677	46.4%	745	21,795	5,095	51,539	872
Brazil	2004 k	84,979	...	...	462	143,864	67,616	47.0%	782	22,355	5,625	56,008	991
Singapore	2001	16,741	...	...	4,086	20,645	...	...	5,039	8,521 x	1,056 x	7,163 r,x	. s
Singapore	2003 x	20,024	...	...	4,745	23,513	5,938	25.3%	5,572	10,578	1,355	8,090 r	. s
Singapore	2004 x	21,359	...	...	4,999	25,251	6,506	25.8%	5,910	12,457	1,335	7,567 r	. s
South Africa	2001	14,182	5,112	36.0%	307	26,913	9,700	36.0%	563	2,952	2,134	8,899	197
South Africa	2003	14,131	5,365	38.0%	301	30,708	11,658	38.0%	654	...	...	...	...
South Africa	2004	17,915	6,852	38.2%	379	37,001	14,152	38.2%	784	5,301	2,040	10,340	234
Uganda	2001	...	...	...	...	568	213	37.5%	23	47 h	301 h	202 h	18 h
Uganda	2003	...	...	...	...	675	253	37.5%	25	...	...	...	...
Uganda	2004	...	...	...	...	724	272	37.6%	26	58 h	384 h	261 h	21 h

Notes and symbols: ... Data not available
h Head count instead of Full-time equivalent
k Country covered by RICYT
l Includes Other supporting staff
r Includes Private non-profit
s Included elsewhere
x Country covered by OECD

Source: UNESCO online database 2008

In sum, South Africa shows relatively low illiteracy rates and high enrolment rates at all levels of education. It does however have much to improve with regard to the quality of its education system. South Africa also has to improve enrolment in science and technology at the tertiary level; and increase labour force participation, particularly among females. South Africa has relatively high numbers of researchers, but the number of researchers in the country is still significantly lower than some other developing countries that are more advanced in terms of scientific and technological achievements.

In the following section, indicators describing South Africa's basic and ICT infrastructure will be reported

Pillar 3: Dynamic infrastructure, successful diffusion of 'old' and 'new' technologies...

'Old' technologies

South Africa is one of the most industrialized countries in Africa with basic and ICT infrastructure superior to that in many other African countries. This can be seen in Table 2.32 below.

The share of the total population in South Africa with access to improved sanitation and water and electricity was larger than the share of the world's population and the total population in sub-Saharan Africa and middle-income countries. The share of the population with access to improved sanitation however decreased slightly, by four percent, in 2004 in comparison to 1990. Access to improved water source increased by five percent. South Africa produces the largest percentage of electricity on the continent. It is, however, currently (in 2008) experiencing a crisis in meeting the increasing demand for electricity due to a lack of foresight planning.

South Africa can improve in the paving of roads. It also has high transport costs, which has an adverse impact on production and investment in the country.

Table 2.32. Diffusion of old technologies - South Africa, Nigeria, Uganda and selected regions

	Sanitation and water				Energy			Roads				Railways						Air transport	
	Population using improved sanitation (%)		Population using improved water source (%)		Electricity consumption per capita (kilowatt-hours)		Population without electricity (millions)	Total network (km)		Paved (% of total roads)		Railways total route (km)		Goods transported (million ton-km)		Passengers carried (million passengers-km)		Registered carrier departures worldwide	
Country/Regions	1990	2004	1990	2004	2004	1990-2004	2005	1995	2001-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2005	1995	2005
South Africa	69	65	83	88	4818[b]	20.8[b]	14	331,265	364,131	41.5	17.2999992	25,555	20,047	95,591	108,513	9,675	991	74,300	148,146
Nigeria	39	44	49	48	157	-1.9	71	193,198	193,200	18.8	15	3,557	3,528	97	77	1,734	174	6,600	8,356
Uganda	42	43	44	60	63	61.5	25	..	70,746	..	23	1,250	259	236	218	..	..	900	317
Low income countries	21	38	64	76	449	..	..	4,051,681	239,226	13.8	..	..	..			..	..	551,100	714,157
Middle income countries	46	61	78	84	2,039	..	..	2,927,700	1,148,177	48	50.5	..	..	8,516	10,311	1,899	1571	1,702,300	2,014,002
Sub-Saharan Africa	32	37	48	55	478	..	547	1,422,796	352,527	15.5	12.1000004	..	..	..	..	..	..	278,900	378,978
World	49	59	78	83	2,701	..	1,577	25,962,342	239,226	40.7	36.2999992	..	..	..	5,543	1,848	2277.5	18,008,200	24,877,724

Note: a Data refer to the most recent year available during the period specified.

b Data refer to the South African Customs Union, which includes Botswana, Lesotho, Namibia and Swaziland.

c Data obtained from UNDP Human Development Report 2007/2008.

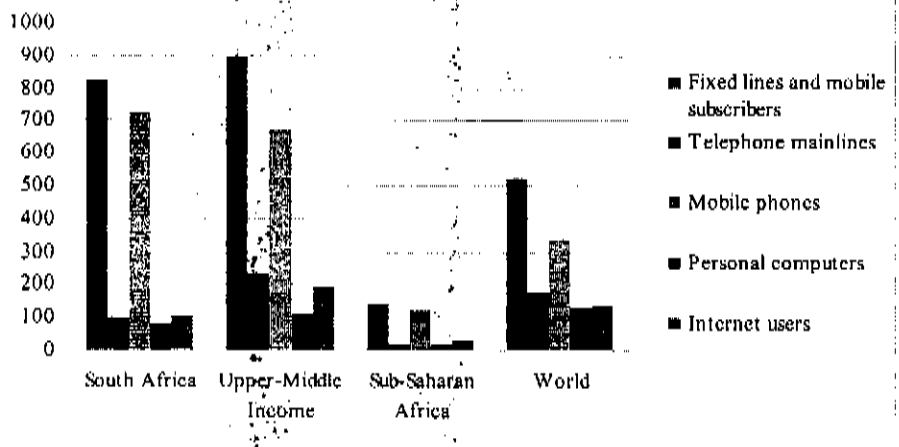
d Data obtained from World Bank online database 2007.

Data source: UNDP Human Development Report 2007/8 and the World Bank online database 2007

'New' technologies

South Africa's telecommunications revenue as a share of its GDP in 2005 was about two percent higher than that in sub-Saharan Africa, upper-middle income countries and the world. In the same year, the number of telephone mainlines, personal computers, and internet users per 1,000 people was lower than the number in most upper-middle countries and the world generally. In contrast, the number of mobile phone owners in South Africa superseded that in upper-middle income countries and the world, presenting the highest growth of the 'new' technologies in the country. Diffusion of the 'new' technologies over the eleven-year period, 1995 to 2005, occurred rapidly with the exception of telephone mainlines, and was significantly greater than that of sub-Saharan Africa, which lagged behind tremendously (see Figure 2.27 and Table 2.33 below).

Figure 2.27. ICT - South Africa in the World, 2004 or 2005, per 1 000 people



Data Source: World Bank online database 2007

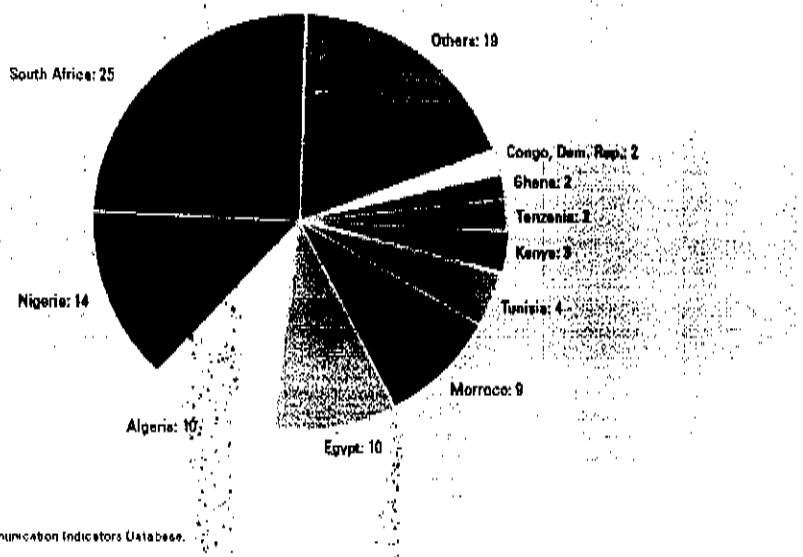
Table 2.33. Diffusion of new ICT technologies - South Africa and selected regions

	South Africa		Upper-Middle Income				Sub-Saharan Africa				World		
			1995-1996		2004-2005		1995-1997		2004-2005			2004-2005	
Indicators	1995	2005	Year	%/value	Year	%/value	Year	%/value	Year	%/value	1995	Year	%/value
ICT Expenditure as % of GDP													
Telecommunications revenue (% GDP)	2.9	5.7	1995	1.4	2004	3.6	1995	1.9	2004	3.3	1.9	2004	3.6
Fixed lines and mobile subscribers per 1,000 people	116	825	1995	161	2005	901	1995	12	2005	142	138	2005	523
Telephone mainlines per 1000 People	102	101	1995	153	2005	230	1995	11	2005	17	122	2005	180
Mobile Phones per 1,000 People	14	724	1995	8	2005	671	1995	1	2005	125	16	2005	342
Personal computers per 1,000 people	28	85	1995	24	2004	113	1997	7	2004	15	42	2004	130
Internet Users per 1000 People	7	109	1996	3	2005	196	1996	1	2005	29	8	2005	137

Data Source: World Bank online database 2007

In 2005, South Africa had one of the largest mobile markets in Africa and three of the top ten mobile operators in Africa were South African operators.

Figure 2.28. The ten largest mobile markets in Africa (%), 2005



Source: ITU World Telecommunication Indicators Database.

Source: Toure (2007, p. 94)

Table 2.34. The top ten mobile operators in Africa

	Operator	Subscribers 2005	Percent change 2005–06	Revenue (US$ millions)	Percent change 2005–06	Yearly average revenue per user (US$)*
1.	Vodacom (South Africa)	19,200	+49	$4,870	+24	$261
2.	Maroc Telecom (Morocco)	10,710	+30	$1,640	+15	$153
3.	MTN Nigeria	10,376	+24	$1,460 (2005)	+9	$76 (2005)
5.	MTN (South Africa)*	10,235	+30	$2,780 (2005)	n/a	$320
4.	MobiNil (Egypt)	9,267	+38	$920 (2005)	+18 (2004–05)	$142
6.	Vodafone Egypt	8,615	+80	$1,019	+95	$170
7.	Meditel (Morocco)	5,155	+28	$533	+7	$103
8.	Tunisie Telecom (Tunisia)	3,265	n/a	$940 (2004)	n/a	n/a
9.	Cell C (South Africa)	2,900	+34	$862	+33	$297
10.	Safaricom (Kenya)	2,512 (2005)	+66 (2004–05)	$355 (2005)	+43 (2004–05)	$141

Source: ITU, from company reports.

* Based on ITU calculations, not operators' official figures. n/a, not available.

Source: Toure (2007, p. 95)

South Africa's environmental resources for innovation

The share of South Africa's total land area that is forest is smaller than the forest area of Nigeria and Uganda, and is nearly 30 percent that of sub-Saharan Africa and a quarter of the world forest area. South Africa's share of the total land area that is forest has remained unchanged in the period 1990 to 2005 (see Table 2.35 below).

Table 2.35: Forest area - South Africa, Uganda, Nigeria and selected regio

Indicators	Forest area: % of total land area (%) 2005	Forest area: Total (thousand sq km) 2005	Forest area: Total change (thousand sq km) 1990-2005	Forest area: Average annual change (%) 1990-2005
South Africa	7.60	92.00	0.00	0.00
Nigeria	12.20	110.90	-61.50	-2.40
Uganda	18.40	36.30	-13.00	-1.80
Sub-Saharan Africa	26.8	5,516.40	-549.6	-0.6
World	30.3	39,520.30	-1,252.70	-0.2

Data source: UNDP Human Development Report 2007/2008

The area of agricultural land in South Africa increased by 8.99 percent in 2003 from the area in 1990, with the share of irrigated land growing by only one percent. The proportion of agricultural land in South Africa, that is irrigated, was 1.6 times that of the proportion of agricultural land in Africa in 2003. The proportion of irrigated land in Africa has not changed much since 1990.

Table 2.36: Irrigated land and agricultural land - South Africa, Africa, 1990, 2000, 2003

Indicators	Irrigated land (total, 1000ha) 1990	2000	2003	Agricultural land (total, 1000ha) 1990	2000	2003	Irrigated land % of Agricultural land (total, 1000ha) 1990	2000	2003
South Africa	1 200	1 498	1 498	14 300	15 712	15 712	8.4	9.5	9.5
Africa	10 989	13 150	13 358	197 781	217 115	225 361	5.6	6.1	5.9

Data source: AfDB Selected Statistics on African Countries 2007 XXVI

In sum, like many other developing countries, diffusion of the 'new' technologies took place at a much faster rate than the diffusion of the 'old' technologies.

In the following section, indicators of South Africa's scientific and technological capabilities and achievements will be reported.

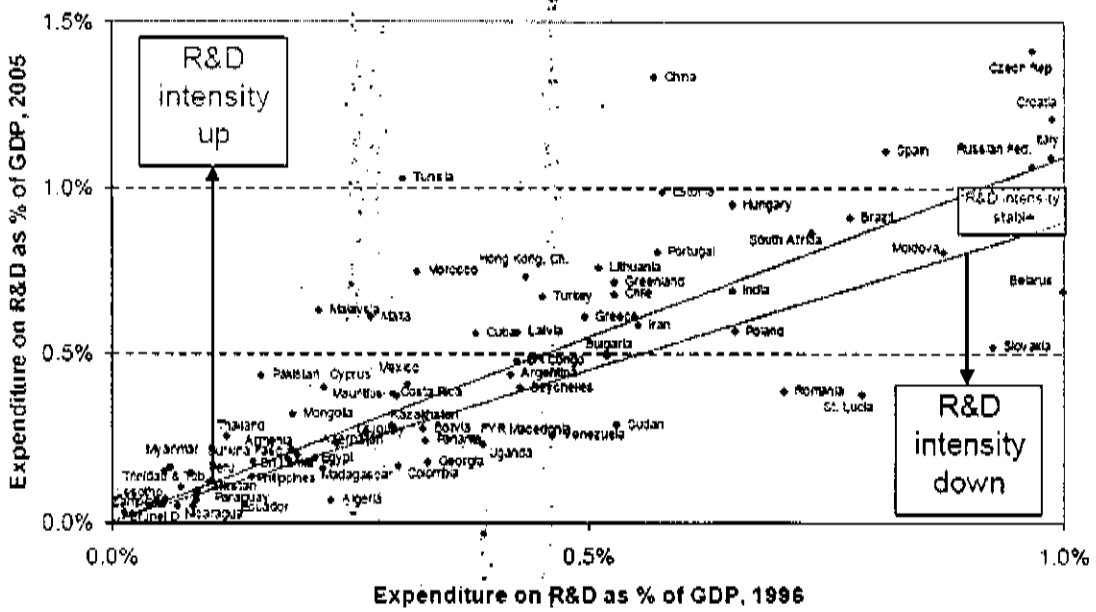
Pillar 4: Innovation: Research and development, creating knowledge at the frontier...

Research and development

South Africa has increased its research and development intensity in recent years. It can be seen in Figure 2.29 below that, like other developing countries in Latin America (such as Brazil), Asia (such as Malaysia) and Africa (such as Morocco), South Africa increased its expenditure on R&D as a percent of GDP but has not reached the one percent mark as yet.

Figure 2.29. R&D intensity, 1996 and 2005

GERD as a percentage of GDP, 1996 (or earliest available year) and 2005 (or latest available year), countries with R&D intensity below 1.5% in 2005.



Source: UNESCO Institute for Statistics, Fact Sheet, October 2007 (p. 4)

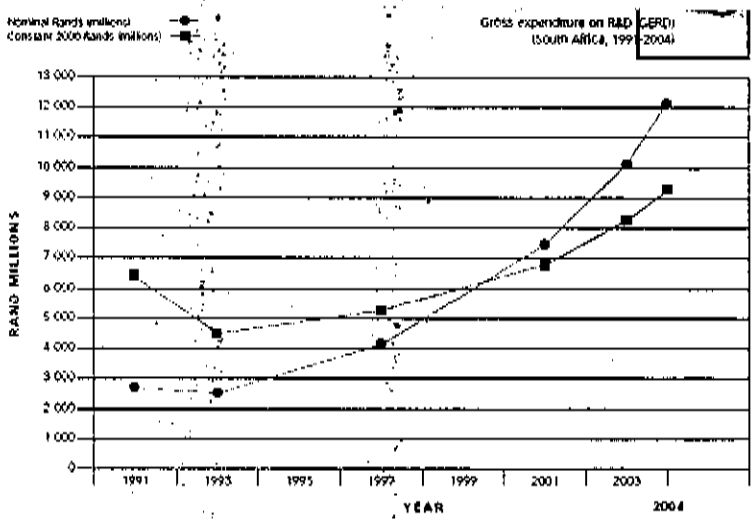
Table 2.37 and Figures 2.30 to 2.31 show the steady increase in total gross domestic expenditure on R&D (GERD) in recent years. South Africa increased its GERD as a share of GDP by 0.07 percent per interval, reaching a share of 0.87 percent in 2004. This sets it up to easily meet the goal of one percent of GERD as a share of R&D by 2008. Most of the GERD in South Africa is funded by the business sector – which contributed more than half of the country's GERD – followed by higher education and then government. Although most of the GERD is funded by the business sector, most of the researchers in the country are employed in higher education sector, amounting to double the number employed in the business sector.

Table 2.37. Expenditure on R&D, South Africa, 2001-2004

Country	Year	Total gross domestic expenditure on R&D (GERD)				Distribution of performance				Source of funds (%)				
		000 Local currency	000 PPP$	As a percentage (%) of GDP	Per capita (PPP$)	Business enterprise	Government	Higher education	Private non-profit	Business enterprise	Government	Higher education	Private non-profit	Abroad
South Africa	2001	7,488,074	2,978,532	0.73%	64.6	53.7%	20.0%	25.3%	0.9%	53.3%	36.2%		5.4%	6.1%
South Africa	2003	10,082,559	3,607,577	0.80%	76.9	55.5%	21.9%	20.5%	2.1%	52.1%	27.9%	3.5%	5.5%	10.9%
South Africa	2004	12,009,981	4,176,398	0.87%	88.5	56.3%	20.9%	21.1%	1.7%	44.5%	23.7%	9.2%	6.8%	15.8%

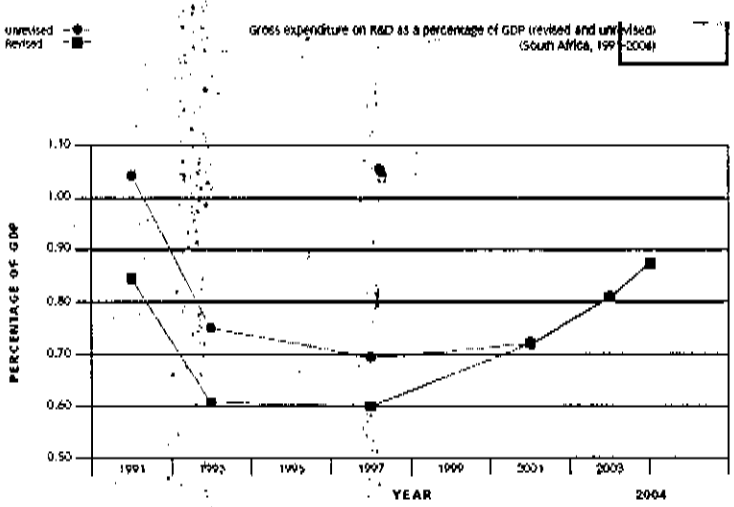
Source: UNESCO online database 2008 .

Figure 2.30. South Africa – Gross expenditure on R&D, 1991-2003



Source: Department of Science and Technology (2006, p. 9)

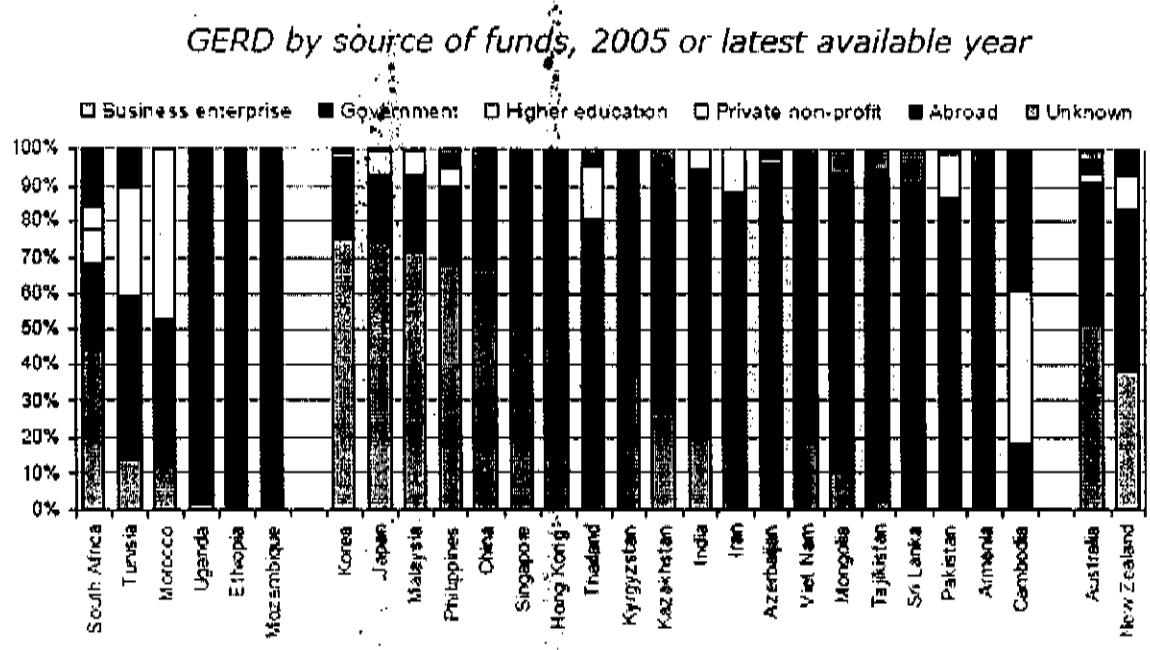
Figure 2.31. South Africa – Gross expenditure on R&D as a percentage of GDP, 1991-2003



Source: Department of Science and Technology (2006, p. 11)

In international comparison, like many of the developing countries in Asia and unlike other developing countries in Africa, the business sector contributes most of the funds dedicated to R&D. Unlike Uganda, Ethiopia and Mozambique, a small share of the funds are sourced from abroad (less than 20%). Whereas a significant proportion of the funds for R&D are provided by the higher education sector in Tunisia and Morocco, a very small percentage is provided by higher education in South Africa (less than 10%) – which is similar to the developing countries in Asia and the Pacific.

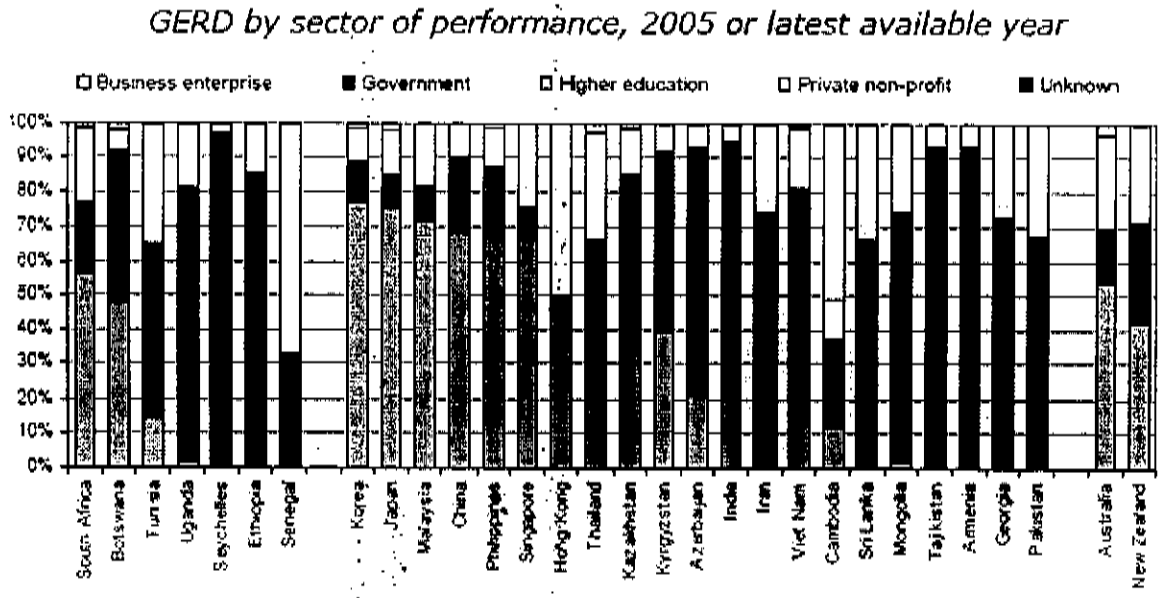
Figure 2.32. R&D funding in Africa, Asia and the Pacific



Source: UNESCO Institute for Statistics, Fact Sheet, October 2007 (p. 6)

Similarly, when looking at R&D performance, most of the R&D is carried out by the business sector but higher education carries out more R&D than it invests in funds. This is in contrast to performance in the other African countries where a large proportion of R&D is carried out by the government, but is similar to the compatible Asian countries.

Figure 2.33. A breakdown of R&D investment in Africa, Asia and the Pacific



Source: UNESCO Institute for Statistics, Fact Sheet, October 2007 (p. 7)

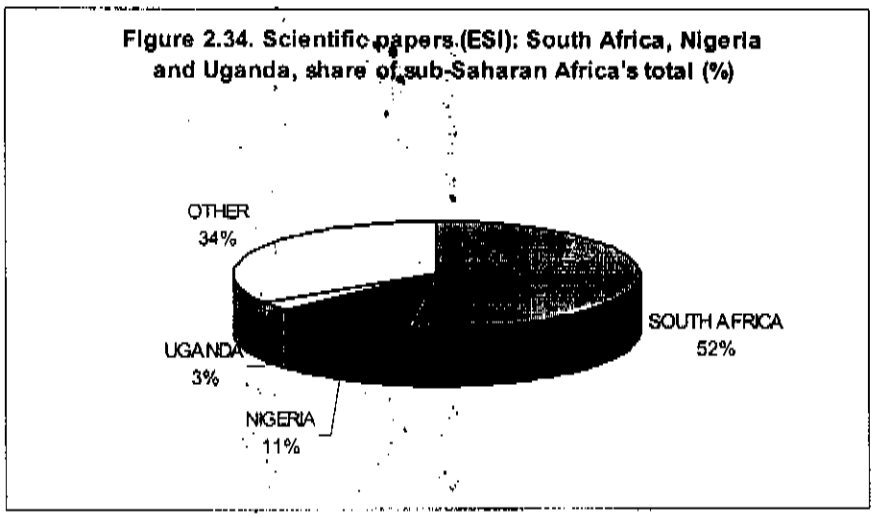
Scientific development

Corresponding to its lead economic position in Africa, South Africa is the lead country in the region with regard to scientific output. Scientific output is measured by the number of scientific publications reported by Thompson's Essential Science Indicators (ESI) during the period 1997 to 2007.

Rank	Country/Territory	Papers		Citations	Citations per paper
		Number	% of total		
1	USA	2,986,569	26.58	42,332,176	14.17
2	JAPAN	808,301	7.19	7,151,726	8.85
13	INDIA	227,761	2.03	991,151	4.35
14	SOUTH KOREA	203,637	1.81	1,114,544	5.47
17	BRAZIL	145,267	1.29	796,761	5.48
28	MEXICO	62,578	0.56	362,710	5.8
32	SINGAPORE	50,931	0.45	327,120	6.42
36	**SOUTH AFRICA**	**45,527**	**0.41**	**301,413**	**6.62**
41	EGYPT	29,138	0.26	111,841	3.84
45	THAILAND	20,622	0.18	118,021	5.72
51	MALAYSIA	13,059	0.12	51,706	3.96

Data source: Thompson's ISI, March 2008, author's calculations

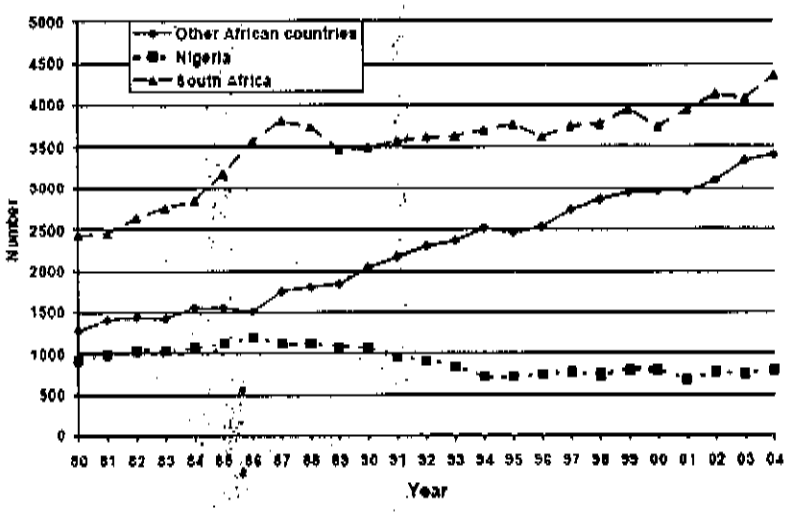
South Africa is ranked 36 in the world in terms of publication output and accounts for a negligible 0.41 percent of the world's scientific publications. The country's scientific performance lags behind some of its comparators in Latin America and Asia. For example, South Africa's publication output is nearly a third of Brazil's publications and only a fifth of India's. South Africa is however the star performer in sub-Saharan Africa accounting for more than half (52.29%) of the total publications produced in the region (see Figure 2.34 below).



Source: Author's calculations based on Thompson's ISI data, March 2008

Schmoch (2005) examined the number of SCI publications. South Africa has the highest number of SCI publications in Africa and its total outputs remained above that of other countries in Africa in the period 1980 to 2004.

Figure 2.35. Number of SCI publications of South Africa and other African countries south of the Sahara, 1980-2004

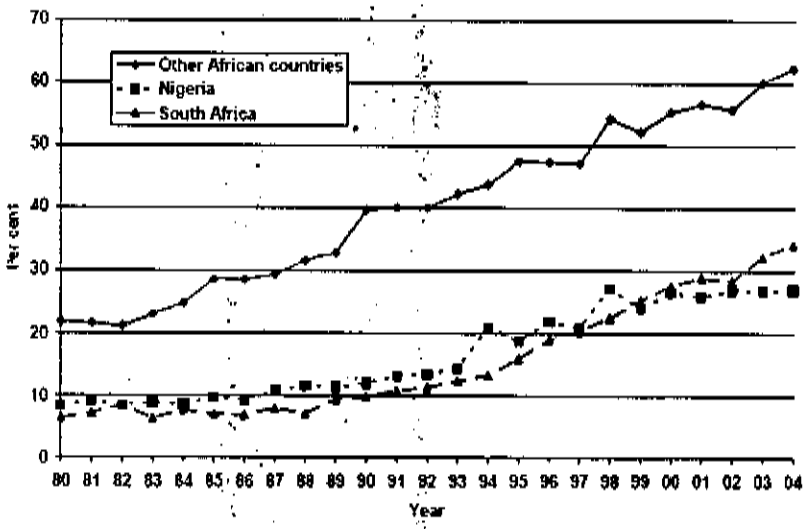


Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 4)

As Figure 2.36 shows, South Africa co-published with advanced countries less often than many other countries in Africa. Schmoch suggests that the high co-publication of the other African countries indicates a level of structural dependence on advanced countries.

Figure 2.36. Share of co-publications of South Africa and other African countries with advanced countries, 1980-2004

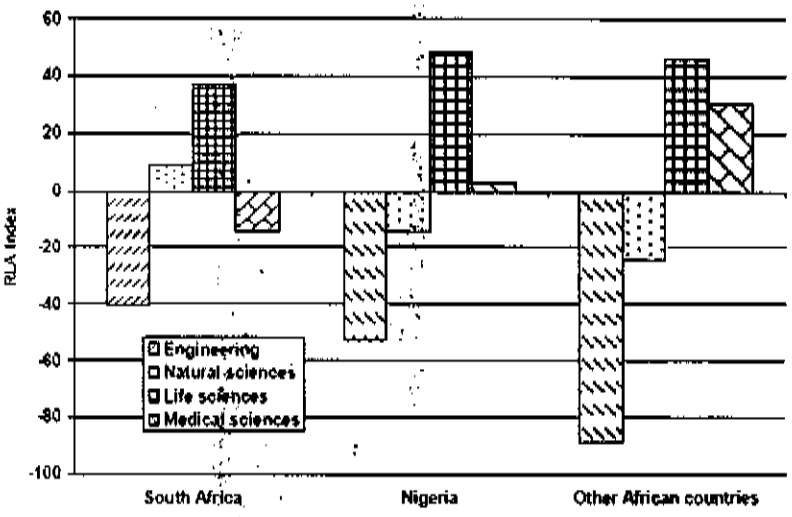


Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 7)

Like most African countries, South Africa shows a strong orientation to the medical sciences and life sciences (Schmoch 2005).

Figure 2.37. Specialisation of South Africa and other African countries on scientific segments



Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 5)

	Field	Papers	Citations	Citations per paper
1	CLINICAL MEDICINE	8,026	76,318	9.51
2	PLANT & ANIMAL SCIENCE	8,223	38,597	4.69
3	ENVIRONMENT/ECOLOGY	2,962	22,130	7.47
4	CHEMISTRY	3,588	21,592	6.02
5	BIOLOGY & BIOCHEMISTRY	2,091	20,600	9.85
6	GEOSCIENCES	2,935	19,367	6.60
7	PHYSICS	2,204	12,551	5.69
8	MICROBIOLOGY	921	11,634	12.63
9	SPACE SCIENCE	1,087	11,416	10.50
10	IMMUNOLOGY	725	11,251	15.52
11	MOLECULAR BIOLOGY & GENETICS	601	9,959	16.57
12	SOCIAL SCIENCES, GENERAL	2,679	8,253	3.08
13	ENGINEERING	2,389	6,974	2.92
14	PSYCHIATRY/PSYCHOLOGY	1,127	5,748	5.10
15	NEUROSCIENCE & BEHAVIOR	502	5,100	10.16
16	AGRICULTURAL SCIENCES	1,010	4,918	4.87
17	PHARMACOLOGY & TOXICOLOGY	638	4,805	7.53
18	MATERIALS SCIENCE	1,011	4,169	4.12
19	MATHEMATICS	1,139	2,361	2.07
20	COMPUTER SCIENCE	560	1,668	2.98
21	ECONOMICS & BUSINESS	658	1,043	1.59
22	MULTIDISCIPLINARY	451	959	2.13
	ALL FIELDS*	45,527	301,413	6.62

* Includes data for all papers from ranked and unranked fields.

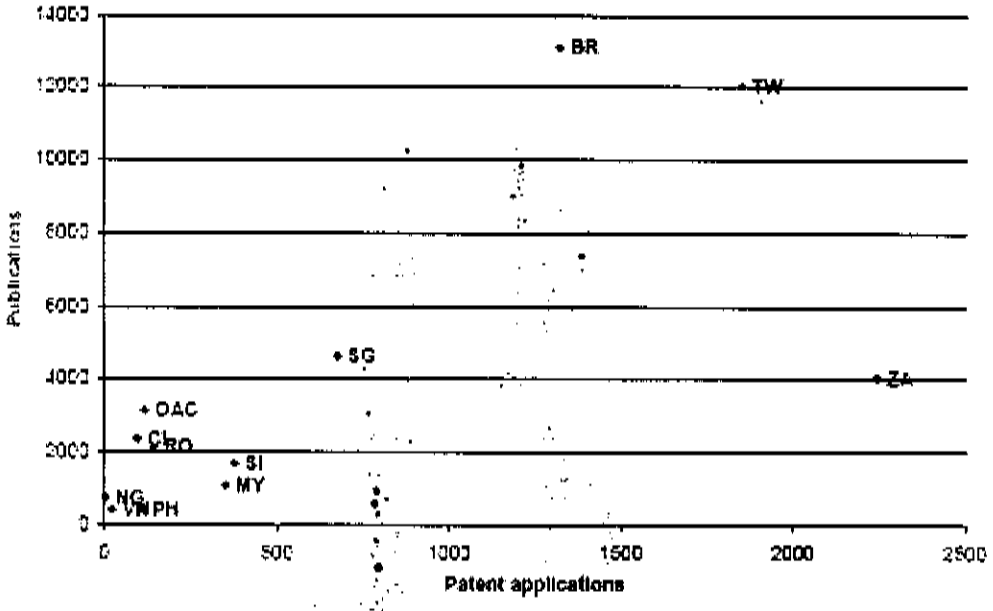
Data source: Thompson's ISI data, March 2008

Technological achievements

Patent activity

As Schmoch (2005, p. 7) indicates that, "a good position in science does not necessarily indicate a high level of prosperity. It is important that the knowledge is closely linked to application and transferred into technological strength." This section looks at South Africa's performance in transferring knowledge to technology. Technological achievement is assessed by looking at the number of patents issued by South Africa and the category of these patents between 1962 and 2006.

Figure 2.38. Publications and patent applications of selected countries

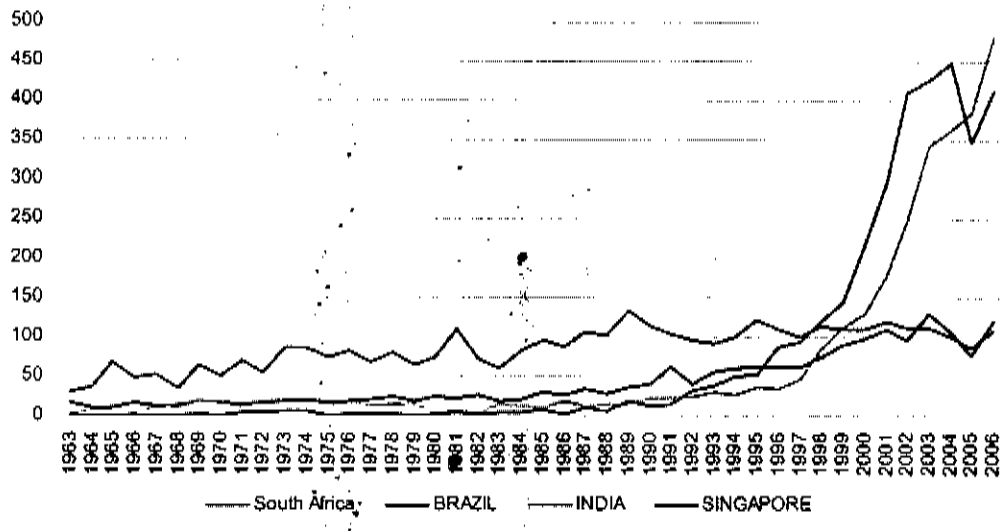


Sources: SCISEARCH (STN), EPPATENT, WOPATENT (Questel-Orbit), computation of Fraunhofer ISI

Source: Source: Schmoch (2005, p. 8)

South Africa had a higher patent output than Brazil, India and Singapore between 1962 and 1998, and patents increased at a steady level during this period. India and Singapore however showed a growth spurt after 1997 and sustained high patent outputs, whereas South Africa and Brazil began to decline in output. South Africa's total patent output was 35.09 percent and 27.59 percent of India's and Singapore's total patents, respectively, granted between 2000 and 2006. During the same period, South Africa was granted 13 more patents than Brazil.

Figure 2.39. Number of patents granted by USPTO, South Africa and selected countries, 1963-2006



Data source: USPTO 2007

Schmoch (2005, p. 7) used a technology classification developed by Fraunhofer ISI in their analysis of South Africa's patent activity, identifying areas in which South Africa specialises in relation to international averages. Schmoch reports that South Africa has a strong focus on Nuclear engineering and weapons (a heritage of the apartheid regime); and produced above average in the fields of consumer goods, mining, food chemistry and food processing, mechanical fields handling and mechanical elements, and biotechnology. According to USPTO records, South Africa was granted a total of 532 patents during the period 2000 to 2006. South Africa's patents fall in a range of classes, the top ten classes – in terms of the number of patents granted per class – are presented in Table 2.40 below. In line with South Africa's specialisation in scientific publiccations, the country's top ten patents during 2001 through to 2005 shows specialisation in the medical and life sciences.

Class	Class Title	2001	2002	2003	2004	2005	Total
210	Liquid Purification or Separation	9	5	4	1	2	21
424	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	4	5	7	1	2	19
75	Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures	7	2	2	4	2	17
340	Communications: Electrical	7	2	3	1	4	17
518	Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof	2	2	1	5	4	14
423	Chemistry of Inorganic Compounds	3	3	2	3	0	11
532	Organic Compounds (Includes Classes 532-570)	2	3	3	3	0	11
15	Brushing, Scrubbing, and General Cleaning	1	2	2	2	2	9
209	Classifying, Separating, and Assorting Solids	1	1	2	3	2	9
502	Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making	2	1	1	3	2	9
	Other classes	82	87	85	74	67	395
ALL	ALL CLASSES	120	113	112	100	87	532

Note: Patent origin is determined by the residence of the first-named inventor
Technology class is determined by the primary classification assigned to the patent
Data source: USPTO 2007

Royalties and license fees

South Africa accounts for less than one percent of the world's total royalty and licence fees, payments and receipts, with its receipts considerably less than its payments. South Africa accounted for 12.33 percent of the total royalty and licence payments and only 2.81 percent of the receipts in upper-middle income countries in 2005. The country does, however, account for most of the royalty and licence payments in sub-Saharan Africa (85.16%) and nearly a third (32.08%) of the region's royalty and licence receipts in 2005. South Africa's share of the total royalty and licence fees receipts in the region, in 2005, declined considerably from its share in 1995 (74%). Its share of the region's total royalty and licence fees payments also declined in 2005 (87.75%) in comparison to 1995, but only slightly. (South Africa's relatively high royalty and licence payments also show its openness to knowledge and technology transfer.)

Table 2.41. Royalty and licence fees, payments [illegible] value (BoP, current US$) [illegible] in world

	1995		2000		2005	
	Number	World* share	Number	World* share	Number	World* share
	Current US$	(%)	Current US$	(%)	Current US$	(%)
Payments						
World	52,459,536,106	100.00	83,076,870,656	100.00	134,689,072,994	100.00
Upper-middle income	1,586,686,357	3.02	3,730,151,000	4.49	8,681,070,050	6.45
Sub-Saharan Africa	334,060,965	0.64	417,038,411	0.50	1,272,129,553	0.94
South Africa	293,134,701	0.56	245,895,910	0.30	1,070,615,302	0.79
Receipts						
World	53,988,334,021	100.00	79,362,690,241	100.00	123,690,029,182	100.00
Upper-middle income	246,039,240	0.46	532,222,543	0.67	1,609,925,096	1.30
Sub-Saharan Africa	60,373,856	0.11	93,103,839	0.12	141,232,915	0.11
South Africa	44,672,004	0.08	49,094,179	0.06	45,302,063	0.04

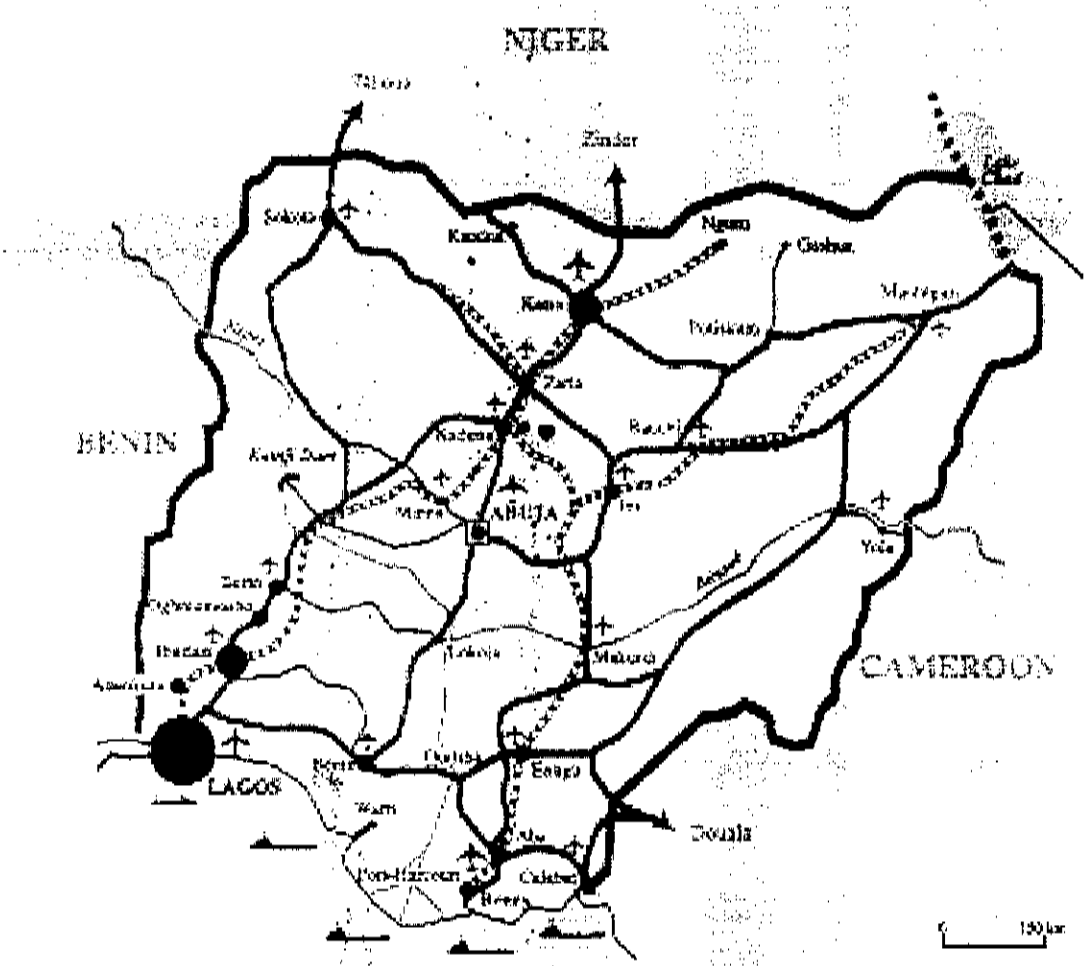
Note: *Author's calculations based on the World Bank data

Data source: World Bank online database 2007

In sum, South Africa leads the sub-Saharan African region in terms of economic performance, and scientific and technological achievement. It has higher levels of openness to knowledge and technological transfer assessed in terms of trade, FDI flows and royalty and licence fees. South Africa also has basic and ICT infrastructure superior to other countries in the region, and a stronger human capital base than other countries in the region. The country does, however, have much to improve at the basic level in terms of overall human development, basic infrastructure, employment rates and the quality of its education system. Another concern is that, although South Africa shows sound capabilities for catch-up, its performance seems to be slipping.

The following section focuses on Nigeria's performance on the various indicators of the four pillars considered critical for catch-up in the knowledge economy.

Disaggregating performance in Nigeria



Source: African Economic Outlook 2007

3. Disaggregating Performance in Nigeria

Nigeria: The Socio-Economic Context

Nigeria is situated on Africa's west coast and occupies 923,768 square kilometers of land; bordering Niger, Chad, Cameroon and Benin (Nigeria UNGASS Report 2007). Nigeria is Africa's most populous country with a population of 131.53 million in 2005, and with an annual growth of 2.17 percent, Nigeria accounts for about 17.70 percent of the population in sub-Saharan Africa, 5.59 percent of the total population in low income economies and 2.04 percent of the world population. In 2005, more than half (52.71%) of the population fell in the age group 15 to 64 years, and slightly more than half (51.80%) lived in rural areas, which is similar to the world average (51.23%). Urbanization in the country is increasing at an annual rate of 3.97 percent, which is about one percent point higher than the world's annual growth. Nigeria's annual growth in total population size slowed in 2005 in relation to its annual growth rate of 2.59 percent in 1996, but growth in population size is still higher than the growth in lower income countries and the world (see Table 3.1 below).

Table 3.1: Population Indicators: Nigeria and selected [illegible] 1996 and 2005

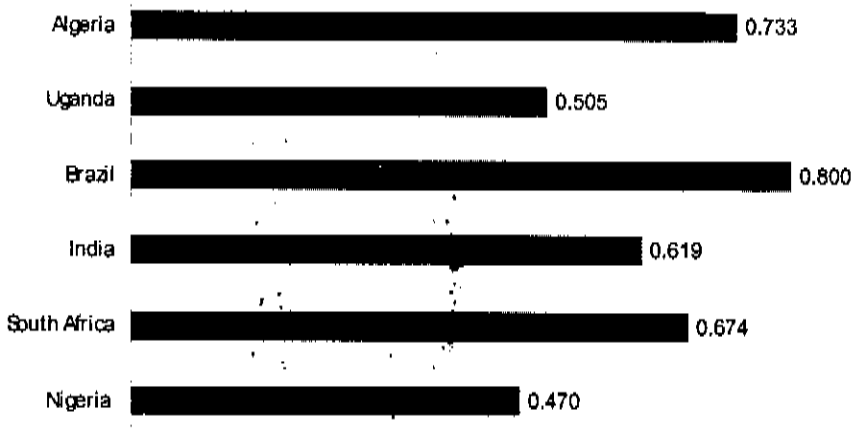
	Nigeria		Low income		Sub-Saharan Africa		World	
Indicators	1996	2005	1996	2005	1996	2005	1996	2005
Population (total in millions)	106.64	131.53	1981.13	2352.43	599.77	743.06	5747.02	6437.68
Population growth (annual %)	2.59	2.17	2.12	1.79	2.63	2.25	1.41	1.19
Population ages 15-64 (% total pop.)	51.17	52.71	56.67	59.28	52.12	53.39	62.11	64.48
Rural population (% of total pop.)	59.62	51.80	72.82	70.04	69.03	64.77	54.76	51.23
Urban population (% of total pop.)	40.38	48.20	27.18	29.96	30.97	35.23	45.24	48.77
Urban population growth (% annual)	4.79	3.97	3.25	2.88	4.22	3.64	2.27	2.04
Life expectancy at birth (total years)*	44.50	43.83	57.69	58.88	46.91	46.65	66.28	67.56
Life expectancy at birth (female years)*	45.34	44.00	58.44	59.73	48.20	47.25	68.36	69.61

Note: * data for 1997 and 2005 as data was not available for 1996.

Data source: Word Bank online database 2007

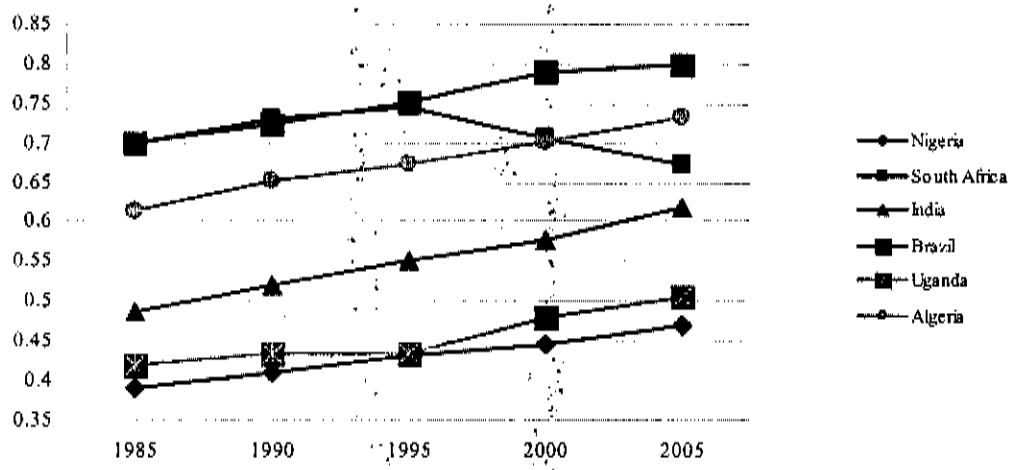
Life expectancy at birth was a low of around 44 years for the total population (and females) in 2005, similar to the country's average in 1996 and that of sub-Saharan Africa. The country's life expectancy is, however, lower than that for low income economies (almost 60 years) and much lower than the world average of almost 70 years. This low life expectancy is shown in the country's poor performance on the Human Development Index (HDI) in 2005. Nigeria is classified as a country of low human development and is ranked at 158 out of the 177 countries included in the report. The HDI is a composite of three sub-indexes (Nigeria's scores are reported in parenthesis): Life expectancy index (0.359), education index (0.648), and the GDP index (0.404).

Figure3.1 HDI in Nigeria and selected developing countries, 2005



Data source: UNDP Human Development Report 2007/2008

Figure 3.2. HDI trends in Nigeria and selected developing countries, 1985-2005



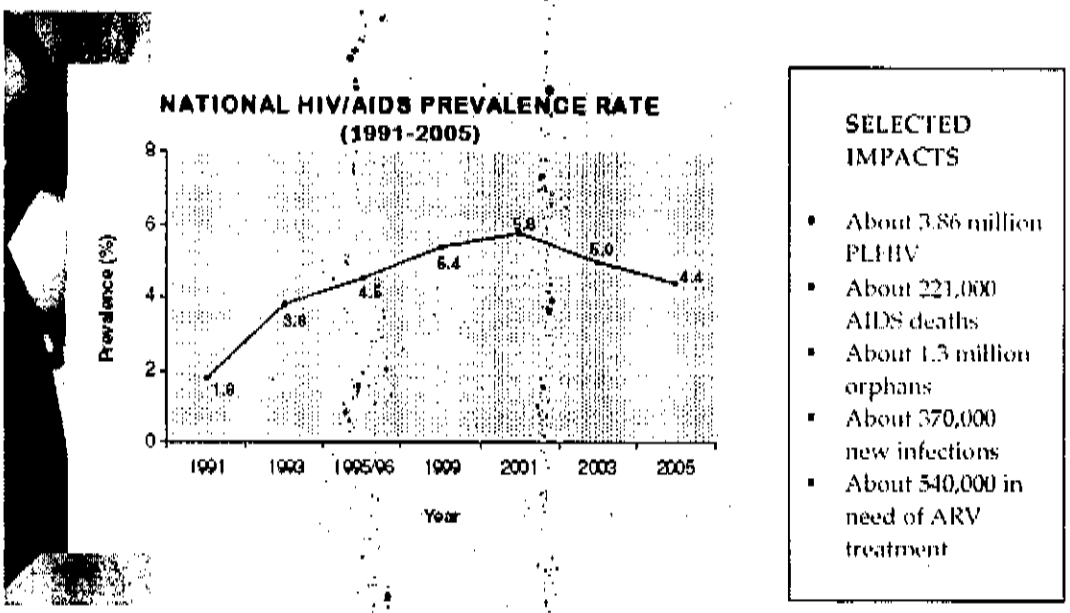
Data source: UNDP Human Development Report 2007/2008

As depicted in Figure 3.1 and Figure 3.2 above, according to the Human Development Report 2007/8, in 2005, Nigeria had the lowest levels of human development in comparison to its comparators: South Africa, Algeria and Uganda in Africa, and developing countries, Brazil and India. Although the country showed a gradual improvement in the period 1985 to 2005, from a HDI value of 0.321 in 1985 to 0.470 in 2005, its level of human development remained poorer than its comparators.

The country's low levels of life expectancy may be a result of the high prevalence of undernourishment, HIV and tuberculosis (TB), which was much higher than that of the world averages (see Table 3.3). Although Nigeria shows a HIV prevalence rate lower

than the prevalence rate in sub-Saharan Africa, it has the second highest number of people living with HIV/AIDS in sub-Saharan Africa, after South Africa, at the end of 2005 (The Henry J. Kaiser Family Foundation 2007). A national report, the Nigeria UNGASS Report 2007, indicates a slightly higher HIV prevalence rate of 4.4 percent in 2005 and, as depicted in Figure 3.3 below, Nigeria shows a decline in prevalence after 2001.

Figure 3.3. HIV prevalence trend in Nigeria (1991-2005)



Source: Nigeria UNGASS Report 2007 (p. 14)

The prevalence of undernourishment in 2004, and HIV among people aged 15 to 49 years and TB in 2005 was lower in Nigeria than many countries in sub-Saharan Africa in the same years (see Table 3.3 below).

Poverty levels in Nigeria

Nigeria has astonishingly high poverty levels with a reported 92.38 percent of the total population living on less than two dollars a day in 2003, a level much the same as that in 1996 (93.29 percent). The country's high levels of poverty is much higher than that of sub-Saharan Africa and the average for low and middle income countries in 1996 (76.42% and 55.52% respectively) and 2002 (73.81% and 50.69% respectively) (see Table 3.2 below). The Human Development Report 2007/8 reported a much lower level of poverty when measured at the national poverty line with 34.1 percent of the total population living at the national poverty line for the most recent date available in the period 1990 to 2004. Inequality, however, declined in 2003 in comparison to 1996. The country's GINI index dropped from 51.95 in 1996 to 43.70 in 2003.

Table 3.2: Poverty in Nigeria and selected regions, 2007

Indicators	Nigeria		Low and middle income		Sub-Saharan Africa	
	Year	%/Value	Year	%/Value	Year	%/Value
GINI index	1996	51.95	..	..	..	..
	2003	43.70	..	..	..	..
Poverty headcount ratio at $1 a day (PPP)	1996	77.88	1996	22.66	1996	47.72
(% of population)	2003	70.82	2002	20.13	2002	42.63
Poverty headcount ratio at $2 a day (PPP)	1996	93.29	1996	55.52	1996	76.42
(% of population)	2003	92.38	2002	50.69	2002	73.81

Data source: World Bank online database 2007

In 2004, Nigeria spent only 4.6 percent of its GDP on health, that is, 23.0 US dollars per capita. Although this expenditure is similar to the average for low income countries (4.7% of GDP and 23.8 US$ per capita), Nigeria's expenditure on health is about 1.7 and 5.5 percent less than the averages for sub-Saharan Africa and the world respectively. The country's expenditure in 2004 did not change much since 2000 (4.3% of GDP and 18.0 US$ per capita). In 2003, it did not reach the level of one physician per 1,000 people and only 35.2 percent of the total number of births were reported to have been attended by skilled staff, that is, nearly half of the world average in 2005 (62.9%). The low number of physicians may have been affected by 'brain drain'. Bhargava and Docquier (2007) reported a total stock of 3,720 Nigerian physicians living abroad in 2003, increasing to 4,065 in 2004. And according to Clemens and Pettersson (2006 cited in the World Bank's Migration and Remittances Factbook 2007), 12,579 or 11.7 percent of the nurses trained in the country were living abroad in 2000.

Table 3.3: Health and poverty: Nigeria and selected regions

	Health expenditure				Physicians		Births attended by		Prevalence of		HIV	Tuberculosis	
	Total		Per capita		(per 1,000 people)		skilled health staff		undernourishment		Prevalence	Prevalence	
	(% GDP)		(PPP US$)				(% of total)		(% of total population)		(% aged 15-49)	(per 100,000 people)	
Country/Regions	2000	2004	2000	2004	Year	Number	Year	%	1997	2004	2005	1995	2005
Nigeria	4.3	4.6	18.0	23.0	2003	0.28	2003	35.2	9.0	9.0	3.9	184.8	282.6
Low income countries	4.2	4.7	16.5	23.8	2004	0.47	2005	40.9	25.2	24.3	1.7	195.0	219.9
Sub-Saharan Africa	5.9	6.3	30.3	45.0			2005	44.7	30.0	30.0	5.8	242.4	348.4
World	9.3	10.1	477.8	648.8	1998	1.60	2005	62.9	14.7	13.9	1.0	128.7	136.4

Data source: World Bank online database 2007

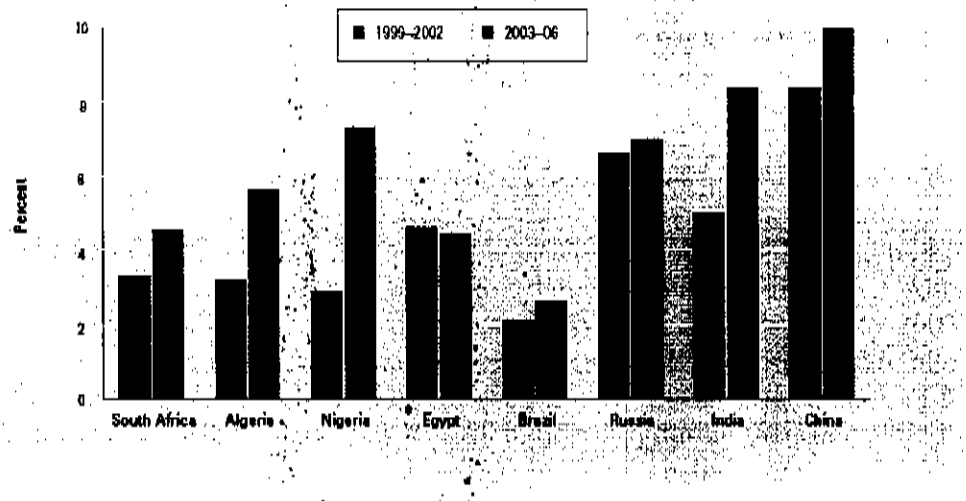
The indicators reported above show that Nigeria, which accounts for about 18 percent of the population in sub-Saharan Africa, has much to improve in overall human development. As it will be shown subsequently, the country shows better performance in economic development as one of the largest economies in Africa, forming part of the SANE economies (consisting of South Africa, Algeria, Nigeria and Egypt). Pillar 1 of the four pillars critical for the knowledge economy, that is, the country's macro-economic environment will now be reported.

Pillar 1: An economic climate conducive to the exposure to, and use and creation of knowledge technologies...

The macro-economic environment

Nigeria and South Africa are the two sub-Saharan African countries forming part of the SANE economies, a group consisting of the four largest economies in Africa. Although Nigeria had the lowest average growth in real GDP in the period 1999 to 2002 (i.e. 2.8%), its economy grew at a faster rate than the other SANE countries in the following period, 2003 to 2006 (averaging 7.3%) (Kasekende et al. 2007). It also showed higher rates than two of the BRIC economies, Brazil and Russia, during the same period. This growth is attributed to the increase in oil prices, as Nigeria is the largest oil producer in Africa and the sixth largest oil exporter in the world (Kasekende et al. 2007). According to Kasekende et al. (2007), Nigeria's oil reserves are expected to last 40 years.

Figure 3.4. Nigeria and the other SANE economies' average real GDP growth rates in comparison to the BRIC economies, 1999–2002 and 2003–06

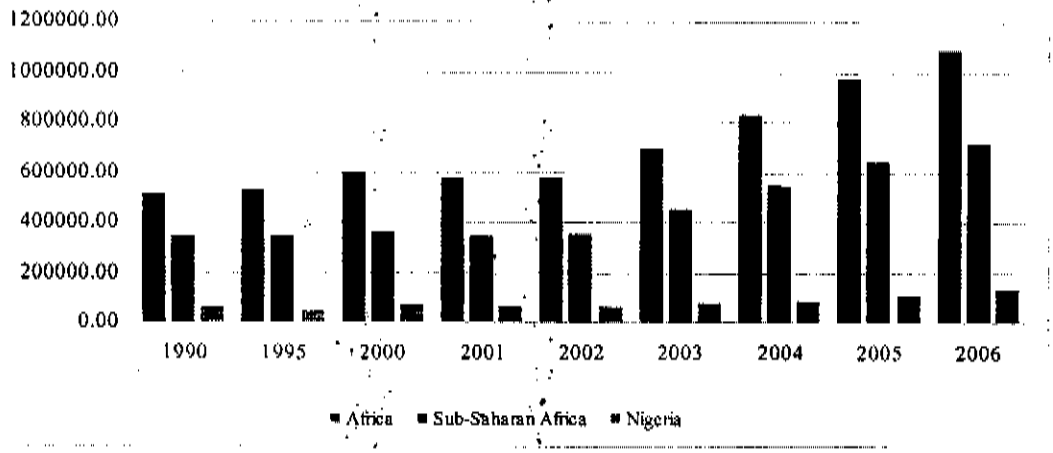


Source: Economic Indicator: AfDB Statistics Department, World Bank *Africa Live Database*, IMF *World Economic Outlook* September 2006.
Note: For the BRIC economies, the average of real GDP growth is calculated for the period 2003–05.

Source: Kasekende et al. (2007)

In 2006, Nigeria accounted for 12.16 percent of the total nominal GDP for Africa and 18.47 percent of sub-Saharan Africa's total nominal GDP. These shares of GDP were nearly half of South Africa's shares of 22.71 percent and 34.48 percent respectively (see Table A2 in the appendix).

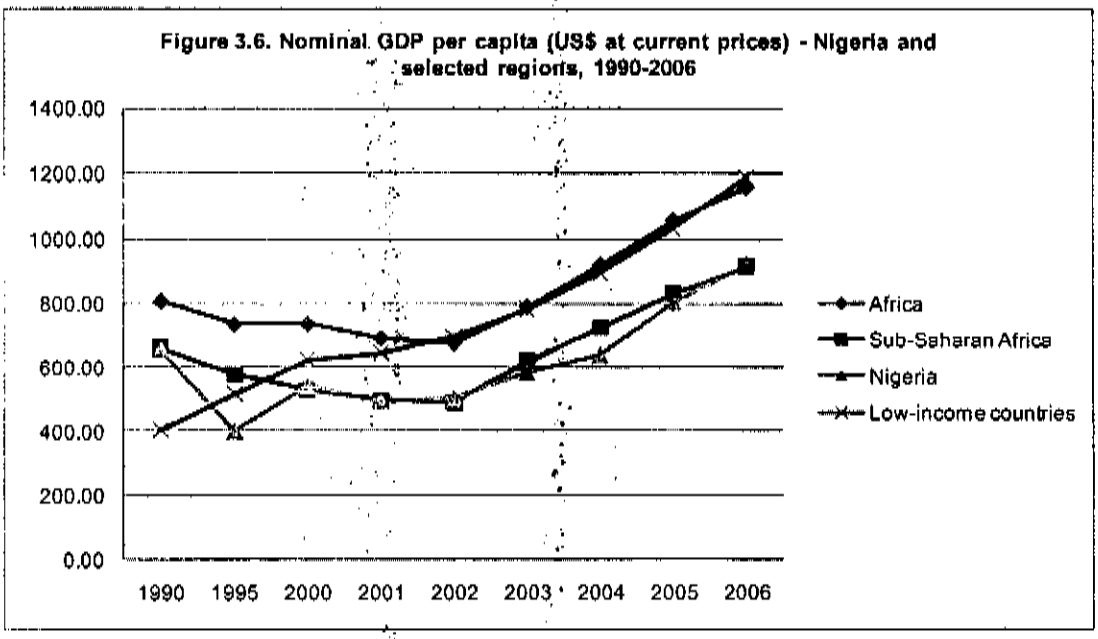
Figure 3.5. GDP, US Dollars at current prices in millions, Nigeria, sub-Saharan Africa and Africa, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Nigeria more than doubled its average annual growth in real GDP in the period 2000 to 2005 (6.57%) in comparison to its average growth rate in the period 1995 to 2000 (2.94%). The country's annual growth rate during the period 1996 to 2006 peaked at 9.57 percent in 2003, which slowed to 5.32 percent in 2006. The African Economic Outlook (2007) attributes Nigeria's improved economic performance to the increasing global oil prices and gains resulting from economic reforms due to the National Economic Empowerment and Development Strategy (NEEDS). Figure 3.6 and Figure 3.7 below, illustrate Nigeria's GDP growth trends between 1989 and 2007, and 1995 and 2007.

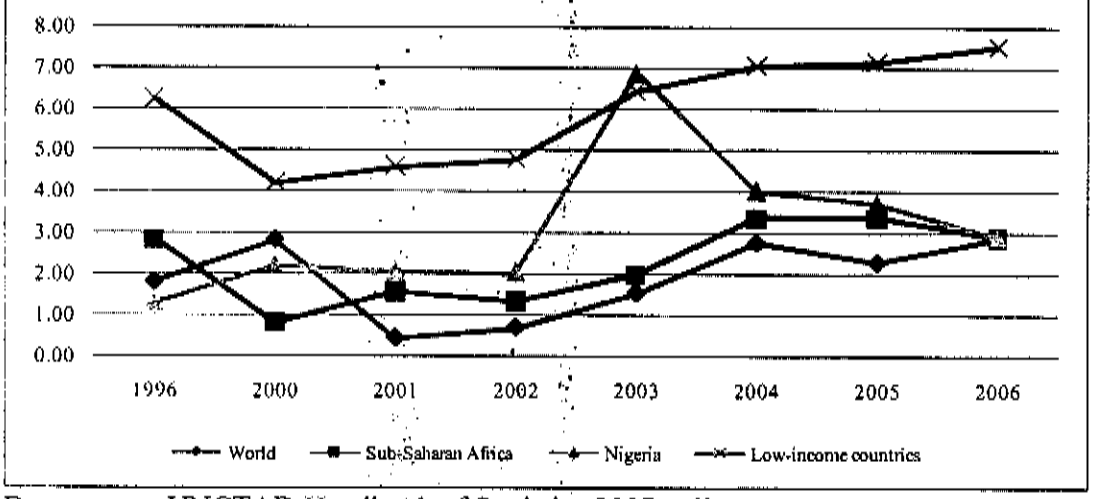
Figure 3.6. Nominal GDP per capita (US$ at current prices) - Nigeria and selected regions, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Nigeria's nominal GDP per capita fell below that of the averages for the Africa region and showed similar performance to that of sub-Saharan Africa over the 16-year period 1990 to 2006. Although the country outperformed most low income countries in per capita levels in 1990, the latter increased in growth consistently during the period, and Nigeria fell below the low income countries rate per capita in the early 1990s.

Figure 3.7. GDP per capita, annual average growth rates, 1996-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Figure 3.7 above illustrates the country's annual average growth rate in GDP per capita for the 10-year period 1996 to 2006. Nigeria's per capita annual growth rate increased significantly from 0.20 percent, during the period 1995 to 2000, to 3.94 percent during the period 2000 to 2005. Growth rates during this period have however been inconsistent, with growth increasing sharply, peaking in 2003 and then dropping sharply in 2004, after which annual growth per capita began to decline again. Nigeria has shown growth rates per capita higher than that of sub-Saharan Africa and the world since 2001, but has not kept pace with most other low income countries.

Table 3.4 Selected macro-economic indicators - Nigeria

	1995	2000	2005	2007	2008
GDP, constant prices (billion, national currency)	3,961.89	4,676.39	6,156.72	6,785.09	7,329.82
GDP, current prices (billion, US $)	35.475	45.737	98.564	126.746	148.611
GDP, constant prices (annual % change)	2.3	5.4	7.2	4.3	8
GDP per capita, current prices (US$)	318.814	357.157	674.071	825.039	943.777
GDP based on PPP (% share of world total)	0.257	0.252	0.274	0.279	0.281
Gross National Savings (% GDP)	..	..	..	..	..
Current Account Balance (% GDP)	-4.2	11.7	9.3	1.8	6
Inflation, average consumer prices (ann. % change)	72.9	6.9	17.8	5.3	7.4

Data source: IMF World Economic Outlook Database October 2007

Table 3.4 presents selected macro-economic indicators, including forecast data for 2007 and 2008, provided by the International Monetary Fund (IMF) (there are slight discrepancies between the IMF data and that provided by UNCTAD reported previously). It is forecast that Nigeria will improve in economic performance in 2008, with GDP in 2008 expected to be 1.5 times higher than its GDP in 2005. GDP per capita is also expected to increase. Nigeria accounts for a very small share of the world's total GDP at purchasing power parity, which is expected to continue to increase gradually, remaining under 0.3 percent.

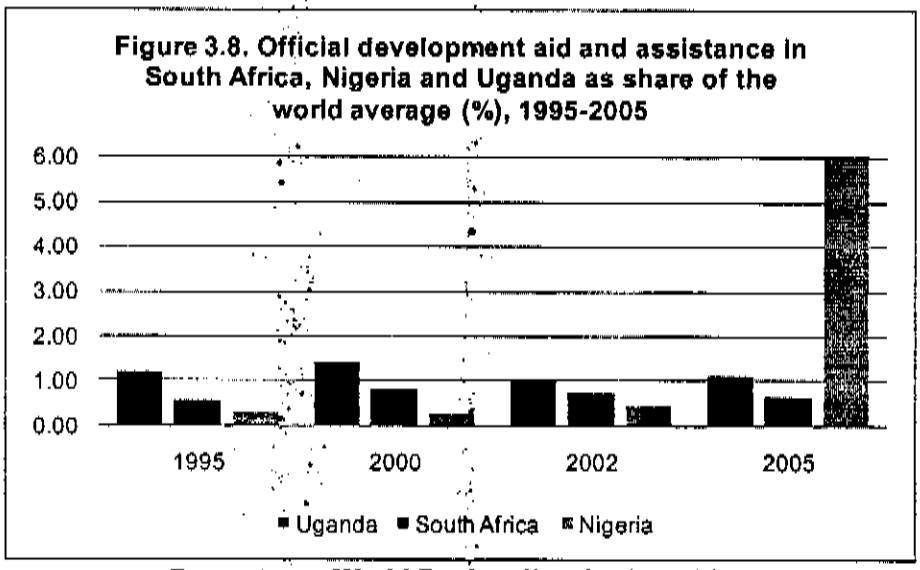
Nigeria had a widening current account deficit of 9.3 percent in 2005 that is expected to decrease to around six percent in 2008 according to the IMF forecast (see Tables 3.4 above).

As shown in Table 3.5 and Figures 3.8 and 3.9 below, official development aid in Nigeria increased sharply in 2005 in comparison to aid values in previous years. Nigeria's share in total aid granted to sub-Saharan Africa and the world total thus also showed a sharp increase to 19.73 percent and 6.05 percent respectively in 2005, and was significantly higher than aid in South Africa and Uganda.

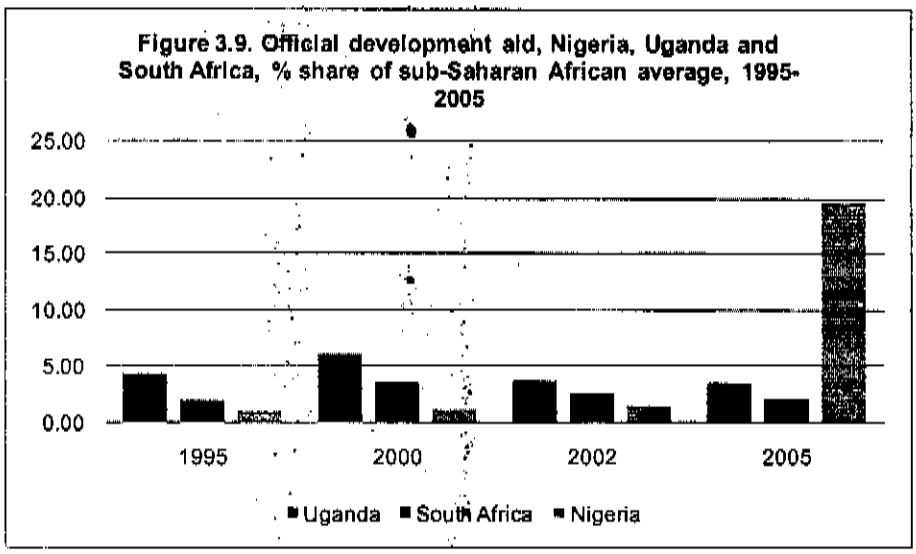
Table 3.5 Development aid [illegible] Nigeria [illegible] South Africa

Indicators	Nigeria				Sub-Saharan Africa			
	1995	2000	2002	2005	1995	2000	2002	2005
Aid (% of GNI)	0.81	0.43	0.72	7.42	6.08	4.09	5.71	5.54
Aid per capita (current US Dollars)	2.03	1.48	2.39	48.94	32.02	19.90	27.25	43.90
Official development assistance and official aid (current US Dollars) ('000)	210,900	173,700	294,030	6,437,310	18,715,950	13,194,050	18,924,730	32,620,150
Aid % of world average	0.31	0.30	0.44	6.05	27.76	22.84	28.34	30.67
External debt, total (DOD, current US Dollars)	34,092,471	31,354,920	30,475,990	22,178,282	235,283,374	211,212,562	211,670,464	214,840,699

Data source: World Bank online database 2007



Data source: World Bank online database 2007



Data source: World Bank online database 2007

Due to the country's higher economic growth in recent years, Nigeria has been able to gradually pay off its external debt. The decrease in external debt is also attributed to debt relief received from the Paris Club of creditor nations, which reduced Nigeria's debt by 60 percent (amounting to about $ 18 billion dollars) (African Economic Outlook 2007). Nigeria's share of sub-Saharan Africa's total external debt was 14.49 percent in 1995, about five percent higher than its share in 2005 (10.32%).

Openness: Trade

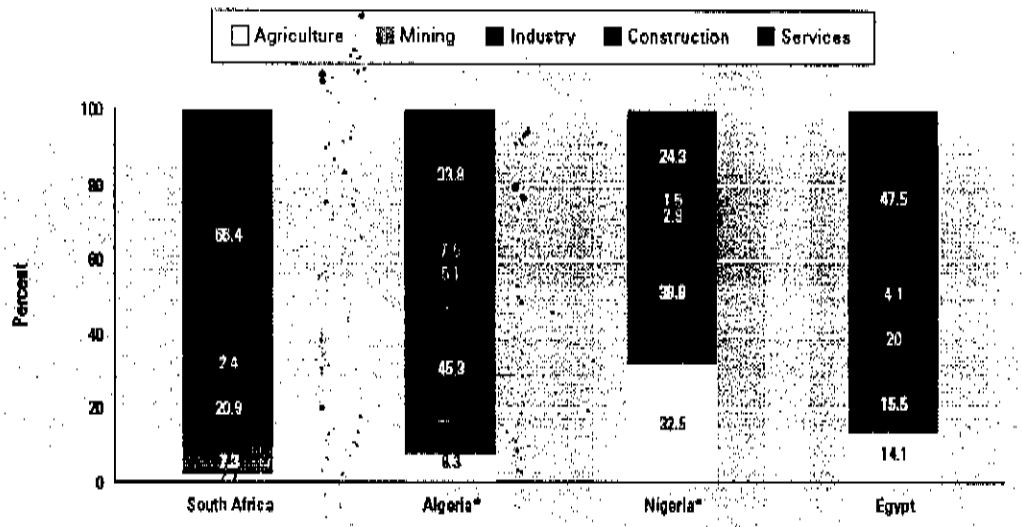
Nigeria's total value of imports and exports in 2006 was slightly lower than in 1990, and were the lowest in 2000 and 2002 (see Table 3.5 below). The country's share of the total value of exports in sub-Saharan Africa in 1990 (39.31%) declined significantly in 2006 (16.75%). Its share of the total value of imports in sub-Saharan Africa in 1990 (29.89%) also declined in 2006 (10.81%). Thus, Nigeria's share of the total exports in sub-Saharan Africa showed a more significant decline in comparison to the drop in imports.

	1990	2000	2002	2005	2006
World					
Gross National Income	22,644,691	31,874,724	32,813,530	44,664,187	48,290,612
Gross capital formation	5,233,919	7,119,261	6,832,953	9,956,231	10,968,066
Gross Fixed capital formation	5,038,329	6,904,770	6,739,880	9,715,788	10,726,170
Exports of goods and services	4,416,844	8,018,553	8,137,642	12,924,248	14,936,923
Imports of goods and services	4,473,221	7,978,734	8,078,063	12,801,579	14,699,058
Sub-Saharan Africa					
Gross National Income	311,479	340,587	332,354	601,947	671,573
Gross capital formation	51,815	55,576	53,586	114,467	132,571
Gross Fixed capital formation	52,474	53,985	53,610	110,287	130,174
Exports of goods and services	114,939	124,120	108,943	210,626	249,946
Imports of goods and services	101,399	101,998	107,858	199,866	231,115
Nigeria					
Gross National Income	45,835	58,969	57,847	99,474	116,374
Gross capital formation	4,731	4,736	4,150	13,569	15,776
Gross Fixed capital formation	4,654	4,727	4,144	13,560	15,766
Exports of goods and services	45,177	34,845	18,137	35,534	41,864
Imports of goods and services	30,308	13,236	15,797	21,430	25,004
Low-income countries					
Gross National Income	1,238,986	2,313,766	2,666,930	4,115,327	4,811,485
Gross capital formation	352,608	671,306	819,426	1,452,589	1,723,089
Gross Fixed capital formation	278,133	637,766	781,825	1,393,868	1,685,301
Exports of goods and services	260,507	602,706	678,362	1,386,600	1,764,701
Imports of goods and services	242,982	548,200	651,019	1,303,304	1,600,734
Developing economies					
Gross National Income	3,764,651	6,671,277	6,739,412	10,110,322	11,729,358
Gross capital formation	985,237	1,690,098	1,721,831	2,843,501	3,272,019
Gross Fixed capital formation	877,592	1,598,413	1,640,175	2,703,083	3,183,333
Exports of goods and services	1,045,647	2,443,203	2,471,716	4,400,522	5,261,183
Imports of goods and services	996,524	2,255,186	2,283,688	3,910,922	4,598,423

Data source: UNCTAD Handbook of Statistics 2007 online

As Africa's largest oil producer, Nigeria's economy displays a dichotomy between its oil and non-oil producing sectors (Kasekende et al. 2007). As shown in Figure 3.10 below, agriculture makes up the largest part of the non-oil sector, and Nigeria's economy has the largest portion of agriculture in comparison to the other SANE countries.

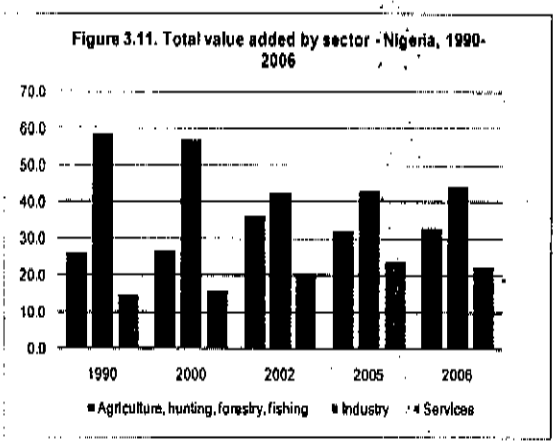
Figure 3.10. Sector contribution to the GDP of Nigeria and the other SANE economies (2005)

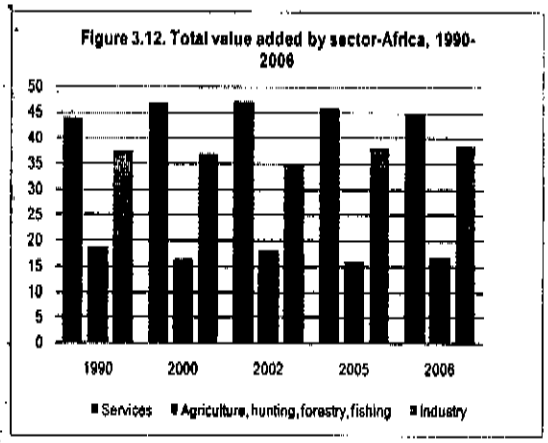


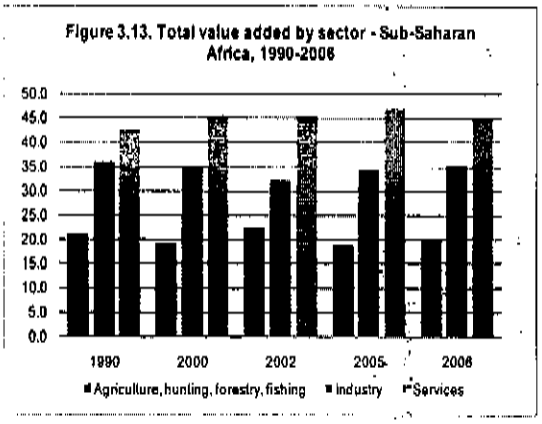
Source: Reserve Bank of South Africa; Algerian Ministry of Finance; Central Bank of Nigeria, December 2005; Central Bank of Egypt; AfDB Statistics Department.
Note: Industry excludes petroleum. * Mining (petroleum).

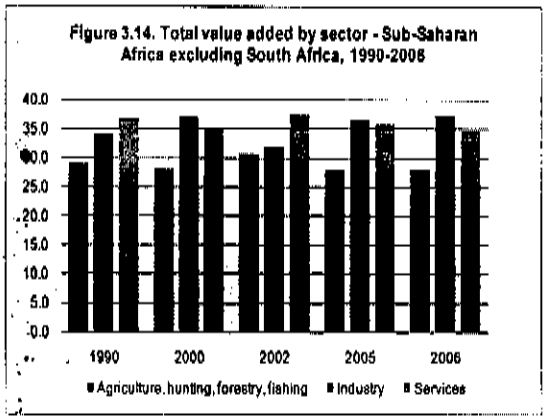
Source: Kasekende et al. (2007, p. 53)

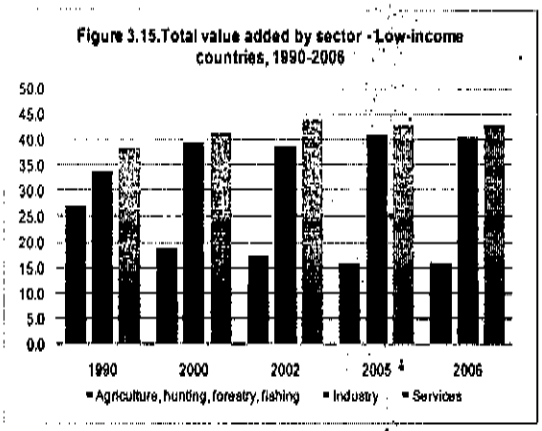
As illustrated in Figures 3.11 to 3.16, the share of agriculture in Nigeria's economy has increased since the 1990s and its share of industry decreased. This is in contrast to the trend in most low income countries and the world. The agricultural share of sub-Saharan Africa's economy also declined, but remained much the same when South Africa was excluded. In 2006, the share of agriculture in Nigeria's economy was 10 times larger than that of South Africa, and the services sector was nearly three times smaller than the services sector in South Africa. The size of the services sector is also small in relation to it comparators, but has grown to 22.50 percent in 2006.

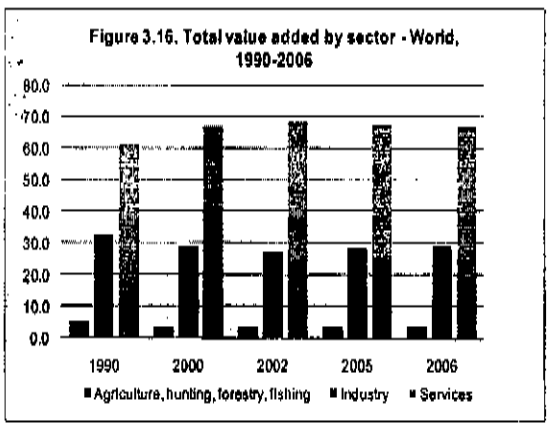








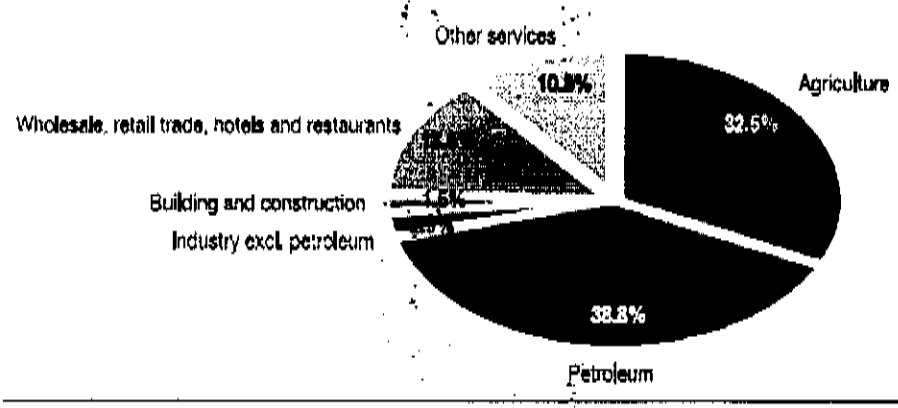




Data source: UNCTAD Handbook of Statistics 2007

In contrast to the South African economy, Nigeria's economy is dominated by primary commodities with petroleum making up about two fifths of the economy and agriculture almost about a third.

Figure 3.17. GDP by Sector (%) – Nigeria, 2005



Source: Authors' estimates based on National Institute of Statistics data.

http://dx.doi.org/10.1787/141527352238

Source: African Economic Outlook 2007

Trade in services increased significantly in 2005 in comparison to the 1990s, with imports higher than exports. In 2005, services exports were fourfold that of 1990, and services imports increased threefold.

Table 3.6. Openness: Trade in services in Nigeria and selected regions
Value (millions of dollars) and share in total (%)

	1990		2000		2002		2005		2006	
Exports	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**
World	830,805	100.0	1,529,340	100.0	1,640,038	100.0	2,494,520	100.0	2,735,658	100.0
Developing economies	154,347	18.6	353,258	23.1	366,925	22.4	593,426	23.8	669,748	24.5
Africa	21,474	2.6	32,910	2.2	36,149	2.2	59,931	2.4	65,203	2.4
Sub-Saharan Africa	11,192	1.3	16,207	1.1	18,195	1.1	30,981	1.2	33,346	1.2
Sub-Saharan Africa (excluding South Africa)	7,785	0.9	11,161	0.7	13,210	0.8	19,824	0.8	21,713	0.8
Low income	32,533	3.9	83,642	5.5	92,725	5.7	179,031	7.2	210,199	7.7
Nigeria	965	0.1	1,833	0.1	2,524	0.2	4,164	0.2	..	..
Imports										
World	860,477	100.00	1,518,794	100.0	1,624,975	100.0	2,404,156	100.0	2,616,583	100.0
Developing economies	184,114	21.40	397,846	26.2	414,326	25.5	641,835	26.7	718,693	27.5
Africa	29,960	3.48	39,866	2.6	44,051	2.7	74,407	3.1	82,153	3.1
Sub-Saharan Africa	21,176	2.46	26,936	1.8	30,503	1.9	53,241	2.2	59,074	2.3
Sub-Saharan Africa (excluding South Africa)	17,438	2.03	21,114	1.4	24,999	1.5	41,087	1.7	44,991	1.7
Low income	39,377	4.58	106,685	7.0	125,102	7.7	207,430	8.6	239,197	9.1
Nigeria	1,976	0.23	3,300	0.2	4,922	0.3	7,321	0.3	..	..

Data source: UNCTAD Handbook of Statistics 2007 online

Merchandise exports and imports grew at a similar average annual rate during the period 1990 to 2000, but in the following period 2000 to 2005, exports grew at a faster rate than the imports (16.7% and 10.7%). Trade in South Africa showed the opposite trend with merchandise imports growing at a faster rate than merchandise exports. Nigeria accounts for 21.88 percent of the total exports in sub-Saharan Africa and only 11.96 percent of the imports, but the country's share in the total imports and exports in sub-Saharan Africa only increased by about two percent from 1990 to 2006. The country's share in world trade is negligible, and is smaller than South Africa's presence in world trade.

Table 3.7: Openness: Merchandise trade – Nigeria (million [illegible]ra) and share in World total (%)

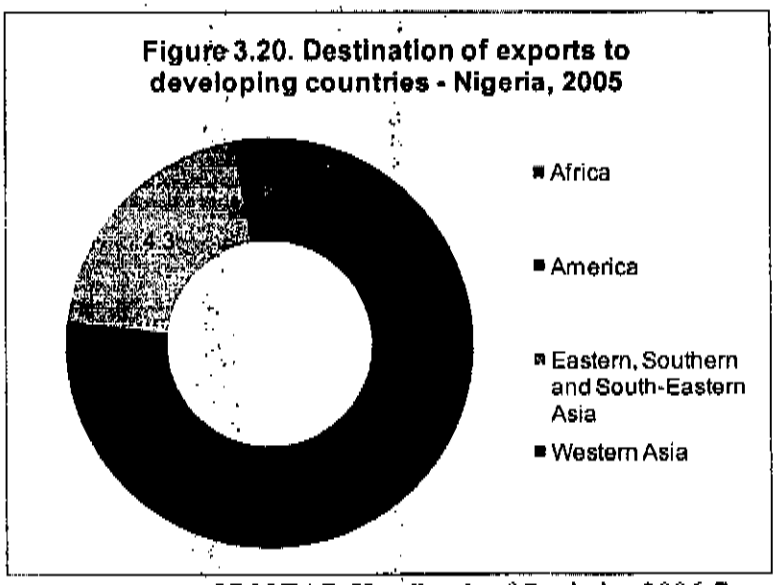
	Annual avg. growth rate		1990		2000		2002		2005		2006	
Exports	1990-2000	2000-2005	Value	%	Value	%	Value	%	Value	%	Value	%
World	6.8	11.3	3 478 571	100.00	6 444 106	100.00	6 472 603	100.00	10 440 780	100.00	11 982 932	100.00
Developing economies	9.0	14.1	842 883	24.23	2 044 590	31.73	2 052 444	31.71	3 750 526	35.92	4 408 951	36.79
Africa	3.3	16.3	106 993	3.08	147 173	2.28	146 432	2.26	298 026	2.85	332 801	2.78
Sub-Saharan Africa	4.0	16.2	66 312	1.91	94 867	1.47	96 580	1.49	190 889	1.83	212 937	1.78
Sub-Saharan Africa (excluding South Africa)	4.8	17.6	42 744	1.23	64 884	1.01	66 856	1.03	139 264	1.33	159 767	1.33
Low income	11.3	19.8	181 965	5.23	518 933	8.05	592 467	9.15	1 214 842	11.64	1 507 576	12.58
Nigeria	3.2	16.7	13 671	0.39	21 174	0.33	18 673	0.29	42 277	0.41	(e)46 590	(e)0.389
Imports												
World	6.7	11.2	3 590 163	100.00	6 642 126	100.00	6 640 572	100.00	10 712 215	100.00	12 203 386	100.00
Developing economies	8.5	13.3	800 081	22.29	1 904 395	28.67	1 911 101	28.78	3 359 059	31.36	3 915 401	32.09
Africa	4.4	14.3	97 037	2.70	130 973	1.97	142 179	2.14	246 931	2.31	278 432	2.28
Sub-Saharan Africa	5.7	15.7	52 704	1.47	83 581	1.26	91 354	1.38	165 665	1.55	188 930	1.55
Sub-Saharan Africa (excluding South Africa)	5.5	14.1	34 305	0.96	53 886	0.81	62 087	0.93	103 360	0.96	119 745	0.98
Low income	9.7	21.3	177 296	4.94	466 373	7.02	549 990	8.28	1 143 944	10.68	1 343 820	11.01
Nigeria	3.1	10.7	5 627	0.16	8 721	0.13	12 442	0.19	15 200	0.14	(e)22 596	(e)0.185

Data source: UNCTAD Handbook of Statistics 2006-7

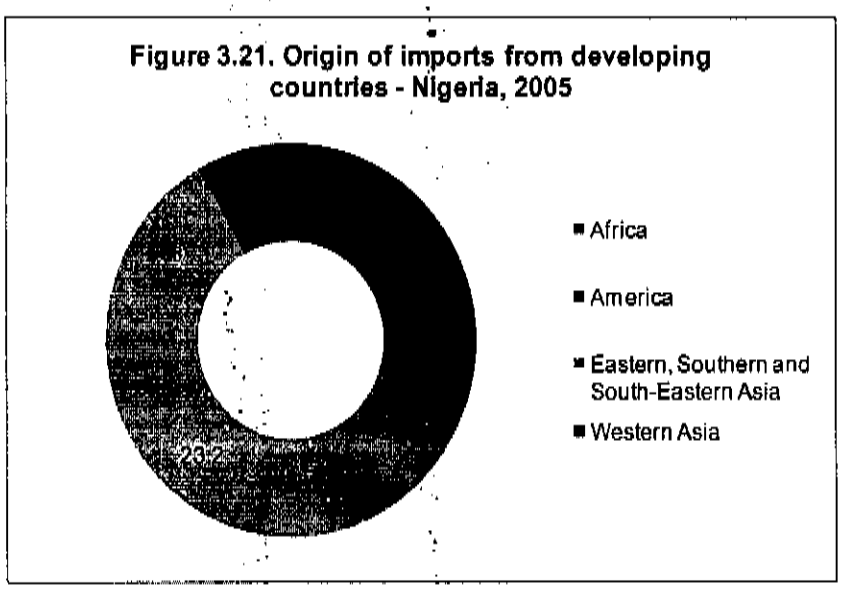
In 2005, more than half of Nigeria's exports to developed countries went to the USA and more than a third to Europe, down 1.7 and 13.9 percent respectively from 1990. About two thirds of the country's imports came from Europe in 1990, and this share was almost half in 2005. In contrast to the large share of exports that went to the USA in 1990 and 2005, only about eight percent of the imports came from this region. In 2005, imports from developed countries (44.5%) decreased to almost half of the imports from the region in 1990 (80.1%).

Data source: UNCTAD Handbook of Statistics 2006-7

Only 21.2 percent of Nigeria's exports went to developing countries in 2005, a significant rise from its share of 7.6 percent in 1990. Like South Africa, the largest share of Nigeria's exports to the developing world went to Africa with this share increasing by only 2.3 percent in 2003. Other significant destinations were America and Eastern, Southern and South-Eastern Asia with exports to these regions increasing by 6.8 and 4.0 percent respectively in 1990. In 2005, imports from developing countries (37.8%) more than doubled from its share in 1990 (16.9%). The largest share of the imports from developing countries in 2005 came from Eastern, Southern and South-Eastern Asia and Africa, with their share of the imports increasing by 11.5 and 5.5 percent from 1990.



Data source: UNCTAD Handbook of Statistics 2006-7



Data source: UNCTAD Handbook of Statistics 2006-7

The figures above indicate that trade shifted slightly towards developing nations from 1990 to 2005. Although the large share of trade with developed economies may indicate the country's openness or exposure to technology transfer from technologically advanced countries, this may be limited considering that Nigeria's trade is dominated by primary goods (or raw materials).

Nigeria's industrial performance:

Nigeria's manufacturing value added (MVA) performance presented in Table 3.8 indicates the country's low level of industrial performance. Although the country had an acceptable average annual growth in MVA during 2000 to 2005, the MVA share of GDP is negligible in comparison to most developing countries and is even lower than the share in sub-Saharan Africa. And MVA per capita is dismal in comparison to most other developing countries, including South Africa with a per capita value of US$ 834. Furthermore, only 1.8 percent of Nigeria's exports were machinery and transport equipment, up from a low 0.2 percent in 1995; and more than a third (38.0%) of its imports was machinery and transport equipment, down from 36.1 percent in 1995 (UNCTAD Handbook of Statistics 2006-7).

Table 3.8. Nigeria - International comparison of industrial performance, 1995-2005

Indicator	Year/Period	Nigeria	Sub-Saharan Africa	Developing countries
MVA, average annual real growth rate (in %)	1995-2000	...	3.2	4.8
	2000-2005	6	3.6	5.2
Non-manufacturing GDP,average annual real growth rate (in %)	1995-2000	2.6	3.6	3.8
	2000-2005	5.8	4.4	4.6
MVA per capita, in constant 1995 US$	1995	15	29	268
	2000	13	30	326
	2005	16	32	455
MVA as percentage of GDP at constant 1995 prices	1995	5.4	9.2	21
	2000	4.8	9	22.4
	2005	4.8	8.8	23.8

Source: UNIDO 2007 (http://www.unido.org)

Openness: FDI flows

In 2006, Nigeria was one of four countries in Africa – including Egypt, Sudan and Tunisia - with FDI inflows higher than 3 billion dollars, which is mainly attributed to cross-border mergers and acquisitions and greenfield investments (UNCTAD World Investment Report 2007).

Cross-border sales increased dramatically in 2006 in comparison to 2004 and 2005. In 2006, the majority (87.78%) of the cross-border sales in West Africa was in Nigeria, and Nigeria's cross-border sales accounted for 16.15 percent of the total in Africa.

Table 3.9. Nigeria – Cross-border merger and acquisition overview (millions of dollars), 1990-2005

	Sales				Purchases			
	1990-2000 (Annual average)	2004	2005	2006	1990-2000 (Annual average)	2004	2005	2006
Nigeria	..	10	43	2 838	2	-	-	21
Memorandum								
Algeria	1	25	-	18	..	-	-	-
Angola	..	-	-	1	..	-	-	-
West Africa	40	1 685	52	3 233	37	-	29	21
Africa	651	4 595	10 509	17 569	1 266	2 718	15 505	11 208
Developing economies	12 277	53 120	94 101	127 372	8 954	37 925	82 426	122 941
World	117 889	380 598	716 302	880 457	117 889	380 598	716 302	880 457

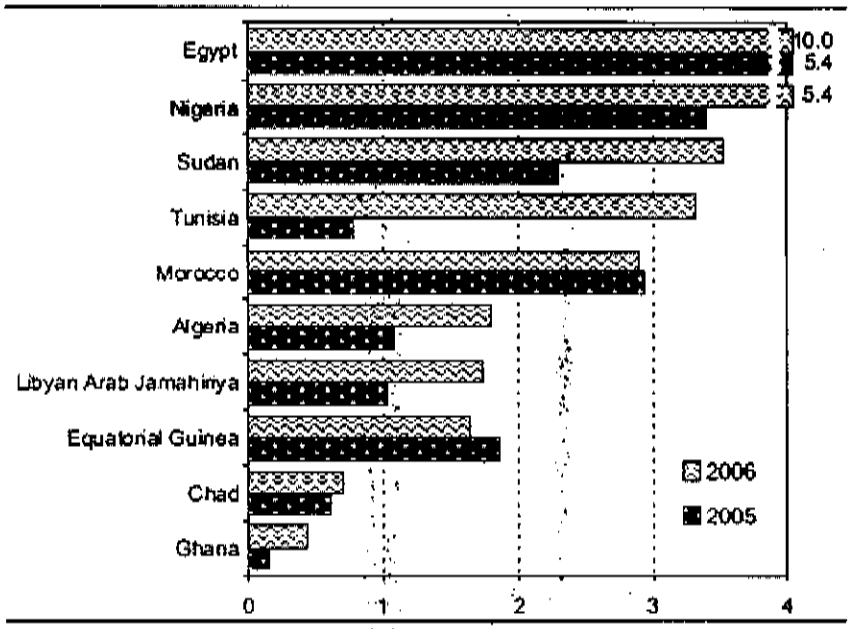
Source: UNCTAD, *World Investment Report 2007*; www.unctad.org/wir or www.unctad.org/fdistatistics
For details, see "definitions and sources" in annex B and annex tables B.4 and 6 in *WIR07*.

Source: UNCTAD, World Investment Report 2007

Nigeria had the fourth highest FDI outflows in Africa in 2006, after South Africa, Morocco and Liberia (UNCTAD, World Investment Report 2007). The increase in FDI inflows in 2006 is attributed to the surge in FDI flows to Africa in the primary sector,

mainly in oil and gas, two of Nigeria's most important natural resources (UNCTAD World Investment Report 2007).

Figure 3.22. Top 10 recipients of FDI[a] in Africa (billions of dollars), 2005-2006



Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics) and annex table B.1.

[a] Ranking based on FDI inflows in 2006.

Source: UNCTAD World Investment Report (2007, p. 37)

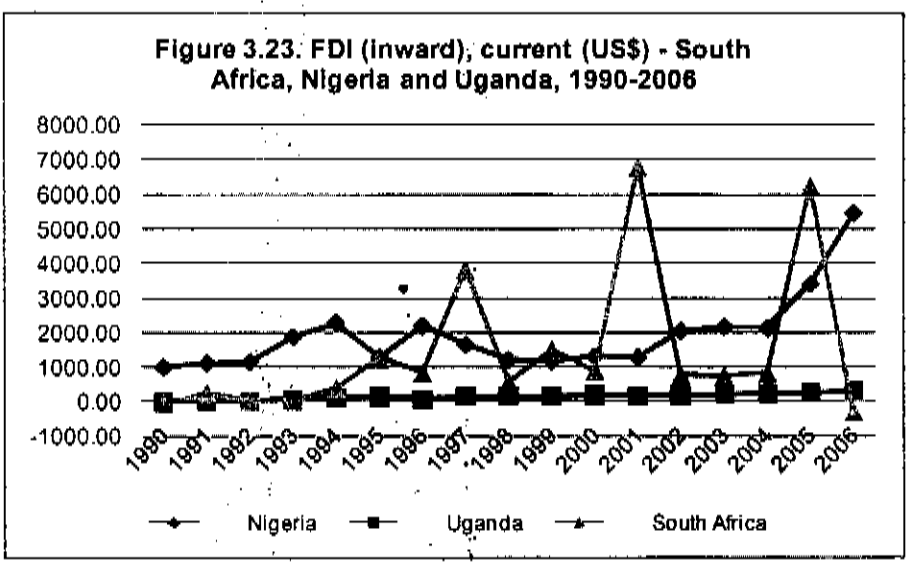
Nigeria's FDI inflows in 2006 accounted for 80 percent of the FDI in West Africa, and was dominated by FDI in its oil industry (mostly from China) (UNCTAD World Investment Report 2007).

Table 3.10. Openness: FDI Flows – Nigeria (millions of [illegible] and percentages)

Country/region		FDI flows					FDI flows (% gross fixed capital formation)			
		1990-2000 Annual avg.	2003	2004	2005	2006	1990-2000 Annual avg.	2004	2005	2006
Nigeria										
	Inward	1 477	2 171	2 127	3 403	5 445	37.5	38.4	49.3	74.8
	Outward	304	167	261	200	228	7.2	4.7	2.9	3.1
Algeria										
	Inward	282	634	882	1 081	1 795	2.4	4.2	4.2	6.6
	Outward	18	14	258	57	35	..	1.2	0.2	0.1
Angola										
	Inward	602	3 505	1 449	- 1 303	- 1 140	32.2	80.4	- 40.1	- 33.3
	Outward	..	24	35	219	93	..	2	6.8	2.7
West Africa										
	Inward	2 094	3 377	3 743	4 997	6 841	19.8	22.6	26.8	34.6
	Outward	477	375	532	591	551	5.3	3.3	3.7	3.4
Africa										
	Inward	6 903	18 677	18 018	29 648	35 544	7.3	12.6	17.8	19.6
	Outward	1 917	1 286	2 059	2 272	8 186	2.2	1.7	1.6	5.1
Developing economies										
	Inward	130 722	178 699	283 030	314 316	379 070	9.3	12.9	12.6	13.8
	Outward	52 836	45 372	117 336	115 860	174 389	3.8	5.5	4.7	6.4
World										
	Inward	495 399	564 078	742 143	945 795	1 305 852	7.8	8.5	10.4	12.6
	Outward	492 622	560 087	877 301	837 194	1 215 789	7.9	10.1	9.2	11.8

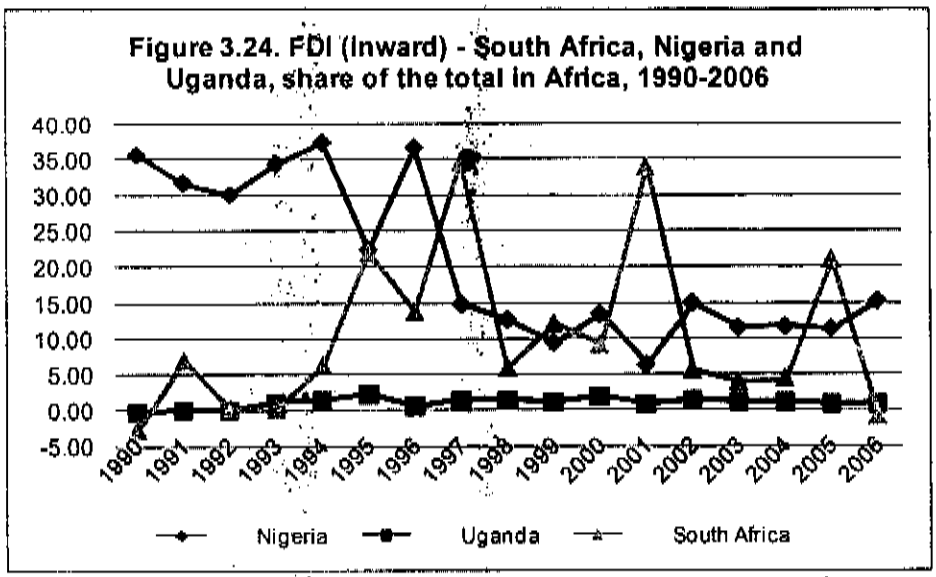
Source: UNCTAD, World Investment Report 2007

As shown in Table 3.10 and Figure 3.23, Nigeria's inward FDI flows increased in real terms between 1990 and 2006, with a sharp increase after 2004.



Data source: UNCTAD, World Investment Report 2007 online

In contrast to Nigeria's increase in real terms, its share of Africa's total inward FDI flows showed a downward trend in the period 1990 to 2006.



Data source: UNCTAD, World Investment Report 2007 online

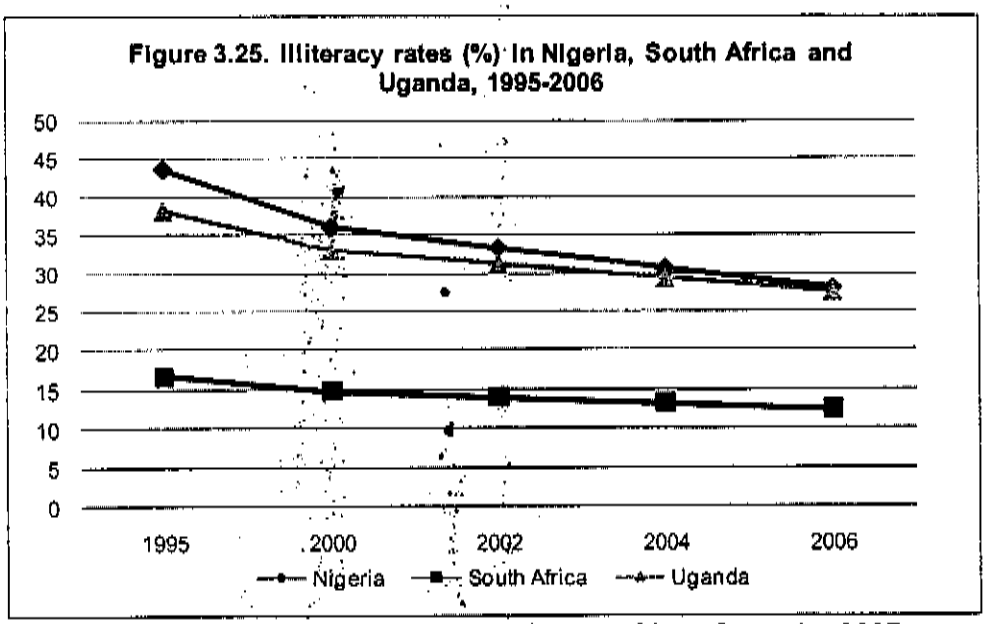
In sum, Nigeria has shown tremendous improvement in recent years and investors have shown renewed interest in the country, particularly due to its large oil reserves. However, Nigeria has low levels of overall human development with relatively high levels of poverty and communicable diseases. Thus, Nigeria's improvement in economic performance in recent years has not resulted in the same level of improvement in human development.

In the following section, indicators of education and human resource capacity in Nigeria will be reported.

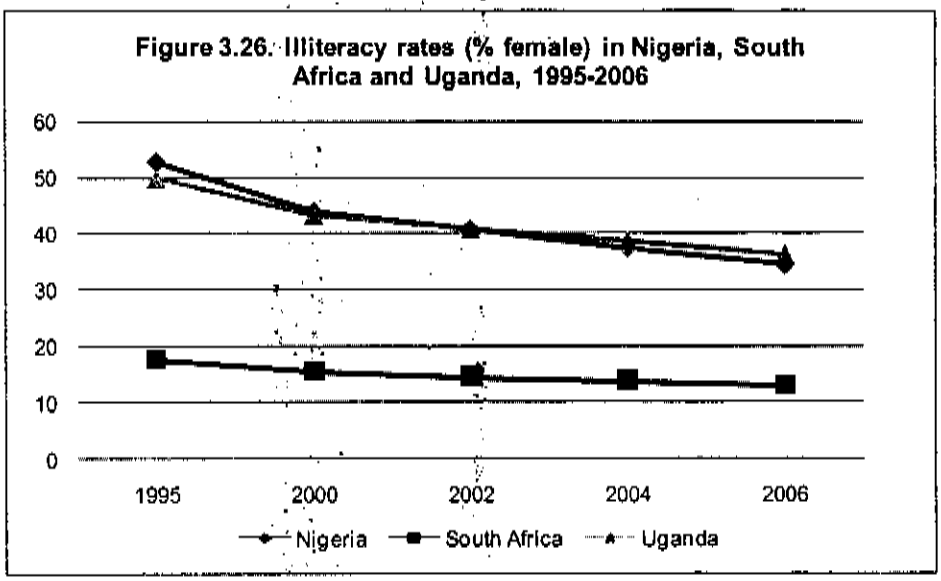
Pillar 2: An educated and skilled population to use, share and create knowledge and technologies...

Education

Illiteracy rates in Nigeria were higher than that of South Africa, but lower than that of Uganda in 1995. The country showed a sharp decline between 1994 and 2001, but after 2001 this decline became more gradual. In 1995, illiteracy among females was almost 10 percent higher than illiteracy in the total population. Although illiteracy among females is decreasing and the gap narrowed, illiteracy among females was 6.3 percent higher than that of the total population in 2006 (see Figures 3.25 and 3.26). The country's illiteracy rate in 2006 dropped by 15.5 percent from a rate of 43.6 percent (almost half of the total population) in 1995. Illiteracy among females dropped by 18.4 percent, but remained high with slightly more than a third (34.4%) of the female population illiterate in 2006.



Data source: AfDB Selected Statistics on African Countries 2007



Data source: AfDB Selected Statistics on African Countries 2007

It can be seen in Tables 3.11 and 3.12 that enrolments at the primary education level were high in comparison to enrolment in secondary education. A large number of children at school-age at the primary education level were not attending school in 1999 and 2005. Only about a third (34.25%) of the school-age population in 2004 had enrolled in secondary education in 2005. Females accounted for slightly less than half of these enrolments.

Table 3.11. Primary education: South Africa, Nigeria and Uganda, and selected regions (age group 6-12 years)

Country/territory	School-age population (000)	Enrolment in primary education: School year ending in 1999		Enrolment in primary education: School year ending in 2005		Out-of-school children (000): School year ending in 1999			Out-of-school children (000): School year ending in 2005			Pupil/teacher ratio: School year ending in 1999	Pupil/teacher ratio: School year ending in 2005
	2004	Total (000)	% F	Total (000)	% F	Total	Male	Female	Total	Male	Female		
Nigeria	21,645	17,907	44	22,267	45	7,189 **	3,158 **	4,031 **	6584 **	2923 **	3661 **	41 **	37
South Africa	7,176	7,935	49	7,444 z	49 z	171	139	32	569 z	321 z	248 z	35	36
Uganda	6,086	6,268	47	7,224	50	...	...	...	...	...	...	...	52
	Sum	Sum	% F	Sum	% F				Sum			Weighted average	
World	641,643	646,731	47	688,285	47	96,459	39,820	56,639	72,124	31,163	40,962	25	25
Developing countries	563,298	560,453	46	607,524	47	92,534	37,859	54,675	68,825	29,386	39,439	27	28
Sub-Saharan Africa	113,594	80,825	46	109,863	47	42,423	19,854	22,569	32,774	14,984	17,789	41	45

(z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Table 3.12. Enrolment in secondary education: South Africa, Nigeria and Uganda, and selected regions

Country/ region	School-age population (000) 2004	Total enrolment: School year ending in 1999 Total (000)	% F	Total enrolment: School year ending in 2005 Total (000)	% F	Enrolment in technical and vocational education: School year ending in 1999 Total (000)	% F	Enrolment in technical and vocational education: School year ending in 2005 Total (000)	% F
Nigeria	18,681	3,845	47	6,398	45	-	-	-	-
South Africa	4,932	4,239	53	4,593 z	52 z	160	44	276 z	40 z
Uganda	4,074	318 **	40 **	760 **	44 **	40 *	30 **	32 **	32 **
	Sum	**Sum**	**% F**	**Sum**	**% F**	**Sum**	**% F**	**Sum**	**% F**
World	775,474	438,570	47	511,936	47	46,955	45	51,100	45
Developing countries	660,691	321,917	46	398,529	47	29,062	46	33,419	46
Sub-Saharan Africa	104,741	21,381	45	33,190	44	1,153	36	2,063	40

Notes: (z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

The pupil-teacher ratio in 1999 declined in 2005 with 37 pupils to one teacher in 2005, which is much higher than the world average and that for developing countries. Although the pupil-teacher ratio in Nigeria was the same as the average in sub-Saharan Africa in 1995, it fell below the average in 2005. This implies an improvement in the conditions of education. However, Nigeria's education system ranks poorly in comparison to other countries in sub-Saharan Africa (regional rank 17), including South Africa (regional rank 5) and Uganda (regional rank 12), and the world (global rank 103) (The Global Campaign for Education 2008). Nigeria ranked particularly low on quality inputs, which measures input into the quality of classroom infrastructure, teaching material and teacher training.

In 2005, Nigeria's tertiary enrolments accounted for more than a third (36.43%) of the total tertiary enrolments in sub-Saharan Africa. In 1999, females accounted for close to half (43.20%) of the enrolments, whereas females accounted for only 34.55 percent in 2005.

Table 3.13. Enrolment in tertiary education: South Africa, Nigeria and Uganda, and selected regions

Country or territory	Total students enrolled (000) School year ending in 1999						School year ending in 2005					
	Total		Male		Female		Total		Male		Female	
Nigeria	699		397		302		1,290	z	844	z	446	z
South Africa	633		292		341		735		334		401	
Uganda	41		27	**	14	**	88	z	54	z	34	z
	Sum						Sum					
World	92,863		48,345		44,517	48	137,769		68,732		69,037	
Developing countries	47,225		27,096		20,129	43	80,150		42,899		37,251	
Sub-Saharan Africa	2,133		1,274		859	40	3,540		2,197		1,343	

(z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Labour force participation

In 2005, two thirds of the total population between the ages of 14 and 65 were employed, with a slight decline in comparison to 1995. Labour force participation in this age group was lower than in Uganda, and the averages for the sub-Saharan African region and the world.

The participation of females, of this age group, in the labour force was very low in 1995 and 2005 with less than half of the total number of females between the ages of 14 and 65 employed. It can be seen in Table 3.15 that the employment of females in Nigeria was much lower than in Uganda and most other countries in sub-Saharan Africa. Females accounted for about a third of the total labour force in both 1995 and 2005.

Table 3.15: Labour force participation - Nigeria, 1995 and 2005

	Nigeria		Uganda		Low income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005	1995	2005
Labor force participation rate, total (% of total population ages 15-64)	66.13	66.33	86.50	84.27	67.92	66.70	75.98	74.36	71.79	70.95
Labor force participation rate, female (% of female population ages 15-64)	49.04	46.59	82.05	81.21	48.63	47.79	64.40	62.56	58.24	57.85
Labor force participation rate, male (% of male population ages 15-64)	87.32	85.80	91.08	87.35	86.52	84.95	87.84	86.29	85.01	83.77
Labor force, female (% of total labor force)	35.97	34.70	47.92	48.27	34.88	34.96	42.76	42.14	39.81	40.08

Data source: World Bank online database 2007

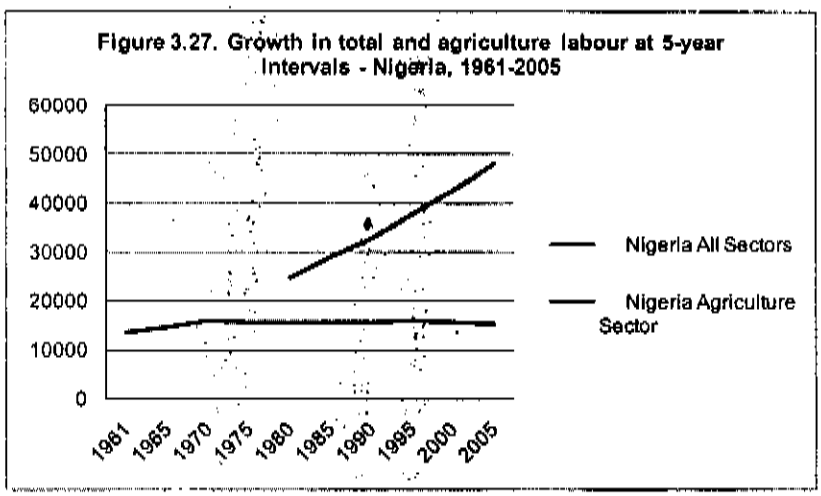
Agriculture labour force

The proportion of the agriculture labour force declined by nearly ten percent in 2005 in comparison to 1995. It can be seen in Figure 3.27 below that employment in agriculture grew in the 1960s, but this growth trend did not continue after 1970. Employment (in real terms) in other sectors, however, grew sharply after 1980.

Table 3.16 Labour force, Agriculture, and % female, and 2005, Nigeria

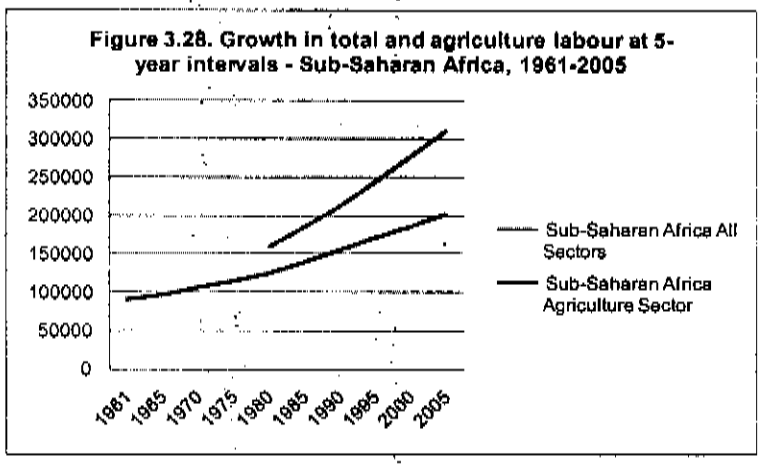
	Nigeria		Low income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005
Labour force (total in thousands)	37,651	47,835	1,616,861	1,924,835	242,702	309,471	2,604,869	3,050,342
Agriculture labour force (total in thousands)	15,634	15,191	1,118,689	1,212,108	170,455	201,546	1,274,611	1,359,910
Agriculture labour force (% of total labour force)	41.52	31.76	69.19	62.97	70.23	65.13	48.93	44.58
Agriculture labour force (total female in thousands)	5,714	5,814	495,171	543,170	80,314	95,759	550,442	598,417
Agriculture labour force (% female)	36.55	38.27	44.26	44.81	47.12	47.51	43.19	44.00

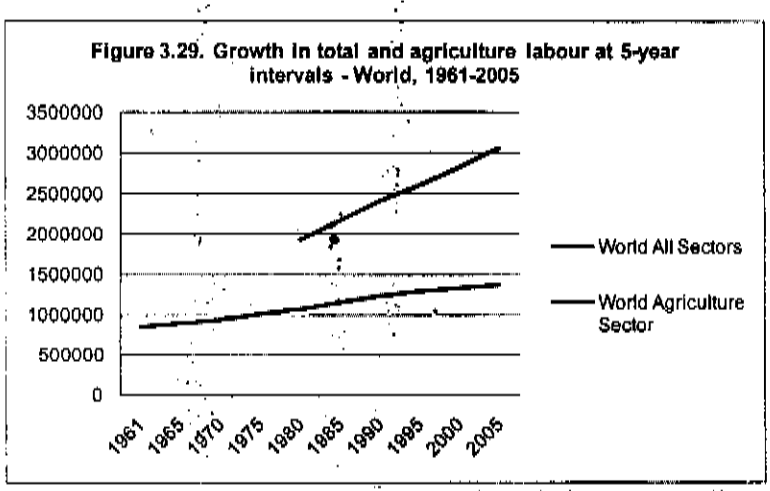
Data source: UNCTAD Handbook of Statistics 2007 online



Data source: UNCTAD Handbook of Statistics 2007 online

The agriculture labour force in Nigeria is not as large as that of most countries in sub-Saharan Africa and the world generally, where employment in this sector continues to grow (see Figures 3.28 and 3.29 below).





Data source: UNCTAD Handbook of Statistics 2007 online

Number of researchers in Nigeria

The number of researchers in Nigeria increased in absolute value and number per million inhabitants between 2000 and 2006. Nigeria's total number of researchers per million inhabitants in 2005 was significantly higher than Uganda's, but significantly lower than South Africa's total. According to UNESCO data, all of Nigeria's researchers are employed in higher education.

Table 3.17. Number of researchers in Nigeria, South Africa and Uganda

Country	Year	Researchers (HC)				Researchers (FTE)				Technicians (HC)				Technicians (FTE)			
		Full-time equivalent (FTE)				Head count				Head count				Full-time equivalent (FTE)			
		Totals	Female	% Female	Researchers (FTE) per million inhabitants	Totals	Female	% Female	Researchers (HC) per million inhabitants	Totals	Female	% Female	Technicians (HC) per million inhabitants	Totals	Female	% Female	Technicians (FTE) per million inhabitants
South Africa	2001	14,182	5,112	36.0%	307	26,913	9,700	36.0%	583	2,952	2,134	8,699	197				
South Africa	2003	14,131	5,365	38.0%	301	30,708	11,658	38.0%	654	...	...	...	...				
South Africa	2004	17,915	6,852	38.2%	379	37,001	14,152	38.2%	784	5,301	2,040	10,340	234				
Uganda	2001	...	...	...	...	568	213	37.5%	23	47 h	301 h	202 h	18 h				
Uganda	2003	...	...	...	...	675	253	37.5%	25	...	...	...	...				
Uganda	2004	...	...	...	...	724	272	37.6%	26	58 h	384 h	261 h	21 h				
Nigeria	2001 a	...	...	...	...	18,867	3,578	19.0%	157	...	...	18,867 h	...				
Nigeria	2002 a	...	...	...	...	18,426	3,359	18.2%	150	...	...	18,426 h	...				
Nigeria	2003 a	...	...	...	...	22,046	4,110	18.6%	175	...	...	22,046 h	...				
Nigeria	2004 a	...	...	...	...	23,871	4,132	17.3%	185	...	...	23,871 h	...				
Nigeria	2005 a	...	...	...	...	27,482	4,624	16.8%	209	...	...	27,482 h	...				

Notes and symbols:

...	Data not available
h	Head count instead of Full-time equivalent
k	Country covered by RICYT
l	Includes Other supporting staff
r	Includes Private non-profit
s	Included elsewhere
x	Country covered by OECD

Data source: UNESCO online database 2008

In sum, Nigeria has shown improvement at the basic education level, as shown by the gradual decline of illiteracy rates and the high enrolments in primary education. The country does, however, have much to improve with regard to enrolment beyond the primary education level and the quality of education. Nigeria could also decrease unemployment, particularly among females.

The distribution of enrolments in tertiary education, by study field, and expenditure on education could not be reported as the data is unavailable.

In the following section, indicators describing Nigeria's basic and ICT infrastructure will be reported

Pillar 3: Dynamic infrastructure, successful diffusion of 'old' and 'new' technologies...

'Old' technologies

Selected indicators of basic infrastructure are presented in Table 3.18 below. As Nigeria's performance on the indicators show, the country has very poor development of basic infrastructure. Nigeria did not show much improvement in basic infrastructure over the 15-year period considered.

The share of the total population in Nigeria with access to improved sanitation was larger than the share of the population with access in sub-Saharan Africa and low-income countries. However, fewer people in Nigeria had access to improved water sources, in 2004, than in sub-Saharan Africa and low-income countries. In Nigeria less than half of the population had access to improved sanitation and water resources in 1990 and 2004. It is apparent that improving access to improved sanitation takes place at a slower rate than improving access to water in sub-Saharan Africa, low-income countries and the world generally. While Nigeria's comparators showed higher access and an improvement in access to water than access to improved sanitation, this was not the case in the Nigeria.

The country also has poor energy infrastructure as indicated by the very large proportion of the total population without electricity. Nigeria accounts for 13 percent of the population living without electricity in sub-Saharan Africa in 2005.

With regard to transportation infrastructure, less than a fifth of the country's roads are paved and this share declined by 3.79 percent in the period 2000 to 2005. The country did, however, increase the number of registered carrier departures in 2005 in comparison to 1995. The number of registered carriers was not however substantial.

Table 3.18. Diffusion of old technologies - South Africa, Nigeria, Uganda and selected regions

	Sanitation and water				Energy			Roads				Railways						Air transport	
	Population using improved sanitation (%)		Population using improved water source (%)		Electricity consumption per capita (kilowatt-hours)		Population without electricity (millions)	Total network (km)		Paved (% of total roads)		Railways total route (km)		Goods transported (million ton-km)		Passengers carried (million passengers-km)		Registered carrier departures worldwide	
Country/Regions	1990	2004	1990	2004	2004	1990-2004	2005	1995	2001-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2005	1995	2005
South Africa	69	65	83	88	4815[b]	20.8[b]	14	331,265	364,131	41.5	17.2999992	25,565	20,047	95,591	108,513	9,675	991	74,300	148,146
Nigeria	39	44	49	48	157	-4.9	71	193,196	193,200	18.8	15	3,557	3,526	97	77	1,734	174	6,600	8,356
Uganda	42	43	44	60	63	61.5	25	..	70,746	..	23	1,250	259	236	218	..	..	280	317
Low income countries	21	38	64	76	449	..	..	4,051,881	239,226	13.8	..	..	..			..	..	551,100	714,157
Middle income countries	46	61	76	84	2,039	..	..	2,927,700	1,146,177	48	50.5	..	..	6,516	10,311	1,899	1571	1,702,300	2,014,002
Sub-Saharan Africa	32	37	46	55	478	..	547	1,422,796	352,527	15.5	12.1000004	..	..	..	..	..	..	278,900	378,978
World	49	59	76	83	2,701	..	1,577	25,962,342	239,226	40.7	36.2999992	..	..	..	5,543	1,848	2277.5	18,008,200	24,877,724

Note: a Data refer to the most recent year available during the period specified.

b Data refer to the South African Customs Union, which includes Botswana, Lesotho, Namibia and Swaziland.

c Data obtained from UNDP Human Development Report 2007/2008.

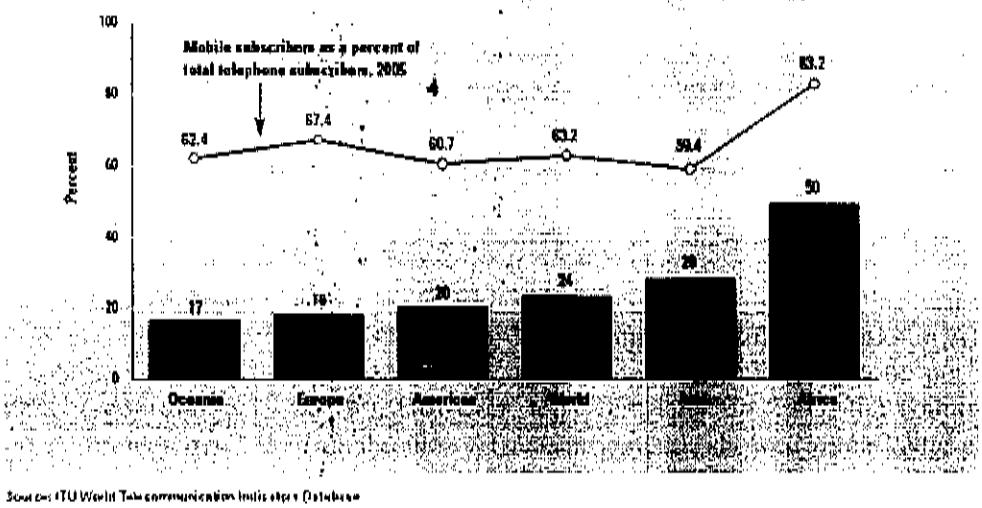
d Data obtained from World Bank online database 2007.

Data source: UNDP Human Development Report 2007/8 and the World Bank online database 2007

'New' technologies

Nigeria has shown phenomenal progress in ICT diffusion in recent years, particularly with regard to mobile telephony. As Toure (2007, p. 98) indicates, "At the turn of the century Nigeria had one of the most backward telecommunications networks in Africa." In 1995, Nigeria had not even reached the milestone of one mobile phone per 1,000 inhabitants (see Table 3.19 below). However, ten years later, in 2005, the country had 141 mobile phones per 1,000 inhabitants. Africa, in general, showed remarkable growth in mobile telephony in recent years with an annual average growth in mobile network subscribers higher than any other region and the world average (see Figure 3.30 below).

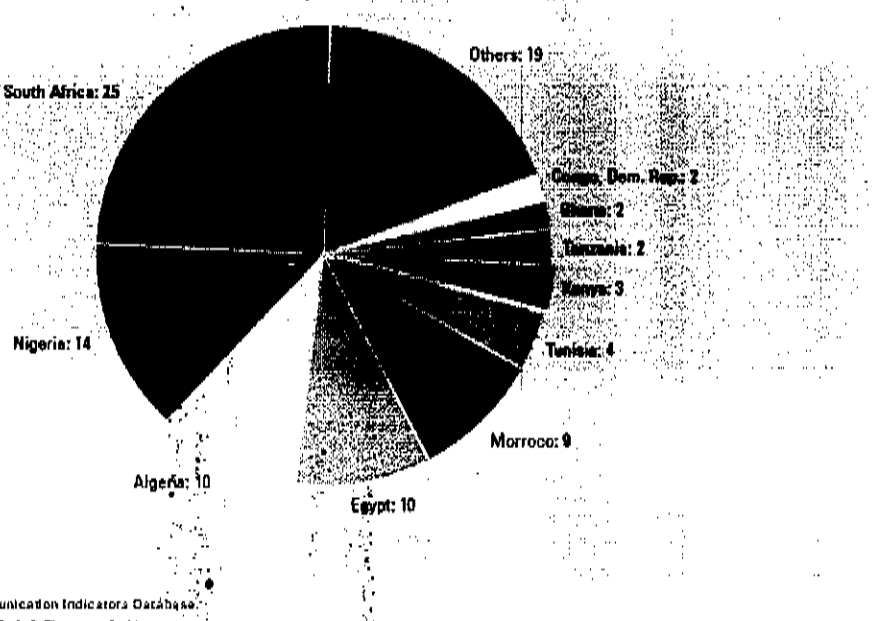
Figure 3.30. Annual average growth in mobile network subscribers: Compound Annual Growth Rate, by world regions, 2000-2005



Source: Toure (2007)

After South Africa, Nigeria has one of the ten largest mobile markets in Africa (see Figure 3.31 below).

Figure 3.31. The ten largest mobile markets in Africa (%), 2005



Source: ITU World Telecommunication Indicators Database

Source: Toure (2007, p. 94)

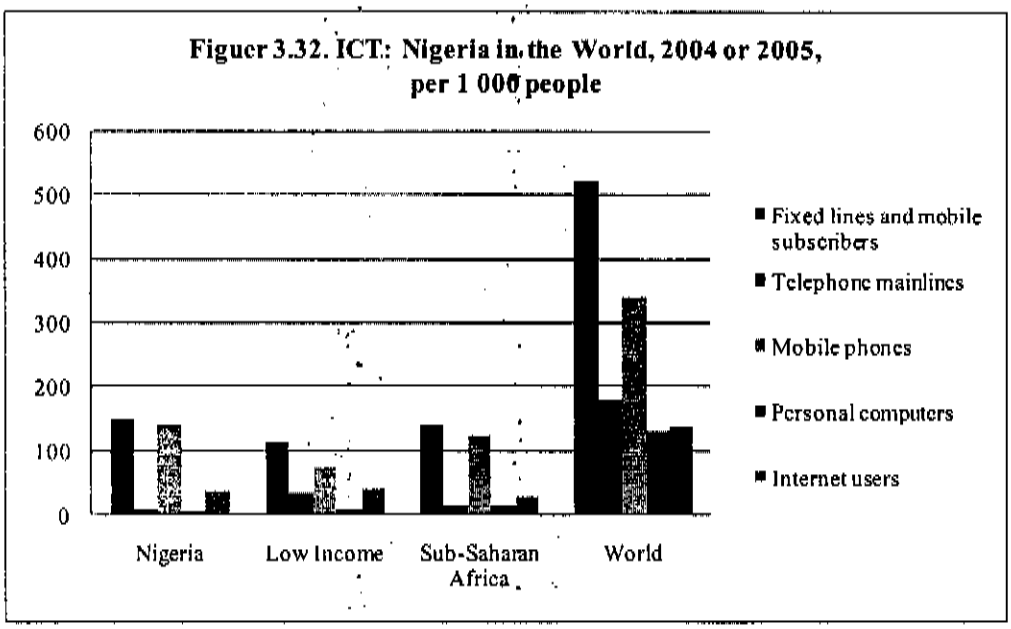
Nigeria also showed dramatic growth in the number of internet users per 1,000 inhabitants. In 1996, Nigeria showed some internet connectivity but had not even reached the level of one internet user per 1,000 inhabitants. However, by 2005, the country had 38 internet users per 1,000 inhabitants, which was higher than that of sub-Saharan Africa but less than the number of internet users in many low-income countries (see Figure 3.32 below). In contrast, the number of personal computers showed minimal growth in 2004 in comparison to 1995.

Table 3.19 Diffusion of [illegible] technologies [illegible] selected regions

	Nigeria				Low Income			Sub-Saharan Africa				World		
Indicators	Year	%/value	Year	%/value	1995	Year	%/value	Year	%/value	Year	%/value	1995	Year	%/value
ICT Expenditure as % of GDP														
Telecommunications revenue (% GDP)	1995	0.9	2005	3.5	2.0	2005	0.7	1995	1.9	2004	3.3	1.9	2004	3.6
Fixed lines and mobile subscribers per 1,000 peop	1995	4	2005	151	11	2005	114	1995	12	2005	142	138	2005	523
Telephone mainlines per 1000 People	1995	4	2005	9	11	2005	37	1995	11	2005	17	122	2005	180
Mobile Phones per 1,000 People	1995	0	2005	141	0	2005	77	1995	1	2005	125	16	2005	342
Personal computers per 1,000 people	1995	5	2004	7	2	2004	11	1997	7	2004	15	42	2004	130
Internet Users per 1000 People	1996	0.1	2005	38	0	2005	44	1996	1	2005	29	8	2005	137

As depicted in Figure 3.32 below, Nigeria's growth in the various telecommunication technologies was similar to that of sub-Saharan Africa and low-income countries, but significantly lower than the world averages.

Figuer 3.32. ICT: Nigeria in the World, 2004 or 2005, per 1 000 people



Data source: World Bank online database 2007

In accordance with the growth in telecommunications, the country's telecommunications revenue increased by 2.6 percent from revenue of less than one percent of its GDP in 1995 to 3.5 percent in 2005, which is similar to that of sub-Saharan Africa and the world average. The revenue in low income countries was however considerably lower and actually declined from its share of total GDP in 2005 in comparison to 1995. In Nigeria, ICT development is also supported by government policy, the National Telecommunications Policy (NTP), introduced in 2000 in response to the growing need for telecommunications and modern infrastructure (Toure 2007).

Nigeria's environmental resources for innovation

The share of Nigeria's total land area that is forest is larger than the forest area of South Africa, but smaller than the forest area of Uganda. Nigeria's forest area is nearly half (45.52%) that of sub-Saharan Africa and 40.26 percent of the world forest area. Nigeria's share of the total land area that is forest declined at an average annual change of 2.40 percent in the period 1990 to 2005, which is significantly higher than the rate of deforestation of its comparators (see Table 3.20 below).

Table 3.20 Forest area - South Africa, Uganda, Nigeria and selected regions

	Forest area			
	% of total land area (%)	Total (thousand sq km)	Total change (thousand sq km)	Average annual change (%)
Indicators	2005	2005	1990-2005	1990-2005
South Africa	7.60	92.00	0.00	0.00
Nigeria	12.20	110.90	-61.50	-2.40
Uganda	18.40	36.30	-13.00	-1.80
Sub-Saharan Africa	26.8	5,516.40	-549.6	-0.6
World	30.3	39,520.30	-1,252.70	-0.2

Data source: UNDP Human Development Report 2007/2008

The area of agricultural land in Nigeria decreased slightly in 2000, but then showed a slight increase in 2003. The size of Nigeria's agricultural land was 14.82 percent of Africa's agricultural land in 2003, which is 1.4 percent smaller than Nigeria's share in 1990. The share of irrigated land was minuscule and remained under one percent in the three years considered.

Table 3.21 Irrigated Land and Agricultural Land - Nigeria and Africa, 1990, 2000, 2003

	Irrigated Land (total, 1000ha)			Agricultural Land (total, 1000ha)			Irrigated Land % of Agricultural Land (total, 1000ha)		
Indicators	1990	2000	2003	1990	2000	2003	1990	2000	2003
Nigeria	230	245	282	32 074	30 850	33 400	0.7	0.8	0.8
Africa	10 989	13 150	13 358	197 781	217 115	225 361	5.6	6.1	5.9

Data source: AfDB Selected Statistics on African Countries 2007 XXVI

It is apparent from the reports on the diffusion of old and new technologies that Nigeria shows relatively poor basic infrastructure and thus poor diffusion of old technologies in comparison to the diffusion of the new technologies, most of which grew rapidly in recent years. The trend in diffusion of old and new technologies is in accordance with reports that in developing countries old technologies take considerably longer to diffuse in comparison to the rapid diffusion (and thus catch-up) with regard to the new technologies.

In terms of environmental resources, deforestation in Nigeria is occurring at a higher rate than its comparators and the country has much to improve in developing agricultural land.

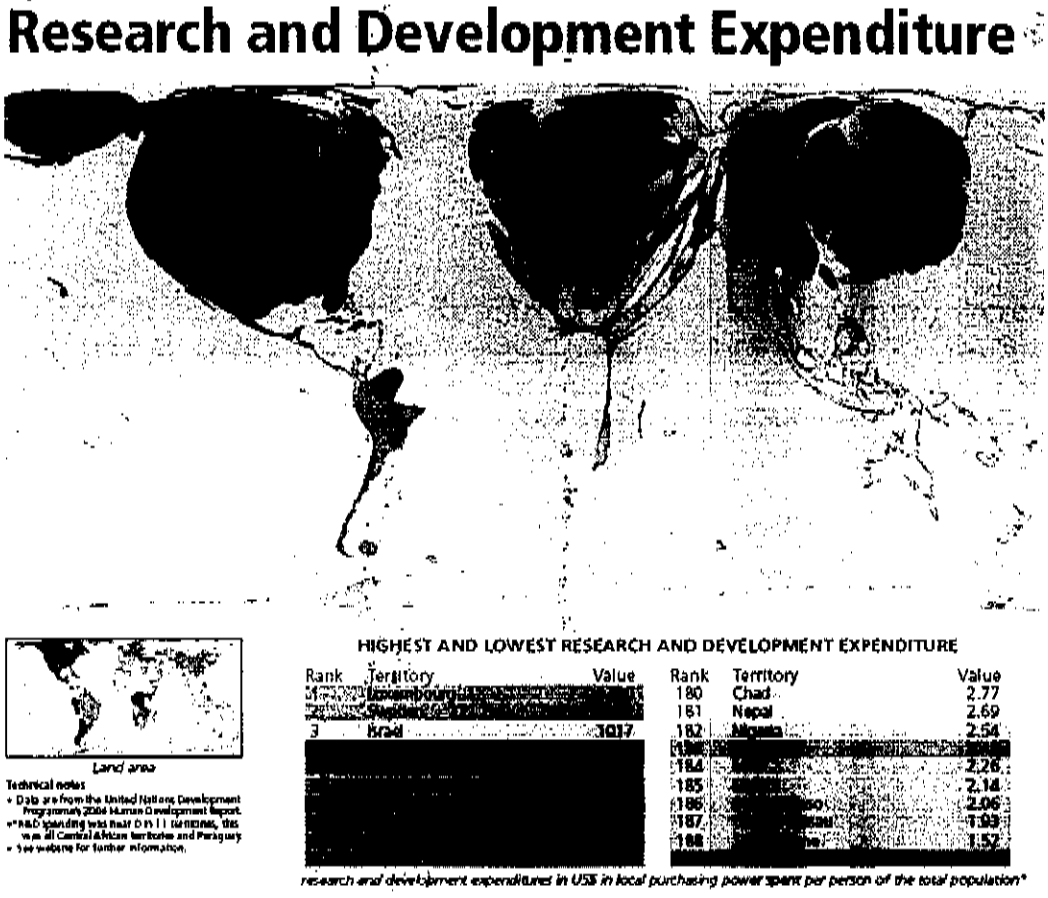
In the next section, indicators of scientific and technological achievements will be reported, including production at the frontier.

Pillar 4: Innovation: Research and development, creating knowledge at the frontier...

Research and development

It can be seen in Figure 3.33 that Africa has the lowest expenditure on R&D in the world, and Nigeria is ranked among the countries with the lowest R&D expenditure in the world.

Figure 3.33. Global R&D expenditure: Countries with the highest and lowest R&D expenditures in the world



Source: www.worldmapper.org

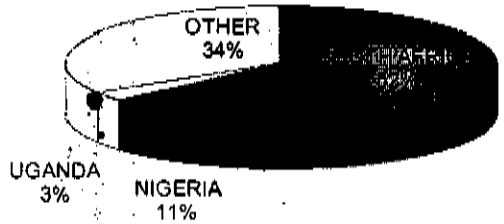
(Data on Nigeria's R&D expenditure over time and per sector could not be found.)

Scientific development

In accordance with Nigeria's economic position in sub-Saharan Africa, that is, second position after South Africa; Nigeria ranked second in the region for scientific output as

measured by the number of scientific publications reported by Thompson's Essential Science Indicators (ESI) during the period 1997 to 2007 (see Figure 3.34 below). There is however, a large disparity between output in Nigeria and that of South Africa.

Figure 3.34. Scientific papers (ESI): South Africa, Nigeria and Uganda, share of sub-Saharan Africa's total (%)



Source: Author's calculations based on Thompson's ISI data, March 2008

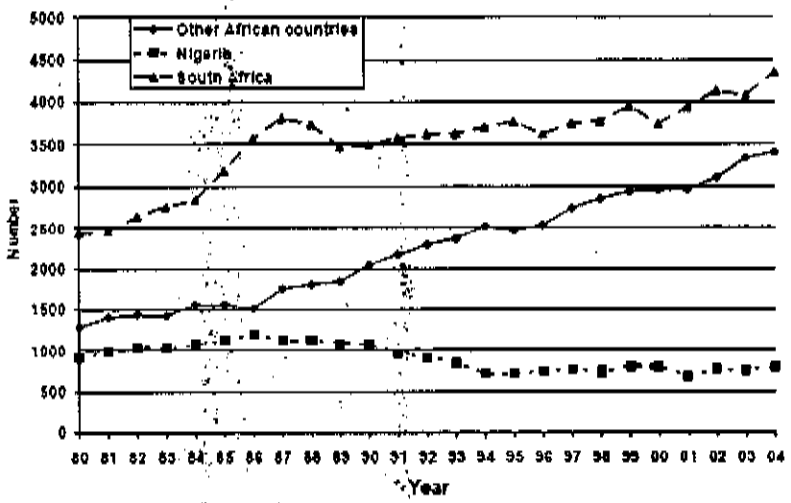
Nigeria also ranked a number of positions below South Africa on the ISI and accounts for a negligible 0.09 percent of the world's scientific publications. The country is ranked 56 in international comparison on the ISI, but occupies second place among the sub-Saharan African countries included, and accounted for 11 percent of the total publications in the region. The country's scientific performance lags behind some of its comparators. Nigeria's scientific output was less than a fifth (21.22%) of South Africa's output (see Table 3.22 below).

Rank	Country/Territory	Papers		Citations	Citations per paper
		Number	% of total		
1	USA	2,986,569	26.58	42,332,176	14.17
2	JAPAN	808,301	7.19	7,151,726	8.85
13	INDIA	227,761	2.03	991,151	4.35
14	SOUTH KOREA	203,637	1.81	1,114,544	5.47
17	BRAZIL	145,267	1.29	796,761	5.48
28	MEXICO	62,578	0.56	362,710	5.8
32	SINGAPORE	50,931	0.45	327,120	6.42
36	SOUTH AFRICA	45,527	0.41	301,413	6.62
41	EGYPT	29,138	0.26	111,841	3.84
45	THAILAND	20,622	0.18	118,021	5.72
51	MALAYSIA	13,059	0.12	51,706	3.96
55	MOROCCO	10,786	0.10	42,146	3.91
56	**NIGERIA**	**9,663**	**0.09**	**30,127**	**3.12**
59	TUNISIA	9,408	0.08	29,709	3.16
64	KENYA	6,496	0.06	55,577	8.56

Source: Thompson's ISI data (March 2008), author's calculations

Schmoch (2005) examined the number of SCI publications. Nigeria has the second highest number of SCI publications in Africa (after South Africa). However, in contrast to South Africa's performance, Nigeria's outputs fall below the total outputs of the other countries in Africa and its publications began to decline after 1990.

Figure 3.35. Number of SCI publications of Nigeria and other African countries south of the Sahara, 1980-2004

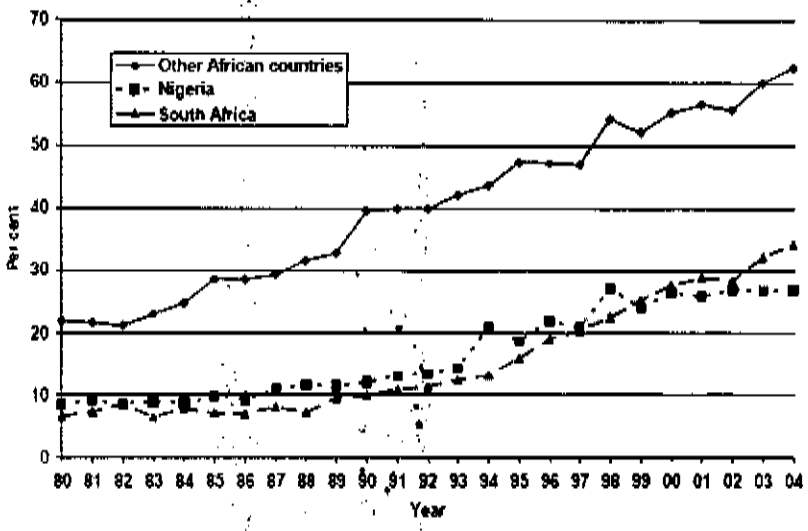


Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 4)

The country, however, showed consistently higher levels of collaboration with advance countries than South Africa. But this changed at the turn of the millenium when South Africa surpassed Nigeria in co-publication rates. However, like South Africa, Nigeria, co-published with advanced countries less often than many other countries in Africa (see Figure 3.36).

Figure 3.36. Share of co-publications of Nigeria and other African countries with advanced countries, 1980-2004

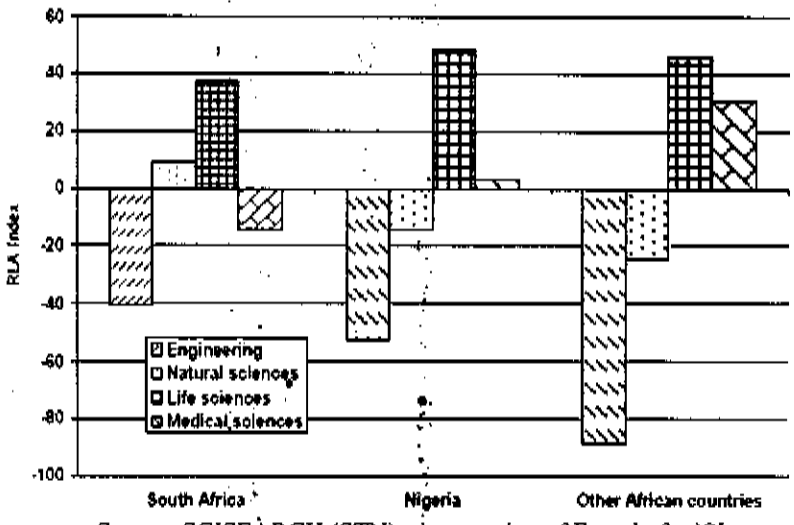


Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 7)

Like most African countries, including South Africa, Nigeria shows a strong orientation to the medical sciences and life sciences (Schmoch 2005). Schmoch indicates that Nigeria's publications in the medical sciences nearly reached international average.

Figure 3.37. Specialisation of Nigeria and other African countries on scientific segments



Source: SCISEARCH (STN), computation of Fraunhofer ISI

Source: Schmoch (2005, p. 5)

Nigeria's specialization in the life sciences and medical sciences can be seen in Table 3.23 below and Figure 3.37 above.

Field	Papers	Citations	Citations per paper
1 CLINICAL MEDICINE	2029	7821	3.85
2 AGRICULTURAL SCIENCES	1600	3556	2.22
3 PLANT & ANIMAL SCIENCE	1228	3128	2.55
4 MOLECULAR BIOLOGY & GENETICS	78	2889	37.04
5 ENVIRONMENT/ECOLOGY	638	1931	3.03
6 PHARMACOLOGY & TOXICOLOGY	461	1464	3.18
7 MICROBIOLOGY	138	1249	9.05
8 BIOLOGY & BIOCHEMISTRY	945	1203	1.27
9 SOCIAL SCIENCES, GENERAL	530	1086	2.05
10 CHEMISTRY	507	1019	2.01
11 PSYCHIATRY/PSYCHOLOGY	127	846	6.66
12 ENGINEERING	450	706	1.57
13 GEOSCIENCES	248	700	2.82
14 IMMUNOLOGY	54	586	10.85
15 MATERIALS SCIENCE	190	569	2.99
16 NEUROSCIENCE & BEHAVIOR	47	401	8.53
17 MATHEMATICS	101	316	3.13
18 SPACE SCIENCE	41	241	5.88
19 ECONOMICS & BUSINESS	57	74	1.3
20 MULTIDISCIPLINARY	18	30	1.67
ALL FIELDS*	9663	30127	3.12

* Includes data for all papers from ranked and unranked fields.

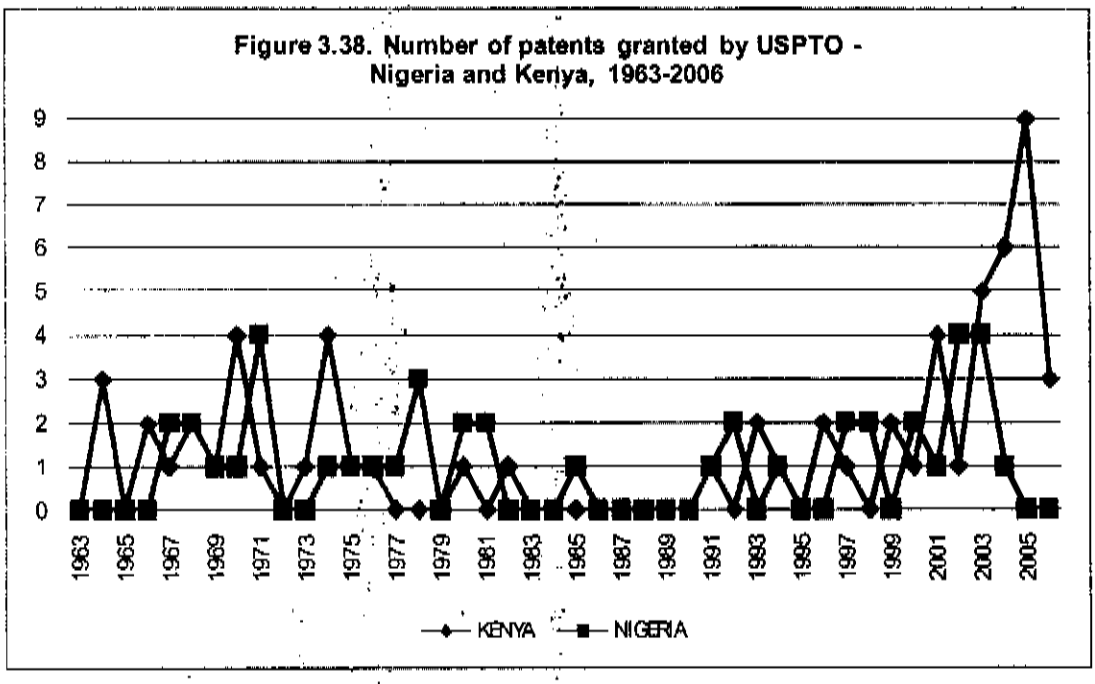
Source: Thompson's ISI data (March 2008)

Technological achievements

Patents

This section reports Nigeria's production at the frontier by assessing the number of patents issued to Nigeria by the USPTO between 1962 and 2007. Nigeria was granted a total of 25 utility patents for the 30-year period 1963 to 1992, seven for the eight-year period 1993 to 2000, and 10 in the six-year period 2001 to 2006. A total of only 42 utility patents were granted to the country between 1962 and 2007. Nigeria's patent output was only about one percent of South Africa's output in the same period. Nigeria has also not kept pace with Kenya, which had the second highest number of patents in the sub-Saharan African region, after South Africa. During the period 1963 to 2000, Nigeria and Kenya showed similar levels of patent activity. However, Kenya surpassed Nigeria between 2000 and 2007, tripling the number of patents in this period (28) in comparison to the previous period 1993-2000 (9). Interestingly, Kenya held third position, after Nigeria, in the sub-Saharan African group for the number of scientific publications; but surpassed Nigeria in patent activity (see Table A3 in the appendix).

Figure 3.38. Number of patents granted by USPTO - Nigeria and Kenya, 1963-2006



Data source: USPTO 2007

In line with Nigeria's specialisation in scientific publications, the country's patents during 2001 through to 2005 show specialisation in the medical and life sciences. It also had patents in mining and information technology.

Class	Class Title	2001	2002	2003	2004	2005	Total
128	Surgery (includes Class 600)	0	2	2	1	0	5
424	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	0	1	1	0	0	2
166	Wells (shafts or deep borings in the earth, e.g., for oil and gas)	0	0	1	0	0	1
706	DP: Artificial Intelligence (Data Processing)	0	1	0	0	0	1
800	Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes	1	0	0	0	0	1
ALL	ALL CLASSES	1	4	4	1	0	10

Data source: USPTO 2007

Royalty and licence fees

In 2005, Nigeria's royalty and licence fees payments accounted for 3.56 percent of the total for sub-Saharan Africa, and 20.21 percent of the total for low income countries. The total payment for sub-Saharan Africa was more than five times greater than the payments for low income countries in 2005. Royalty and licence fees receipts and payments over time could not be reported as this data was unavailable for Nigeria. Royalty and licence fees payments presents a means by which knowledge is transferred from more advanced countries to Nigeria.

	1995		2000		2005	
	Number	World share	Number	World share	Number	World share
Payments	Current US$	(%)	Current US$	(%)	Current US$	(%)
World	52,459,536,106	100.00	63,076,870,656	100.00	134,689,072,994	100.00
Low income	125,395,436	0.24	438,945,462	0.53	224,011,892	0.17
Sub-Saharan Africa	334,060,965	0.64	417,038,411	0.50	1,272,129,553	0.94
Nigeria	0	0.00	..	..	45,264,104	0.03
Uganda	0	0.00	0	0.00	1,463,500	0.00
Receipts						
World	53,988,334,021	100.00	79,362,690,241	100.00	123,690,029,182	100.00
Low income	14,917,743	0.03	95,917,676	0.12	46,940,539	0.04
Sub-Saharan Africa	60,373,856	0.11	93,103,839	0.12	141,232,915	0.11
Nigeria	0	0.00	..	..	..	..
Uganda	0	0.00	0	0.00	7,423,808	0.01

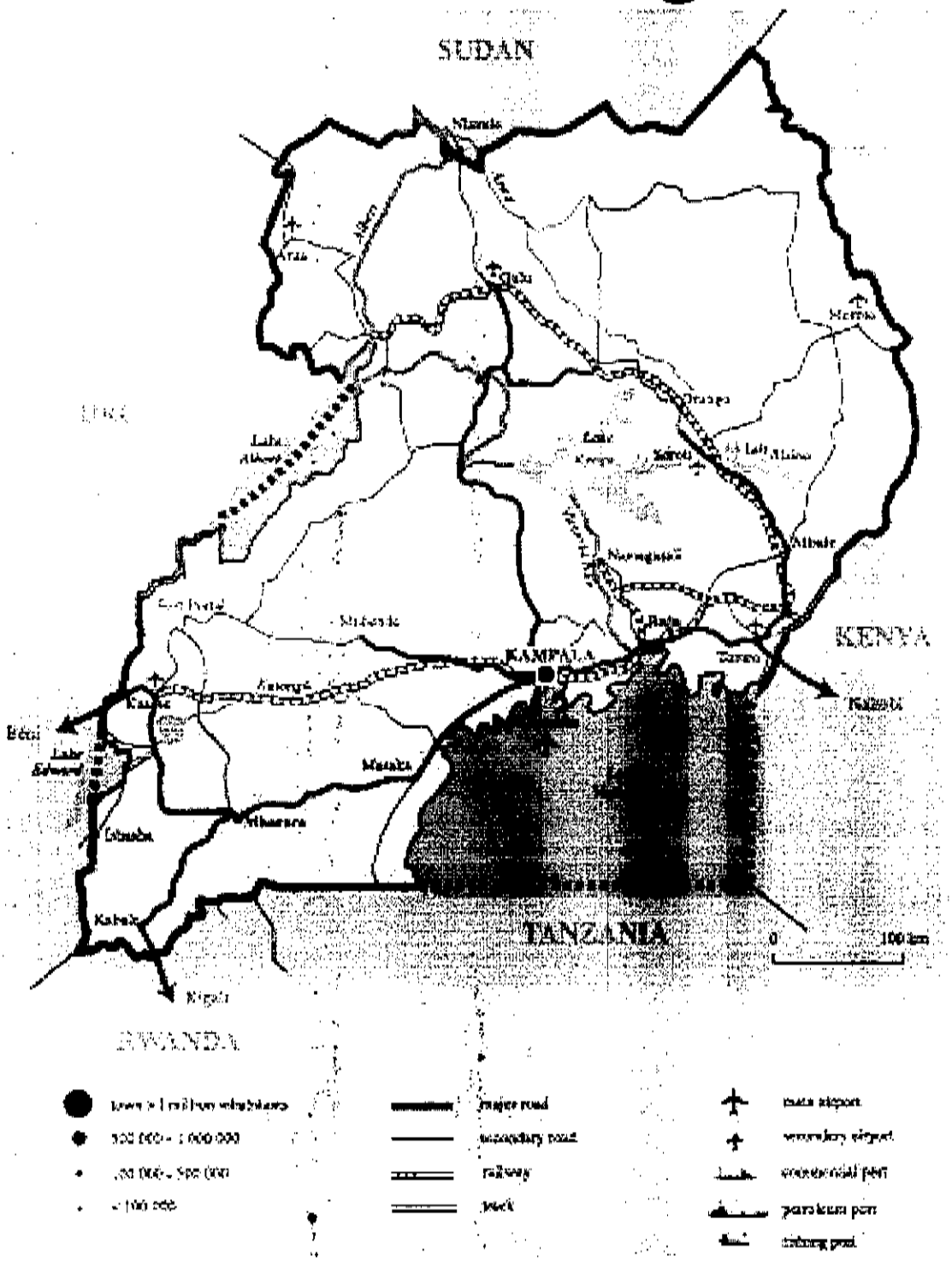
Data source: World Bank database online 2007

In sum, this section shows that Nigeria has not shown much progress in transferring knowledge into the generation of new technologies. Nigeria however, also lags behind in scientific output, but performs better on scientific output than patent activity. The country

also seems to be stagnating, since the turn of the millenium, when its comparators are making immense improvement in their scientific and technological performance. As Schmoch (2005, p. 10) states, Nigeria is in principle, "...sufficiently large to initiate a self-dependent knowledge-based development. But for this purpose an enormous re-orientation of public policy would be necessary."

The following section focuses on Uganda's performance on the various indicators of the four pillars considered critical for catch-up in the knowledge economy.

Disaggregating performance in Uganda



Source: African Economic Outlook 2007

4. Disaggregating Performance in Uganda

Uganda: The Socio-Economic Context

Uganda is a landlocked country in East Africa, bordered by Sudan, Kenya, Tanzania, Rwanda and the Democratic Republic of Congo (Uganda UNGASS report 2007).

Uganda is one of the smallest countries in Africa with a population of 28.82 million in 2005, a population size accounting for about 3.88 percent of sub-Saharan Africa, 1.22 percent of the total for low income economies and less than one percent (0.45%) of the world population. The country's population is growing faster than most countries in the world, and growth is higher than the average growth in sub-Saharan Africa. In 2005, Uganda had a growth rate of 3.52 percent, a slight increase in comparison to its annual growth reported in 1996 (3.02%). Uganda's urban population is also growing much faster than that of most countries south of the Sahara, that is, 4.31% in comparison to sub-Sahara's 3.64% annual growth. The majority of the country's population still, however, lives in rural conditions with only 12.60 percent of the population being urban. Uganda also has a lower percentage of the population falling in the 15 to 64 year-age-group, with 47.09 percentage of the population in this age group in comparison to the world average of 64.48 percent.

Table 4.1: Population indicators - Uganda and selected regions, 1996 and 2005

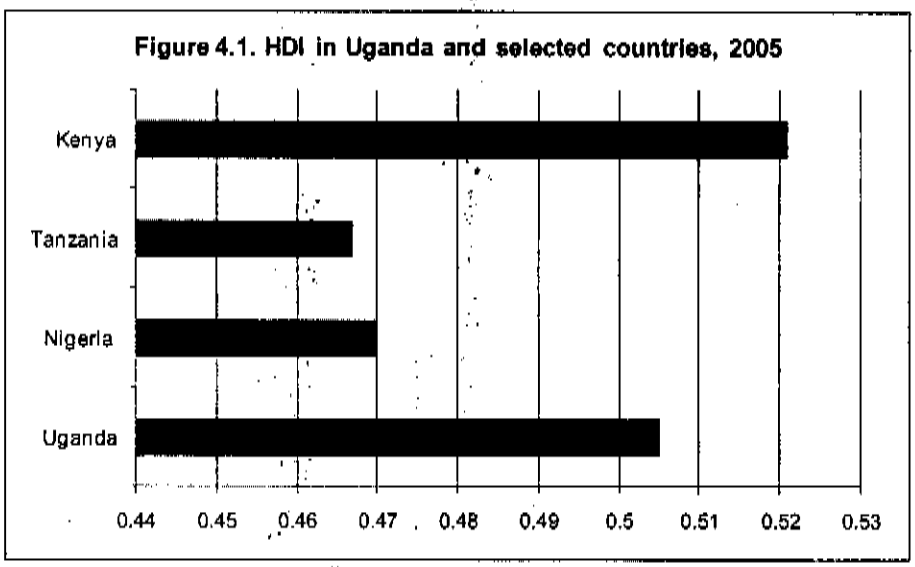
	Uganda		Low income		Sub-Saharan Africa		World	
Indicators	1996	2005	1996	2005	1996	2005	1996	2005
Population (total in millions)	21.53	28.82	1981.13	2352.43	599.77	743.06	5747.02	6437.68
Population growth (annual %)	3.02	3.52	2.12	1.79	2.63	2.25	1.41	1.19
Population ages 15-64 (% total pop.)	47.52	47.09	56.67	59.28	52.12	53.39	62.11	64.48
Rural population (% of total pop.)	88.22	87.40	72.82	70.04	69.03	64.77	54.76	51.23
Urban population (% of total pop.)	11.78	12.60	27.18	29.96	30.97	35.23	45.24	48.77
Urban population growth (% annual)	3.70	4.31	3.25	2.88	4.22	3.64	2.27	2.04
Life expectancy at birth (total years)*	42.66	49.95	57.69	58.88	46.91	46.65	66.28	67.56
Life expectancy at birth (female years)*	43.06	50.64	58.44	59.73	48.20	47.25	68.36	69.61

Note: * data for 1997 and 2005 as data was not available for 1996.

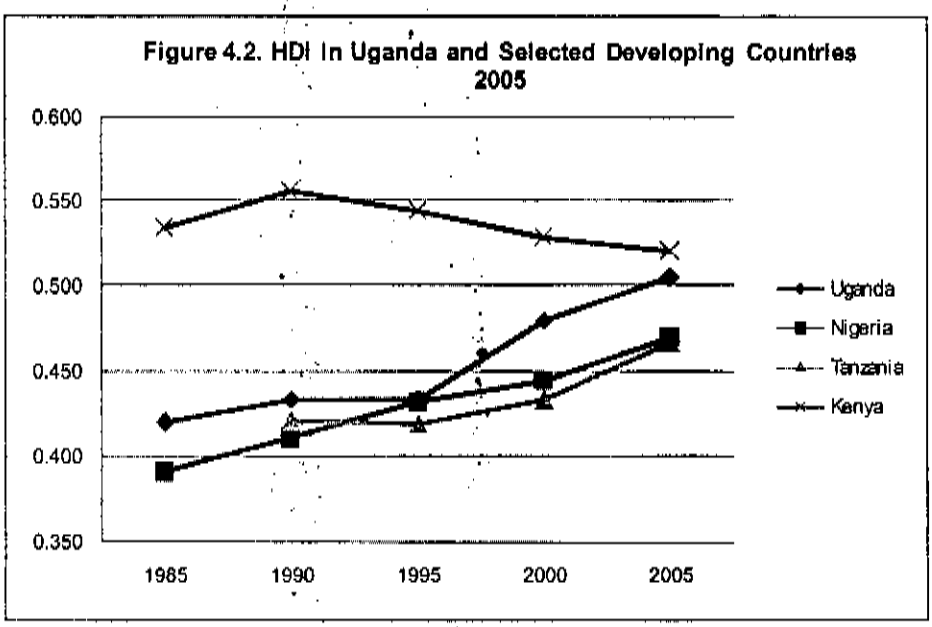
Data source: Word Bank online database 2007

Life expectancy at birth was a low of around 50 years for the total population (and females) in 2005, which is higher than the country's averages in 1996 (around 43 years) and that of sub-Saharan Africa (around 47 years). The country's life expectancy is, however, lower than that for low income economies (almost 60 years) and much lower than the world averages of almost 70 years. This low life expectancy is shown in the country's poor performance on the Human Development Index (HDI) in 2005. Uganda is the second last country, above Gambia, falling in the category of countries of medium human development and is ranked at 154 out of the 177 countries included in the Human Development Report 2007/8. The HDI is a composite of three sub-indexes (Uganda's

scores are reported in parenthesis): life expectancy index (0.412), education index (0.655), and the GDP index (0.447).



Data source: UNDP, Human Development Report 2007/8

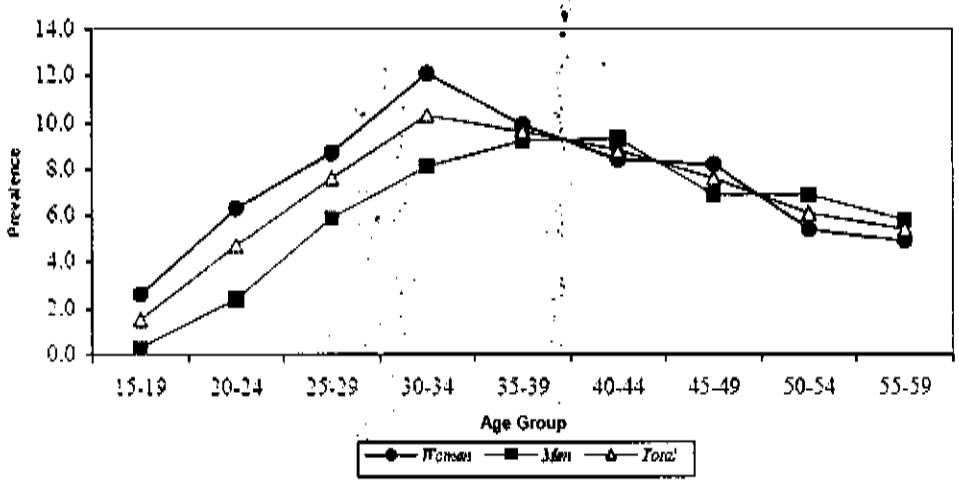


Data source: UNDP, Human Development Report 2007/8

As depicted in Figure 4.1 and Figure 4.2 above, according to the Human Development Report 2007/8, in 2005, Uganda achieved higher levels of human development than some of the other low income economies in the region, including Nigeria and Tanzania. The country showed much improvement in the period 1985 to 2005 (0.420 and 0.505 in 1985 and 2005 respectively) and surpassed Nigeria and Tanzania in human development, and is likely to surpass Kenya that has shown a downward trend after 1990.

Uganda's low life expectancy is affected by the high prevalence of HIV and tuberculosis in the country. The prevalence of HIV among people aged 15 to 49 years and tuberculosis in 2005 was higher than many countries in sub-Saharan Africa, and considerable higher than prevalence in low income economies and the world. Uganda is one of the top 20 countries in sub-Saharan Africa with regard to high prevalence of HIV and the number of people living with HIV/AIDS at the end of 2005 (The Henry J. Kaiser Family Foundation 2007).

Table 4.2. HIV Prevalence between ages 15-59 years by age and sex (2004/5)



Source: UNGASS Country Progress Report, Uganda 2007 (p. 12)

The country is working with international development agencies (such as the UN) to reduce HIV prevalence and reports progress in combating the spread of the pandemic. A national report, UNGASS Country Progress Report for Uganda 2007, shows lower prevalence in the age group 15 to 24 years in the period 2004 to 2005, which the report states is suggestive of a decline in the incidence of new infections. Prevalence of HIV in Uganda is not as high as some sub-Saharan countries such as South Africa which had a prevalence rate as high as 18.8 percent in 2005.

Poverty levels in Uganda

Data on the percentage of the total population living on less than one and two dollars a day was not available and thus the country's poverty levels in relation to its comparators could not be assessed. Poverty at the national poverty line is reported in Table 4.3 below for 2000 and 2003. The share of the population living at the national poverty line was about four percent higher in 2003 than it was in 2000. The country has a high level of inequality as indicated by its GINI index of 45.7 in 2002.

Table 4.3 Poverty in Uganda and selected [illegible]

Indicators	Uganda		Low & Middle Income		Sub-Saharan Africa	
	Year	%/Value	Year	%/Value	Year	%/Value
GINI index	2002	45.7	..	..	..	..
	..	..	..	..	..	..
Poverty headcount ratio at $1 a day (PPP)	..	..	1996	22.65695101	1996	47.72
(% of population)	..	..	2002	20.13314333	2002	42.63
Poverty headcount ratio at $2 a day (PPP)	..	..	1996	55.52057431	1996	76.42
(% of population)	..	..	2002	50.68845616	2002	73.81
Poverty headcount ratio at national poverty line	2000	33.8	..	..	..	..
(% of population)	2003	37.7	..	..	..	..
Poverty headcount ratio at rural poverty line	2000	37.4	..	..	..	..
(% of rural population)	2003	41.7	..	..	..	..
Poverty headcount ratio at urban poverty line	2000	9.6	..	..	..	..
(% of urban population)	2003	12.2	..	..	..	..

Data source: World Bank online database 2007

The country however reported a lower prevalence of undernourishment in 2004 than the average for low income economies and sub-Saharan Africa; but still higher than the world average (see Table 4.4 below). Prevalence of undernourishment in Uganda was however 10 percent higher than that in Nigeria (9%) in 2004.

Table 4.4 Health [illegible] Uganda and [illegible] regions

Country/Regions	Health Expenditure Total (% GDP)		Health Expenditure Per capita (PPP US$)		Physicians (per 1, 000 people)		Births attended by skilled health staff (% of total)		Prevalence of undernourishment (% of total population)		HIV Prevalence (% aged 15-49)	Tuberculosis Prevalence (per 100,000 people)	
	2000	2004	2000	2004	Year	Number	Year	%	1997	2004	2005	1995	2005
Uganda	6.6	7.6	15.6	19.0	2004	0.08	2001	39.0	26.0	19.0	6.4	318.6	368.8
Low income countries	4.2	4.7	16.5	23.8	2004	0.47	2005	40.9	25.2	24.3	1.7	195.0	219.9
Sub-Saharan Africa	5.9	6.3	30.3	45.0			2005	44.7	30.0	30.0	5.8	242.4	348.4
World	9.3	10.1	477.8	648.8	1998	1.60	2005	62.9	14.7	13.9	1.0	128.7	136.4

Data source: World Bank online database 2007

In 2004, Uganda spent only 7.6 percent of its GDP on health, that is, 19.0 US dollars per capita. Expenditure in 2004 was 10 percent more than that spent in 2000. Although this expenditure is higher than the average for low income economies (4.7%) and sub-Saharan Africa (6.3%), its expenditure on health per capita was lower than these comparators (23.8 and 45.0 US$ per capita). Uganda's expenditure (share of GDP) was also 2.5 percent lower than the world average.

In 2003, it did not reach the level of one physician per 1,000 people and only 39 percent of the total number of births were reported to have been attended by skilled staff. The low number of physicians may have been affected by 'brain drain'. Bhargava and Docquier

(2007) reported a total stock of 375 Ugandan physicians living abroad in 2003, increasing to 402 in 2004. And according to Clemens and Pettersson (2006 cited in the World Bank's Migration and Remittances Factbook 2007), 1,122 or 10.2 percent of the nurses trained in the country were living abroad in 2000.

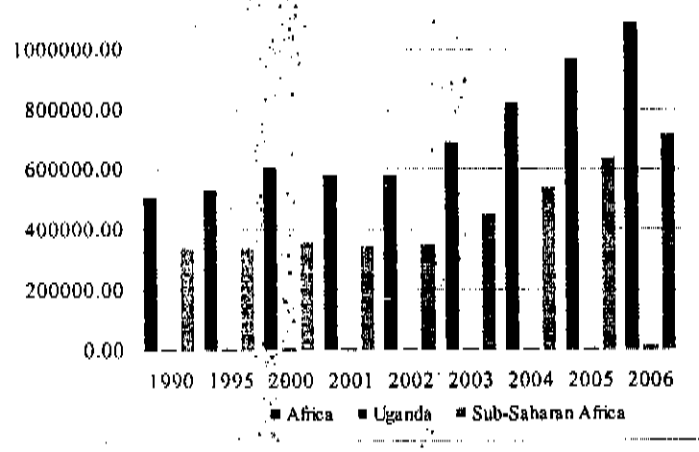
The indicators reported above show that Uganda, which accounts for only 3.88 percent of the population in sub-Saharan Africa, shows a trend of improvement in overall human development surpassing some other low income African countries. The country, however, has much to improve with regard to combating the prevalence of communicative diseases and poverty.

Pillar 1: An economic climate conducive to the exposure to, and use and creation of knowledge technologies...

The macro-economic environment

Uganda is one of the 50 least developed countries in the world. That being said, Uganda is also one of the most economically successful countries in East Africa with relatively low inflation and relatively high economic growth (African Economic Outlook 2007). Uganda, together with Tanzania, Kenya, Burundi and Rwanda formed the East African Community (EAC). The EAC is working towards establishing a single currency for East Africa by December 2009 (African Economic Outlook 2007). In 2006, Uganda accounted for 10 percent of the total nominal GDP for East Africa, 1.44 percent of sub-Saharan Africa and 4.59 percent of the total for the least developed countries in Africa and Haiti (see Table A4 in the appendix). Uganda's GDP is however negligible in relation to the total for Africa (see Figure 4.3 below).

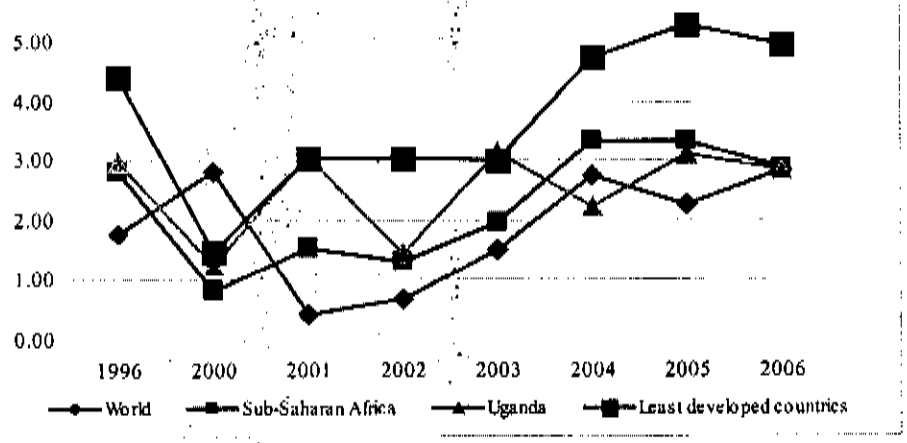
Figure 4.3 GDP, US Dollars at current prices in millions, Uganda, sub-Saharan Africa and Africa, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Uganda had a lower average annual growth in GDP in the period 2000 to 2005 (5.84%) than it had in the period 1995 to 2000 (6.75%). The lower levels of economic growth in recent years may be a result of the decline in agricultural production due to drought. Uganda achieved its highest annual growth rate in recent years, 6.50 percent, in 2003. Uganda sustained economic growth above 5.5. percent since 2003 and almost reached the target of seven percent annual growth in GDP required to achieve the millennium goal of halving poverty levels by 2015. The African Economic Outlook 2007 attributes Uganda's sound economic performance to sound macro-economic management and pro-market reforms, which are supported by the large inflows of official development assistance (ODA). Figure 4.4 below illustrates Uganda's strong GDP growth trend between 1989 and 2007.

Figure4.4 GDP per capita, annual average growth rates, Uganda and selected regions, 1996-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Although Uganda shows promising economic growth rates, including growth GDP per capita, its nominal GDP per capita has remained below the averages for sub-Saharan Africa and the least developed countries over the 16-year period, 1990 to 2006.

Uganda showed the highest growth rates between 2002 and 2007. The country's growth has however not kept pace with the spectacular growth rates achieved in some other least developed countries.

Table 4.5 Selected macro-economic indicators

Indicators	1995	2000	2005	2007	2008
GDP, constant prices (billion, national currency)	6,573.11	8,932.29	11,779.22	13,191.11	14,045.36
GDP, current prices (billion, US $)	5.582	5.91	8.734	11.141	12.241
GDP, constant prices (annual % change)	11.3	5.3	6.7	6.2	6.5
GDP per capita, current prices (US$)	267.175	243.123	303.088	360.229	382.018
GDP based on PPP (% share of world total)	0.06	0.067	0.073	0.074	0.075
Gross National Savings (% GDP)	..	..	..	..	..
Current Account Balance (% GDP)	-1.3	-7.1	-2.1	-2.4	-6.3
Inflation, average consumer prices (ann. %'chang	6.8	5.8	8	7.5	5.1

Data source: IMF World Economic Outlook Database October 2007

Table 4.4 presents selected macro-economic indicators, including forecast data for 2007 and 2008, provided by the International Monetary Fund (IMF) (there are slight discrepancies between the IMF data and that provided by UNCTAD reported above). It is forecast that Uganda's annual growth in GDP will remain strong. Uganda's current account deficit is however expected to widen in 2008, and inflation is expected to decrease.

Openness: Trade

The total value of Uganda's exports and imports in 2006 was nearly six and five times the value in 1990, respectively. In 2006, Uganda's total exports accounted for less than one percent (0.6%) of the total exports in sub-Saharan Africa, whereas its imports accounted for 1.44 percent. The share of Uganda's exports and imports of sub-Saharan Africa's in 2006 increased from its share in 1990 (0.22% and 0.64% respectively). According to the African Economic Outlook (2007, p. 537), "Uganda continues to depend largely on a few agricultural exports, especially coffee, fish, tea and cotton, and thus remains vulnerable to external shocks to terms of trade."

	1990	2000	2002	2005	2006
World					
Gross National Income	22,644,691	31,874,724	32,813,530	44,664,187	48,290,612
Gross capital formation	5,233,949	7,119,261	6,832,953	9,956,231	10,968,066
Gross Fixed capital formation	5,038,329	6,904,770	6,739,880	9,715,788	10,726,170
Exports of goods and services	4,416,844	8,018,553	8,137,642	12,924,248	14,936,923
Imports of goods and services	4,473,221	7,978,734	8,078,063	12,801,579	14,699,058
Sub-Saharan Africa					
Gross National Income	311,479	340,587	332,354	601,947	671,573
Gross capital formation	51,815	55,576	53,586	114,467	132,571
Gross Fixed capital formation	52,474	53,985	53,610	110,287	130,174
Exports of goods and services	114,939	124,120	108,943	210,626	249,946
Imports of goods and services	101,399	101,998	107,858	199,866	231,115
Sub-Saharan Africa excluding South Africa					
Gross National Income	203,733	210,883	224,268	364,842	429,939
Gross capital formation	31,951	34,431	35,784	70,293	86,099
Gross Fixed capital formation	31,029	33,862	36,951	69,020	85,200
Exports of goods and services	87,790	87,086	72,365	144,106	179,553
Imports of goods and services	80,383	68,891	75,542	131,116	154,004
Uganda					
Gross National Income	3,587	5,597	5,911	9,014	9,702
Gross capital formation	537	1,086	1,237	2,187	2,565
Gross Fixed capital formation	537	1,061	1,214	2,158	2,532
Exports of goods and services	251	614	701	1,293	1,490
Imports of goods and services	645	1,353	1,593	2,771	3,325
Low-income countries					
Gross National Income	1,238,986	2,313,766	2,666,930	4,115,327	4,811,485
Gross capital formation	352,608	671,306	819,426	1,452,589	1,723,089
Gross Fixed capital formation	278,133	637,766	781,825	1,393,868	1,685,301
Exports of goods and services	260,507	602,706	678,362	1,386,600	1,764,701
Imports of goods and services	242,982	548,200	651,019	1,303,304	1,600,734

Data source: UNCTAD Handbook of Statistics 2007 online

The country's average annual growth in merchandise exports for the period 2000 to 2005 decreased by one percent in comparison to the previous period, 1990 to 2000; and its merchandise imports decreased by a high 15.5 percent. Uganda accounted for less than one percent of the total merchandise exports in sub-Saharan Africa in 1990 and 2006 with the country's share in 1990 doubling in 2006 (0.23% and 0.46% respectively). Uganda's share in the total merchandise exports by the least developed countries in Africa and Haiti in 1990 and 2006 was greater (0.95% and 1.42% respectively) than its share of the total merchandise exports in sub-Saharan Africa.

Table 4.7 Openness: Merchandise trade - Uganda's value (millions of US$) and share in world total (%)

	Annual avg. growth rate		1990		2000		2002		2005		2006	
Exports	**1990-2000**	**2000-2005**	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**
World	6.8	11.3	3 478 571	100.00	6 444 106	100.00	6 472 603	100.00	10 440 780	100.00	11 982 932	100.00
Developing economies	9.0	14.1	842 883	24.23	2 044 590	31.73	2 052 444	31.71	3 750 526	35.92	4 408 951	36.79
Africa	3.3	16.3	106 993	3.08	147 173	2.28	146 432	2.26	298 026	2.85	332 801	2.78
Sub-Saharan Africa	4.0	16.2	66 312	1.91	94 867	1.47	96 580	1.49	190 889	1.83	212 937	1.78
Sub-Saharan Africa (excluding South Africa	4.8	17.6	42 744	1.23	64 884	1.01	66 856	1.03	139 264	1.33	159 767	1.33
Low income	11.3	19.8	181 965	5.23	518 933	8.05	592 467	9.15	1 214 842	11.64	1 507 576	12.58
Uganda	15.4	14.4	152	0.00	460	0.01	443	0.01	863	0.01	970	0.01
Imports												
World	6.7	11.2	3 590 163	100.00	6 642 126	100.00	6 640 572	100.00	10 712 215	100.00	12 203 386	100.00
Developing economies	8.5	13.3	800 081	22.29	1 904 395	28.67	1 911 101	28.78	3 359 059	31.36	3 915 401	32.09
Africa	4.4	14.3	97 037	2.70	130 973	1.97	142 179	2.14	246 931	2.31	278 432	2.28
Sub-Saharan Africa	5.7	15.7	52 704	1.47	83 581	1.26	91 354	1.38	165 665	1.55	188 930	1.55
Sub-Saharan Africa (excluding South Africa	5.5	14.1	34 305	0.96	53 886	0.81	62 087	0.93	103 360	0.96	119 745	0.98
Low income	9.7	21.3	177 296	4.94	466 373	7.02	549 990	8.28	1 143 944	10.68	1 343 820	11.01
Uganda	21.0	5.5	288	0.01	1 538	0.02	1 111	0.02	1 895	0.02	2 504	0.02

Data source: UNCTAD Handbook of Statistics 2007 online

Uganda's share of the total services exports by the least developed countries in Africa and Haiti in 1991 and 2006 was considerably higher than its share in sub-Saharan Africa: 0.71 percent and 5.37 percent respectively in comparison to its share of 0.19 percent and 1.30 percent in sub-Saharan Africa. Uganda's total services exports increased dramatically in 2006 in comparison to 1991 with its total services exports in 1991 representing 4.49 percent of its services exports in 2006 (see Table 4.8 below).

Table 4.8. Openness: Trade in services in Uganda and selected regions
value (millions of dollars) share (%)

	1990		2000		2002		2005		2006	
Exports	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**	**Value**	**%**
World	830,805	100.0	1,529,340	100.0	1,640,038	100.0	2,494,520	100.0	2,735,658	100.0
Developing economies	154,347	18.6	353,258	23.1	366,925	22.4	593,426	23.8	669,748	24.5
Africa	21,474	2.6	32,910	2.2	36,149	2.2	59,931	2.4	65,203	2.4
Sub-Saharan Africa	11,192	1.3	16,207	1.1	18,195	1.1	30,981	1.2	33,346	1.2
Sub-Saharan Africa (excluding South Africa)	7,785	0.9	11,161	0.7	13,210	0.8	19,824	0.8	21,713	0.8
Low income	32,533	3.9	83,642	5.5	92,725	5.7	179,031	7.2	210,199	7.7
Uganda	..		213	0.0	225	0.0	508	0.0	463	0.0
Imports										
World	860,477	100.00	1,518,794	100.0	1,624,975	100.0	2,404,156	100.0	2,616,583	100.0
Developing economies	184,114	21.40	397,846	26.2	414,326	25.5	641,835	26.7	718,693	27.5
Africa	29,960	3.48	39,866	2.6	44,051	2.7	74,407	3.1	82,153	3.1
Sub-Saharan Africa	21,176	2.46	26,936	1.8	30,503	1.9	53,241	2.2	59,074	2.3
Sub-Saharan Africa (excluding South Africa)	17,438	2.03	21,114	1.4	24,999	1.5	41,087	1.7	44,991	1.7
Low income	39,377	4.58	106,685	7.0	125,102	7.7	207,430	8.6	239,197	9.1
Uganda	195	0.02	459	0.0	558	0.0	800	0.0	972	0.0

Data source: UNCTAD Handbook of Statistics 2007 online

In 1990 and 2006, the largest share of Uganda's exports to developed countries went to Europe with this share decreasing by 24.6 percent in 2005 from 1990, and the exports to USA and Japan increasing by 4 percent and 2.5 percent respectively. The share of total exports sent to developed countries declined by about 33 percent in 2005 (57.4%) in comparison to 1990 (90.5%). The largest share of Uganda's imports, in 2005, came from Europe, USA and Japan with shares of imports to these countries decreasing by 16.7, 0.8 and 0.6 percent respectively from shares in 1990. The share of total imports to developed countries declined by 19.1 percent in 2005 in comparison to 1990.

Figure 4.5. Destination of exports to developed countries - Uganda, 2005

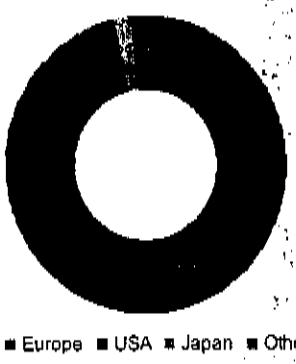
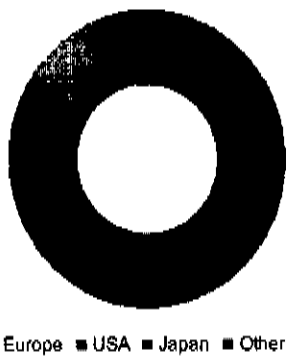


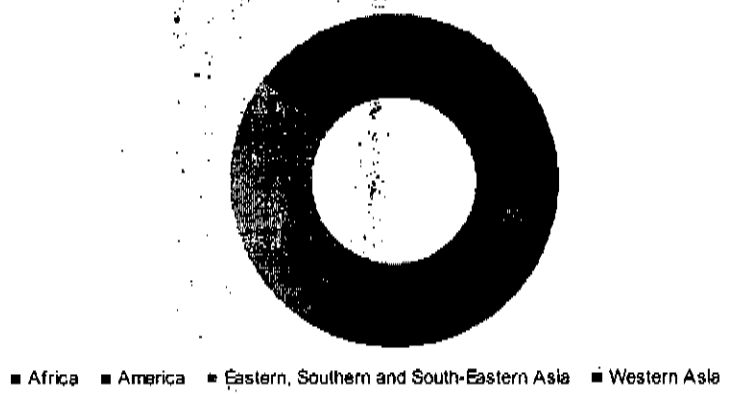
Figure 4.6 Origin of imports from developed countries - Uganda, 2005



Data source: UNCTAD Handbook of Statistics 2007 online

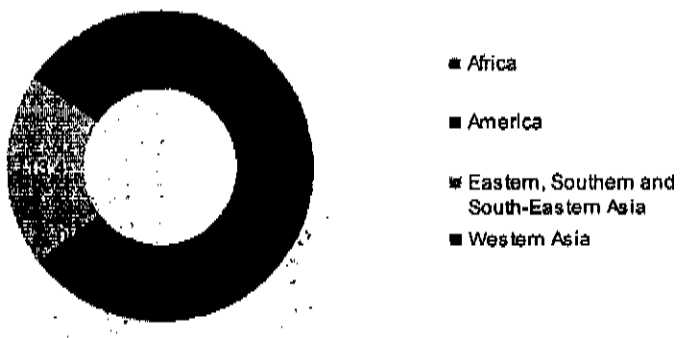
And the largest share of exports to the developing world went to Africa, with this share increasing by 12.8 percent in 2005 (19.7%) from its share in 1990 (6.9%); and exports to Eastern and Southern and South-Eastern Asia increased by 7.4 percent. The share of the total exports to developing countries increased by 24.6 percent in 2005 in comparison to 1990. In 2005, most of Uganda's imports came from Africa and imports from this region increased by 4.5 percent in comparison to 1990. Imports from Eastern and Southern and South-Eastern Asia increased by 4.7 percent. Uganda's imports from developing countries increased by 18 percent in 2005 in comparison to 1990. In 2005, most of Uganda's imports came from developing countries (67.6%) and most of its exports went to developed countries (57.4%).

Figure 4.7 Destination of exports to developing countries - Uganda, 2005



Data source: UNCTAD Handbook of Statistics 2007 online

Figure 4.8. Origin of imports from developing countries - Uganda, 2005



Data source: UNCTAD Handbook of Statistics 2007 online

Uganda's industrial performance:

Table 4.9 shows the country's performance of manufacturing value added. Uganda's MVA is low in comparison to most other developing economies. In 2005, the country's MVA per capita (US$ 31) was similar to sub-Saharan Africa, but considerably lower than the average for developing countries (US$ 455). In 2005, 5.2 percent of Uganda's exports were machinery and transport equipment, up from a low 1.2 percent in 1995; and 2.4 percent were chemicals, up from 1.0 percent in 1995. And more than a quarter (26.2%) of its imports were machinery and transport equipment in 2005, down from 34.8 percent in 1995 (UNCTAD Handbook of Statistics 2006-07).

Table 4.9: Uganda - International [illegible] of Industrial [illegible] 1995-2005

Indicator	Year/Period	Uganda	Sub-Saharan Africa	Developing countries
MVA, average annual real growth rate (in %)	1995-2000	13.2	3.2	4.8
	2000-2005	4.8	3.6	5.2
Non-manufacturing GDP,average annual real growth rate (in %)	1995-2000	5.8	3.6	3.8
	2000-2005	5.8	4.4	4.6
MVA per capita, in constant 1995 US$	1995	18	29	268
	2000	28	30	326
	2005	31	32	455
MVA as percentage of GDP at constant 1995 prices	1995	6.2	9.2	21
	2000	8.4	9	22.4
	2005	8	8.8	23.8

Data source: UNIDO 2007

Figures 4.9 to 4.14 below present trade by sector for Uganda and its comparators. Uganda has a trade structure more similar to that of the sub-Saharan African region. The country's agricultural sector (as a share of GDP) is slightly larger than the agriculture sector in sub-Saharan Africa, but slightly smaller than the African region as a whole. Uganda's industry is also smaller than that of many other sub-African and low-income countries. The agricultural sector in Uganda showed a gradual decline, whereas its industry and services sectors increased between 1989 and 2007. This seems to be the global trend followed by many low income countries, but not so much by African countries.

Figure 4.9. Total value added by sector - Uganda, 1990-2006

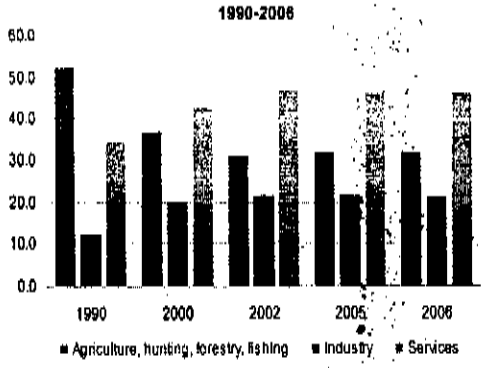


Figure 4.10. Total value added by sector-Africa, 1990-2006

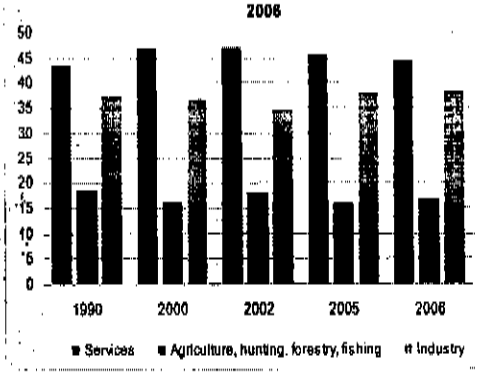


Figure 4.11. Total value added by sector - Sub-Saharan Africa, 1990-2006

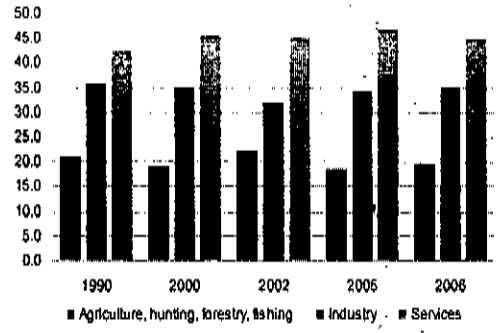


Figure 4.12. Total value added by sector - Sub-Saharan Africa excluding South Africa, 1990-2006

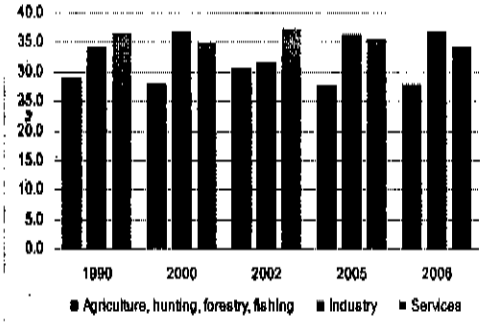
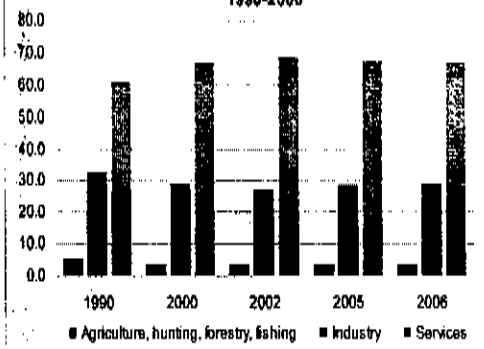


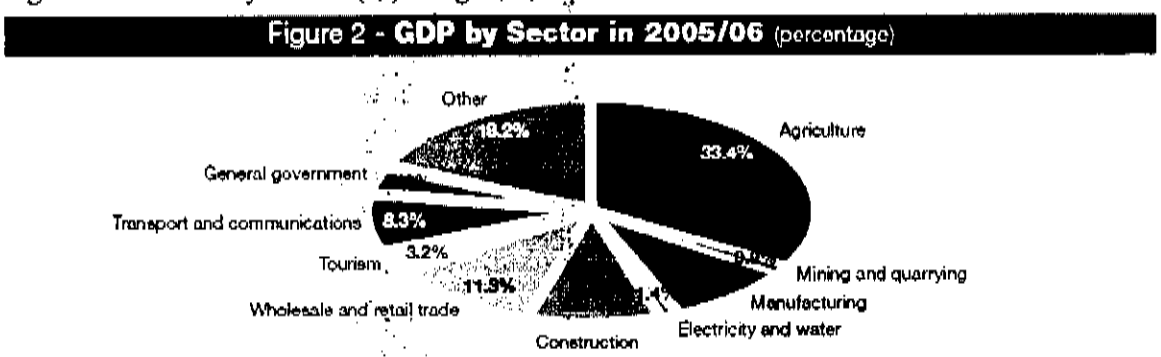
Figure 4.13.Total value added by sector - Low-income countries, 1990-2006

Figure 4.14. Total value added by sector - World, 1990-2006



Data source: UNCTAD Handbook of Statistics 2007 online

Figure 4.15. GDP by Sector (%) – Uganda, 2005



Source: Authors' estimates based on local authorities' data.

http://dx.doi.org/10.1787/302741068763

The figure above, which presents a breakdown of the economy in 2005, further illustrates that although the agriculture sector in Uganda declined by 20 percent between 1989 and 2007 (from 52.8 percent in 1990 to 32.2 percent in 2006), the Ugandan economy is still very much dominated by agriculture (UNCTAD 2006-7). The African Economic Outlook (2007) provides a list of constraints to the Ugandan agriculture sector: Heavy

concentration on low-value crops, limited processing of raw produce, limited access to support services (e.g. crop and veterinary extension services and food processing technology), inadequate infrastructure (e.g. transport, electricity and water), lack of market information, and high local taxes. In 2005, the second largest sector in the Ugandan economy was the services sector, which is dominated by wholesale and retail trade.

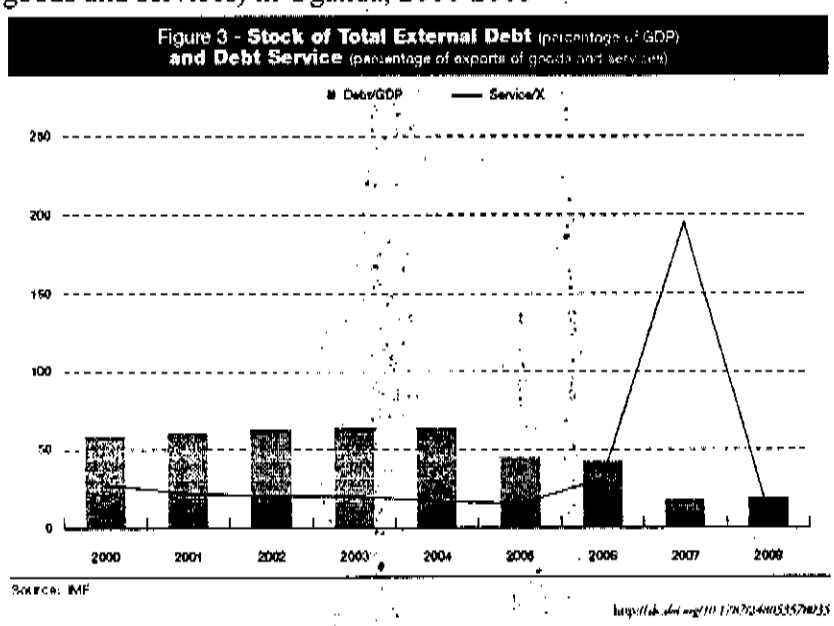
Uganda's total external debt in 2005 was 1.25 times larger than the absolute value in 1995, increasing its share in the total external debt in sub-Saharan Africa from 1.52 percent in 1995 to 2.08 percent in 2005 (see Table 4.10). Figure 4.16 below, however, shows that the country's stock of external debt as a share of its GDP actually shows a downward trend in recent years.

Table 4.10. Development Aid and debt: Uganda and Sub-Saharan Africa

	Uganda				Sub-Saharan Africa			
Indicators	1995	2000	2002	2005	1995	2000	2002	2005
Aid (% of GNI)	14.62	14.13	12.45	14.00	6.08	4.09	5.71	5.54
Aid per capita (current US Dollars)	39.86	33.61	27.33	41.58	32.02	19.90	27.25	43.90
Official development assistance and official aid (current US Dollars) ('00(	832,870	817,090	709,650	1,198,040	18,715,950	13,194,050	18,924,730	32,620,150
Aid % of world average	1.24	1.41	1.06	1.13	27.76	22.84	28.34	30.67
External debt, total (DOD, current US Dollars)	3,583,122	3,498,126	3,993,316	4,462,552	235,283,374	211,212,562	211,670,464	214,840,699

Data source: World Bank online database 2007

Figure 4.16. Stock of total external debt (% of GDP) and debt service (% of exports of goods and services) in Uganda, 2000-2008



Source: African Economic Outlook (2007, p. 538)

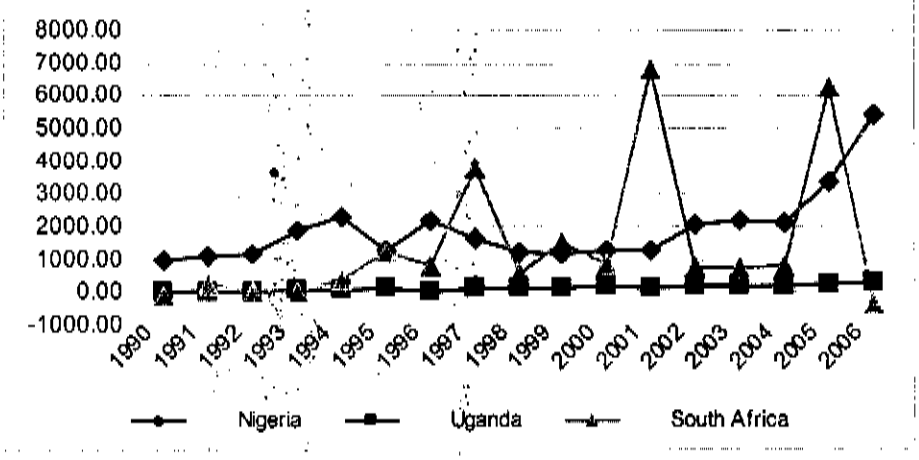
The African Economic Outlook (2007) indicates that Uganda's debt burden has been eased by the Heavily Indebted Poor Country (HIPC) initiative and the Multilateral Debt Relief Initiative (MDRI). The MDRI cancelled 100 percent of the country's debt owed to the African Development Bank, the IMF and the World Bank.

Uganda's official development aid (ODA) as a share of GNI has remained more than double that of sub-Saharan Africa in the period 1994 and 2006 (see Table 4.10 above). In 2005, Uganda's ODA accounted for 3.67 percent of the total ODA in sub-Saharan Africa, down from its share of 6.19 percent in 2000. Uganda's share of the world average ODA was more than one percent in 1995, 2000, 2002 and 2005; which is higher than South Africa and Nigeria's share of the world average in all years except 2005 when Nigeria had a surge in ODA. Uganda shows much dependence on external aid for development.

Openness: FDI flows

Uganda's FDI inward flow is negligible in comparison to that of South Africa and Nigeria. As illustrated in Figure 4.17 below, Uganda shows a gradual increase in inward FDI in recent years, whereas Nigeria showed a surge in FDI and South Africa's FDI inward flows have fluctuated in recent years.

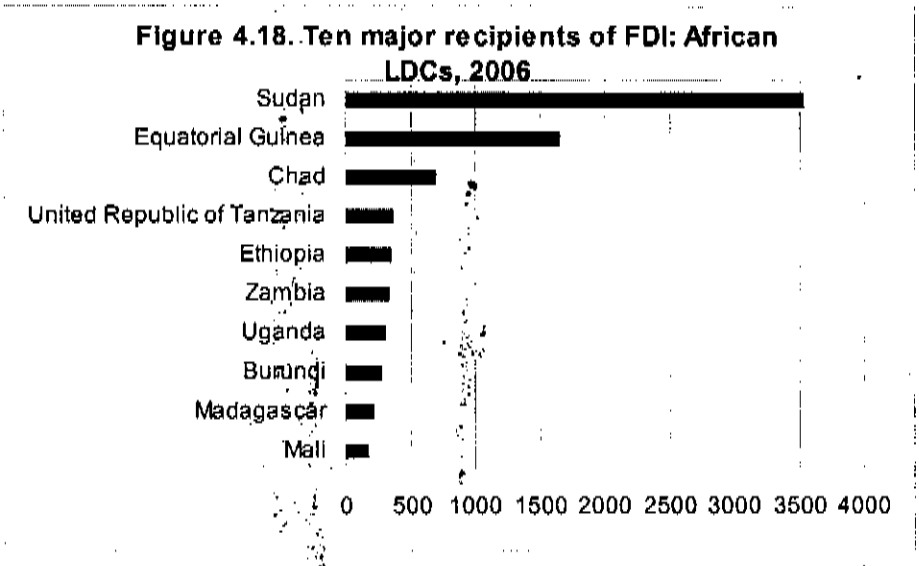
Figure 4.17. FDI (inward), current (US$) - South Africa, Nigeria and Uganda, 1990-2006



Data source: UNCTAD, World Investment Report 2007 online

In 2006, Uganda was the seventh largest recipient of FDI of the least developed countries (see Figure 4.18) with FDI inflows less than 10 percent of Sudan's total for 2006, the top recipient in the LDC group (UNCTAD World Investment Report 2007). Although FDI flows into Uganda increased in recent years, its FDI inflows are low in comparison to other countries in East Africa and other LDCs, as illustrated in Figure 4.18. Obwona (2001) indicates that Uganda is not as attractive for FDI as some of the other countries in the region. For example, Uganda is a landlocked country, which presents difficulties in transporting imported raw materials and fuel and thus costs are higher in comparison to

Kenya and Tanzania. Other factors include poor infrastructure, expensive and unreliable utility services, adverse labour conditions (low productivity with high wage demand), and access to export markets is difficult (Obwona 2001). The Ugandan government is however committed to providing policy and incentives for attracting FDI inflows (see Obwona (2001) for a detailed report on the government's efforts to increase FDI inflows).



Data source: UNCTAD, World Investment Report 2007 online

In 2006, Uganda was one of the 13 countries in Africa with FDI inflows in the region of 0.2 and 0.4 billion dollars (see Table 4.11). FDI inflows in Uganda increased by 19 percent; which was partly due to investments from Australia in the oil industry, and investments from Egypt, India, Kenya, South Africa and the U.S. in services and agroprocessing (UNCTAD World Investment Report 2007).

Table 4.11. Africa – distribution of FDI flows among economies, by range, 2006

Range	Inflows	Outflows
Over $3.0 billion	Egypt, Nigeria, Sudan and Tunisia	South Africa
$2-2.9 billion	Morocco	..
$1.0 billion	Algeria, Libyan Arab Jamahiriya and Equatorial Guinea	.
$0.5- 0.9 billion	Chad	..
$0.2-0.4 billion	Ghana, United Republic of Tanzania, Ethiopia, Zambia, Congo, Namibia, Cameroon, Uganda, Burundi, Botswana, Gabon, Côte d' Ivoire and Madagascar	Morocco, Liberia and Nigeria
Less than $0.1 billion	Mali, Democratic Republic of the Congo, Mozambique, Seychelles, Cape Verde, Djibouti, Guinea, Mauritius, Somalia, Gambia, Benin, Senegal, Lesotho, Togo, Kenya, Sierra Leone, Guinea-Bissau, Zimbabwe, Swaziland, Malawi, Burkina Faso, Central African Republic, Niger, Rwanda, Eritrea, Comoros, São Tomé and Principe, Mauritania, Liberia, South Africa and Angola	Egypt, Libyan Arab Jamahiriya, Angola, Algeria, Tunisia, Kenya, Botswana, Mauritius, Sudan, Seychelles, Senegal, Congo, Sierra Leone, Swaziland, Niger, Malawi, Mali, Mozambique, Cape Verde, Zimbabwe, United Republic of Tanzania, Benin, Burkina Faso, Guinea-Bissau, Côte d' Ivoire, Namibia, Togo and Gabon

Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics) and annex table B.1.

[a] Countries are listed according to the magnitude of FDI.

Source: UNCTAD, World Investment Report 2007 (p. 37)

Uganda's FDI inflows in 2006 accounted for 17.16 percent of the FDI inflows in East Africa, 0.86 percent of the total for Africa and a negligible 0.08 percent of the developing world. FDI inflows in the country as a share of that in East Africa increased by nearly two percent in 2006 in comparison to 2003 when it accounted for 15.42 percent of the total in East Africa.

FDI inflows, in Uganda, as a share gross fixed capital formation increased at an average annual rate of 8.4 percent in the period 1990 to 2000, and the share in 2004 increased by 2.1 percent in 2006.

Table 4.12: Openness: FDI and trade [illegible] (Millions of US$ and percentages)

Country/region		FDI flows					FDI flows (% gross fixed capital formation)			
		1990-2000 Annual Avg.	2003	2004	2005	2006	1990-2000 Annual Avg.	2004	2005	2006
Uganda										
	Inward	**82**	**202**	**222**	**257**	**307**	**8.4**	**12.2**	**12.7**	**14.3**
	Outward	..	..	..	..	..	..	..	..	..
Angola										
	Inward	602	-3 505	1 449	- 1 303	- 1 140	32.2	60.4	- 40.1	- 33.3
	Outward	..	24	35	219	93	..	2	6.8	2.7
Kenya										
	Inward	29	82	46	21	51	1.5	1.8	0.6	1.3
	Outward	3	2	4	10	24	..	0.2	0.3	0.6
East Africa										
	Inward	459	1 310	1 318	.. 1 205	1 789	5.9	11.1	8.2	11.5
	Outward	21	2	44	65	42	0.7	1.1	1.2	0.5
Africa										
	Inward	6 903	18 677	18 018	29 648	35 544	7.3	12.6	17.8	19.6
	Outward	1 917	1 266	2 059	2 272	8 186	2.2	1.7	1.6	5.1
Developing economies										
	Inward	130 722	178 699	283 030	314 316	379 070	9.3	12.9	12.6	13.8
	Outward	52 836	45 372	117 336	115 860	174 389	3.8	5.5	4.7	6.4
World										
	Inward	495 399	564 078	742 143	945 795	1 305 852	7.8	8.5	10.4	12.6
	Outward	492 622	560 087	877 301	837 194	1 215 789	7.9	10.1	9.2	11.8

Source: UNCTAD, World Investment Report 2007

During the period 1990 to 2006, Uganda's cross-border sales accounted for a sixth of the sales in East Africa and the majority (91.91%) of the cross-border purchases.

Table 4.13. South Africa – Cross-border merger and acquisition overview (millions of dollars), 1990-2005

	Sales				Purchases			
	1990-2000 (Annual average)	2004	2005	2006	1990-2000 (Annual average)	2004	2005	2006
Uganda	..	-	-	334	..	250	-	-
Memorandum								
Angola	..	-	-	1	..	-	-	-
Kenya	..	265	32	2	..	-	12	-
East Africa	12	285	396	2 081	..	272	496	558
Africa	651	4 595	10 509	17 589	1 266	2 718	15 503	11 208
Developing economies	12 277	53 120	94 101	127 372	8 954	37 925	82 426	122 941
World	117 889	380 598	716 302	880 457	117 889	380 598	716 302	880 457

Source: UNCTAD, *World Investment Report 2007*, www.unctad.org/wir or www.unctad.org/fdistatistics
For details, see "definitions and sources" in annex B and annex tables B.1 and B.6 in "FDI/TNC".

Source: UNCTAD, World Investment Report 2007 (country fact sheet)

In sum, although Uganda's economic performance is not as strong as Nigeria and South Africa's, Uganda plays a key role in economic development in East Africa and has shown impressive growth in recent years.

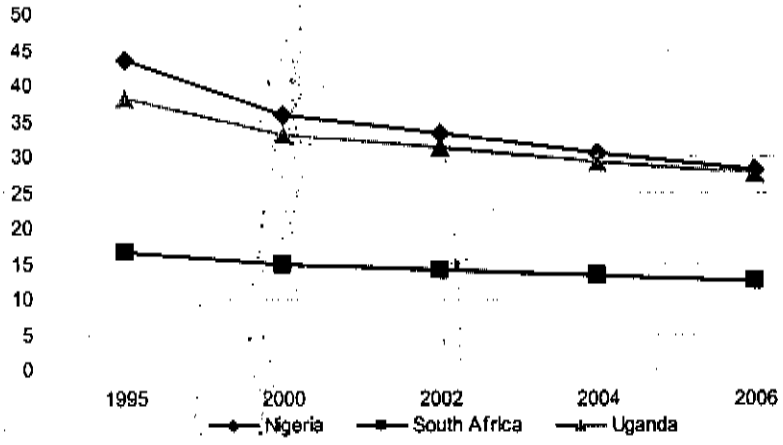
In the following section, indicators of education and human resource capacity in Uganda will be reported.

Pillar 2: An educated and skilled population to use, share and create knowledge and technologies...

Education

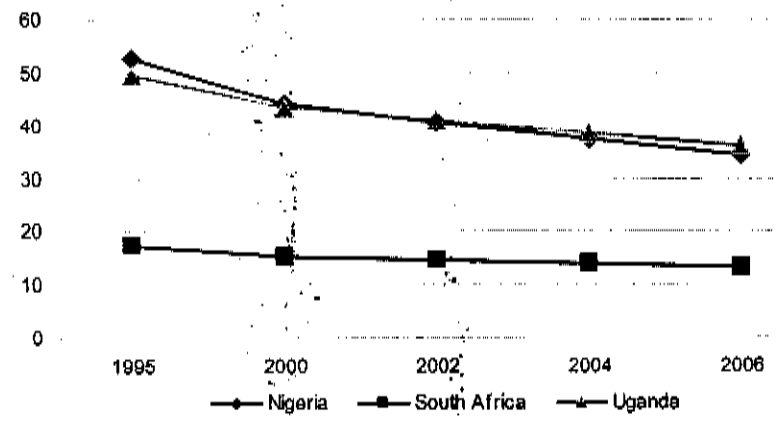
Uganda has high illiteracy rates, with a quarter of the total population illiterate in 2006. Like Nigeria and South Africa, Uganda had a sharp drop in illiteracy between 1994 and 2001 and this decline became more gradual after 2000. Illiteracy rates in Uganda dropped by 10.6 percent in 2006 in comparison to 1995. Illiteracy among females is particularly high with slightly more than a third (36.2%) of the female population illiterate in 2006, a significant decline from 1995 when half of the female population was illiterate.

Figure 4.19. Illiteracy rates (%) in Nigeria, South Africa and Uganda, 1995-2006



Data source: AfDB Selected Statistics on African Countries 2007

Figure 4.20. Illiteracy rates (% female) in Nigeria, South Africa and Uganda, 1995-2006



Data source: AfDB Selected Statistics on African Countries 2007

The country's total expenditure as a percentage of its gross national income and government expenditure in 2005 was on par with expenditure in South Africa and sub-Saharan African, and slightly higher than the world average and the average for developing countries. Like many countries in sub-Saharan Africa, including South Africa, the Ugandan government shows greater commitment to primary education than secondary education. Uganda's expenditure on primary education (as a share of the total expenditure on education) is, however, significantly higher than many other sub-Saharan African countries with an expenditure 12.4 percent higher than that of sub-Saharan Africa in 2005. Uganda's expenditure on secondary education in 2005 was a third of the country's expenditure on primary education. The tendency to place greater emphasis on primary education is likely to have been influenced by international development agencies, which encourages developing countries to focus on education, sometimes to the detriment of secondary education.

Table 4.14. Commitment to education: Public spending, Nigeria, South Africa and Uganda and selected regions, 1999-2005

Country/ region	Total public expenditure on education as % of GNP		Total public expenditure on education as % of total government expenditure		Public current expenditure on primary education as % of public current expenditure on education		Public current expenditure on primary education as % of GNP		Public current expenditure on secondary education as % of public current expenditure on education		Public current expenditure on secondary education as % of GNP	
	1999	2005	1999	2005	1999	2005	1999	2005	1999	2005	1999	2005
Nigeria	...	...	...	...	...	...	...	...	...	...	...	...
South Africa	6.2	5.5	22.2	17.9	45.2	42.5	2.74	2.3	33.7	33.2	2.0	1.8
Uganda	...	5.3 **,z	...	18.3 **,z	...	61.9 **,z	...	2.5	...	19.9 **,z	...	0.8 z
World[1]	4.5	4.9	...	14.4	...	34.3	...	1.5	...	35.0	...	1.7
Developing countries	4.4	4.7	...	...	...	...	...	1.8	...	...	...	1.5
Sub-Saharan Africa	3.7	5.0	...	...	...	49.5	...	2.1	...	27.2	...	1.1

1. All regional values shown are medians.
(z) Data are for 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Enrolment in primary and secondary education was in line with expenditure on education. Enrolment in secondary education in 2005 was nearly a fifth (18.65%) of the school-age population in 2004. Although Uganda also offers the option to enroll in technical and vocational education, accounting for some of the secondary-level school-age population, the proportion of the school-age population enrolled in technical and vocational education was small.

Females accounted for half of the enrolments in primary education in 2005, but slightly less than half of the enrolments in secondary education in the same year. Uganda thus has much to improve with regard to enrolment at the secondary education level, in comparison to the primary level, in terms of numbers and gender equity.

Table 4.15. Primary education: South Africa, Nigeria and Uganda, and selected regions (age group 6-12 years)

Country/territory	School-age population (000)	Enrolment in primary education: School year ending in 1999		Enrolment in primary education: School year ending in 2005		Out-of-school children (000): School year ending in 1999			Out-of-school children (000): School year ending in 2005			Pupil/teacher ratio: School year ending in 1999	Pupil/teacher ratio: School year ending in 2005
	2004	Total (000)	% F	Total (000)	% F	Total	Male	Female	Total	Male	Female	1999	2005
Nigeria	21,645	17,907	44	22,287	45	7,189 **	3,158 **	4,031 **	6584 **	2923 **	3661 **	41 **	37
South Africa	7,176	7,935	49	7,444 z	49 z	171	139	32	569 z	321 z	248 z	35	36
Uganda	6,086	6,288	47	7,224	50	...	...	...	...	...	...	...	52
	Sum	Sum	% F	Sum	% F	Sum			Sum			Weighted average	
World	641,643	646,731	47	688,285	47	96,459	39,820	56,639	72,124	31,163	40,962	25	25
Developing countries	563,298	560,453	46	607,524	47	92,534	37,859	54,675	68,825	29,386	39,439	27	28
Sub-Saharan Africa	113,594	80,825	46	109,663	47	42,423	19,854	22,569	32,774	14,984	17,789	41	45

(z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Table 4.16. Enrolment in secondary education: South Africa, Nigeria and Uganda, and selected regions

Country/region	School-age population (000)	Total enrolment: School year ending in 1999		Total enrolment: School year ending in 2005		Enrolment in technical and vocational education: School year ending in 1999		Enrolment in technical and vocational education: School year ending in 2005	
	2004	Total (000)	% F	Total (000)	% F	Total (000)	% F	Total (000)	% F
Nigeria	18,681	3,845	47	6,398	45	-	-	-	-
South Africa	4,932	4,239	53	4,593 z	52 z	160	44	276 z	40 z
Uganda	4,074	318 **	40 **	760 **	44 **	40 **	30 **	32 **	32 **
	Sum	Sum	% F	Sum	% F	Sum	% F	Sum	% F
World	775,474	438,570	47	511,936	47	46,955	45	51,100	45
Developing countries	660,691	321,911	46	398,529	47	29,062	46	33,419	46
Sub-Saharan Africa	104,741	21,381	45	33,190	44	1,153	36	2,063	40

Notes: (z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Uganda also has much to improve with regard to quality in education. The pupil-teacher ratio in 2005 was 52 pupils to one teacher; which is significantly higher than its comparators, including Nigeria. Uganda's education system ranks poorly in comparison to other countries in sub-Saharan Africa (regional rank 12) and the world (global rank 90) (The Global Campaign for Education 2008). Uganda was ranked relatively poorly on most aspects (except political will): Achievement of universal basic education, growth in enrolments, quality inputs, equal opportunities, and transparency and accountability (The Global Campaign for Education 2008).

In 2005, Uganda's tertiary enrolments accounted for 2.49 percent of the total tertiary enrolments in sub-Saharan Africa with the total tertiary enrolments in 2005 double that of 1999. Females accounted for less than half of the enrolments in both 1999 and 2005, with an increase in the proportion of female enrolments (i.e. 34.15% and 38.64% respectively).

Table 4.17. Enrolment in tertiary education: South Africa, Nigeria and Uganda, and selected regions

Country or territory	Total students enrolled (000) School year ending in 1999						2005					
	Total		Male		Female		Total		Male		Female	
Nigeria	699		397		302		1,290	z	844	z	446	z
South Africa	633		292		341		735		334		401	
Uganda	41		27	**	14	**	88	z	54	z	34	z
	Sum						**Sum**					
World	92,863		48,345		44,517	48	137,769		68,732		69,037	
Developing countries	47,225		27,096		20,129	43	80,150		42,899		37,251	
Sub-Saharan Africa	2,133		1,274		859	40	3,540		2,197		1,343	

(z) Data are for the school year ending in 2004.
(*) National estimate.
(**) UIS estimate.

Source: UNESCO Education for All Global Monitoring Report 2008

Table 4.18. Tertiary education: Distribution of students by field of study and female share in each field, 2005

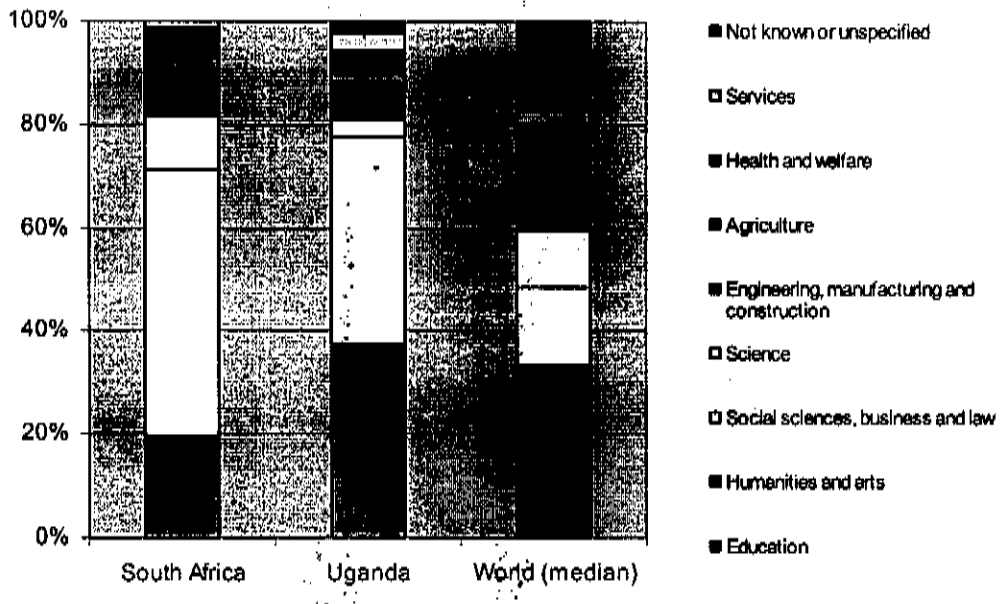
Study field	Percentage distribution by field of study in selected countries and the world in 2005 South Africa Total %	% F	Nigeria Total %	% F	Uganda Total %		% F		World (median) Total %	% F
Education	14	71	..	..	32	z	39	z	12	71
Humanities and arts	5	60	..	..	5	z	41	z	22	56
Social sciences, business and law	51	56	..	..	40	z	41	z	15	35
Science	11	44	..	..	3	z	24	z	11	30
Engineering, manufacturing and construction	9	24	..	..	7	z	19	z	13	16
Agriculture	2	42	..	..	2	z	22	z	4	32
Health and welfare	6	68	..	..	4	z	40	z	5	63
Services	1	65	..	..	4	z	53	z	2	31
Not known or unspecified	-	-	..	..	2	z	55	z	17	.

Data in bold are for the school year ending in 2006.
(z) Data are for the school year ending in 2004.

Source: UNESCO Education for All Global Monitoring Report 2008

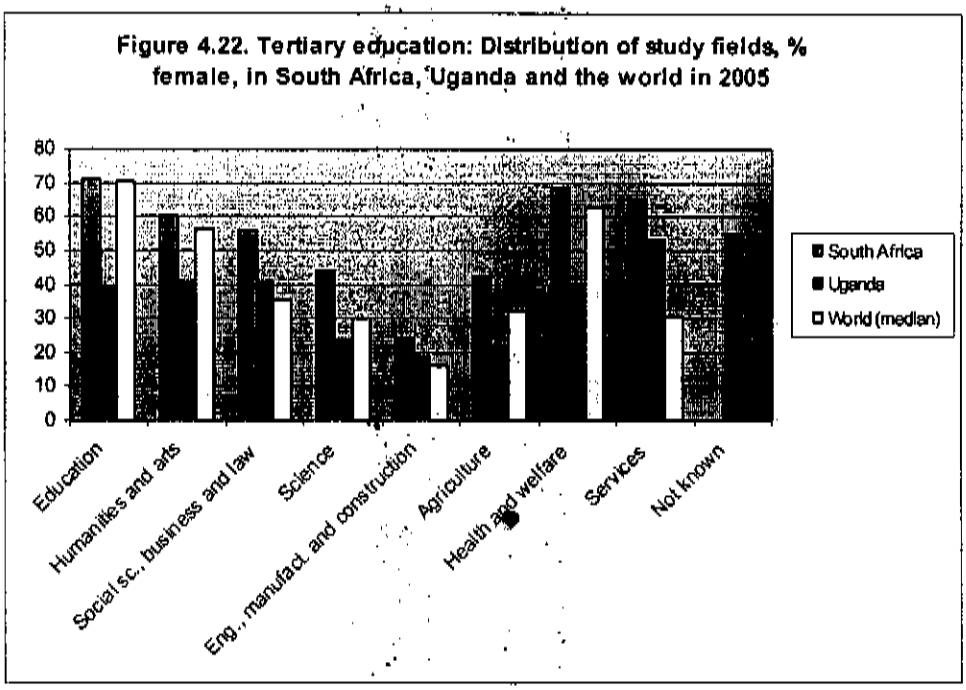
The distribution of enrolment by study field in Uganda in 2005 was similar to the distribution in South Africa in the same year with a greater concentration in the social sciences, business and law, and education. The major differences in distribution in Uganda and the world are in the humanities and arts, and engineering, manufacturing and construction with most countries in the world showing a higher concentration in these fields in comparison to Uganda.

Figure 4.21. Tertiary education: Percentage distribution across fields of study in South Africa, Uganda and the world in 2005



Data source: UNESCO Education for All Global Monitoring Report 2008

Uganda, like most countries in the world, had greater numbers of females enrolled in the more traditionally female study fields, accounting for more than half of the enrolments in education, humanities, social sciences and health and welfare (see Table 4.18 above and Figure 4.22 below). In Uganda, services was also dominated by females. Females account for a significantly smaller proportion of the more traditionally male study fields, engineering and science, with the difference more pronounced in the former. Agriculture was also dominated by males.



Data source: UNESCO Education for All Global Monitoring Report 2008

Labour force participation

Labour force participation in Uganda was significantly greater than in sub-Saharan Africa and the world generally, in 1995 and 2005. In 1995 and 2005, more than 80 percent of the total population between the ages of 14 and 65 were employed with a slight decline from labour force participation in 1995 (i.e. 2.23%).

The participation of females, in this age group, in the labour force was very high in comparison to many other countries in the world with more than 80 percent of the total number of females between the ages of 14 and 65 employed. Females accounted for almost half of the total labour force in both 1995 and 2005. Although employment rates among males declined by 3.73 percent in 2005 in comparison to 1995, employment among males was higher than most other countries in the world.

Table 4.19: Labour force participation, Uganda, 1995 and 2005

	Uganda		Low income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005
Labor force participation rate, total (% of total population ages 15-64)	86.50	84.27	67.92	66.70	75.98	74.36	71.79	70.95
Labor force participation rate, female (% of female population ages 15-64)	82.05	81.21	48.63	47.79	64.40	62.56	58.24	57.85
Labor force participation rate, male (% of male population ages 15-64)	91.08	87.35	86.52	84.95	87.84	86.29	85.01	83.77
Labor force, female (% of total labor force)	47.92	48.27	34.88	34.96	42.76	42.14	39.81	40.08

Data source: World Bank online database 2007

Agriculture labour force

The proportion of employment in agriculture, about 90 percent, was significantly larger than the proportion in sub-Saharan Africa where 65 percent of the labour force is in agriculture; low-income countries where about sixty percent of the labour force is in agriculture; and the world with nearly half of the labour force in agriculture. In 2005, females made up nearly half of the agriculture labour force in Uganda; whereas, in the same year, nearly half of the agriculture labour force in sub-Saharan Africa was female. The percentage of the labour force in agriculture in Uganda did however decline between 1994 and 2006 (see Table 4.20 and Figures 4.23 to 4.25 below).

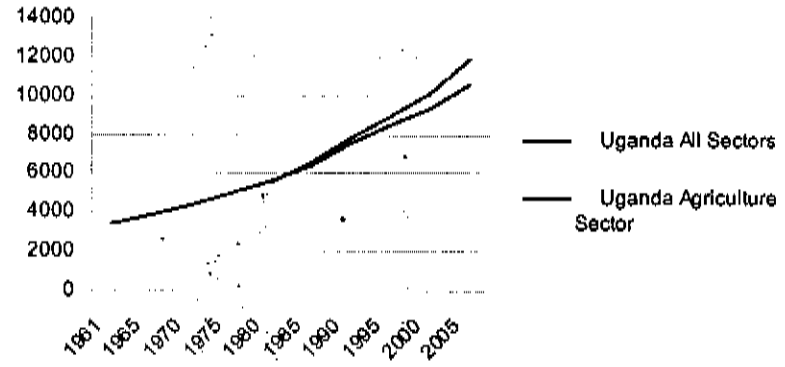
Table 4.20: Labour force, Agriculture (total and % female), 1995 and 2005, Uganda

	Uganda		Low Income		Sub-Saharan Africa		World	
Indicators	1995	2005	1995	2005	1995	2005	1995	2005
Labour force (total in thousands)	8,953	11,858	1,616,861	1,924,835	242,702	309,471	2,604,869	3,050,342
Agriculture labour force (total in thousands)	8,458	10,566	1,118,689	1,212,108	170,455	201,546	1,274,611	1,359,910
Agriculture labour force (% of total labour force)	94.47	89.10	69.19	62.97	70.23	65.13	48.93	44.58
Agriculture labour force (total female in thousands)	4,213	5,190	495,171	543,170	80,314	95,759	550,442	598,417
Agriculture labour force (% female)	49.81	49.12	44.26	44.81	47.12	47.51	43.19	44.00

Data source: UNCTAD Handbook of Statistics 2007 online, author's calculations

The Ugandan labour force, of which agriculture makes up about 90 percent, has been growing steadily since the 1960s and remains strong.

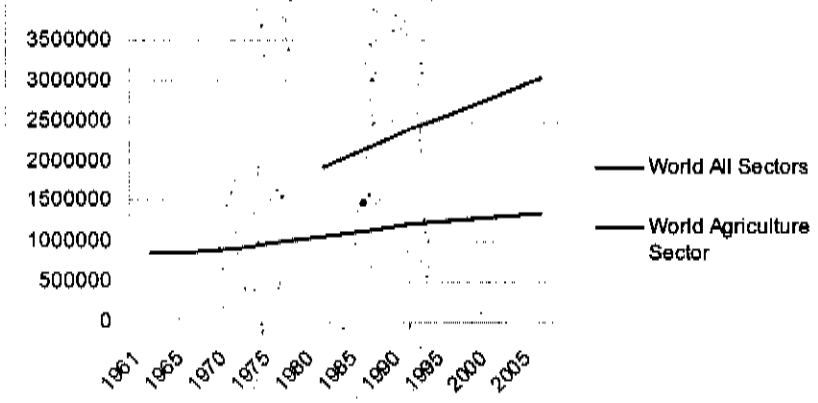
Figure 4.23. Growth in total and agriculture labour at 5-year intervals - Uganda, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007

In comparing Figures 4.23, 4.24 and 4.25, it can be seen that the agricultural sector in Uganda is stronger than that in many other countries in the sub-Saharan Africa and world in general.

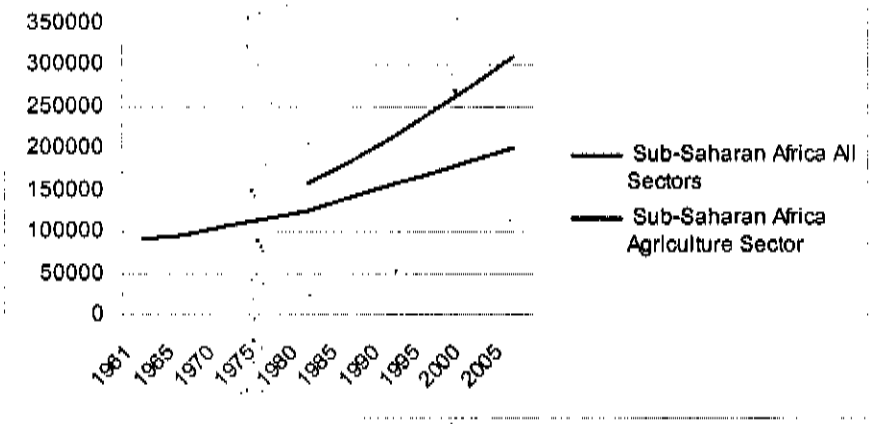
Figure 4.24. Growth in total and agriculture labour at 5-year intervals - World, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007

Uganda accounts for 3.76 percent of the total population in sub-Saharan Africa and Uganda's total agriculture labour force accounts for 5.24 percent of the total agriculture labour force in sub-Saharan Africa.

Figure 4.25. Growth in total and agriculture labour at 5-year intervals - Sub-Saharan Africa, 1961-2005



Data source: UNCTAD Handbook of Statistics 2007

Number of researchers in Uganda

The number of researchers in Uganda doubled in 2005 in comparison to 1996. Uganda does, however, have fewer researchers per million inhabitants than many countries in Africa, including some other least developed countries in Africa such as Gambia and Zambia. Although, the difference in the number of researchers per million inhabitants between Uganda and other least developed countries in Africa is not major, Uganda does have much to improve in catching-up with other developing countries. For example, in 2004, the number of researchers per million inhabitants was 3.32 percent of the number in South Africa and 14.05 percent of that in Nigeria.

Most of the researchers in Uganda are employed by the government and the higher education sector. The number of researchers employed by the government and higher education sector was seven and five times the number of researchers in the business sector respectively. This trend is similar to that of other low income countries, like Zambia, where the government share of the GERD is larger than the share of the business sector.

Table 4.21: Number of researchers [illegible] and selected countries, 2001-2004

Country	Year		Researchers by [illegible] Full-time equivalent (FTE)				Researchers by [illegible] Head count				Researchers by sector of employment (FTE)			
			Total	Female	% Female	Researchers (FTE) per million inhabitants	[illegible]	[illegible]	Female	[illegible] per million inhabitants	[illegible]	[illegible]	Higher education	Private non-profit
Brazil	2001	k	67,785	...	...	384	116,539	52,326	44.9%	661	20,674	4,652	41,876	583
Brazil	2003	k	79,301	...	...	437	135,080	62,677	46.4%	745	21,795	5,095	51,539	872
Brazil	2004	k	84,979	...	...	462	143,864	67,616	47.0%	782	22,355	5,625	56,008	991
Singapore	2001		16,741	...	...	4,086	20,645	...	...	5,039	8,521 x	1,056 x	7,163 r,x	. s
Singapore	2003	x	20,024	...	...	4,745	23,513	5,938	25.3%	5,572	10,578	1,355	8,090 r	. s
Singapore	2004	x	21,359	...	...	4,999	25,251	6,506	25.8%	5,910	12,457	1,335	7,567 r	. s
South Africa	2001		14,182	5,112	36.0%	307	26,913	9,700	36.0%	583	2,952	2,134	8,899	197
South Africa	2003		14,131	5,365	38.0%	301	30,708	11,658	38.0%	654	...	...	...	...
South Africa	2004		17,915	6,852	38.2%	379	37,001	14,152	38.2%	784	5,301	2,040	10,340	234
Uganda	2001		...	...	...	...	568	213	37.5%	23	47 h	301 h	202 h	18 h
Uganda	2003		...	...	...	...	675	253	37.5%	25	...	...	...	...
Uganda	2004		...	...	...	...	724	272	37.6%	26	58 h	384 h	261 h	21 h

Notes and symbols / Notes et symboles :

... ... Data not available / Données non disponibles

h h Head count instead of Full-time equivalent / Personnes physiques au lieu d'Équivalents temps plein

k k Country covered by RICYT / Pays couvert par le *RYCIT*

l l Includes Other supporting staff / Incluant Personnel de soutien

r r Includes Private non-profit / Incluant Institutions privées sans but lucratif

s s Included elsewhere / Inclus ailleurs

x x Country covered by OECD / Pays couvert par l'OCDE

Source: UNESCO online database 2008

In sum, Uganda has much to improve in increasing the number of enrolments in secondary and tertiary education, enrolment in science and engineering, in improving the quality of education in the country, and developing its R&D human resources. Uganda has, however, showed improvement in developing its human resources in recent years, although this improvement has been gradual. Uganda also has relatively high levels of labour force participation and shows adequate levels of gender equality in enrolment in education and labour force participation. The high labour force participation rate among females is probably due to the fact that the majority of the labour force is in employed in the agricultural sector.

The second component making up absorptive capacity in developing countries, that is adequate basic and ICT infrastructure, will now be reported.

Pillar 3: Dynamic infrastructure, successful diffusion of 'old' and 'new' technologies...

'Old' technologies

Uganda has shown much improvement in providing its population with access to an improved water source and electricity in recent years (see Table 4.22 below). The proportion of the population with access to an improved water source increased by 16 percent between 1990 and 2004. In 2004, 60 percent of the population had access to an improved water source; which is similar to that in most of the least developed countries, slightly larger than many countries in sub-Saharan Africa, but smaller than the average for low income countries and the world. Although, electricity consumption increased by 61.5 percent during the period 1990 to 2004, a large proportion of the total population was living without electricity in 2005.

Uganda has not, however, showed much improvement in the share of its total population with access to improved sanitation. Improvement in access to sanitation has been slow in developing countries generally. Uganda improved by only one percent between 1990 and 2004 with less than half of the population having access to improved sanitation in 2004.

Uganda also has much to improve with regard to its transportation infrastructure with only 23 percent of the roads paved during the period 2000 to 2005 and a reduction in the number of registered carrier departures.

Table 4.22. Diffusion of old technologies - South Africa, Nigeria, Uganda and selected regions

	Sanitation and water				Energy			Roads				Railways						Air transport	
	Population using improved sanitation (%)		Population using improved water source (%)		Electricity consumption per capita (kilowatt-hours)	(% change)	Population without electricity (millions)	Total network (km)		Paved (% of total roads)		Railways, total route (km)		Goods transported (million ton-km)		Passengers carried (million passengers-km)		Registered carrier departures worldwide	
Country/Regions	1990	2004	1990	2004	2004	1990-2004	2005	1995	2001-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2000-2005[a]	1995	2005	1995	2005
South Africa	69	65	83	88	4818[b]	20.8[b]	14	331,265	364,131	41.5	17.2999992	25,555	20,047	96,591	108,513	9,675	991	74,300	148,146
Nigeria	99	44	49	48	157	-1.9	71	193,198	193,200	18.8	15	3,557	3,528	97	77	1,734	174	6,600	8,356
Uganda	42	43	44	60	63	61.5	25	..	70,746	..	23	1,250	259	236	218	..	..	900	317
Low income countries	21	38	64	76	449	..	..	4,051,881	239,226	13.8	..	..	..			..	..	551,100	714,157
Middle income countries	46	61	78	84	2,039	..	..	2,927,700	1,148,177	48	50.5	..	..	8,516	10,311	1,899	1571	1,702,300	2,014,002
Sub-Saharan Africa	32	37	48	55	478	..	547	1,422,796	352,527	15.5	12.1000004	..	..	..	..	..	..	278,900	378,978
World	49	59	78	83	2,701	..	1,577	25,962,342	239,226	40.7	36.2999992	..	..	..	5,543	1,848	2277.5	18,008,200	24,877,724

Note: a Data refer to the most recent year available during the period specified.

b Data refer to the South African Customs Union, which includes Botswana, Lesotho, Namibia and Swaziland.

c Data obtained from UNDP Human Development Report 2007/2008.

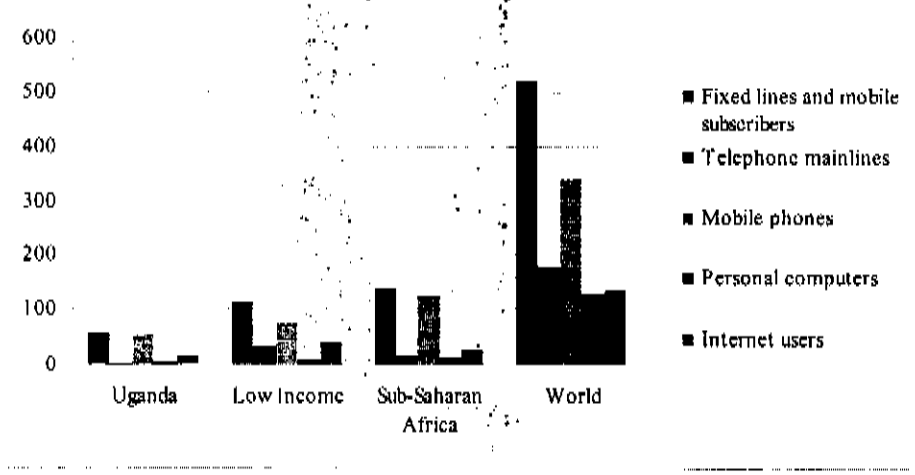
d Data obtained from World Bank online database 2007.

Data source: UNDP Human Development Report 2007/8 and the World Bank online database 2007

'New' technologies

The diffusion of 'new' technologies, that is, ICTs, occurred at a much faster pace than the diffusion of 'old' technologies. Uganda's telecommunications revenue as a share of its GDP in 2005 was nearly one percent higher than that in sub-Saharan Africa and the world in 2004. Uganda's telecommunications revenue as a share of its GDP increased by 3.3 percent in 2005, in comparison to 1995. Like many other countries in sub-Saharan Africa and the world generally, the greatest improvements were in the diffusion of mobile technology and internet access. In 1995, access to ICTs was non-existent, except for fixed telephone technology, which did not improve much in recent years. (The rapid diffusion of mobile telephony in developing countries can be attributed to the lack of fixed-line infrastructure.) Uganda has, however, not kept pace with many other countries in sub-Saharan Africa and many other low-income countries (see Figure 4.26 below). The number of mobile phones per 1,000 inhabitants was 42.48 percent of the average for sub-Saharan Africa.

Figure 4.26. ICT: Uganda in the World, 2004 or 2005, per 1 000 people



Data source: World Bank online database 2007

Table 4.23. Diffusion of 'new' ICT technologies: Uganda and selected regions

	Uganda		Low Income			Sub-Saharan Africa				World		
				2004-2005		1995-1997		2004-2005			2004-2005	
Indicators	1995	2005	1995	Year	%/value	Year	%/value	Year	%/value	1995	Year	%/value
ICT Expenditure as % of GDP												
Telecommunications revenue (% GDP)	0.9	4.2	2.0	2005	0.7	1995	1.9	2004	3.3	1.9	2004	3.6
Fixed lines and mobile subscribers per 1,000 peop	2	56	11	2005	114	1995	12	2005	142	138	2005	523
Telephone mainlines per 1000 People	2	3	11	2005	37	1995	11	2005	17	122	2005	180
Mobile Phones per 1,000 People	0	53	0	2005	77	1995	1	2005	125	16	2005	342
Personal computers per 1,000 people	0	9	2	2004	11	1997	7	2004	15	42	2004	130
Internet Users per 1000 People	0	17	0	2005	44	1996	1	2005	29	8	2005	137

Data source: World Bank online database 2007

Uganda's environmental resources for innovation

The share of Uganda's total land area that is forest is larger than the share of the land area in South Africa and Nigeria. Uganda accounts for 0.66 percent of the forest area in sub-Saharan Africa and 0.09 percent of the world forest area. Uganda's share of the total land area that is forest declined by 1.80 percent in the period 1990 to 2005, faster than the average rate of deforestation in sub-Saharan Africa (see Table 4.24 below).

Table 4.24: Forest area - South Africa, Uganda, Nigeria and selected regions

	Forest area			
	% of total land area (%)	Total (thousand sq km)	Total change (thousand sq km)	Average annual change (%)
Indicators	2005	2005	1990-2005	1990-2005
South Africa	7.60	92.00	0.00	0.00
Nigeria	12.20	110.90	-61.50	-2.40
Uganda	18.40	36.30	-13.00	-1.80
Sub-Saharan Africa	26.8	5,516.40	-549.6	-0.6
World	30.3	39,520.30	-1,252.70	-0.2

Data source: UNDP Human Development Report 2007/2008

Although the area of agricultural land in Uganda increased by 6.8 percent in 2003 in comparison to 1990; the area of irrigated land remained unchanged.

Table4.25: Irrigated land and agricultural land - Uganda and Africa - 1990, 2000, 2003

	Irrigated Land (total, 1000ha)			Agricultural Land (total, 1000ha)			Irrigated Land % of Agricultural Land (total, 1000ha)		
Indicators	1990	2000	2003	1990	2000	2003	1990	2000	2003
Uganda	9	9	9	6 850	7 160	7 350	0.1	0.1	0.1
Africa	10 989	13 150	13 358	197 781	217 115	225 361	5.6	6.1	5.9

Data source: AfDB Selected Statistics on African Countries 2007 XXVI

In sum, this section shows that the diffusion of new technologies occurred at a much faster pace than the diffusion of old technologies. Uganda has much to improve in basic infrastructure, particularly access to improved sanitation and adequate transportation; and still lags behind other developing countries with regard to access to ICTs. Uganda also has to improve in developing its agricultural land.

Pillar 4: Innovation: Research and development, creating knowledge at the frontier...

Research and development

Table 4.26 shows the steady increase in total gross domestic expenditure on R&D (GERD) between 1995 and 2006. Uganda increased its GERD as a share of GDP by 0.74 percent in 2005 in comparison to 1996, surpassing the one percent mark. In 1996, Uganda only allocated 0.51 percent of its GDP in R&D and failed to distribute any of the funds with most of the funds coming from abroad. Table 4.26 presents GERD indicators provided by UNESCO. It can be seen that international donors contributed around 90 percent of the country's GERD during the period 1996 and 2005. Of the 10 percent that Uganda contributed, most of the funds are provided by the public sector.

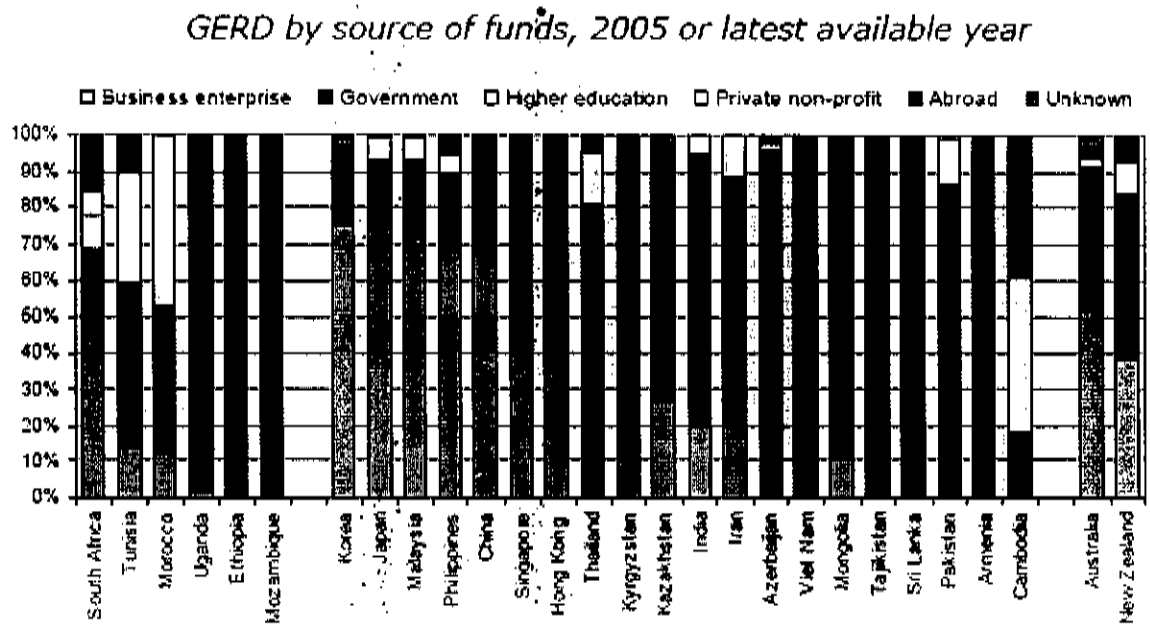
Table 4.26. Expenditure on R&D (New Uganda Shilling) - Uganda, 1996-2005

Country	Year	Total gross domestic expenditure on R&D (GERD)				GERD by sector of performance (%)					GERD by source of funds (%)				
		000 Local currency	000 PPP$	As a percentage (%) of GDP	Per capita (PPP$)	Business enterprise	Government	Higher education	Private non-profit	Not distributed	Business enterprise	Government	Higher education	Private non-profit	Abroad
Uganda	1996	31,422,430 v	108,550 v	0.51% v	5.0 v	...	...	...	...	100.0%	2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	1997	34,866,530 v	118,783 v	0.53% v	5.4 v	4.7% w	66.2% w	27.4% w	1.7% w		2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	1998	43,074,110 v	136,392 v	0.57% v	6.0 v	4.7% w	66.2% w	27.4% w	1.7% w		2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	1999	53,213,760 v	171,127 v	0.65% v	7.3 v	4.7% w	66.2% w	27.4% w	1.7% w		2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	2000	65,740,280 v	208,078 v	0.73% v	8.6 v	4.7% w	66.2% w	27.4% w	1.7% w		2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	2001	81,215,540 v	247,173 v	0.81% v	9.8 v	4.7% w	66.2% w	27.4% w	1.7% w		2.2% w	6.6% w	0.6% w	0.3% w	90.3% w
Uganda	2002	100,301,000 v	323,053 v	0.98% v	12.4 v	5.0% w	66.0% w	27.0% w	2.0% w		2.0% w	7.0% w	0.6% w	0.3% w	90.1% w
Uganda	2003	123,872,000 v	370,857 v	1.05% v	13.8 v	5.0% w	66.0% w	27.0% w	2.0% w		2.0% w	7.0% w	0.6% w	0.3% w	90.1% w
Uganda	2004	152,982,000 v	442,491 v	1.16% v	15.9 v	5.0% w	66.0% w	27.0% w	2.0% w		2.0% w	7.0% w	0.6% w	0.3% w	90.1% w
Uganda	2005	188,933,000 v	522,114 v	1.25% v	18.1 v	5.0% w	66.0% w	27.0% w	2.0% w		2.0% w	7.0% w	0.6% w	0.3% w	90.1% w

Source: UNESCO online database 2008

In international comparison, like many of the developing countries in Africa, most of the funds dedicated to R&D were sourced from abroad (more than 50%). This is in contrast to South Africa where a small percentage is sourced from abroad (less than 20%) and most of the GERD is provided by the business sector.

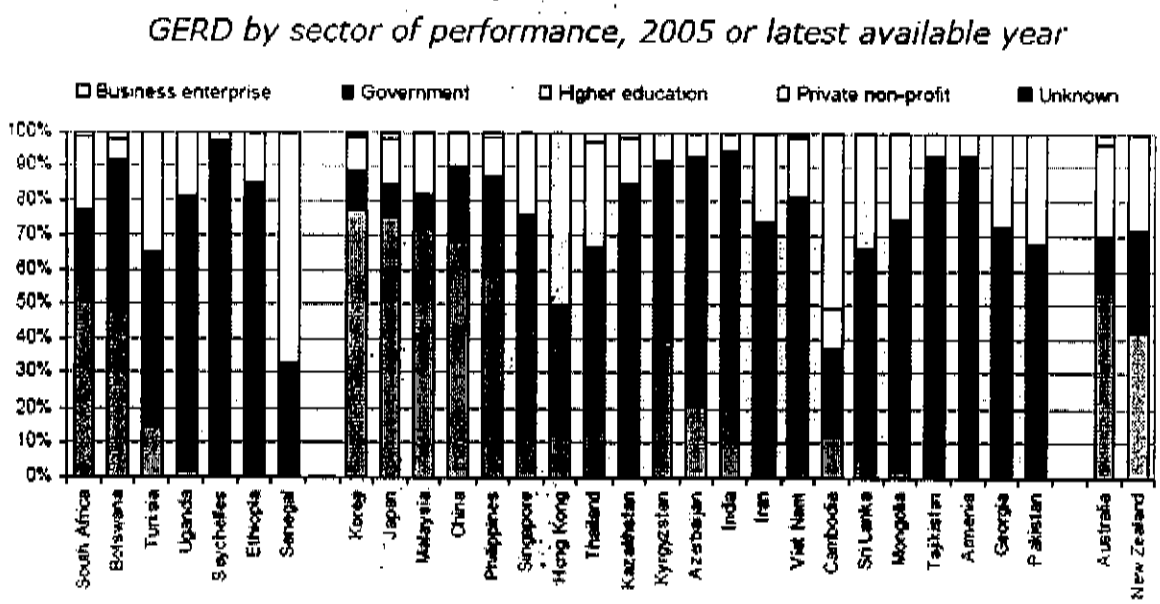
Figure 4.27. R&D funding in Africa, Asia and the Pacific



Source: UNESCO Institute for Statistics, Fact Sheet, October 2007 (p. 6)

Similarly, when looking at R&D performance, most of the R&D is carried out by the public sector and less than five percent is being carried out by the business sector. This is in line with the breakdown of R&D investment in the other African countries where the business sector carries out a small percentage of the R&D or does not conduct any R&D.

Figure 4.28. A breakdown of R&D investment in Africa, Asia and the Pacific



Source: UNESCO Institute for Statistics, Fact Sheet, October 2007 (p. 7)

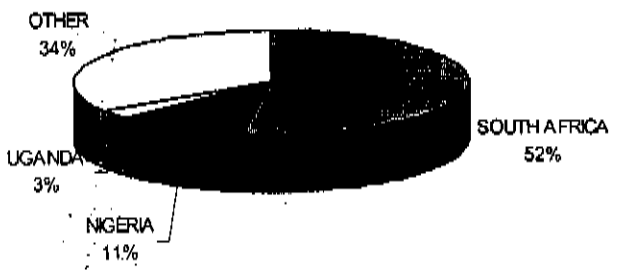
Scientific development

Uganda's scientific output is negligible in comparison to that of South Africa and Nigeria with the number of scientific publications in Uganda representing 5.14 percent of the South Africa's total publications and 24.20 percent of the Nigeria's (see Figure 4.29 and Table 4.27 below). Uganda ranked 89th in international comparison and 7th in sub-Saharan Africa for the total number of publications included in the ESI. The country accounts for 2.69 percent of the total publications in sub-Saharan Africa.

Rank	Country/Territory	Papers		Citations	Citations per paper
		Number	% of total		
1	USA	2,986,569	26.58	42,332,176	14.17
2	JAPAN	808,301	7.19	7,151,726	8.85
17	BRAZIL	145,267	1.29	796,761	5.48
36	SOUTH AFRICA	45,527	0.41	301,413	6.62
45	THAILAND	20,622	0.18	118,021	5.72
51	MALAYSIA	13,059	0.12	51,706	3.96
56	NIGERIA	9,663	0.09	30,127	3.12
64	KENYA	6,496	0.06	55,577	8.56
68	INDONESIA	5,189	0.05	33,324	6.42
79	TANZANIA	3,036	0.03	21,649	7.13
82	PERU	2,928	0.03	23,554	8.04
88	ZIMBABWE	2,368	0.02	15,232	6.43
89	**UGANDA**	**2,338**	**0.02**	**20,911**	**8.94**
91	GHANA	2,100	0.02	11,740	5.59
148	CHAD	119	0.00	815	6.85

Data source: Thompson's ISI data (March 2008), author's calculations

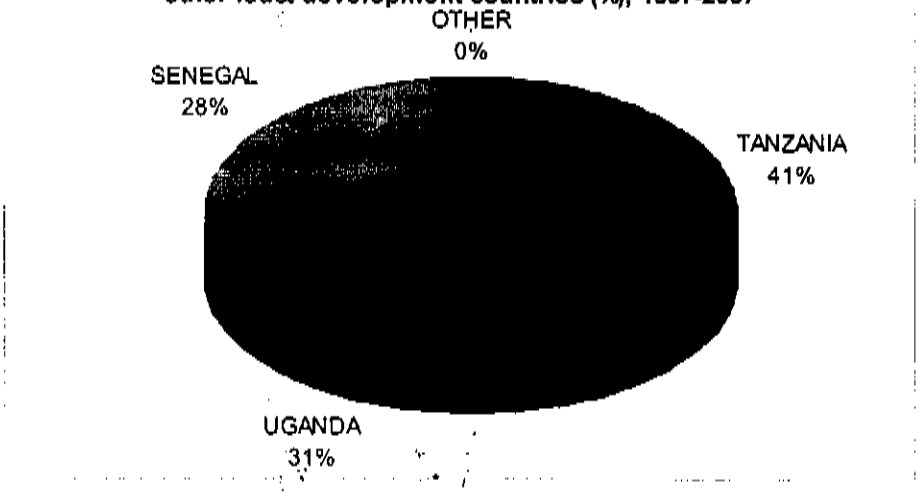
Figure 4.29. Scientific papers (ESI): South Africa, Nigeria and Uganda; share of sub-Saharan Africa's total (%)



Data source: Thompson's ISI data (March 2008), author's calculations

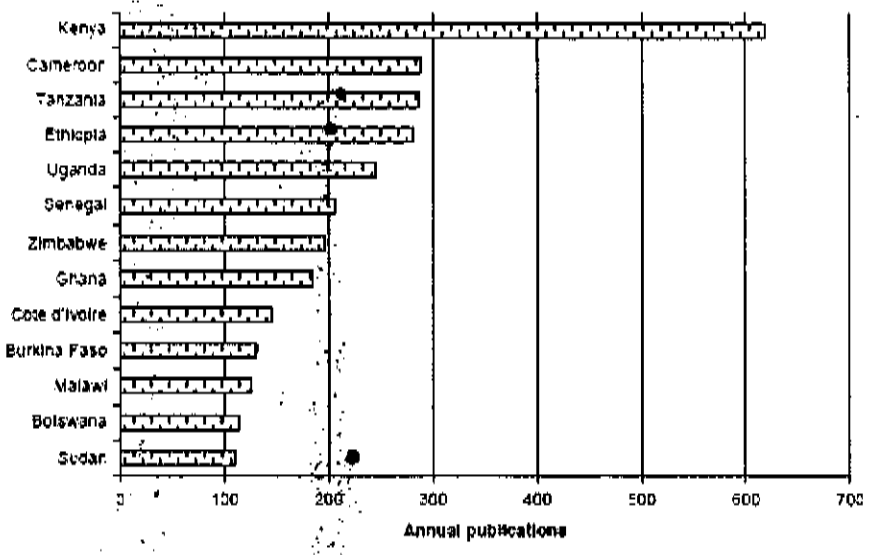
In assessing Uganda's scientific achievements in comparison to the other least developed countries included in the ES, it was found that Uganda's scientific achievement shows up better in comparison to the least developed countries with Uganda accounting for 17 percent of the total publications between 1996 and 2008. However, the country's scientific performance lags behind Tanzania, the lead of the least developed countries with (see Figure 4.30 and Table 4.27).

Figure 4.30. Scientific papers (ESI) - Uganda in relation to other least development countries (%), 1997-2007



Data source: Thompson's ISI data (March 2008), author's calculations

Figure 4.31. Countries with the most publications in 2003/2004 among the African countries other than South Africa and Nigeria



Source: SCISEARCH (STN), computation of Fraunhofer ISI
Source: Schmoch (2005, p. 5)

Like South Africa and Nigeria, the breakdown of Uganda's scientific publications by study field shows a specialization in the life sciences and medical sciences, which is the general trend in the region (Table 4.28 below). Uganda also specializes in social sciences and agricultural sciences.

Field	Papers	Citations	Citations per paper
1 CLINICAL MEDICINE	756	9302	12.3
2 IMMUNOLOGY	288	5099	17.7
3 PLANT & ANIMAL SCIENCE	358	1432	4
4 MICROBIOLOGY	91	1359	14.93
5 ENVIRONMENT/ECOLOGY	259	1237	4.78
6 SOCIAL SCIENCES, GENERAL	207	893	4.31
7 BIOLOGY & BIOCHEMISTRY	58	573	9.88
8 AGRICULTURAL SCIENCES	148	471	3.18
9 PSYCHIATRY/PSYCHOLOGY	31	186	6
ALL FIELDS*	2338	20911	8.94

* Includes data for all papers from ranked and unranked fields.

Data source: Thompson's ISI data (March 2008)

Technological achievements

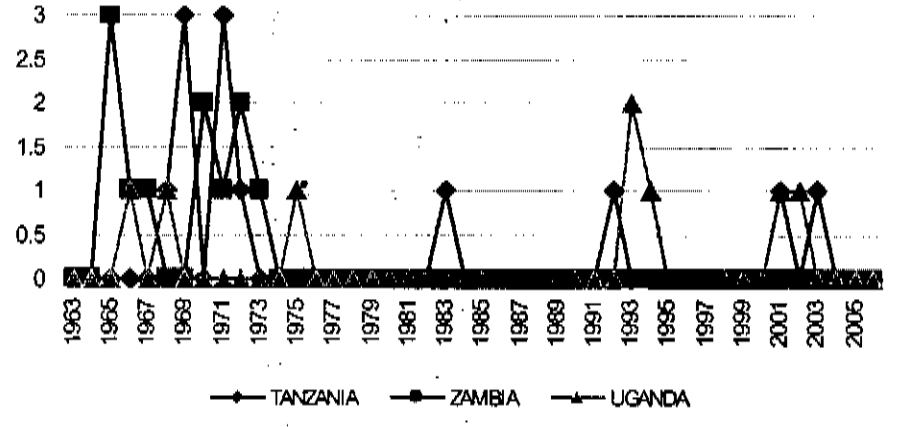
Patents

This section reports on Uganda's production at the frontier, which indicates the country's capability in transferring knowledge to the generation of technologies. The number of patents issued to Uganda by the USPTO between 1962 and 2007 is used to assess the country's technological achievement. In total Uganda had only eight utility patents granted to the country between 1962 and 2007. Uganda was granted three utility patents for the 30-year period 1963 to 1992, three for the eight-year period 1993 to 2000, and two in the six-year period 2001 to 2006.

As was the case with scientific achievements, Uganda's patent output is negligible in comparison to South Africa and Nigeria.

We thus assess Uganda's performance in relation to other least developed countries. Similar to performance on the scientific indicators, Tanzania leads among the African least developed countries with regard to patent activity. Tanzania had a low 12 patents granted between 1962 and 2007, that is four more than Uganda in the same period. Interestingly, even though Uganda's scientific publications were more than double that of Zambia, another least developed country, it had fewer patents than Zambia. However, all of Zambia's patents were granted before 1974. As shown in Figure 4.32 below, the major disparity was performance in the 1970's.

Figure 4.32. Number of patents granted by USPTO - Uganda, Tanzania and Zambia, 1963-2006



Data source: USPTO 2007

In recent years, 2001 to 2005, Uganda was granted patents in ICT.

Class	Class Title	2001	2002	2003	2004	2005	Total
345	Computer Graphics Processing and Selective Visual Display Systems	0	1	0	0	0	1
375	Pulse or Digital Communications	1	0	0	0	0	1
ALL	ALL CLASSES	1	1	0	0	0	2

Data source: USPTO 2007

Except for a few patents in biotechnology, Uganda has not specialised in patent activity related to its scientific performance. This indicates the countries weakness in transferring knowledge to the technology generation.

Class	Class Title	1966	1968	1975	1993	1994	2001	2002	Total
424	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	0	0	1	1	0	0	0	2
83	Cutting	1	0	0	0	0	0	0	1
210	Liquid Purification or Separation	0	0	0	1	0	0	0	1
345	Computer Graphics Processing and Selective Visual Display Systems	0	0	0	0	0	0	1	1
375	Pulse or Digital Communications	0	0	0	0	0	1	0	1
401	Coating Implements with Material Supply	0	0	0	0	1	0	0	1
414	Material or Article Handling	0	1	0	0	0	0	0	1
ALL	ALL CLASSES	1	1	1	2	1	1	1	8

Data source: USPTO 2007

Royalty and licence fees

In 2005, Uganda's royalty and licence fees payments accounted for 0.12 percent of the total for sub-Saharan Africa, and its receipts accounted for 5.26 percent of the region's total receipts.

Table 4.31: Royalty and licence fees payments and receipts, Uganda and selected regions, value (BoP, current US$) and share in total (%)

	1995		2000		2005	
	Number	World share	Number	World share	Number	World share
Payments	Current US$	(%)	Current US$	(%)	Current US$	(%)
World	52,459,536,106	100.00	83,076,870,656	100.00	134,689,072,994	100.00
Low income	125,395,436	0.24	438,945,462	0.53	224,011,892	0.17
Sub-Saharan Africa	334,060,965	0.64	417,038,411	0.50	1,272,129,553	0.94
Nigeria	0	0.00	..	..	45,264,104	0.03
Uganda	0	0.00	0	0.00	1,463,500	0.00
Receipts						
World	53,988,334,021	100.00	79,362,690,241	100.00	123,690,029,182	100.00
Low income	14,917,743	0.03	95,917,676	0.12	46,940,539	0.04
Sub-Saharan Africa	60,373,856	0.11	93,103,839	0.12	141,232,915	0.11
Nigeria	0	0.00	..	..	..	..
Uganda	0	0.00	0	0.00	7,423,808	0.01

Data source: World Bank database 2007, author's calculations

In sum, this section shows that Uganda's scientific and patent activities are negligible, as was expected considering that the country is classified as one of the 50 least developed countries in the world. Uganda does, however, show competitive performance in scientific achievements in relation to other least developed countries, indicating the countries strength in scientific performance. The country shows a weakness in transferring knowledge into the generation of new technologies.

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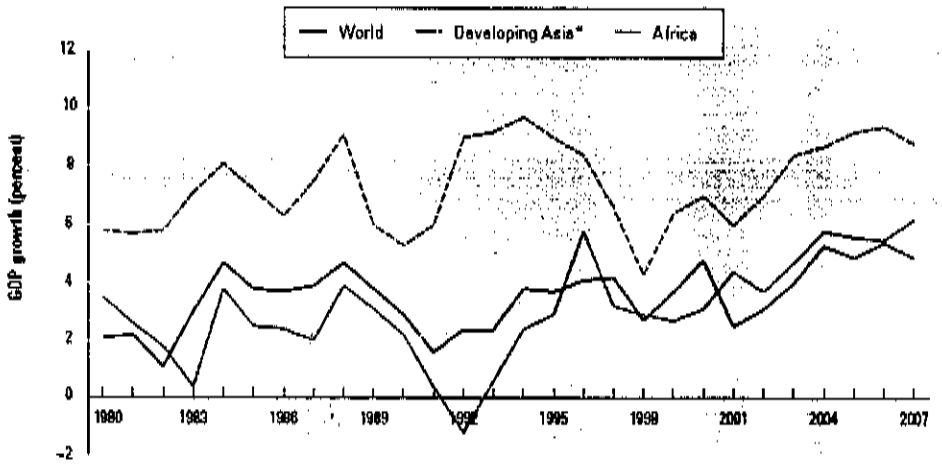
Appendix 1

Figure A1. Africa's comparative growth performance (1980–2007)



Source: IMF, 2007.

* Developing Asia comprises Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Kiribati, Lao People's Democratic Republic, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tonga, Vanuatu, and Vietnam.

Source: World Economic Forum, The Africa Competitiveness Report 2007 (http://www.weforum.org/pdf/gcr/africa/1.1.pdf)

It can be seen in Figure A1 that Africa finally surpassed the world average GDP growth rate at the turn of the millennium and managed to sustain growth since then.

Table A3: Pa

	1963-19			
	Number of patents			
Country/territory	1963	1964	1992	t
Total, U.S. and foreign origin	45679	47375	97444	
Subtotal, U.S. origin	37174	38410	52253	
Subtotal, foreign origin	8505	8965	45191	
JAPAN	407	544	21925	
SOUTH KOREA	0	3	538	
SOUTH AFRICA	**30**	**37**	**97**	
INDIA	4	7	24	
BRAZIL	17	10	40	
MALAYSIA	1	0	5	
EGYPT	0	1	1	
KENYA	0	3	0	
NIGERIA	**0**	**0**	**2**	
TANZANIA	**0**	**0**	**1**	
UGANDA	**0**	**0**	**0**	

Note: * data for 1964-1992

2006	
23,469.80	48,597,902.62
71,283.99	1,091,260.71
41,116.42	718,788.48
42,046.47	247,814.36
06,137.51	3,194,732.46
6,897.58	7,373.31
1,055.58	1,159.18
835.35	914.11
5,049.09	5,132.60
3,371.22	3,926.73

Data source: USPTO 2007, author's calculatior

Table A4. GDP total and per capita in US Dollars at current prices:- Uganda and selected regions

	1990	1995	2000	2001	2002	2003	2004	2005	2006
Nominal GDP (US Dollars at current prices)									
World	22129834.46	29694936.89	31850290.56	31640016.54	32930149.59	37018680.88	41609769.17	44923469.80	48597902.62
Africa	514192.98	535652.07	605467.44	582087.45	580767.82	695289.03	827709.44	971283.99	1091260.71
Uganda	3652.19	6046.31	5733.63	5788.14	6031.11	6497.97	7793.18	9190.41	10339.65
Sub-Saharan Africa	342810.60	344258.45	360308.29	346313.21	353104.70	452120.90	545474.15	641116.42	718788.48
Least developed countries	153109.16	154458.20	178782.23	183601.03	200561.16	223477.50	258631.74	303723.10	356968.27
Low-income countries	1286829.16	1805836.19	2365002.35	2487472.46	2721513.29	3105726.97	3605194.50	4220129.19	4926062.46
Nominal GDP per capita (US Dollars at current prices)									
World	4180.13	5192.83	5202.25	5102.21	5244.13	5823.05	6466.13	6897.58	7373.31
Africa	808.31	738.96	738.99	693.87	676.32	791.15	920.40	1055.58	1159.18
Sub-Saharan Africa	661.67	578.64	531.25	497.90	495.17	618.58	728.25	835.35	914.11
Uganda	204.71	284.73	232.23	227.28	229.46	239.43	278.05	317.49	345.82
Least developed countries	291.75	257.30	263.48	264.11	281.60	306.27	345.98	396.64	455.11
Low-income countries	404.72	517.28	623.38	645.58	695.71	782.24	894.85	1032.44	1188.00

Data source:UNCTAD Handbook of Statistics 2007 online

Appendix 2

Methodological challenges

The main objective of this paper is to describe the socio-economic context and technological climate of each of the three countries. The first methodological challenge was deciding on indicators most relevant and useful for describing innovative capabilities in the sub-Saharan African context. Various papers on innovative capabilities and indicators of innovative capabilities in developing countries have been published, but there is no consensus on the indicators that are most appropriate. We surveyed the extant literature to determine the most common indicators used in deciding on the selection of indictors included in this paper. We also tried to present the data on a disaggregated level in order to gain a fuller picture of innovative capabilities in the context of sub-Saharan Africa, thus providing greater detail than the composite indices commonly used. Consideration was given to the (social and economic) developmental levels of the three countries and the importance of environmental resources in the context of sub-Saharan Africa.

The paper focuses on each of the countries separately, describing their:

- social development – including indicators of population dynamics, and human development (HDI) and poverty levels
- economic development – including selected macroeconomic indicators, GDP, domestic savings, foreign trade, debt and development aid received, and other economic indicators
- education and human resources – including enrolment in primary, secondary and tertiary education, assessing the quality of education, and employment and unemployment rates
- infrastructure – including ICT infrastructure, basic infrastructure (transportation facilities, energy production, and access to improved water and sanitation), and environmental resources – forest area, agricultural land and irrigated land
- level of scientific and technological sophistication – research and development, scientific papers and citations, patent activity, and royalties and licences.

Each of the three country's performance on the various indicators is reported in relation to each other (SA, Uganda and Nigeria), its geographic and income regions, and the world. In order to assess the countries' performance and progress on the various indicators, performance is reported over different periods of time. It was initially decided to report on each of the indicators for the period 1995 to 2005/2006 (depending on the availability of data). This was, however, not possible as the availability of data varies for each of the indicators and for the various countries and relevant regions – which restricted the reporting and presentation of data in this paper. It was also found that for most of the indicators, the most recent date of data was 2005. And the most common indicators, including the macroeconomic indicators, and commonly used indicators of scientific and technological sophistication (i.e. ICT infrastructure, patent activity, ISI indicators, and royalties and licences) were more easily obtainable for comparative

countries and regions over time than the more basic indicators (basic infrastructure, literacy rates and poverty levels).

The best data sources were the international development organisations' online databases and publications including: the International Monetary Fund (IMF), United Nations Conference on Trade and Development (UNCTAD), World Bank online database, United Nations Educational, Scientific and Cultural Organization (UNESCO), United States Patent and Trademark Office (USPTO), Thomson ISI indictors, and United Nations Development Programme. These sources make the data available in excel format, which is easier to working with in compiling tables and selecting data relevant for the purposes of this paper. The Africa Development Bank's (AfDB) publications, The Africa Development Indicators 2007 and Selected Statistics on African Countries 2007 Volume XXVI, were also useful. These resources were however limited in that the publications generally do not report data for any income and geographic regions besides various regions in Africa (and this data is also not reported consistently for all indicators). I found that most of the data included in the AfDB publications were also obtainable from the international development agencies' online resources, and for some indicators more up-to-date data could be obtained from the latter.