Education and training systems in India

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Table of contents

1. Introduction

The opening up of the India economy and unprecedented increase in the inflow of FDI, mostly towards service sector, coincided with a structural change in the economy wherein the service sector, mostly oriented towards the export market, has been emerging as the growth engine of the economy. Given the high labour intensity of service sector in general and the unprecedented growth of IT and software sector that requires highly skilled manpower, there has been an increase in the growth in the demand for skilled manpower. Yet, public investment in education has been only of the order of 3.5 per cent of the GDP and in a context of growing demand for resources to improve primary education, the focus government has been mainly on primary education which in turn manifested in the allocation of over 70 per cent of total public investment in education for the school education. Given the generally held view that private returns to higher education is higher than social returns (Tilak 2005), higher education has increasingly been driven, especially in the recent past, by the private investment. While there has been an increasing participation by the private sector in all spheres of education, it was more pronounced in higher education.

What have been the implications of greater participation of private sector in higher education on the nature of manpower being generated and its quantity and quality? How effective has been the existing regulatory structure to govern the system of education and training system in the country in a context of greater private sector participation? What are implications of the changing manpower structure on sustaining competitiveness and growth of different sectors of the economy? While the availability of a large pool of skilled human power at relatively low cost has been instrumental in attracting FDI in to the country it also has its implications on the education and training system in the country. Hence, it is also important to explore the implications of the entry of Multinational firms and India's increasing participation in GINs on the education and training system in the country. These are some of the issues of immense policy relevance and this preliminary paper is an attempt to provide a background to address these issues.

We begin with a discussion on the school education and the second section deals with higher education. The information gathered and the preliminary analysis undertaken in this paper tends to cast serious doubt on the ability of the market induced new initiatives to sustain India's current competitiveness that exists today thanks mainly to the varied interventions undertaken during the post independence period. Also, the sectoral imbalances that emerge with growth of a few sectors like IT and software could have its adverse effect on other sectors of the economy due to accentuated manpower shortage. In such a context, a case could be made for more effective promotional and regulatory system in higher education and policies to harness the opportunities opened by GINs to improve the education system.

2. School education in India: trends and patterns

As is well known, from the colonial rulers India inherited a stagnant economy poorly endowed with human capital with illiteracy rate as high as 85 per cent. No wonder, the GDP growth rate was less than two percent during the first half of the nineteenth century and per capita income growth (0.5 percent per annum) was only one fourth of the GDP growth rate. Apart from the stagnancy in growth, in terms of the structural characteristics, it exhibited all the characteristics of an underdeveloped economy wherein agriculture accounted for 85 percent of the population and

industrial sector, mostly traditional industries, employed only about 10 per cent of the labour force. Given the high rate of illiteracy prevalent at the time of independence on the one hand and the imperative of skilled manpower to achieve the desired economic transformation with prime role for science and technology (Government of India 1958), the planners adopted a strategy where both primary education and higher education were promoted with an equal vigour. Nonetheless greater importance always has been for primary and secondary education and that during the first five year plan (1951-56) the primary and secondary education together accounted for over 88 per cent of the total outlay for education. Even in 2005-06 out of the total expenditure of 3.46 per cent of the GDP on education school education accounted for 2.5 per cent of GDP (71 % of total expenditure) and that of higher education has been only 0.94 per cent of GDP (Government of India, Ministry of Human Resource Development 2008)

As a result, there are has been a significant increase in the number of institutions engaged in school education[1]. During the period since 1950 the total number of schools increased nearly four-fold. However, it is evident from table 1 that the growth rate in the number of institutions (schools) at all levels showed a declining trend until 1991 and since then there has been an upward trend. More specifically, during the five years since 2000 nearly 0.14 million schools were added - much more than what was added in any of the decades since 1950. Along with remarkable increase in the number of institutions, various schemes have been introduced from time to time by the state. This included, but not limited to, *Sarva Shiksha Abhiyan* (SSA), the Non-formal Education Program (1979-90), Operation Blackboard for small rural schools (1986), Total Literacy Campaigns (1988), District Primary School Education Program (1994-2002) and more recently the mid-day meal schemes.

Table1: Trend in the Number of Institutions in School educations in India

Year	Primary	Annual Growth	Upper Primary	Annual Growth	Sec./ Sr. Sec/ Inter/ Pre. Jr. Colleges	Annual Growth	Total	Annual Growth
1950-51	209671		13596		7415		230682	
1960-61	330399	5.76	49663	26.53	17329	13.37	397391	7.23
1970-71	408378	2.36	90621	8.25	37051	11.38	536050	3.49
1980-81	494503	2.11	118555	3.08	51573	3.92	664631	2.40
1990-91	560935	1.34	151456	2.78	79796	5.47	792187	1.92
2000-01	638738	1.39	206269	3.62	126047	5.80	971054	2.26
2001-02	664041	3.96	219626	6.48	133492	5.91	1017159	4.75
2002-03	651382	-1.91	245274	11.68	137207	2.78	1033863	1.64
2003-04	712239	9.34	262286	6.94	145962	6.38	1120487	8.38
2004-05	767520	7.76	274731	4.74	152049	4.17	1194300	6.59
2005-06	772568	0.66	288493	5.01	159667	5.01	1220728	2.21

Source: Government of India, Ministry of Human Resource Development,
Tables of Statistics of School Education, http://www.education.nic.in/stats/statpub.asp

[1] In India school education involves 12 years of schooling excluding two years of pre-school. The 12 years are schooling is divided into primary (6-11 years and classes I to IV), upper primary (11-14 age and classes VI-VIII), secondary (14-16 age and Classes IX-X) and senior Secondary (16-18 age and classes XI – XII).

These initiatives resulted in a remarkable increase in the Gross Enrolment Ratio (GER)[2] over time. It is evident that the Gross Enrolment Ratio increased from 32 per cent in 1950-51 to nearly 95 per cent in 2005-06 (table 2). The table further indicates that in terms of annual growth in enrollment, there has been a declining trend up 1990-91 and since then there has been an upward trend. To be more specific, the growth in annual enrollment declined from 1.66 to 0.3 during 1990s with the exception of 1980s wherein the annual change was as high as 1.11. Since 2001 there has been a steady increase in enrolment with the result that the enrolment during the first five years since 2001 was as high as over 12 per cent much more than what was recorded during all the decades since 1960 (see table 2). There are evidence to indicate that the period since 1980s recorded much higher rate of economic growth as compared to the previous decade and also there has been a decline in poverty. During 1983 and 2004 the rural poverty declined from 46.9% to 28.4%, at a rate of one percentage point a year (Lanjouw and Murgai, 2009). This tends to suggest that higher rate of economic growth may have enabled previously poorer families to enroll their children in school thereby recording higher enrolment ratio. Indeed, since 1990 as the rate of economic growth picked up along with new initiatives in school education, there has also been rapid increase in literacy rate and school participation (Dougherty and Herd, 2008).

Table 2: Trend in gross enrolment ratio up to class VIII

Year	Primary (I-V)			Upper Primary (VI-VIII)			Elementary (I-VIII)			Annual Change
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	
1950-51	60.60	24.80	42.60	20.60	4.60	12.70	46.40	17.70	32.10	
1960-61	82.60	41.40	62.40	33.20	11.30	22.50	65.20	30.90	48.70	1.66
1970-71	95.50	60.50	78.60	46.30	20.80	33.40	75.50	44.40	61.90	1.32
1980-81	95.80	64.10	80.50	54.30	28.60	41.90	82.20	52.10	67.50	0.56
1990-91	94.80	71.90	83.80	80.10	51.90	66.70	90.30	65.90	78.60	1.11
2000-01	104.90	85.90	95.70	66.70	49.90	58.60	90.30	72.40	81.60	0.30
2001-02	105.30	86.90	96.30	67.80	52.10	60.20	90.70	73.60	82.40	0.80
2002-03	97.50	93.10	95.30	65.30	56.20	61.00	85.40	79.30	82.50	0.10
2003-04	100.60	95.60	98.20	66.80	57.60	62.40	87.90	81.40	84.80	2.30
2004-05	110.70	104.70	107.80	74.30	65.10	69.90	96.90	89.90	93.50	8.70
2005-06	112.80	105.80	109.40	75.20	66.40	71.00	98.50	91.00	94.90	1.40

Source: Government of India, Ministry of Human Resource Development,
Tables of Statistics of School Education, http://www.education.nic.in/stats/statpub.asp

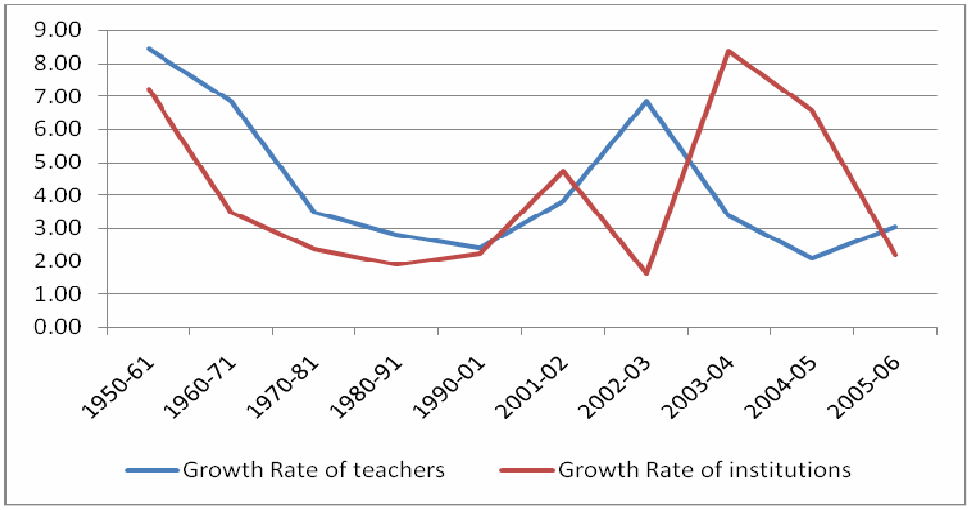
However as per the latest statistics available (2005-06) the GER at secondary and senior secondary level is at a much lower level of 52.2 per cent and 48.5 per cent respectively (GOI Ministry of Human Resource Development 2008) which in underlines the need for more focused efforts.

2.1 Limits

While these achievements are remarkable, there are evidences to doubt the equity in access and quality of education. Fig 1 presents growth in the number of

[2] GER is the total enrolment of pupil in grade or cycle or level of education, regardless of age, expressed as percentage of the corresponding eligible official age-group population in a given school year.

Fig 1: Growth in the number of schools and teachers



institutions and teachers. The figure indicates that up to 1991 growth rate in the number of teachers remained at a higher level than that of the growth institutions. But since 1991 the growth in the number of teachers lagged behind that of institutions. As a result, the number of students per teacher increased at all levels. To be more specific, as is evident from table 3 in primary schools the number of students per teacher increased from 24 in 1950-51 to 46 in 2005-06 and the corresponding increase in upper primary was from 20 to 34 and that in secondary and senior secondary level the increase was from 21 to 33.

Table 3: Trend in pupil teacher ratio

Year	Primary	Upper Primary	Sec./Sr. Secondary
1950-51	24	20	21
1960-61	36	31	25
1970-71	39	32	25
1980-81	38	33	27
1990-91	43	37	31
2000-01	43	38	32
2001-02	43	34	34
2002-03	42	34	33
2003-04	45	35	33
2004-05	46	35	33
2005-06	46	34	33

Source: Government of India, Ministry of Human Resource Development,
Tables of Statistics of School Education, http://www.education.nic.in/stats/statpub.asp

It is also a matter on concern that the dropout ratio, though declined over the years, remains at an unacceptably higher level. Data presented in table 4 indicates that while the drop out ratio is about 26 per cent at the primary level, it is as high as 62 per cent in the secondary and higher (senior) secondary level. Also, it is evident that at the primary level the drop out ratio is higher for the boys

and at the elementary level it is almost equal at nearly 50 per cent for both boys and girls.

Table 4: Drop-out rates of all categories of students

Year	Primary (1-V)			Elementary (I-VIII)			Secondary (I-X)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1960-61	61.70	70.90	64.90	75.00	85.00	78.30	N.A	N.A	N.A
1970-71	64.50	70.90	67.00	74.60	83.40	77.90	N.A	N.A	N.A
1980-81	56.20	62.50	58.70	68.00	79.40	72.70	79.80	86.60	82.50
1990-91	40.10	46.00	42.60	59.10	65.10	60.90	67.50	76.90	71.30
1992-93	43.80	46.70	45.00	58.20	65.20	61.10	70.00	77.30	72.90
1995-96	41.40	43.00	42.10	56.60	61.70	58.80	66.70	73.70	69.90
2000-01	39.70	41.90	40.70	50.30	57.70	53.70	66.40	71.50	68.60
2001-02	38.40	39.90	39.00	52.90	56.90	54.60	64.20	68.60	66.00
2002-03	35.85	33.72	34.89	52.28	53.45	52.79	60.72	64.97	62.58
2003-04	33.74	28.57	31.47	51.85	52.92	52.32	60.98	64.92	62.96
2004-05	31.81	25.42	29.00	50.49	51.28	50.84	60.41	63.88	61.92
2005-06	28.71	21.77	25.97	48.97	48.98	48.80	60.10	63.56	61.92

Source: Government of India, Ministry of Human Resource Development,
Tables of Statistics of School Education, http://www.education.nic.in/stats/statpub.asp

There are evidence to indicate that considerable educational investment has been made in past decades by state governments. Examples of state sponsored schemes include *Lok Jumbish* and *Shiksha Karmi* programs in Rajasthan, Education Guarantee Scheme in Madhya Pradesh, *Balyam* program of Andhra Pradesh and Basic Education Program in Uttar Pradesh. Andhra Pradesh is also home to one of the largest *Anganwadi* systems in India which brought children from particularly poor households into schools. Whilst in some *states* such initiatives have led to significant growth in school enrolment, there exist large disparities in educational achievement across states in India – about two-thirds of the children who do not attend school are in five of the poorest states: Bihar, Uttar Pradesh, West Bengal, Madhya Pradesh, and Rajasthan (Dougherty and Herd, 2008). Persistence of schooling inequalities in some *states* raises concerns regarding the extent to which educational investment has translated into greater access and equality in educational opportunities. Dreze and Sen (1995) attribute existing inequality in educational achievement to variation in efforts to expand basic education in different states. To them, if inequality in the access to education continues to restrict the benefit of (public) investment in education to children from higher social class and the majority (religious) group, educational opportunities are unlikely to equalize.

A recent study on inequality in access to education in India (Asadullah and Yalonetzky 2010) also shows that India's record in reducing inequality of educational opportunity in post liberalization is characterized by considerable variation across states and regions. The state of Kerala stands out as the least unequal in terms of educational opportunities irrespective of the index used. In general, Southern states experienced lower inequality in educational opportunity when compared to Northern states. This finding is consistent with observed North-South divide in social outcomes in India - numerous earlier studies have pointed out how Southern states such as Kerala and Tamil Nadu differ from Uttar Pradesh and Bihar in education and health outcomes (Dreze and Sen, 1995). In addition, even after excluding the single success story, Kerala, significant inter-state divergence

remains amongst the remaining states. The study also finds a positive correlation between reduction of inequality of educational opportunity and poverty reduction and growth. If true, this suggests that social inequality does not matter as long as economic growth and poverty reduction is in place. However, as argued by Deaton and Dreze (2002), "Much else than liberalisation has happened in the nineties, and while issues of economic reform are of course extremely important, so are other aspects of economic and social policy" that help reducing the inequality in the access to education.

3. Higher Education: trends and patterns

The Science Policy Resolution (GoI 1958), which perhaps laid the foundation of India's national system of innovation, noted that India's enormous resource - manpower- becomes an asset in the modern world only when trained and educated. This stand led to substantial investment in establishment of an elaborate system of education conducive for addressing not only the issue of widespread illiteracy but also the growing demand for highly skilled manpower for a growing economy. During the early years greater focus and faster growth was recorded in the educational system at the lower level. The higher education system also caught up later.

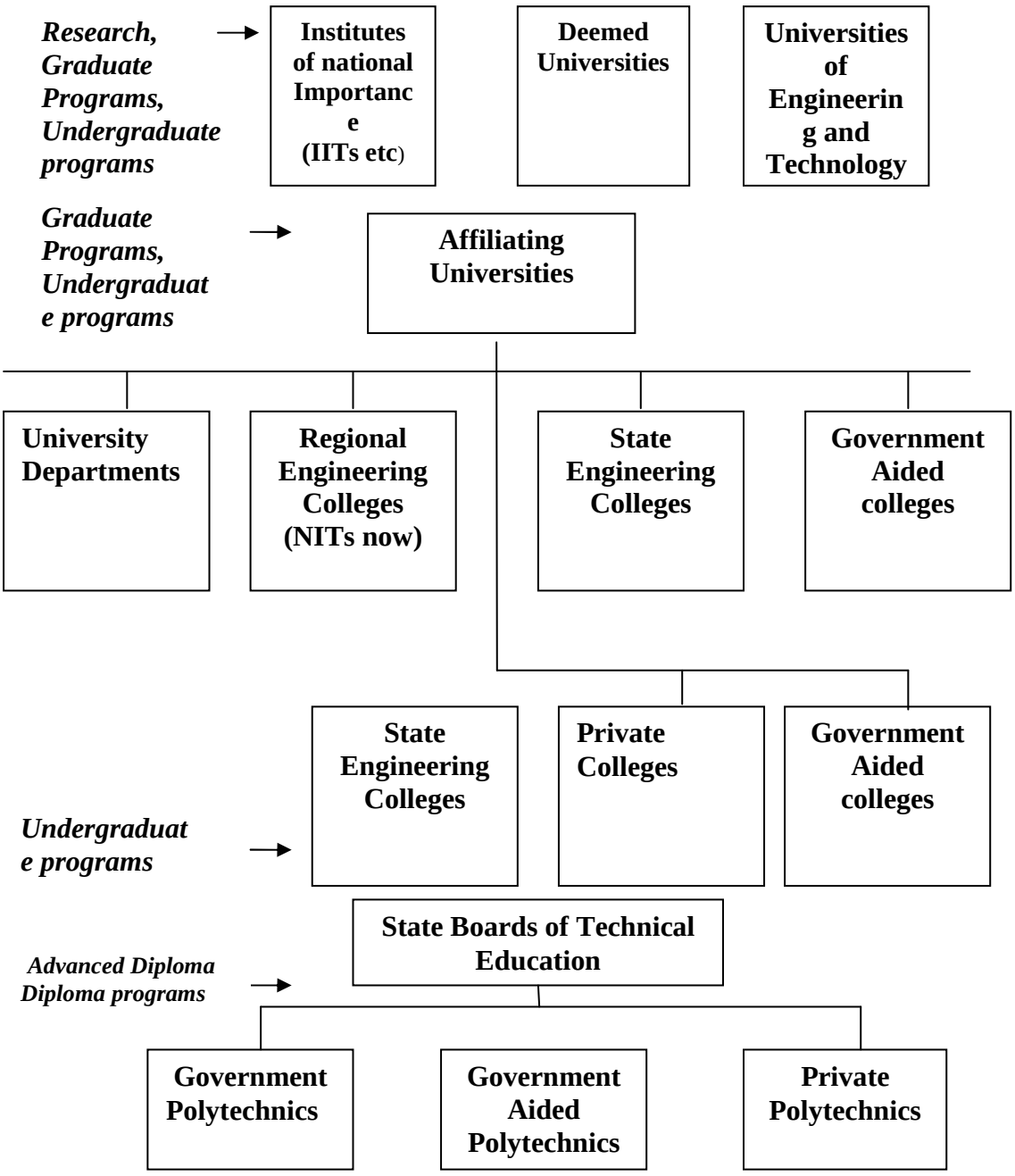
3.1 Structure of higher education

The basic structure of technical and higher education in India can be observed from the figure given in fig 2.1. The system is basically a three tier one with each level producing different levels of output. The first includes the premier institutions in the country whose main objective is to produce world-class manpower and undertake research. These institutions are established by the Parliament / state legislatures as institutions of national importance. Most of these institutes are completely funded by the Ministry of human Resource Development under the Central Government. The important institutions in this list are the Indian Institute of Technologies.

The second level of higher education institutions come under the university education systems that consists of over 300 universities. They vary in terms of their academic, administrative and financial arrangements. Universities can either be established by an Act of Parliament or by the state legislatures. Those established by the Act of Parliament are called the Central universities and the ones set up by the state legislatures are called state universities. Some higher education institutions are granted the 'deemed to be university' status by the central government through gazette notifications. The university system in India operates with teaching and research departments of universities as well as the affiliated colleges. These affiliated colleges are of three type viz., government run, government aided and private self financing. Universities, deemed to be universities and institutions of national importance are degree-granting institutions.

The vocational educational system is mostly under the control of the state government with the state boards of technical education being the controlling agency and government, government aided and private polytechnics as the major educational institutions.

Figure1: Structure of higher education in India



Source: The World Bank (2002)

3.2 Regulatory mechanism

As per the Indian constitution all education, including university education, has been the responsibility of the states. In 1976, education was brought to the concurrent list of Indian constitution and today the central government is on equal footing with the states for all levels of education. Though the Constitution does not stipulate that the Centre should maintain standards, by realizing that neither coordination nor determination of standards is possible without having some centralized control (Singh, 2004), this role has been assumed by the central government in the course of evolution of higher education system in the country. For this purpose, the central government established different statutory bodies over the years. Hence there are multiple agencies (see table 6) and a complex and often overlapping web of rules and regulations that govern the higher

Table 6: Regulatory and statutory bodies for higher education in India

Name	Main role	Overlaps with the role of
University Grants Commission (UGC)	Funding, recognition of institutions and degree titles, maintaining overall standards.	Other professional councils and the Distance Education Council (DEC)
Distance Education Council (DEC) under the IGNOU Act	Funding, maintaining standards of open education	Other professional councils and the UGC
All India Council for Technical Education (AICTE)	Approval for technical institutions and limited funding role for quality improvement	UGC, DEC, Pharmacy Council of India, Council of Architecture and the State Councils for Technical Education
Council of Architects (CoA)	Registration of architects and recognition of institutions for education in architecture and town planning	AICTE
Medical Council of India (MCI)	Registration of medical practitioners and recognition of medical institutions and qualifications	State Medical Councils and the State Governments; UGC and DEC to a limited extent
Pharmacy Council of India (PCI)	Registration of pharmacists and approval of pharmacy institutions	AICTE and State Pharmacy Councils
Indian Nursing Council (INC)	Accepts qualifications awarded by universities within and outside India	22 State Nursing Councils with different Acts have registering powers
Dental Council of India (DCI)	Recommend to the Central Government for approval of dental colleges etc.	Ministry of Health
Central Council of Homeopathy	Maintain Central Register of Homoeopaths.	State Councils
Central Council of Indian Medicine(CCIM)	Maintain central register.	State Councils
Rehabilitation Council of India (RCI)	Recognition of institutions for physiotherapy and related fields	State governments
National Council for Teacher Education (NCTE)	Recognition of teacher education institutions	DEC
Indian Council for Agricultural Research (ICAR)*	Coordinate and fund agricultural education	UGC

Bar Council of India (BCI)	Listing of Members of Bar	State Bar Councils

* Not a statutory body
Source: Agarwal (2006)

education system in the country with the UGC as the apex body. The state governments; the thirteen professional councils at the national level and five professional councils at the state level; the state councils; and affiliating universities are the key stakeholders in the regulatory arrangement in the country.

3.3 Growth of higher education institutions and enrolment

The growth of higher education in India has been phenomenal. Starting with 1950-51when India had only 27 universities, 370 colleges for general education and 208 colleges for

Table 7: Trend in the number of higher education institutions

Year	Colleges for general education	Annual growth rate	Colleges for professional education	Annual growth rate	Universities/ deemed Universities/ institutes of national importance	Annual growth rate
1950-51	370		208		27	
1960-61	967	16.14	852	30.96	45	6.67
1970-71	2285	13.63	992	1.64	82	8.22
1980-81	3421	4.97	3542*	25.71	110	3.41
1990-91	4862	4.21	886	-7.50	184	6.73
2000-01	7929	6.31	2223	15.09	254	3.80
2001-02	8737	10.19	2409	8.37	272	7.09
2002-03	9166	4.91	2610	8.34	304	11.76
2003-04	9427	2.85	2751	5.40	304	0.00
2004-05	10377	10.08	3201	16.36	343	12.83
2005-06	11698	12.73	5284	65.07	350	2.04

Source: Government of India Ministry of Human Resource Development, National Level Educational Statistics, available at http://www.education.nic.in/stats/statpub.asp
Note: **Includes institutions for Post Matric Courses*

professional education (e.g. engineering, medicine). By 2005-06, the number of colleges for general education increased to over 11 thousand, professional colleges to 5284 and that of universities/ deemed universities and institutes of national importance of 350. It may be noted that the growth in professional colleges during the recent years has been much higher. To illustrate, during the first 40 years (1950-90) the number of professional colleges increased by a little over four fold whereas during the 15 years (1990-2005) the number of such colleges increased by nearly six times. In case of the number of colleges for general education the trend appeared to be different; during the first forty years, their number increased more than 13 fold where as during the last 15 years their number hardly increased by 2.5 times. Thus it appears that there has been a marked shift since 1991 from general education to professional courses like engineering. This could be attributed mainly to the

growing demand from the industrial and service sectors like IT and software for such manpower both from the local and foreign firms.

The growth at the national level in terms of the total number of institutions, however, conceals the inter-state variation in the access to higher education across different states in India. Table 8 provides the distribution HEI institutions across states

Table 8: Distribution of higher education institutions across leading States

States/ UTs	Universities & institutes	Arts, science &commerce colleges	Engineering, tech & arch colleges	% share of population
Andhra Pradesh	5.31	13.70	17.80	7.4
Assam	1.43	2.97	0.26	2.6
Bihar	5.51	6.84	0.64	10.7
Gujarat	6.73	4.43	2.88	4.9
Haryana	1.63	1.44	2.88	2.1
Himachal Pradesh	1.43	0.81	0.38	
Jammu&Kashmir	1.22	0.56	0.32	
Karnataka	4.90	7.95	8.58	5.1
Kerala	2.24	1.62	6.34	3.1
Madhya Pradesh	3.47	6.09	4.74	7.9
Maharashtra	19.39	8.70	12.36	9.4
Orissa	2.86	6.00	2.88	3.6
Punjab	1.63	1.98	3.39	2.4
Rajasthan	5.10	6.42	3.20	5.5
Tamil Nadu	7.35	5.92	17.22	6.1
Uttar Pradesh	8.78	13.99	7.30	17
West Bengal	6.33	3.20	3.84	7.8
Delhi	3.67	0.58	1.28	1.3
INDIA	100 (490)	100 (11698)	100 (1562)	

Source: Government of India Ministry of Human Resource Development, National Level Educational Statistics, available at http://www.education.nic.in/stats/statpub.asp

along with the state's share in total population. It is evident that there is much variation in terms of the distribution of institutions reflective of the inter-state variation in the access to higher education. While of the states like Andhra Pradesh, Karanataka, Maharashtra and Tamil Nadu has much higher proportion of universities, engineering colleges and arts and science collages compared to their population share, less developed states like Bihar lags much behind. This tends to indication the high level of inequality in the access to higher education across different states. Such regional differences in the access to higher education across different sates and regions in the country is bound to have its implications on the vibrancy of the regional innovation system which in turn will have its bearing of different regions to global, innovative and get networked with the global firms. Hence, going by the evidence from the INGINEUS survey, tends to suggest that firms operating in states like Karnataka, Maharashtra and Andhara Pradesh and Tamil Nadu participates more intensively in Global innovation network as compared to their counterparts in other states.

Along with the increase in the institutional facilities there has been a commensurate increase the number of students enrolled in higher education. The level of enrolment in these universities

increased from 0.15 million in 1947 to nearly five million by 1980 indicating an annual growth rate of 7.5 per cent sustained over 35 years. The stock of persons with third level education rose from 0.5 per cent of the population above age of 25 years in 1951 to 2.5 percent in 1981 wherein the total number was 7 million in comparison with 1.5 million in 1950 (IAMR different Years). Table 9 presents data on student enrolment

Table 9: Trend in enrolment for higher education

Year	Total Enrolment	Increase over the preceding year	Percentage
1983-84	33,07,649	1,74,556	5.60
1985-86	36,05,029	2,00,933	5.90
1990-91	49,24,868	3,22,188	7.00
1995-96	65,74,005	4,60,076	7.50
1996-97	68,42,598	2,68,593	4.10
1997-98	72,60,418	4,17,820	6.10
1998-99	77,05,520	4,45,102	6.10
1999-00	80,50,607	3,45,087	4.50
2000-01	83,99,443	3,48,836	4.30
2001-02*	88,21,095	4,21,652	5.00
2002-03*	92,27,833	4,06,738	4.60
2003-04**	100,09,137	7,81,304	8.50
2004-05**	117,77,296	17,68,159	17.70

Source: University Grants Commission
* Provisional
** **Source:** Government of India, 2007. Selected Educational Statistics 2004-2005

since 1983. It is evident that the total number of students enrolled in the universities and colleges crossed 11.7 million of which 13 percent were in University Departments and the rest in affiliated colleges (Government of India 2007).

While we don't have data for the distribution of students by discipline, in 2003 of the 2 million-odd graduates, engineering and medicine graduates accounted for 7 percent and 0.7 percent respectively. Nearly two-thirds of the colleges in 2005 were classified by the University Grants Commission (UGC – the apex government regulatory body for higher education) as "Arts, Science, and Commerce Colleges". Recent growth is much greater in professional colleges (especially engineering, management and medicine), as well as in private vocational courses catering especially to the IT sector (Agarwal 2006).

Despite the remarkable increase in student enrolment in higher education, the GER in higher education remains at very low level of 11.5 per cent in India (see table 10). When it comes to backward castes like Scheduled castes and scheduled tribes the ratio is still lower at 8.3 per cent 6.6 per cent respectively.

Table 10: GER in higher education

All Category students			
Year	Boys	Girls	Total
2001-02	9.28	6.71	8.07
2002-03	10.3	7.47	8.97
2003-04	10.59	7.65	9.21
2004-05	11.58	8.17	9.97
2005-06	13.54	9.35	11.55
Scheduled Caste Students			
Year	Boys	Girls	Total
2001-02	7.67	3.64	5.76
2002-03	8	3.73	5.97
2003-04	8.34	4.34	6.44
2004-05	8.1	5.2	6.72
2005-06	10.14	6.4	8.37
Scheduled Tribe Students			
Year	Boys	Girls	Total
2001-02	5.84	2.63	4.21
2002-03	5.57	2.43	3.98
2003-04	6.22	3.11	4.65
2004-05	6.31	3.45	4.86
2005-06	8.55	4.7	6.6

Table11: GER An international Comparison

	Gross Enrolment Ratio			
Countries	**Primary**	**Lower secondary**	**Upper secondary**	**Tertiary**
Countries with High EDI (>0.950)				
USA	99	102	88	83
UK	107	103	107	60
France	111	115	117	56
Germany	101	102	96	n.a.
Sweden	97	104	102	82
Norway	98	102	127	80
Countries with Medium EDI (0.800 to 0.950				
Brazil	140	114	94	24
Mexico	109	104	55	24
China	113	101	50	20
Egypt	101	96	75	34
Indonesia	117	77	50	17
Sri Lanka	98	95	70	n.a.
Countries with Low EDI (<0.800)				
Saudi Arabia	91	87	88	28
India	119	75	43	11
Pakistan	87	33	11	5
Bangladesh	109	64	34	6
Nigeria	103	37	31	10

This compares very poorly with developed and other developing countries like china. While the GER in the tertiary sector in developed countries like USA is as high as 83 per cent and 20 per cent in China (see table 11), India fares very poorly in this respect.

3.4 Emergence of private sector

Till about 1980, the growth of higher education was largely confined to arts, science and commerce wherein the government, apart from supporting higher education by the establishment of universities and colleges, also financed institutions set up by the private sector through grant-in-aid. In the 1980s *inter alia* on account of the turnaround in the economy, greater opportunities on account of opening up, there was an unprecedented increase in the demand for higher education relevant to the needs of business and industry. Also, there was growing middle class with the ability to pay for higher education[3]. A large number of professional institutions – engineering, medicine, management, teacher education have come up in the private sector over the last 2-3 decades. At present, in the professional stream, 78 per cent of all institutions and enrolments are in the private sector (see table 12).

Table 12: Role of private sector in professional education

Course	**No. of institutions**		**Percentage increase**	**Private share**
	1999-2000	2005-06		2003-04
Engineering	669	1478	121	88
Pharmacy	204	629	208	94
Hotel Mgmt.	41	70	70	90
Architecture	78	118	51	67
Teacher Edu.	1050	5190	395	68
MCA	780	976	25	62
MBA	682	1052	55	64
Medicine(Allopathic)	174	229	32	46
Physoitherapy	52	205	294	92
Total	3730	9947	167	78

Source: Government of India Ministry of Human Resource Development, National Level Educational Statistics, available at http://www.education.nic.in/stats/statpub.asp

When it comes to engineering it is as high as 88 per cent while the corresponding share in medical education is only 46 percent. Many of these private institutions got degree granting powers either as deemed to be universities or even full-fledged private universities through the state legislatures over the last five years (Agarwal 2006).

However, when it comes to different states we get a divergent picture. In case of engineering colleges, over 95 per cent of the total number of colleges is in the private sector where as in less

[3] As per NSS (2003), there has been sharp hike in private spending on education over the last decade or so. The per capita private expenditure on education almost quadrupled from 1.2% in 1983 to 4.4% in 2003. In urban areas, the growth was a strapping 200% from 2.1% in 1983 to 6.3% in 2003. The rural sector showed a high growth of 262% from a mere 0.8% in 1983 to 2.9% in 2003.

developed states like Bihar the share is only 44 per cent. Similar pattern could be observed in case of medical education as well (see table 13).

Since 1980s there has also been a substantial increase in the vocational training. Some of this was due to the expansion of the existing systems of training like the expansion of the Industrial Training Institutes (ITIs) and the polytechnics. Here again the growth was almost entirely with private initiatives. In the year 1980, there were 830 ITIs. This number rose to 1900 in 1987. During the 1990s, there was a steep growth. Now there are 4040 ITIs in the country with capacity of more than 700 thousand seats. Sixty five per cent of ITIs are in the private sector. There were only 332 polytechnics in the country in the year 1980. Now there are nearly 1200 polytechnics with 51 per cent in the private sector (Agarwal 2006).

Table 13: Distribution private educational institutions in engineering and Medicine across different states

State	Medical colleges			Engineering colleges		
	Govt.	Private	% Private	Govt.	Private	% Private
Andhra Pradesh	14	14	50	10	213	95.5
Assam	3	0	0	3	0	0
Bihar	6	2	25	4	3	42.9
Chattisgarh	2	0	0	2	9	81.8
Delhi	5	0	0	7	7	50
Gujarat	8	4	33.3	9	16	64
Haryana	1	2	66.6	7	29	80.5
Himachal Pradesh	2	0	0	2	3	60
Jharkhand	0	2	100	4	2	33.3
Karnataka	4	22	84.6	13	99	88.4
Kerala	7	8	53.3	31	51	62.2
Madhya Pradesh	5	1	16.7	6	47	88.7
Maharashtra	19	18	48.6	16	133	89.3
Orissa	3	0	0	6	38	86.4
Punjab	3	3	50	11	27	71
Tamil Nadu	12	7	36.8	16	234	93.6
Uttar Pradesh	10	2	16.7	25	58	69.9
Uttaranchal	0	2	100	5	4	44.4
West Bengal	7	0	0	15	37	71.2

Source: Government of India Ministry of Human Resource Development, National Level Educational Statistics, available at http://www.education.nic.in/stats/statpub.asp

Growth of enrolment in higher education, apart from the entry of private institutions, was facilitated by the scheme to provide educational loans. A National Loan Scholarship Scheme started by the Central Government in 1963 was discontinued in 1991 because of its dismal performance, very low rate of recovery, unrealistic rate of scholarship and thin spread. In pursuance to a Supreme Court direction in 1995, the Reserve Bank of India circulated a loan scheme to all public sector banks in 1995. It started to pick up, however the education loan portfolio of banks in India remained small amount till late nineties. It was from the year 2001/02, when the Government of India announced a new comprehensive educational loan scheme to be implemented by the public sector banks in India that the education loan portfolio grew in India. As of 30 June 2005, Public Sector Banks had a total

outstanding exposure of Rs.71 billion against 488,000 education loan accounts. With less than 100,000 students (out of 3.5 million students graduating each year) availing education loans, financing of higher education through student loans is still insignificant - only 2-3 % students avail of student loans (Agarwal 2006) . In comparison, 85 % students in UK and Sweden, 50% in USA and Canada and 77 % in Australia had availed of student's loans in recent years (Usher, 2005).

Here it may also be noted that, private participation in school education has also been increasing over time (see table 14) though not upto the level what we have observed in

Table 14: Distribution of schools under different management

	Primary			**Upper Primary**			**Senior Secondary**		
Year	**Govt.+local body**	**Private aided**	**Private unaided**	**Govt.+local body**	**Private aided**	**Private unaided**	**Govt.+local body**	**Private aided**	**Private unaided**
1973-74	93.34	5.01	1.64	77.57	17.75	4.67	37.39	57.02	5.59
1978-79	93.99	4.42	1.59	78.44	16.9	4.66	39.15	57.3	3.55
1986-87	93.08	4.34	2.57	75.12	16.3	8.58	45.22	44.79	9.99
1993-94	92.1	3.78	4.12	79.45	9.53	11.02	47.05	37.78	15.17
1996-97	91.66	3.34	5	75.54	10.25	14.2	45.7	36.2	18.1
1997-98	91.25	3.78	5.37	74.51	9.72	15.87	45.75	34.85	19.4
1998-99	91.25	3.27	5.48	74.04	9.2	16.76	45.2	34.12	20.68
1999-00	91.13	3.17	5.7	73.12	9.05	17.83	43.63	33.98	22.4
2001-02	90.92	3.07	6.01	76.41	7.81	15.77	42.45	33.99	23.56
2002-03	88.75	3.63	7.63	72.56	7.37	20.07	42.75	29.3	27.95
2003-04	90.68	2.85	6.48	72.31	6.68	21.01	39.33	28.67	32
2004-05	90.2	2.55	7.24	72.2	6.41	21.39	41.05	29.35	29.6
2005-06	89.11	3.09	7.79	71.97	6.14	21.88	38.71	28.87	32.42

case of higher education. It is evident that the government manages almost 90 per cent of the primary schools where as it share is 72 per cent in upper primary and a still low level of 39 per cent in case of senior secondary schools. Within the private sector, the share of un aided schools has been increasing and that of aided schools declining. The decline of aided schools has been most pronounced in case of senior secondary schools (from 57% to 29%) followed by upper primary (18% to 6%) and primary (from 5% to 3%).

During this period there were a number of foreign players who entered the higher education sector. As per a study conducted by NIEPA, 131 foreign education providers were identified to be operating in India in 2005 enrolling around a few thousand students in the country. The study found that the majority of the foreign education providers offer vocational or technical programmes. These were mainly from the USA or the UK. There were twinning arrangements or programme-based collaborations. There is no major foreign education provider operating in India through its offshore campus or branch campus. Vast majority of students enrolled in programmes offered by foreign providers were financed from personal funding sources. A little more than a quarter also took education loans. The fee levels were usually very high (Rani 2002)

3.5 Trends in outrun

Over the last 50 years there has been substantial increase in the outrun (successful completion) of students from both degree and diploma categories of engineering education. But it needs to be noted that with increased enrolment and private participation there has been a drastic decline in the out turn especially for degree holders where it has declined from over 60 per cent in the early 1950s to 37 per cent in 2000 (Table 15). There is also evidence to indicate that the trend continues. The declining trend in the out turn tends to suggest that with increasing number of institutions and greater demand for engineering graduates, a large number of students who are not adequately equipped to undergo the course get admission by payment. Also, it could be attributed to the quality of training being provided

Table 15: Admission and outrun from engineering discipline 1951-2000

	Degree			**Diploma**		
	Admission	**Outrun**	**%**	**Admission**	**Outrun**	**%**
1951	4788	2893	60.42	6216	2626	42.25
1961	15497	7026	45.34	26525	10349	39.02
1971	18207	18223	100.09	33154	17699	53.38
1981	34835	19012	54.58	61114	35487	58.07
1991	70481	44724	63.46	117835	65325	55.44
2000	197081	74223	37.66	159555	92323	57.86

Source: Compiled from IAMR, Manpower Profile India yearbook various Years

by these institutes especially when there are serious shortage of trained teachers as the remuneration by these institutes are not comparable to the industry. Joseph and Harilal (2001) argued that due to greater demand for manpower by the IT sector, and the resultant resource movement effect has had its adverse effect on the teaching and research activities in the country.

3.6 Educated unemployment

It is paradoxical to note that along with increasing enrolment and growing number of institutions, the available data tends to suggest that there has been an increasing trend in the unemployed among the educated. The unemployment rate of graduates is found to be as high as at 17.2 per cent and is significantly higher than the overall rate of unemployment in the country. Nearly 40 per cent of the graduates are not productively employed. Of the total unemployed population of 44.5 million, unemployed graduates are 4.8 million (Census of India, 2001). Similar observation could also be made from table 16 based on the National

Table 16: Level of education and unemployment (per 1000 in labour force)

	1993-94	1999-2000	2004-05	1993-94	1999-2000	2004-05
URBAN	**Male**			**Female**		
not literate	11	14	12	4	6	8
Literate primary	25	30	23	45	25	41
Middle	57	56	49	157	111	121
Secondary	63	55	49	200	144	181
higher secondary	85	83	51	222	189	189
graduate& above	64	66	64	206	163	196
Secondary & above	69	66	60	206	163	194
RURAL						
not literate	3	4	4	2	2	7
Literate primary	8	11	13	10	9	24
Middle	30	28	24	53	47	59
Secondary	67	52	44	199	147	150
higher secondary	98	73	62	291	227	259
graduate& above	132	106	80	346	331	344
Secondary & above	88	68	59	249	204	231

Source: NSSO Employment unemployment Survey 2004-05

Sample survey data wherein one could observe a positive correlation between unemployment and the level of education. As per the NSSO data, unemployment among the females and those in the rural areas is higher than in urban areas. In case of urban male graduates 64 per thousand population is unemployed whereas it as high as 196 for females. When it comes to rural areas, unemployment rate among those with graduate and above education is 80/1000 for male and 344/100 for female (table 16).

Unemployment among the engineers is also found to be increasing. In a sense there appears to be an increasing mismatch between the skill set required by the industry and what is offered by the university. This is not surprising in a context wherein the interaction between university and industry in general is at a very low level. In a study of India's manufacturing sector Joseph and vinoj (2010) finds that only about 11 per cent of the universities interact with the industry though it is found to be at higher level in case of emerging industries like IT and software. These observations needs to be viewed against the commonly held view that India is endowed with highly skilled manpower which is turn acts as a key factor facilitating India's participation in Global Innovation Networks. The existence of significant skill mismatch and limited university industry interaction is bound to have its adverse impact not in terms of India's participation in GINs but also in upgrading GINs. These issues are to be explored in detain in the case studies.

3.7 Training by the industry

In the context of mis-match between the demand and supply of manpower, both in terms of quality and quantity, various initiatives at the level of individual firms and industry associations, especially in IT and software, is taking place. In case of firms, most of the leading ones have their own training facility to induct the university graduates into the industry. One the leading IT firms in the country – Infosys - for example has a training facility to train 20,000 persons at point in time. In

addition to building up in-house training most of the leading IT firms are having interface with the universities and colleges wherein they influence the curriculum. However, it takes place mainly in the IT sector

Given the manpower constraint, the leading IT industry association (NASSCOM) also has undertaken varied initiatives to enhance the supply of manpower and improve their employability at all the levels. In a context wherein high income earning opportunities were provided by the IT industry for the graduates, there has been a decline in the number of students entering for post graduate courses and Ph D. In this context, NASSCOM has been working with Ministry of Human Resource Development to create highly specialized professionals with skill sets in emerging, "on-the-horizon" technologies that are not yet mainstream. These will typically include research in areas such as banking, insurance, analytics, remote sensing, water, agriculture, energy, transportation, environment, geosphere, natural sciences, nanotechnology, healthcare, networks and mobile computing, image processing, and cyber security, among others.

Ministry of Human Resource Development (MHRD) with support from NASSCOM and the IT industry has recommended the launch of five new IIITs (Indian Institutes of Information Technology), based on the Public-Private Partnership model. In all, the Ministry of Human Research and Development aims to set up around 20 IIITs over the next few years.

Encouraged by the success of its Assessment and Certification program (NAC) for the BPO sector, NASSCOM has introduced a similar testing and accreditation offering, NAC-Tech, for the IT services sector. The aim is to make NAC-Tech an industry standard for evaluating students aspiring to find jobs in the technology/engineering industries. NAC-Tech will also help the industry, academic institutions and individual colleges to understand the potential of their students and determine their caliber, in terms of industry relevance and employability.

Another pioneering initiative by NASSCOM in partnership with the Ministry of Human Resource Development is the "Finishing Schools for Engineering Students" program, which is expected to enable young technical graduates to become industry-ready. The "Finishing School" for engineering graduates who are seeking employment has been launched in a pilot mode in May 2007. The pilot has been conducted during the summer months of May-June, 2007, for a period of eight weeks in eight institutions, including IIT Roorkee and seven NITs—Calicut, Durgapur, Kurukshetra, Jaipur, Surathkal, Trichy and Warangal. he "Finishing School" covers the curriculum provided on technical and soft skills development. The students get an opportunity to reinforce some basic engineering skills and in addition, acquire industry-specific knowledge and skills, soft skills, and management and employment skills, which are being delivered by trained faculty and practicing IT and ITES industry consultants. The students also get an opportunity to take the NAC-Tech (NASSCOM Assessment of Competence–Tech), an employment benchmarking test and participate in a Job Fair.

NASSCOM also has initiated the IT Workforce Development (ITWD) program, keeping the issues and concerns of the industry at one end and challenges of the academia at the other end. As part of this initiative, NASSCOM has been nurturing the IT industry-academia interface through workshops and conferences, faculty sabbaticals, training programs and mentorship initiatives to ensure better synchronization between IT education and the industry requirements. The one-day industry-academia workshops for instance, have been different locations. These have helped improve industry-academia interactions within different regions, enable a flow of information and discussion on the IT industry and create a plank for experience sharing. The faculty training

workshops (or sabbaticals) are enabling faculty to realize the gaps in the present style of teaching and the approach to take in the core areas[4].

As part of the mentorship program, IT companies are providing consistent and continuous guidance for over 12-24 months to a particular college(s)/institute(s) and enabling it to transform into a center where quality education is imparted. NASSCOM also work very closely with academic bodies such MHRD, AICTE and UGC to standardize the curriculum and pedagogy. Yet another intuitive is to encourage research and survey-oriented projects to showcase the best practices in the area of industry-academia alliances and developing White Papers on certain fundamental and critical requirements such as curriculum, information on engineering institutions and skills sets desired/available pan India.

In order to develop entry-level human-power, especially for the BPO industry, and equip them with relevant hard and soft skills that ensure employability, NASSCOM has launched a key endeavor, the NAC. NASSCOM's Assessment of Competence (NAC) was launched as an industry standard assessment and certification program to ensure the transformation of a "trainable" workforce into an "employable workforce" hence creating a robust and continuous pipeline of talent for the BPO sector.

NAC successfully completed its pilot phase in 2006 and was rolled out in Rajasthan where 2500 people took the NAC test. A job fair was held in association with the Department of Information Technology & Communication (DoIT&C) and Government of Rajasthan after the scores were released in Jaipur in March 2007. Later NAC has been extended to Tier II and Tier III cities and towns of different states that can be strengthened into BPO hubs and used as playgrounds for nurturing job-ready professionals. NASSCOM has also organized awareness campaigns at colleges/universities in different states wherein students are being briefed about the BPO industry and the opportunities it offers in terms of jobs. It is envisaged that NAC will help align educational curriculum offered by universities and colleges in the country with the needs of the ITES-BPO sector. The initiative is also expected to help ITES-BPO players reduce their hiring costs, improve efficiencies, enlarge the candidate pool and perhaps more importantly reduce; if not remove the current escalation the market is seeing in entry level wages (NASSCOM 2005).

4. Conclusions

Given the important role of education and skill generating system in a country for generating a vibrant regional/national innovation system which intern is at the core of a country's ability to be an active participant and beneficiary of Global Innovation Network, this background paper has undertaken an analysis of the trends and patterns in India's education and training system. The paper explored both the primary and higher education system. The paper noted India's remarkable achievements in school enrolment which in turn was facilitated by a host of regional and national level initiatives. Nonetheless, there are empirical evidence to show that India has to travel miles to ensured adequate access, equity and efficiency in the school education system especially at the higher school level. When it comes to higher education also India has made significant progress especially during the period since 1990s. However, our analysis highlighted issues of concern like limited industry-university interaction, widening inequality across regions in terms of the access to higher education and more so in its equality. Such regional differences, it was an argued, are bound

[4] Here it may be of relevance to explore the attached link http://www.nasscom.in/download/issue-2-july-sep-05.pdf

have its implications not only on the emergence of a regional innovation system but also on its vibrancy which in turn influence the ability of a particular region/state to participate in Global Innovation Network. What its more, remarkable increase in the supply of skilled manpower, increasingly at the instance of private sector participation, appears to have had led to an overall deterioration in the quality of manpower and an increasing mismatch between the skills set offered by the education system and required by the industry. Needless to say this is also likely to have its implication not only in the emergence of GINs but also in its up gradation.

These deficiencies have indeed attracted the attention of the industry and the policy-makers. The paper noted various initiatives undertaken by the industry associations like NASCOM to address the varied issues confronted by the higher education system. From the government side various committees have been appointed to look into these issues. The Yashpal Committee on the higher education system and the National Knowledge Commission headed by Pitroda have come up with a series of recommendations which in general called for addressing the key issues of "access, equity and excellence". While the concern by both the industry and government need to be appreciated, much needs to be implemented to help India to emerge as an active participant in and beneficiary of Global Innovation Network.

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Foreign Direct Investment in South Africa

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Table of contents

1. Introduction

South Africa is seen as the economic powerhouse in sub-Saharan Africa, but although South Africa has a sophisticated business environment and infrastructure, the country has a dual economy with some aspects resembling a mature market economy with a relatively large industrial platform, while large parts of the society still live under developing country conditions in informal settlements where high levels of poverty and inequality prevail (Estrin and Meyer 2004a). The goal of opening up markets, liberalisation of the economy and an increase in Foreign Direct Investment (FDI) in South Africa should thus be to contribute to economic growth that will enable employment creation and lead to equality.

With the right conditions, such as good education and entrepreneurial opportunities, large numbers of young workers can drive a nation's economic growth to remarkable levels (Nilekani 2009). In South Africa 54.3% of the economically active population is younger than 30 years of age (StatsSA 2009) which could provide a great potential in terms of an employment base and markets for economic growth if proper education and entrepreneurial opportunities were provided.

South Africa's economy is currently 6% the size of China's (or 4% in terms of population) and the 24th largest in the world (Conway, *et al* 2010). South Africa's natural resource mining industry provides an important basis for economic development and the country has a growing middle class and large capital market. Overall South Africa is evaluated not too risky for investors, except for a security risk as a result of the high crime rate (Business Monitor International 2009a). Although South Africa is one of the least corrupt countries in sub-Saharan Africa, according to Transparency International's 2008 Corruption Perceptions Index, corruption in South Africa was perceived to be greater in 2008 than it was in 2007. Positive though is that South Africa has adopted the OECD Anti-Bribery Convention which is important for foreign investors in industries with a significant risk of bribery (Conway, *et al* 2010).

Macroeconomic management in South Africa was strong over the past decade, with reduced levels of public debt, generally low inflation, and a progression from a fiscal deficit to a fiscal surplus, and a consistently positive rate of economic growth.[1] The post-apartheid government has sought to liberalize trade and enhance international competitiveness by lowering tariffs, abolishing most import controls, undertaking some privatization, and reforming the regulatory environment. While this has resulted in several large foreign acquisitions in banking, telecommunications, tourism, and other sectors, FDI has fallen short of the government's expectations (US Department of State 2009).

The South African government is seeking the expansion of the role of innovation and enhanced capabilities. In terms of research and innovation, South Africa does well in comparison to other emerging countries and its national system of innovation (NSI) is relatively well established (TIPS 2009:8).

FDI according to the international Monetary Fund (IMF) is generally defined as ownership of at least 10% of the voting rights in an organisation by a foreign resident or several affiliated foreign residents, including equity capital, reinvested earnings, and long-term loan capital (IMF 1993). FDI can influence a host economy in many ways, including technology transfer; technology spillovers;

[1] SA's current account deficit narrows – Reserve Bank, *BuaNews online, 3 September* 2009, Accessed February 2010, www.buanews.gov.za.

research and development (R&D); employment creation; exports and imports; and competition. FDI is thus especially of interest to policy makers in an emerging market such as South Africa where growth and employment creation is needed (Estrin and Meyer 2004b).

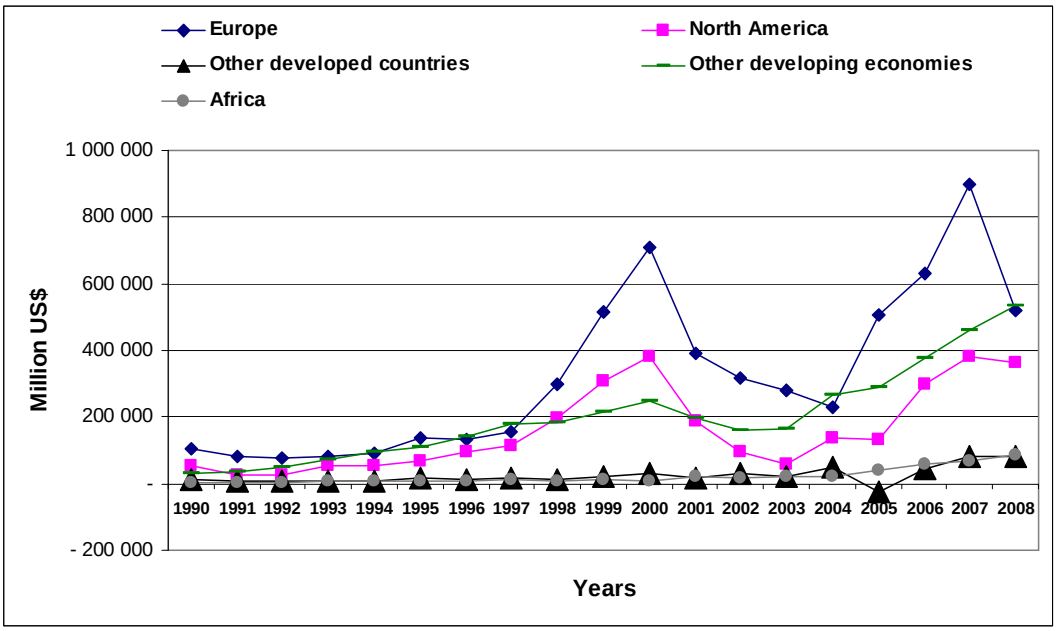
This paper will explore FDI in South Africa by looking at trends in FDI in Africa; the history of FDI in South Africa; inward FDI into South Africa and its origin; sectoral distribution of FDI; outward FDI; how conducive the local South African context is for FDI; R&D in South Africa; systems of innovation; and signs of global innovation networks (GINs) emerging by analysing the impact of FDI on South Africa by mode and type of entry, and the motives of transnational corporations (TNCs) for investing in South Africa.

2. FDI trends in Africa

Investment in Africa by foreign investors since the 1990s was concentrated in resource extraction and market-seeking activities, notably mining, finance, retail and infrastructure (EDGE Institute, African Investment Database 2003).

By comparing inward FDI flow to Africa and other economies in the world, it is shown in Figure 1 that since 1990, FDI inflows into Africa have increased with an average annual growth of 21.1% over the 1990-2008 period, while FDI inflows into other developing economies combined (excluding Africa), had an average annual growth of 16.9%, North America 10.9%, Europe 9.3% and other developed economies 11.5% over the same period. FDI inflows into Africa are, however, still small in comparison to other regions and according to the World Investment Report (UNCTAD 2009), there is likely to be a decline in FDI inflows into Africa following five years of uninterrupted growth.

Figure 1: Inward FDI flows, by host region and economy, 1990-2008



Source: UNCTAD 2009

Africa only absorbed 0.5% of world FDI outflows in 2008, because of small economies, the dominance of natural resources (which can limit diversified investments), high taxes, and high risks in Africa (UNCTAD 2009). The political and regulatory environment in Africa can impact negatively on greenfield investments. However, since 2004, both greenfield investments and M&As grew in Africa (TIPS 2009).

Recent FDI inflows to Africa are driven by the mineral resource sector and this raises concerns about the broader developmental suitability of such investments. Furthermore, FDI into Africa is concentrated in only a couple of countries. Four African countries (South Africa, Nigeria, Angola and Egypt) received 62% of inward FDI in Africa (Economic Commission for Africa 2010). Issues pertaining to operational guarantees and market size limitations remain problematic in Africa. High production costs in Africa and South Africa in addition limit entry by FDI into value addition/beneficiation activities (UNCTAD 2008a). Notwithstanding, South Africa is hosting the highest number of TNCs with more than 640 affiliates (UNCTAD 2008b).

3. History of FDI in South Africa

Gelb and Black (2004a) indicate that foreign companies have been present in South Africa since Britain established a colony in South Africa in the 19th century and the economy was then focused on agricultural exports to Europe. Industrial development was initiated by the discovery of mineral deposits from the 1860s, first diamonds and later gold. Domestic manufacturing was stimulated by the Gold Standard collapse in 1933; import difficulties during World War II; and import-substitution policies, commonly found in developing countries in the 1950s and 1960s. By the early 1970s, 40% of FDI stock was in manufacturing, 25% in financial and business services and 15% in mining.

Gelb and Black (2004a) further report about the international campaign against apartheid between the 1970s and the early 1990s, as a result of which FDI to South Africa slowed. At the start of the 1990s, however, there were still 450 foreign firms in South Africa of which 85% from Europe and 30% from North America. The democratic election in 1994 ended the disinvestment pressures. Even before 1994, fiscal deficit and price inflation was lowered, tariffs were reduced, the capital account and financial system were liberalised and the policy regime became outward-orientated with the aim to attract foreign investment. Since the Growth, Employment and Redistribution (GEAR) policy in South Africa, FDI was seen as a route to address savings shortages (Government of South Africa 1996).

South Africa became a member of the General Agreement on Trade and Tariffs (GATT) in 1994 and average tariff levels were reduced. Foreign exchange control regulations in place in 1994 had been eliminated by 1998. Privatisation in South Africa was slow due to domestic political opposition and global market conditions since 1999. Investment facilitation agencies have been established since 1994 and South Africa has concluded many bilateral investment treaties since 1994 (Gelb and Black 2004a).

Nevertheless, FDI has been disappointing. Between 1990 and 1993, South Africa's total inflows were 1.4% of the country's per capita income, while FDI inflows per capita for the developing world as a whole were 3.5% of per capita income (UNCTAD YEAR??). Since then, however, FDI started to pick-up. Between 1995 and 2002, net inward FDI to SA was 1.5% of all developing

countries, and South Africa received 12% of net inward FDI flows to sub-Saharan Africa (World Bank 2003).

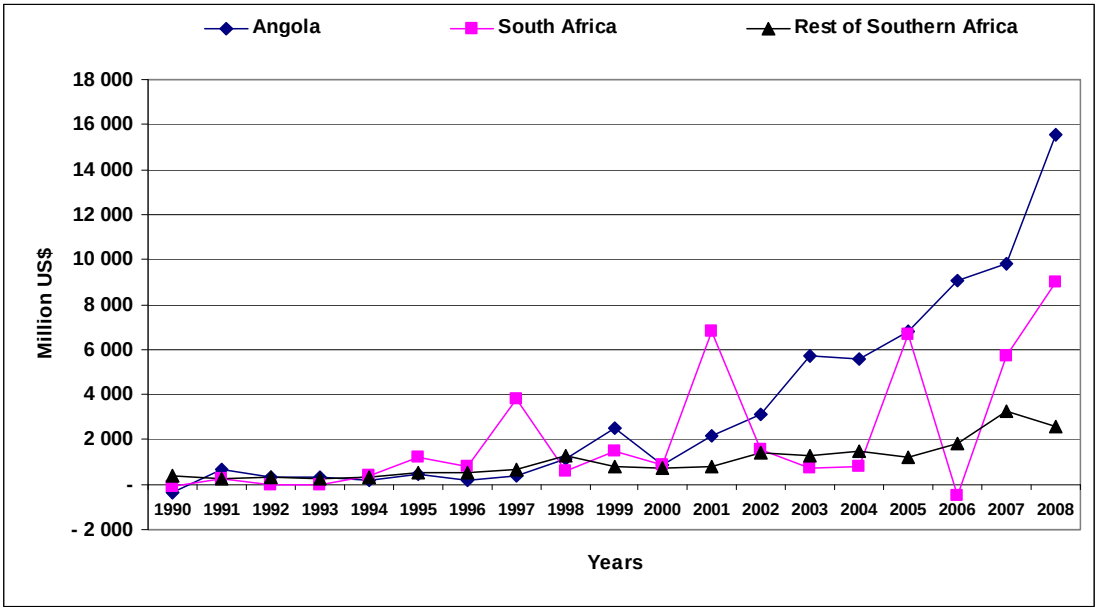
4. Inward FDI to South Africa

Southern Africa accounted for 31% of the inflows to Africa, making it the leading recipient in 2008. FDI inflow to Angola and South Africa drove FDI inflows to Sub-Saharan Africa (Figure 2). Angola's high FDI inflows were due to an expansion of investment in oil exploration and exploitation activities (UNCTAD 2009). According to the South African Reserve Bank (SARB), FDI inflows to South Africa have reached US$ 3.2 billion in 20092. Investors have heavily invested in mining and quarrying, manufacturing, and finance and business services in South Africa (SARB 2008). Although increases in FDI inflows into South Africa can be attributed mainly to a couple of large foreign investment transactions, there are indications of large increases in FDI inflows to South Africa since 2000 when compared to the 1990s.3

The first, large investment in South Africa since 1994 was the sale of 30% of equity in Telkom (the state-owned telephone company) to a strategic partner in 1997, although this was delayed and only occurred in 2003. Large FDI movements occurred beyond 1999, although FDI to South Africa fluctuated as shown in Figure 2. Foreigners purchased large volumes of shares in South African companies. Anglo American took over De Beers in 2001 and Barclays Bank acquired 32% of Absa's ordinary shares in 2005. Also in 2005, Vodafone, a telecommunication firm incorporated in England, acquired 46.5% of Vodacom, a South African telecommunication company. It is further illustrated that FDI inflows were comparatively low for specific years – 2002-2004 – and in favour of other countries in the Southern African region. FDI inflows then surged, partly as a result of further payments by the State-run Industrial and Commercial Bank of China (ICBC) of US$ 5.6 billion for a 20% stake in Standard Bank, which represents South Africa's biggest FDI deal since 1994[4].

[2] SA's current account deficit narrows – Reserve Bank, *BuaNews online, 3 September* 2009, Accessed February 2010, www.buanews.gov.za.
[3] *Financial Mail*, May 2009.
[4] Standard Bank in partnership deal with world's largest bank, *Standard Bank Media releases,* 25 October 2007.

Figure 2: Inward FDI flows to South Africa, Angola and the rest of Southern Africa, 1990-2008



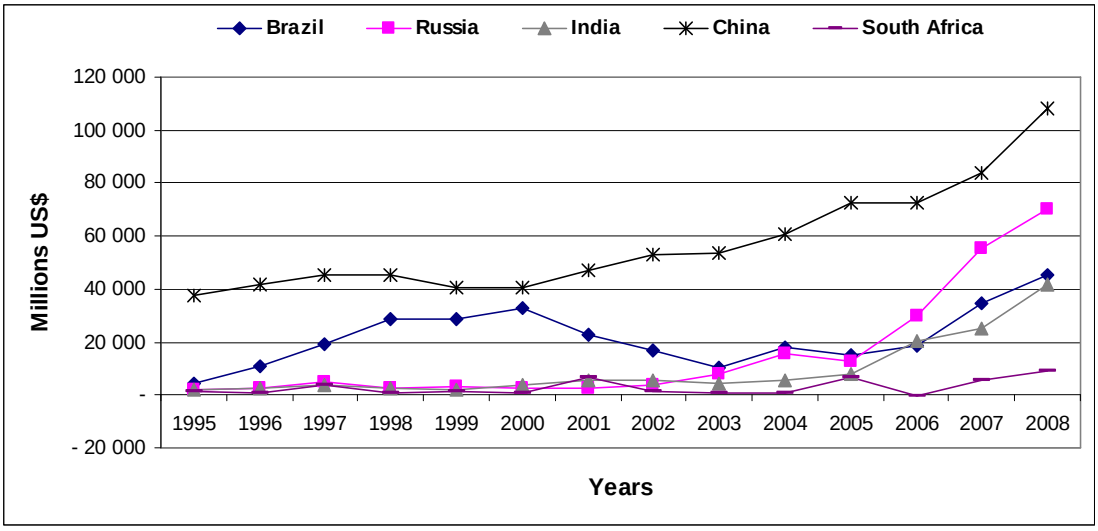
Source: UNCTAD 2009

Emerging economies are the leaders among developing countries with more developed financial markets than other developing countries and are recipients of substantial share of FDI inflows (Loots 2006). With the financial recession, however, FDI inflows have been significantly impacted upon and the emerging economies of Brazil, Russia, India, China and South Africa (BRICS) currently also face a distinct challenge to account for the economic recession (UNCTAD 2009).

Worldwide there has been a general drop in FDI inflow over the 2002-2003 period and strong growth in 2007 and 2008 up to the financial crisis. In 2008 the total FDI inflow to emerging economies was about US$ 274 billion, accounting for roughly 16% of total worldwide FDI inflow (Figure 1).

The BRICS countries have all experienced FDI inflow growth over the 1995-2008 period (Figure 3) and China, as the leading destination of FDI inflows among the BRICS countries, recorded as much as US$ 108 billion FDI inflow for 2008 (UNCTAD 2009). China has experienced relatively constant high FDI inflow over this period, while FDI inflow to the other four emerging countries was more inconsistent, although all have experienced strong FDI inflow growth, especially in the two years before the financial crisis. Drivers of FDI growth into China seem to be market size, low labour costs and export competitiveness (Zhou and Lall 2005). Another very important driver of FDI inflow to China could be its spending on R&D which was 1.49% of GDP in 2007/8 (DST and HSRC 2008).

Figure 3: Inward FDI flows to BRICS countries, 1990-2008



Source: UNCTAD 2009

FDI inflow to Russia had a robust average annual growth of as much as 31.2% which represents the strongest FDI inflow growth among the BRICS countries over the 1995-2008 period, mainly in natural resources and despite tightening regulations (UNCTAD 2009). Russia's R&D spending of 1.12% of GDP could be a contributing factor to its FDI inflow growth. India's average annual growth of 23.6% in FDI inflow over this period was mainly as a result of the attraction of software and high-tech industries in this country (Patibandla and Petersen 2006).

1. The Indian, Brazilian and South African (IBSA) co-operation agreement (launched in 2003) has highlighted cross border investment in IBSA markets. Indian companies in sectors like pharmaceuticals, the automotive industry, and alternative fuels (like ethanol and oil shelling) have invested in Brazil and South Africa. South Africa has enjoyed some Indian investment and more recently Brazilian investment, but investment of South African origin in Brazil is still far more than Brazilian investment here. Brazilians are seeking markets in other African countries - notably Angola and Mozambique – instead5.
2. Confidence by foreign direct investors in Brazil's economy is indicated by the observation that about 36% of FDI inflows into that particular economy was driven by greenfield investment rather than by cross-border M&As which led to an average annual growth of 19.6% in FDI inflows over the 1995-2008 period (TIPS 2009). Brazil has established the Investment and Technology Transfer Promotion System for Companies under the Brazilian Ministry of External Relations to attract FDI to Brazil and stimulate partnerships between Brazil and foreign companies. Trade with Brazil suggests that real opportunities for the IBSA trilateral development initiative are in the food and beverage, as well as energy sector. Transfer of technology is one area with great potential in IBSA - especially in renewable energy and biofuels.6

[5] India, Brazil and South Africa Should Gang Up With China, *allAfrica.com*, 13 October 2008.
[6] India, Brazil and South Africa Should Gang Up With China, *allAfrica.com*, 13 October 2008.

South Africa, on the other hand, had an average annual growth of 16.5% in FDI inflow over the same period and growth has been primarily *market-seeking* and more likely *acquisition* or joint ventures which may improve *business performance in the country* by upgrading technologies, intangible assets, management capabilities and labour skills within the specific organisations (Estrin and Meyer 2004b). Since the Behr Group for example acquired its South African operation, the South African subsidiary increasingly became important in the development of a worldwide spare parts business by supplying heat exchangers (Behr 2001). The South African subsidiary's capability for development work is now expanding partly because of high assistance from the parent company (Gelb and Black 2004b).

However, market-seeking investors use know-how from acquired firms or joint venture partners and have little incentive to try and alter the business environment, while with more *efficiency-seeking* and *greenfield* investments the investor tends to built new operations with resources provided by the investor and may replace the plant, equipment, labour and product line with positive effects on employment, since all jobs in a project are newly created (Estrin and Meyer 2004a). Greenfield FDI can, however, also lead to crowding out of local firms that use traditional labour intensive methods of production (Meyer and Estrin 2004).

South Africa's R&D spending performance (0.93% of GDP) was also not good in comparison to that of China (1.49% of GDP) and Russia (1.12% of GDP), although better than India's R&D spending (0.80% of GDP) in 2006/7 (DST and HSRC 2008).

4.1 Origin of inward FDI to South Africa

Most FDI flows into South Africa are from countries that traditionally had strong economic ties with the country, especially European countries and the United States. The strong investor relations between South Africa, the EU and the Americas can, in part, be explained by well-established trade and tourism links. Investors from these regions have heavily invested in mining and quarrying, manufacturing, and finance and business services in South Africa (Gelb and Black 2004a). Recent deals with Barclays (2005) and Vodafone (2006) in the UK suggest that the pattern of FDI into South Africa has continued. Furthermore, the recent Trade, Development and Co-operation Agreement (TDCA) between the EU and South Africa is in the process of removing 90% of all trade barriers (Olympio, et al 2009). The large share of inward FDI originating from the US since 1994 has been due to the return of US companies that left the country during apartheid. There are an estimated 600 American companies (including subsidiaries, joint ventures, local partners, agents, franchises, and representative offices) doing business in South Africa (US Department of State 2009).

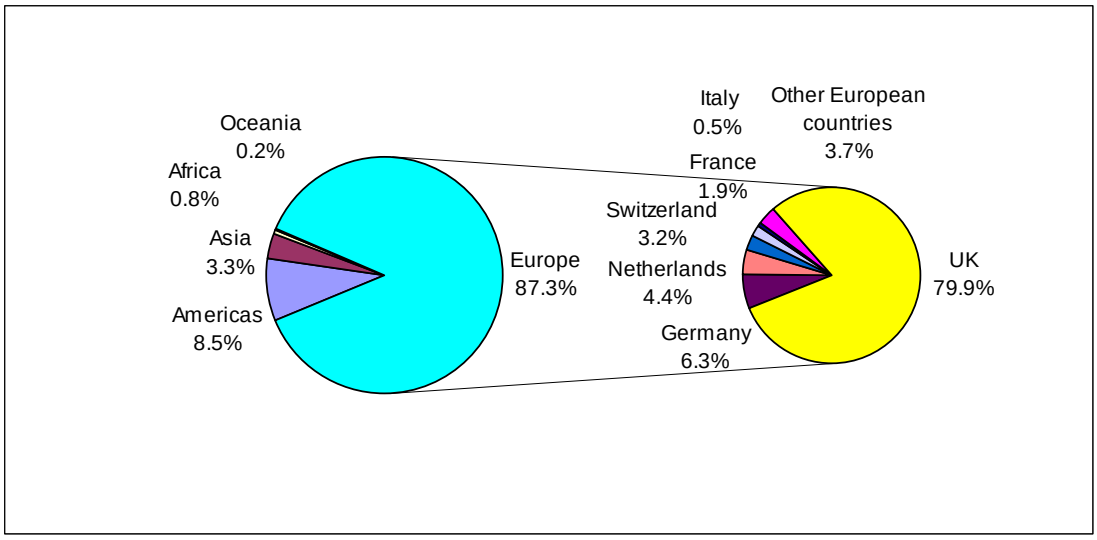
Although developing countries are increasingly becoming important for FDI into South Africa since 1994, developed countries are still responsible for most FDI into South Africa. The fastest expansion in FDI inflows to South Africa by developing countries has been from Latin America and the Caribbean since 2000 (TIPS 2009).

According to SARB's December 2008 Quarterly Bulletin most FDI stock in South Africa in 2007 came from Europe (87.3%), followed by North and South America (8.5%), Asia (3.3%), Africa (0.8%), and Oceania (0.2%), as shown in Figure 4. Most FDI from Europe to South Africa came from the UK (79.9%), Germany (6.3%), the Netherlands (4.4%), other European countries (3.7%), and some from Switzerland (3.2%), France (1.9%), and Italy (0.5%) in 2007. The USA (72.2%) was

responsible for most FDI from the Americas, while Japan (52.2%) for most FDI from Asia to South Africa in 2007.

China is South Africa's number-one trading partner and the country expects greater investment from China in the future.7 India is South Africa's tenth largest foreign investor and trade between India and South Africa has tripled between 2003 and 2007.[8] Since FDI outflows to South Africa are still primarily from the UK, FDI in South Africa would, however, be influenced primarily by conditions prevailing in that particular market.

Figure 4: Inward FDI stock in South Africa, by region and country of origin, 2007



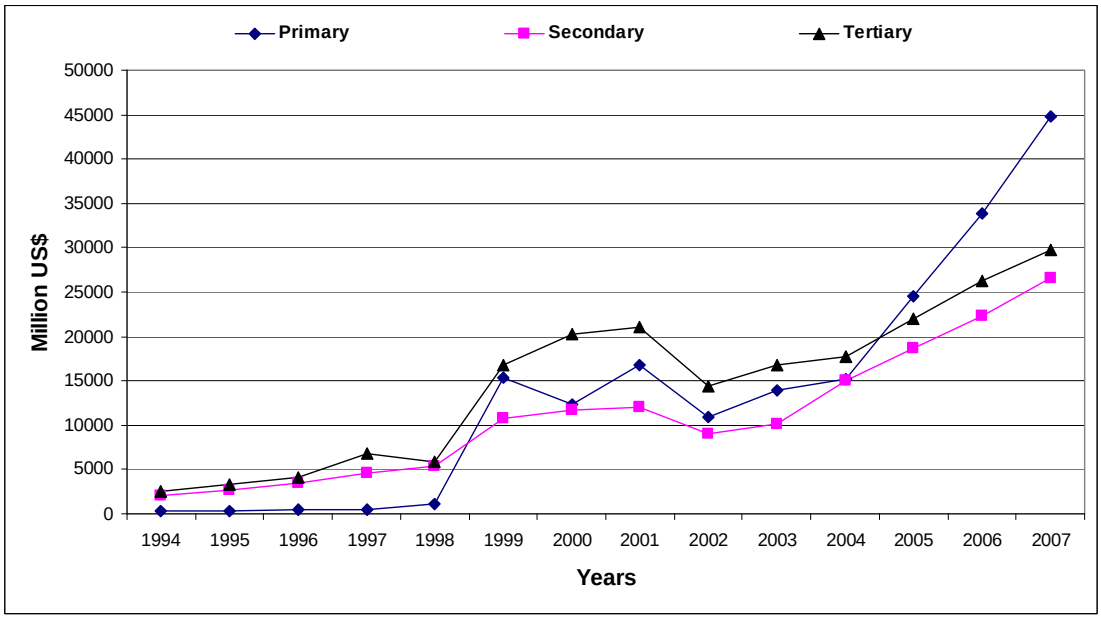
Source: SARB 2008

4.2. Sectoral distribution of FDI

Over the whole 1994-2007 period, average FDI into South Africa was mainly concentrated in the tertiary sector (37.9%) and slightly less in the primary sector (34.4%), with just over a quarter in the secondary sector (Figure 5). The primary sector has, however, increasingly become more prominent over the years, especially since 1999 to eventually form as much as 44.3% of FDI inward stock into the country in 2007. FDI inward stock in the primary sector in South Africa had an average annual growth of 46.8% over the 1994-2007 period, while FDI inward stock in the tertiary sector revealed an average annual growth rate of 29.5% and in the secondary sector 26.2% over this period.

[7] SA and China sign trade deals worth R2,3bn, *Engineering News*, 31 March 2010.
[8] SA, India are strategic partners, says Davies, *Engineering News*, 24 August 2009.

Figure 5: Inward FDI stock in South Africa, by main sector, 1994-2007



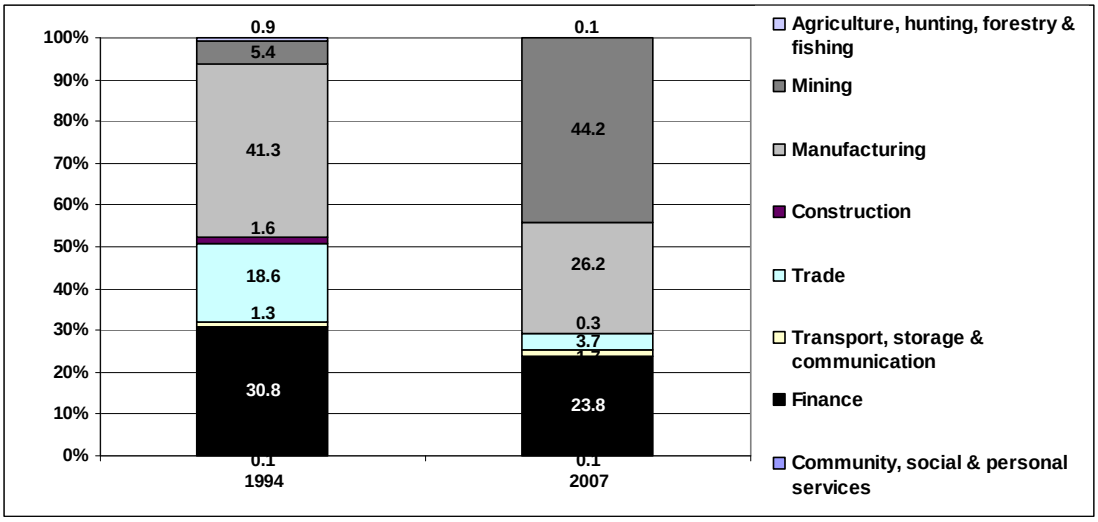
Source: SARB, Quarterly Bulletin, various

In Figure 6 it is shown that FDI inward flows have mainly been in the mining, manufacturing, and the financial and business industries since the 1990s. Growth in FDI inward stock in the primary sector was concentrated in the mining industry. In 1994 mining represented only 5.4% of FDI inward stock in the country and as much as 44.2% in 2007. In 2006 FDI inward flow turned slightly negative (see Figure 2), largely owing to the sale of gold mining interests by Canada's Barrick (in South Deep mine) and Russia's Polyus in Gold Fields (Economist Intelligence Unit 2007). Nonetheless, South Africa has large stocks of a variety of mineral resources that are important to investors. Infrastructure and access to ports are furthermore relatively good in South Africa. According to the World Bank, South Africa's port performance is higher than average when compared to sub-Saharan Africa and upper middle income countries.[9]

Conversely, manufacturing formed the dominant industry (41.3%) with regard to FDI inward stock in 1994 and decreased to just over a quarter in 2007. The finance industry contributed the second most to FDI inward stock in South Africa in 1994, but also decreased from about a third of FDI inward stock in 1994 to 23.8% of the FDI inward stock in 2007.

[9] Naamsa questions port tariff, *Business Report*, 13 April 2010.

Figure 6: Inward FDI stock in South Africa, by industry, 1994 and 2007



Source: SARB, Quarterly Bulletin, various

According to the World Investment Report (UNCTAD 2009), the net effect of the global financial crisis is expected to dampen FDI inflows to all the sub regions of Africa, except Southern Africa where consolidation of activities in certain industries is expected to lead to more inflows, particularly to South Africa. Companies across the industrial spectrum have found South Africa an attractive target, although it did not rank among the 25 most attractive FDI destinations in 2010.

According to the 2010/11-2012/13 Industrial Policy Action Plan (IPAP) in South Africa (Davies 2010), the key sectors of focus in the country will be the seven existing key IPAP sectors (automotive; plastics, pharmaceuticals and chemicals; clothing, textiles, footwear and leather; biofuels; forestry, paper, pulp and furniture; culture and tourism; and business process servicing); three new areas of focus (metal fabrication, capital and transport equipment; 'green' and energy-saving; and agro-processing); as well as sectors with long-term advanced capabilities (nuclear; advanced materials; and aerospace).

4.2.1 Mining and energy

After World War II, the manufacturing and services sectors in South Africa attracted much more FDI than mining, however, the De Beers transaction in 2001 had major implications for the sectoral distribution of foreign liabilities related to direct investment and has pushed the share of FDI stock of mining and quarrying (Figure 5). Mining investments have been driven by the abundance of natural resources across South Africa, while energy generation has increasingly become important with ever greater demand for energy. South African TNCs are well represented in the minerals and energy industrial sectors, which include Sasol (petrochemicals and chemical products) and major mining companies such as Goldfields, Anglo Platinum, Impala Platinum, Anglogold Ashanti, and De Beers Consolidated Mines Limited. Other key South African TNCs are in metals (ArcelorMittal South Africa), road transport and logistics (Imperial and Super Group) and in energy, mainly ESKOM (TIPS 2009).

4.2.2 Manufacturing

The manufacturing sector is a major contributor to the South African economy which contributes over half of all exports and is the second largest employer (NACI 2002). The sector is dominated by the motor industry, textiles, metals beneficiation, chemicals, ICT and electronics, and agricultural processing (BMI-TechKnowledge 2009).

Manufacturing firms that developed under substitution policies in protected developing country markets tended to operate at a lower scale and were domestic market orientated (Black 1996). Prior to 1980 the South African domestic vehicle market was growing rapidly with high protection that acted as a magnet to foreign firms. Foreign ownership was low in the late 1980s and the automotive industry became inward orientated with economic stagnation. With more export-orientation since the 1990s when the South Africa economy opened up, foreign firms provided export contracts for component suppliers by facilitating access to their global networks. Foreign firms established joint ventures or set up new plants and brought in new technology. This accelerated the transfer of industry best practices in production organisation to suppliers. The Motor Industry Development Programme (MIDP) by which experts could earn import rebate credits had success in facilitating internationalisation which underpinned growing exports and investment in the automotive industry. Spillovers from foreign investment in the vehicle industry have mainly been of a vertical nature accruing to those suppliers which have had greater access to markets and technology as a result of being drawn into the international networks of multinational car companies (Gelb and Black 2004b).

Currently the automotive industry is one of South Africa's most important sectors, with many of the major multinationals using South Africa to source components and assemble vehicles for both the local and international markets. Most major multinational vehicle manufacturers such as BMW, Toyota, Volkswagen, Daimler-Chrysler and Ford are represented, while component manufacturers (Arvin Exhaust, Senior Flexonics, Corning, Bloxwitch) have established production bases in the country. The vehicle industry in South Africa is promising with regards to both exports and the domestic market (SouthAfrica.info 2010).

The manufacturing sector is starting to move to higher levels of sophistication and efficiency through the implementation of various ICT solutions and ICT forms the basis of most advances in manufacturing technologies. The history of ICT adoption in manufacturing in the country goes back a long way, with early installations of mainframe equipment taking place particularly in the multinationals of the oil industry, and then in local growth industries such as beverages (South African Breweries, Stellenbosch Farmer's Winery) in the chemical industry (AECI) and in the fabricated metal industry (ISCOR). Technology has enabled access to more accurate information and has transformed the production, distribution and supply chain management processes (BMI-TechKnowledge 2009).

South Africa's electronics industry revenues in the country are growing at levels well above the overall GDP growth rate with key players such as Siemens, Alcatel, Ericsson, Altech, Grintek, Spescom, Tellumat and Marconi. First world know-how in business and a developing country environment make South Africa an ideal test lab for innovations and the South African software industry is one of the growth sectors (Paterson and Roodt 2009).

There has been a shift in global investment towards agriculture in Africa, driven by the global race for resources and food. [10]The South African agri-food industry has a number of competitive

[10] Development of African agricultural projects attracting investors, *Business Day*, 2 September 2010.

advantages, making it both an important trading partner and a viable investment destination. A world-class infrastructure, counter-seasonality to Europe, vast biodiversity and marine resources, and competitive input costs make the country a major player on the world's agri-food markets (South Africa.info 2010). South Africa's sugar industry, for example, is one of the most cost competitive producers in the world and since 2009 South Africa had duty-free access to the EU market, creating significant export opportunities for the country. There is also a growing global demand for biofuels which could have a major impact on the country's agricultural sector (Business Monitor International 2009b).

South Africa's traditional industries have been resource based, particularly in minerals. Manufacturing can add value to the exports of ore or primary metal forms by converting ores to primary metals and primary metals to higher value added manufactured products and manufacturing can also complement the service sector. South Africa's metal industry with vast natural resources and supportive infrastructure represents about a third of all South Africa's manufacturing (NACI 2002).

The chemical industry is the largest of its kind in Africa and products of the chemical sector are the basis for almost every manufacturing activity in South Africa. South Africa accounts for an estimated 87% of the total SADC output. South Africa has a natural advantage in mineral feedstock; yet most of these are exported in un-beneficiated form. There are substantial beneficiation opportunities to transform the raw material using local factors (labour and capital) to a more finished product that has a higher value than the sale of the raw material (DTI 2006).

Manufacturing is important to South Africa and the country is facing challenges in the manufacturing industry that requires assistance from the South African government and associated partners. The National Research and Development Strategy (NRDS) and the Integrated Manufacturing Strategy (IMS) recognise the need to move from raw material-intensive manufactured goods towards increasingly knowledge-intensive goods and services. High value manufacturing will generate demand for the provision of technology intensive services and manufacturing can be an important catalyst for upgrading the entire economy (NACI 2002).

4.2.3 Transport, storage and communication

Since 2003 there was a shift of FDI inward stock to the transport, storage and communication sector in South Africa, mainly as a result of new investments in information technology (IT) and telecommunications with a compensating decrease in the share of wholesale and retail trade, catering and accommodation (Figure 5 and Figure 6).

South Africa has the most developed telecoms network in Africa. Telkom, MTN and Vodacom have been driving the investments in telecommunication delivery systems. In the IT industry there is strong evidence of spillovers from foreign to domestic firms (Gelb and Black 2004a:208). South Africa's IT industry is characterised by technology leadership, particularly in the field of electronic banking services. South African companies are world leaders in inter alia, pre-payment, revenue management and fraud prevention systems (Cape Media Corporation 2010). As the leading ICT player in Africa, several international leaders in the IT sector operate subsidiaries from South Africa, including IBM, Unisys, Microsoft, Intel, Systems Application Protocol (SAP), Dell, Novell and Compaq (Cape Media Corporation 2010).

Lack of transportation networks has consistently been highlighted as a constraint to economic growth and, as such, companies are capitalising on the renewed efforts to upgrade transport

facilities across the continent. Major infrastructure and road system projects associated with the 2010 FIFA World Cup will have a positive impact on the business environment in South Africa (Business Monitor International 2009a).

4.2.4 Finance

South African companies' interests have historically been in Africa, both for banks and insurance services. Financial services have grown in the region along with financial literacy and a decrease in restrictions on foreign banks. More than a fifth of all firms entering South Africa go into the financial and business service sector (Estrin and Meyer 2004c:28). In the financial and insurance sectors a number of TNCs are in operation. Alexander Forbes and Kumba Resources are large financial service providers. Most TNCs are in insurance; these include Old Mutual, SANLAM, Liberty Group, and Momentum Life Assurers. South African banks have an important role to play in Africa's development. Barclays, who once owned FNB has historically, along with Standard Chartered, had an extensive footprint throughout Africa, and has now purchased a controlling stake in Absa. Together these banks are currently represented in 14 African countries (TIPS 2009).

4.2.5 Agro-processing

According to the World Investment Report (UNCTAD 2009), worldwide the agriculture and extractive industries have weathered the financial crisis relatively well compared with business-cycle-sensitive industries such as metal manufacturing and there is a better outlook for FDI in industries such as agribusiness, services and pharmaceuticals. The report reveals that FDI flows in agricultural production tripled to US$ 3 billion annually between 1990 and 2007, driven by the food import needs of populous emerging markets, growing demand for biofuel production, and land and water shortages in some developing home countries. It is indicated that FDI in the entire agricultural value chain is much higher, with food and beverages alone representing more than US$ 40 billion of annual flows. The report proposes public-private partnerships as an effective tool for bringing a "new green revolution" to Africa. With FDI in agriculture on the rise, there are indications that South-South investment in agricultural production is on the increase as well (UNCTAD 2009).

The National Agricultural Marketing Council (NAMC) has called for proposals to conduct research into mapping, understanding and quantifying agro-food chains in South Africa, focusing on the nature and extent of market power and competition concerns. The NAMC has also requested proposals for R&D into trade, paying attention to optimal business models to leverage the potential of emerging farmers to enter and participate in global value chains, with options for the private and public sector.[11]

South African food and beverage companies have become global players, such as beer producer SAB Miller. Some agri-industry firms have also exported knowledge services such as Illovo Sugar and Bosch Engineering in the sugar milling field. In South Africa it is notable that a number of companies have extended their reach in agriculture-related investments such as the former Anglo American entities of Mondi (forests and paper) and Tongaat-Hulett (sugar). Some major international agro-processing companies with presence in South Africa include Unilever, Coca-cola, Parmalat, HJ Heinz, Kellogg, Nestlé, Groupe Danone, Cadbury-Schweppes, Virgin Cola, McCain Foods of Canada, and Pillsbury (US Department of State 2009).

[11] Council to launch study into market power of SA agro-food chains, *Engineering News*, 23 March 2009.

In the Southern African Development Community (SADC) region some forms of collaboration around issues of food security across national borders are taking place. The IPAP (Davies 2010) has furthermore singled out agro-processing as one of the new areas of focus.

5. Outward FDI

Since 1994 South African firms also have become significant foreign investors themselves and mining houses started to make mineral investments internationally. South Africa is the biggest source of outward FDI in Africa, and South African TNCs account for the majority of African TNCs. The top 10 contributors to outward FDI from Africa were South Africa, Egypt, Morocco, Liberia, Angola, Algeria, Nigeria, Mauritius, Gabon and Botswana. With sub-Saharan Africa opening up to South African firms, the stock of South African direct investment assets in Africa grew 18% per annum between 1995 and 2001 (SARB 2001, 2003).

South Africa is a major outward investor in the services sector which is often neglected by other investors that are keener on natural resource exploitation. The single largest outward investment by South Africa was sealed in 2006 with the purchase by a mobile-phone operator, MTN, of Dubai-listed Investcom for US$ 5.5 billion (Economist Intelligence Unit 2007).

South Africa is the most prominent investor in Africa, as it is the only economy in Africa with outward FDI of over US$ 1 billion. In 2007 South Africa invested over US$ 3 billion throughout the world, with many of its TNCs acquiring stakes in major projects within SADC and outside, particularly in banking, information and communication technologies (ICTs), infrastructure development and natural resource industries (TIPS 2009).

With the currency crisis of 2001, FDI flows out of South Africa declined between 2000 and 2003. 2003 marked a turning point, as outward FDI accelerated from then on. In 2005 the value of FDI assets was US$ 32 billion, by the end of 2007 this figure had increased to just below US$ 61 billion. In 2007 Europe received 61.5% of South African FDI outflows, Africa 18.8%, Asia 9.9%, the Americas 6.0%, and Oceania 3.8% (SARB 2008).

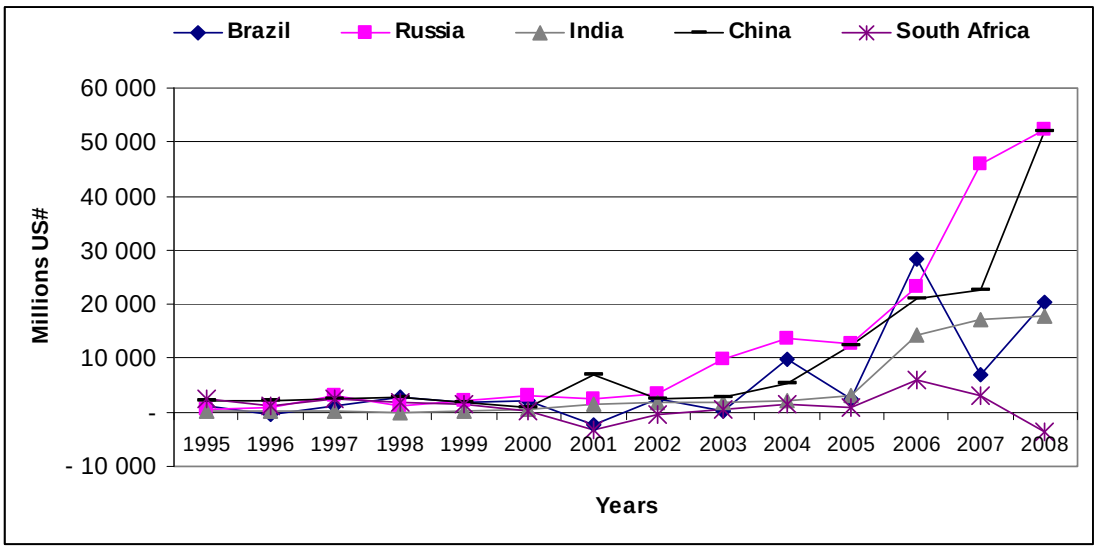
Among the BRICS economies, China with its exports and participation in many markets, was the dominant player with regard to FDI outflows up to 1998, then again in 2001, but was then surpassed by Russia (Figure 7). Russia started of from a very low FDI outflow base in 1995, overtook China in 1999 and also in 2002-2008 to reach the highest FDI outflows among the five emerging economies. FDI outflows from Brazil fluctuated to a large extent over the 1995-2008 period, but gradually started to pick up in 2002 to reach an average annual growth rate of 14.7% over the entire 1995-2008 period. South African and Brazilian firms see themselves as competitors in some of the large economic sectors which dominate South Africa, e.g. the automotive sector (TIPS 2009).

India has started from a low base in 1995, but has seen FDI outflows increasing since 2001 on the back of its growing IT software and computer-producing industries to eventually reach an average annual growth rate of 46.9% over the 1995-2008 period. South African companies involved in diamonds and alcoholic beverages have also invested in India. Investment between India and South Africa is supported by the presence of a strong Indian community in South Africa.

South Africa's FDI outflow has been decreasing over the 1995-2008 period. Logistics is a major challenge and the country needs to make the environment more competitive to attract investment, as high port costs owing to cargo dues were not a common port charge elsewhere in the world. In other

countries, port infrastructure was paid for by central revenue funds or city funds and not recovered from port users.[12]

Figure 7: Outward FDI flows, by home country and economy, 1995-2008



Source: UNCTAD 2009

6. The South African context for FDI

A highly favourable context to FDI has been established in South Africa. The government of South Africa views FDI as a means to drive growth, improve international competitiveness, and obtain access to foreign markets, though few government documents contain specific reference to FDI (TIPS 2009). AsgiSA, the most recent framework guiding national government, has induced various policy changes with regard to currency volatility and value; infrastructure backlogs; lack of skills; low cost of labour; the regulatory environment; performance of SMMEs; and government capacity. Virtually all business sectors are open to foreign investors and there are almost no restrictions on the form or extent of foreign investment. Only in the banking sector are foreign investors restricted to a certain extent (US Department of State 2009).

The Department of Trade and Industry (DTI) sought to influence FDI towards particular development and value chain upgrading goals via Trade and Investment South Africa (TISA). TISA is concerned with linking smaller firms with larger foreign players so the latter can access export contracts. TISA tries to link foreign investors with local suppliers in parallel with government's objective to redistribute economic resources to historically disadvantaged players (Government of South Africa, DTI 2009).

The Black Economic Empowerment (BEE) strategy is a government program to increase the participation in the economy of historically disadvantaged South Africans which also allows TNCs to score equity ownership 'points'. A large portion of FDI increases in 2007 was attributed to BEE

[12] Naamsa questions port tariff, *Business Report*, 13 April 2010.

activity, as for every US$ 13 million spent on a merger; some US$ 3 million was spent on BEE (Ernst & Young Mergers & Acquisitions Review 2007). Fujitsu Siemens sold a 25% stake in its South African operations to a BEE partner in 2008. Conversely, Hewlett-Packard (HP), instead of selling 30% to a local black partner, set up an institute that focused on skills development of local black staff and new ICT graduates[13]. Most TNCs favour the alternative equity option spearheaded by HP, rather than the sale of a stake of their business, but large BEE deals still continue to be concluded, such as MTN's agreement to transfer 30% of equity ownership in 2009. Companies now see empowerment as a critical component, especially in the ICT sector (TIPS 2009).

BEE actors in the primary sector in South Africa, especially the coal industry, have increasingly established international contracts. Before 1999, there was limited export focus in the mineral extraction sector (Figure 5 and 6), but large TNCs in the primary sector became more connected to local previously disadvantaged service providers following legislative changes since 1999. Anglo-American for instance spent US$ 3.3 billion on total BEE procurement and enterprise development in 2008 (TIPS 2009).

Some state-owned enterprises were privatised in the 1995-2004 period, however, the government has been restructuring most of the remaining state-owned enterprises rather than proceeding with plans for privatisation since 2004. Opportunities for private investment in the power sector are likely to follow the Department of Minerals and Energy's (DME's) announced policy to grant up to 30% of new energy projects to the private sector. The planned privatisation of smaller parastatals, such as Safcol (forestry) and, in the case of Denel (defense), with partial buy-ins by foreign suitors of Denel subsidiaries, can also provide foreign investment opportunities (TIPS 2009).

6.1 Incentives

The business environment in South Africa is attractive (Business Monitor International 2009a): The legal system in South Africa has proved effective at enforcing contracts, and regulations are generally applied impartially; foreign investors are free to buy and sell private entities at any time; South Africa's physical infrastructure is among the most developed in sub-Saharan Africa; with 100% foreign ownership permitted, government approval of investment is not required; labour costs are relatively low; and targeted tax breaks provide for allowances of 50-100% of an approved investment under the DTI scheme. South Africa's Intellectual Property (IP) Laws Amendment Act and the Counterfeit Goods Act are an indication of the country's determination to protect the rights of local and foreign companies. The Park index of intellectual property rights (IPR) protection for instance shows India and South Africa as having relatively stronger institutions compared with Brazil and China (Conway, *et al* 2010).

The Policy Framework in South Africa provides for tariff reductions, increased industrial financing and additional incentives for investors. Firms are protected by a sophisticated commercial law and effective Competition Commission and Tribunal. The major international banks have a presence in the country. Foreign and domestic investors have access to the South African stock market. Until the financial crisis, the stock market was the 13th largest in the world and 36% of the stock market capitalisation was owned by foreigners (TIPS 2009).

Industrial Development Zones (IDZ) provide duty-free import of production-related materials and zero VAT on materials sourced from South Africa along with the right to sell into South Africa

[13] HP's alternative empowerment accepted, *Business Day*, 27 August 2007.

upon payment of normal import duties on finished goods. The Skills Support Programme provides up to 50% of training costs and 30% of worker salaries for a maximum of three years to encourage the development of advanced skills (US Department of State 2009). The new proposed East London Industrial Development Zone (ELIDZ) multi-vehicle assembly plant where vehicle manufacturers will share the same assembly facilities will reduce financial risk for start-up or lower-volume-selling brands, as it will enable them to test the market without having to make major capital investments, while also reaping some rewards.[14]

The Chinese government has shown interest in buying 10 000 units of a South African designed vehicle platform from a local company, The Virleo group, as well as rights to produce the platform in the Asian country. Virleo wants to set up a plant in the ELIDZ to produce a few hundred of these vehicle platforms each year and then license foreign companies or governments to replicate the vehicle in their own countries.[15]

South Africa's various provinces have furthermore development agencies that offer incentives to encourage investors to establish or relocate industry to areas throughout South Africa. The incentives vary from province to province and may include reduced interest rates, reduced costs for leasing land and buildings, cash grants for the relocation of physical plants and employees, reduced rates for basic facilities, railage and other transport rebates, and assistance in the provision of housing (US Department of State 2009).

Some sectoral export incentives are especially of relevance to investors. The Automotive Production and Development Programme (APDP) provide duty credits to vehicle assemblers for which 18-20% of the value of light motor vehicles is produced domestically as from 2013. Under the Automotive Investment Scheme (AIS), which forms part of the APDP, vehicle manufacturers are able to redeem 20% of their automotive investment, should they achieve certain production milestones and manufacturers can push this up to 30% if they achieve a certain level of local content. The AIS was an important part in facilitating the recent increase in the Ford Motor Company of Southern Africa's investment from US$ 0.2 to 0.4 billion.[16]

Another scheme which encourages exports from foreign firms is 'rebate 470.03 of schedule 4 of the Customs and Excise Act' (of 1964) that allows for the rebate of customs duties on components and materials specified in permits for use in the manufacture, processing, finishing, equipping or packing of goods exclusively for export. This instrument to support firms turned to export, has barely been used in SA, except by some clothing firms (TIPS 2010).

6.2 Barriers

Despite a relatively open economy there are some barriers that could hamper FDI flow into the country (Business Monitor International 2009a): The country's under-funded power sector constitutes a serious problem for doing business, although with the recent loan of US$ 3.05 billion granted to Eskom by the World Bank, future improvement in electricity provision is foreseen[17]; progress has been slow in the liberalisation of the South African telecommunications market, although the national operator Telkom has reported accelerating demand for its ADSL offers and

[14] East London plant plans road trip to Asia; still negotiating APDP benefits, *Engineering News,* 12 April 2010.
[15] China looks into buying modular vehicle platform from SA group, *Engineering News,* 12 April 2010.
[16] New auto investment scheme, with budget, nears completion, *Engineering News,* 8 April 2010.
[17] Eskom to 'ring fence' Hitachi contracts from World Bank proceeds, *Engineering News,* 9 April 2010.

the forthcoming rollout of WiMAX and WiFi services to boost connectivity; South Africa's education system remains an obstacle; HIV/AIDS affects the most productive sections of the country's labour force; privatisation plans have been scaled back; although there is relaxed capital controls, foreign investors must face local borrowing restrictions; and the 2% training levy on the salaries of expatriates to enter the country under an expedited visa procedure is also a disincentive.

According to the SA Innovation survey 2005 (DST and HSRC 2008), lack of relevant skills appear a major deterrent to innovation. Gelb and Black (2004b) indicate that skilled labour especially matters at pre-entry and market selection stages, but skills interact with other entry determinants such as labour costs. Ziton, a South African firm was for example acquired by a US company for its technological abilities and low producer and overhead costs.

Constraints in especially engineering skills in South Africa are limiting further expansion into Africa (OECD 2007:173). IT service provider TNCs highlight challenges such as protracted procurement procedures and lack of skills as key impediments to South Africa's ability to upgrade and innovate[18].

SARB approval is furthermore required for the sale of all forms of South African-owned IPR. Approval is generally granted by SARB if the transaction occurs at arm's length and at fair market value. IPR owned by non-residents is not subject to any restrictions in terms of repatriation of profits, royalties, or proceeds from sales (US Department of State 2009).

A few regulations solely applicable to foreign entities still remain. Foreign companies need to register as external companies to register immovable property and are subject to the Companies Act which excludes relief from tax. If at least 75% of a company is owned by a non-resident, restrictions apply to borrowing from the domestic market. Restrictions apply around the establishment of a foreign bank. Foreign investors are required to employ a proportion of nationals and provide a minimum level of capital. On the whole there is a favourable TNC context in SA and a range of incentives to investors (TIPS 2009).

6.3. Research and Development

According to the R&D survey in 2007/8 (DST and HSRC 2008), R&D spending in South Africa grew in volume by nearly 13% in 2007-08, although it dropped from 0.95% to 0.93% of GDP which is the first decline since 2002. This is lower than the worldwide R&D expenditure of 1.74% of GDP in 2007. South Africa, however, recorded a steady increase in investment in R&D from 0.60% in 1997 to 0.95% in 2006-07, before the unexpected decline. Positive though is that South Africa had spent relatively more than most other middle or low-income countries on R&D, outpacing India's 0.80% and Argentina's 0.51% of GDP. But countries such as China, with 1.49% of GDP spent on R&D, and Russia (1.12%) were far ahead while Sweden, Japan and Korea all spent more than 3% of GDP on R&D in 2007-08, with Sweden at the top with 3.6%.

In South Africa the Gauteng province has almost 61% of business enterprise R&D expenditure, the Western Cape 14%, and Kwa-Zulu Natal 9.1%. This is in line with R&D clusters and concentration of TNCs in South Africa. Kahn (2007:8) suggests that Gauteng's gross R&D expenditure is at the level for R&D intensive regions in Europe.

[18] Outdated systems hinder service delivery, *Business Day,* 16 September 2008.

The R&D survey reveals that South Africa had 31,352 full-time equivalent R&D workers in 2007-08. Encouraging is that according to the Unesco Institute for Statistics, the number of researchers in South Africa grew by nearly a third over five years to 2008. Two in five researchers were women, a proportion higher than most other countries. Full-time equivalent researchers' rates are also a third less costly in South Africa than in similar institutions elsewhere (TIPS 2009).

R&D is predominantly placed in experimental research (46.3% of all R&D expenditure) in engineering and natural sciences (20% of total R&D expenditure), in accordance with the structure of the SA economy. R&D expenditure was mainly in the chemical sector which contained petroleum, coke & nuclear fuel, chemical & chemical products (including pharmaceutical) and plastic products. Secondly R&D expenditure was in manufacturing in transport equipment (23.4% of BERD) which is in line with the economic structure (DST and HSRC 2009).

The survey indicated that business is responsible for about 56% of R&D expenditure. Business Expenditure on R&D (BERD) is, however, low against international standards. Government accounts for 23% of R&D expenditure.

South Africa displays a poor R&D spending performance compared to international TNCs R&D spending and only one South African TNC, Sasol, is among the top 10 international R&D TNC spenders (TIPS 2009).

The R&D tax incentive programme in South Africa entails a reduction by 150% of expenditure in scientific or technological R&D, including an accelerated depreciation of the relevant assets. Government thus signals the intention to speed up R&D spending in the near future and support through programmes such as the Technology and Human Resources for Industry Programme (THRIP), a joint DTI and National Research Foundation (NRF) programme that seeks to enhance technology development by supporting researchers. Large funding is also available for Higher Education Institutions (HEIs) and research institute collaboration from government (TIPS 2009).

The HSRC's R&D survey reveals that HEIs account for 21% and research institutes for 17% of all in-house R&D expenditure in South Africa. South Africa has eight statutory science research councils. Kruss (2005) indicates that innovation requires a critical mass of researchers and the depth and scope of cooperation among SA HEIs is insufficient.

Kahn (2007) found that 68% of foreign R&D performing firms had collaborations with South African universities, while 44% of such firms collaborated with local science councils. The author indicates that the proportion devoted to R&D by research institutes and by HEIs is high by international standards.

Four South African universities are also ranked in the top 500 of the 2007 Shanghai Jaio Tong rankings. In terms of numbers of universities in the Shanghai rankings, this places South Africa 'ahead' of countries such as Russia, Poland, Greece, Hungary, Czech, Turkey, India, Singapore, Mexico, Argentina and Chile; on a par with Norway; and just behind New Zealand, Hong Kong, Finland and Brazil.[19] South Africa's 23 universities are very small in terms of research capacity, although often very large in terms of student numbers. South Africa is not effectively supporting fields of research in which it excels. That is because the government is not sufficiently focused on areas of established excellence, is not pumping enough funding into university-based research and is not properly implementing the research priorities that it identifies.[20]

[19] Universities set priorities for research, *University World News*, 11 November 2007.
[20] Universities set priorities for research, *University World News*, 11 November 2007.

6.4. Systems of innovation

In terms of research and innovation, South Africa does well in comparison to other emerging countries and its NSI is relatively well established (UNCTAD 2005). South Africa has considerable economic potential and a comprehensive foundation of science, technology and innovation policy.

In the 2010 Global Innovation Index, South Africa was ranked the first in Africa and 51st out of a total of 132, measured according to innovation criteria such as patents per million population, publication of scientific journals, research and development expenditure, and others that capture innovation in emerging markets and the effects of innovation on social welfare.[21] However, socio-economic developmental demands require efforts for long-term sustainability and the critical question in the context of a late-developing country like South Africa is whether the innovation system can carry through the required innovation effectively and to the benefit of the entire population (Kruss and Lorentzen 2007).

6.4.1 Challenges

Key challenges in South Africa include inadequate funding, a skills shortage, too little private sector R&D, innovation among knowledge-intensive firms, protection and exploitation of IPR, integrating a fragmented Science and Technology system and setting up technology transfer and commercialisation offices in universities.[22]

According to the OECD review report (2007) there was relatively too much focus on the role of public institutions performing R&D and an under-appreciation of the role of innovation that is not primarily linked to formal R&D, including indigenous knowledge, and activities in the informal economy, along with the role of non-R&D capabilities in the areas of engineering, design, and related management and technical functions. The report further pointed out that technology competencies of large firms should be disseminated to smaller firms through policies that supported both internal and external human capital formation and knowledge development.

Kruss and Lorentzen (2007) indicate that central to technology diffusion is the presence in firms of a workforce that is able to absorb new technologies, to optimize transfer of technological capacity to firms, and the creation of locally-based expertise. Various funding initiatives have been important in creating awareness in firms, universities and science councils of the benefits of interaction, and in fostering a number of university-industry linkages that have yielded postgraduate students, publications, patents, new processes and artefacts in priority sectors (HSRC 2003). The Department of Science and Technology (DST) for instance established the Innovation Fund to provide financial incentives for longer-term, large innovation research projects with cross-sectoral collaborative consortia composed of researchers from higher education, government, the private sector and civil society. The Department of Trade and Industry (DTI) introduced the 'Technology and Human Resources for Industry Programme (THRIP) that operated by matching the funds invested in innovation research by private companies, while the Support Programme for Industrial Innovation (SPII) supported innovation of products or processes in private sector firms, providing incentives in the form of matching grants (Kruss and Lorentzen 2007).

However, Kruss and Lorentzen (2007) argue that intermediate and high level engineering skills required to work on expanded infrastructure development projects or on innovation in firms in

[21] SA, Tunisia, Mauritius top Africa innovators, *University World News*, 11 April 2010.
[22] SA, Tunisia, Mauritius top Africa innovators, *University World News*, 11 April 2010.

South Africa are not available on a sufficient scale, which acts as a constraint on economic growth. They indicate that national efforts to promote research capacity have yet to show significant effects and higher education policy incentives need to promote greater collaboration and less segmentation across the system to strengthen research and innovative capacity. The authors are of the opinion that policy-making needs to be coordinated across government and be informed by conditions in local firms, sectors and higher education and the interaction between them and incentives need to be improved to direct and promote the NIS to address poverty and equality and at the same time grow technological capacity.

Although an adequate framework of IPRs is a key to the enhancement of collaboration, technology transfer and diffusion, over-regulation could discourage firms from collaboration with universities or licensing new technologies developed in universities, and thus act as a constraint on innovation (Wolson 2007).

The OECD review report (2007) noted a relatively unique feature of the South African economy with a high share of business R&D in total R&D combined with a heavily resource-based structure of the economy. Key tenets of the National Research and Development Strategy (NRDS) such as the Technology and Innovation for Poverty Reduction Programme or the idea to marry resource-based industries to the knowledge economy had, however, not been implemented (Lorentzen 2008). Lorentzen (2008) is of the opinion that knowledge intensification of resource-based activities along the Scandinavian model should be high on the agenda, rather than the declared intention to diversify the economy away from its commodity base.

The OECD report (2007) further criticized the fact the not enough attention had been paid in South Africa to what is likely to be the principal channel of technology, namely FDI and other forms of technology import, while foreign technology that interacts with domestic innovation could be key to technology advancement. Interactions between TNCs and domestic players can contribute to a NSI and a positive correlation between innovation and growth is documented (UNCTAD 2005).

According to Lorentzen and Barnes (2004) the availability of foreign capital and the presence of local capabilities to make use of it, is important for innovation. Indigenous technological activity often interacts with imported knowledge in the form of FDI. Firms that become technologically mature may take on more advanced knowledge embodied in FDI. FDI alone will not promote technological innovation, but local technological competence is required in addition. The authors argue that the NIS, especially the education and training subsystem that provides for learning and upgrading and which are promoted by foreign capital can lead to innovation.

Kruss and Lorentzen (2007) indicate that South African innovation programmes and funding mechanisms primarily focus on R&D and science institutions, rather than on firms. There is little evidence in policy of any analysis of the sort of benefits that accrue to local innovators and the consequences for growth and job creation. They argue that where uncertainty prevents investment in greater technological specialization, government must provide the public goods that reduce transaction costs. Lorentzen (2009) indicates that extensive research is required to inform government policy activity and the innovation community on linkages between firms and other NIS actors, especially in the higher education sector.

The HSRC's R&D survey (2008) found that nearly 11% of South Africa's R&D was financed from abroad. Nevertheless, foreign enterprises work mostly separately from domestic enterprises on innovation of potential high commercial value (Kahn 2007).

The need for fast product development and absorption of product changes in South Africa has translated into comparatively high levels of R&D in the automotive sector. In turn, the presence of

platinum reserves in South Africa and high international platinum prices in the early to mid-2000s caused South Africa to become a leader in the catalytic converters sub-sector. South Africa supplies between 10-15% of global catalytic converters (TIPS 2009).

Also in healthcare and aerospace, South Africa displayed strong innovative capabilities. The European Commission (2007) suggests that South Africa also has strong R&D capacity in bio-technology which emerged in medical sciences when South Africa attempted to produce HIV/AIDS related drugs. Aerospace has developed as a result of large defense budgets and a long history of telemetry in South Africa (Kahn 2007). In technology and marketing, TNCs find South Africa good, however, less so on product quality which suggests a mismatch between technology and output (TIPS 2009).

6.4.2 Regional systems of innovation

Storper (1997) claims that regional communities and firms are in fact the building blocks of the resurgent regional economies that are driving globalisation processes today. Others, such as Maskell *et al.* (1998) point out that processes of knowledge sharing and networking, key to new economic processes, are connected to dynamics arising from proximity but they require something more than simply taking advantage of basic agglomeration effects: "The strategies and actions of a firm are thus influenced by the capabilities of the area in which it is embedded. Accordingly, the capabilities of an area can – in interaction with international market structures and industry specific technological trajectories – over time result in the formation of specific patterns of specialization and local demand, subsequently leading to distinctive technological competencies for firms in the area" (Maskell *et al.*, 1998:51-52).

TNCs operating in regions with well developed innovation systems are often able to take advantage of multiple layers of innovation capability. This is particularly true where there is a high degree of international collaboration in fields of innovation and alignment of systems of innovation, but also where transactional and bureaucratic barriers are on the one hand minimised, but on the other hand also allow for degrees of IPR protection to satisfy the TNCs (TIPS 2009).

South Africa has some good examples of technological concentrations. The armaments parastatal, Denel, headquartered outside Pretoria over many years supported a significant level of research at tertiary institutions and also generated spillovers in the supplier field, as well as a supply of skills in the economy that has found itself in diverse fields such as software development, telecommunications, fabric design and optics. South Africa has also a well developed capability in the mining field which is supported by strong regional capability in the greater Johannesburg area where much traditional mining activity was concentrated. There have been some efforts from government bodies such as the NRF, the DTI, and the DST to support such regional capabilities (TIPS 2009).

The expansion in the automotive components suppliers' production and exports sub-sector in the Eastern Cape in South Africa is also a good example of a regional cluster. One of the key factors that enabled Volkswagen South Africa to secure a contract to export 55 000 new-generation Polos in 2010 was the investment of approximately US$ 81 million by suppliers, including Rehau, Bentler, Flextech, Faurecia and Grupo Antolin, in the Nelson Mandela Bay Logistics Park (NMBLP). This investment has resulted in the creation of 685 highly skilled, new jobs in the Metro

and 77% of suppliers to Volkswagen of South Africa are now based in Nelson Mandela Bay. This is critically important in Volkswagen's globalisation strategy.[23]

Local familiarity, experience with emerging markets and integration into regional trading blocs play an important role in the FDI process. Countries in SADC and beyond might, to some degree, see South Africa as providing a measure of a functioning NSI which can offer some capabilities to them. Some forms of collaboration, for instance around issues of food security, are already seeing institutions across these national borders working together. However, matters of language, distance, resources, infrastructure and systems of governance, to name but a few issues, all impact on such collaboration (TIPS 2009).

6.4.3 Policies impacting on innovation systems

There is a clear policy framework in place for the South African NSI since the White Paper on Science and Technology (DACST 1996); AsgiSA focuses on the development of an innovative economy; South Africa aims to boost the development of capabilities in industrial sectors and to upgrade technological inputs through the Advanced Technology Manufacturing Strategy (ATMS); and R&D generally is boosted.

Ensuring a supply of reasonable quality inputs (raw materials, machinery, real estate, professional services, reliability of telecommunication and utilities) is a prerequisite for FDI to developing countries. Policies with respect to labour skills and infrastructure, particularly of utilities (especially electricity) and telecommunications are vital. The visa and immigration regulations in South Africa have been frequently mentioned as an obstacle (Business Monitor International 2009a).

Timing of FDI entry is determined by changes in the regulatory conditions and the liberalisation of the industry (McCarthy and Puffer 1997). The policy environment plays a role in investment decisions, but more important than general FDI policies are the industry-specific policies to actively promote a sector. The banking sector is a highly regulated sector and sets conditions for foreign banks, but with liberalisation of the banking sector in South Africa business opportunities has been created (Estrin and Meyer 2004b:338; US Department of State 2009).

The automotive policy in South Africa may have been absolutely critical for the establishment of the export-orientated automotive components industry (Lorentzen and Barnes 2004). The MIDP linked domestic assemblers and component producers with foreign markets and resulted in affiliate set-up and firm acquisition in South Africa. In 2008 the South African cabinet approved a new APDP which includes production incentives to replace the MIDP which had included export incentives. Investments made by vehicle manufacturers in South Africa (spanning from 2009-2013) now total US$ 1.2 billion, creating 3 500 direct assembly jobs, while also acting as a catalyst for US$ 0.5 billion in investments in the component industry.[24] The APDP will aim to increase production in the automotive sector to 1.2 million vehicles per year by 2020 (IDC 2008).

According to Jafta and Boshoff (2008) positive steps have been taken by government with regards to FDI, although boosting innovation is not that clear. The authors are of the opinion that the South African Government has a top down perspective on innovation instead of putting innovating actors at central stage with the innovative firm interacting with other role players. They argue that the South African government is excluding especially the users of the results of the NSI activities with

[23] VW's South African unit to double its Polo exports in 2010, *Engineering News*, 4 December 2009.
[24] New auto investment scheme, with budget, nears completion, *Engineering News*, 8 April 2010.

its one-way process and key actors are set at different levels by the NSI, as well as the policy focus articulated by the National Advisory Council on Innovation (NACI). Codified knowledge is becoming more pervasive, but the translation of knowledge into a commercially feasible product or service requires tacit knowledge (Lundvall 2007). Nelson (2003) indicates that physical technological processes fail to lead to innovation if not accompanied by organisational and other processes. Jafta and Bosoff (2008) are of the opinion that innovation policy thus needs to take a *systems perspective*. The authors indicate that the South African authorities only focus on R&D as innovation input, while other factors such as development capabilities and the variety of knowledge (tacit and codified) are not consistently recognised which underplays the importance of tacit knowledge for commercial purposes. There is in addition a lack in government institutions to innovate and there is a lack of interaction required for innovative activities. Very important is that the dimensions required for knowledge building, such as the development of basic education is only currently being addressed. Furthermore, the protection of large state-owned companies curbs innovation. The interrelationships between sectors and innovation in the IT industry are for example influenced by telecommunication regulations. The efficiency of government support measures (except in the automotive sector) in attracting TNCs has not been analysed (TIPS 2009).

Positive is that the Department of Science and Technology (DST) has expressed support for creating jobs through innovation, and R&D. Plans to establish and begin operations at the Technology Innovation Agency are under way and this may help to address the innovation gap.[25] DST promised attention to the funding mechanisms used in agencies and the introduction of a new funding model to improve access to funds.

7. Signs of movement towards Global Innovation Networks

UNCTAD (2005) and others have documented that as TNCs increasingly focus on global technology sourcing, a growing share of world R&D is invested in a location other than the home country. The factors determining the global location of innovation activities are related to the availability of knowledge resources in the host country or region as well as learning and capability building in the country of origin. These are related to the endowment of human capital and technology and the ability to transform those resources into innovations. The latter refers to the innovation system (Lundvall 1992). GPNs are no longer exclusively driven by efficiency considerations, but also by human capital and technologies. They have partially transformed into GINs. This new phenomenon creates opportunities to promote faster technological change and broader diffusion of technological advances worldwide (OECD 2007). What are the sign of GINs in South Africa?

7.1 The impact of FDI on the South African economy

Glass and Saggi (1998) argue that the technology gap between the host and home country indicates the absorptive capacity of host country firms. The larger the gap, the less likely are host country firms to have the human capital and technological know-how to benefit from the technology transferred by TNCs (Holger and Strobl 2003:582). The presence of FDI may itself create pressure

[25] Govt promises innovation boost, Audra Mahlong, Johannesburg, *University World News*, 12 June 2009.

on local firms to upgrade their technologies, and local institutions to accommodate the needs of a market economy (Cheung and Lin 2004).

Although South African authorities are strong supporters of FDI, investments in South Africa are still insufficient to sustain growth. South Africa's share of FDI in overall capital inflows is low and dominated by portfolio investment (Business Monitor International 2009a). FDI has the potential to generate managerial and technological capabilities and the presence of TNCs in the country can lead to the demand for semi-skilled and skilled workers with accompanying wage increases. Conversely, there are also potential adverse effects from FDI. These include the crowding out of domestic investments; reduced tax revenue which has implications for social and welfare programmes; and competition for FDI can lead to environmental degradation and the creation of pollution (Lahiri 2008). To determine the net impact of FDI is thus a challenge. The universal claims of positive spillover effects resulting from FDI have been widely disputed. The limited data available in South Africa also suggests that the spillover effects are likely to be mixed (TIPS 2009:42). Although investment can have negative impacts, investment always yield some positive external benefits to the host economy (Estrin and Meyer 2004b:338), as our subsequent discussion shows.

7.1.1 Spillovers from FDI by mode and type of entry

Positive spillovers from TNCs were found with regard to industry performance where partial acquisitions took place and a positive link was found between human resource investment and performance. However, a problem is experienced with low training levels and expenditure by foreign affiliates, except in consumer goods where affiliates spent 4% of their turnover on training in 2000 (Gelb & Black 2004a:205).

Capabilities are transferred more readily onto domestic entrepreneurs by export-orientated TNCs than by market-orientated TNCs (Gelb and Black 2004a). According to the authors, export-orientated TNCs contribute to networks and learning effects, production capabilities and the upgrading of processes for foreign markets. The authors indicate that with an acquisition direct technological spillovers take place to a larger extent than with a greenfield or joint venture entry mode. The Behr Group in Germany for example had an export drive and acquired a South African operation in 1999. Behr SA that produces radiators, automotive air conditioners and condensers gained access to cutting edge R&D, upgrading of technology, intangible assets, management and labour skills as a result of the acquisition and this led to an automotive supplier cluster in South Africa (Gelb and Black 2004b:216).

Some firms in South Africa had significant productivity gains that resulted from linkages with for example Toyota through the adoption of particular production approaches and exchanges of knowledge, but there was little for supplier firms to leverage the gains in other markets that they could produce to. The adoption of the approaches required an almost full orientation of the plant and its capacity to the needs of Toyota supplier firms, while previously more diverse operations of these supplier firms might have put them in a stronger position in an economic downturn (Robbins and Morris 2007).

A platform for technological transfer can be created by backward and forward linkages between local firms and TNCs. Suppliers to Toyota were for example exposed to considerable exchanges of knowledge, not only with Toyota, but also in some cases with some of Toyota's global supplier networks. In terms of forward linkages Toyota also exposed its dealer sales network in South Africa

to systems and knowledge that would improve sales and service performance of Toyota vehicles in the country (Robbins and Morris 2007).

Original equipment manufacturers in the automotive sector accounted for about 10% of South Africa's manufacturing exports until the financial crisis in 2008. Prior to the international crisis, about 180 000 jobs would have been located in the automotive components suppliers' production and exports sector (TIPS 2009).

Greenfield and joint venture entry is usually market-seeking. Greenfield entry involves new facilities or expansion of existing facilities or systems and management, integrates the host country into the global economy, but has modest technology spillovers. ABN Amro (a Dutch bank) for example established a branch in South Africa in 1995 in response to the financial sector liberalisation in South Africa after 1994. The ability of branches to use their parent company's rating created strong incentives for banks to opt for a greenfield entry by establishing a branch rather than a subsidiary. An acquisition requires regulatory approval and transaction costs that delay entry. However, liberalisation in specifically the securities market in South Africa did not protect domestic firms to a large extent and the greenfield banking entry by ABN Amro was soon followed by a partial acquisition in securities trading. South Africa with its sophisticated financial service was at first underestimated by ABN Amro which was market-seeking and relying on a local partner. South Africa, however, supported the investment banking operation rather than the market-sustaining activities (Gelb and Black 2004b).

Foreign firms gain by tapping into the portfolio of foreign clients of a partner, while the national partner loses footing over its foreign clients. In the transaction between Barclays and Absa for instance, the learning motives of Barclays overrode those of Absa and the acquisition deal turned into a joint venture, rather than an acquisition (TIPS 2009).

Experience in South Africa is that foreign entry in the financial services sector has lead to the 'overdevelopment' of the financial services sector with a high-tech, efficient and competitive top-end market, but a underprovided and very costly bottom-end service to consumers (Gelb and Black 2004b:241).

Although enhanced capabilities and efficiency improvements were yielded at the innovation and assembly process level in the automotive, as well as in the textile and clothing industries as a result of FDI, FDI is predominantly in non-tradable industries, such as services in South Africa (TIPS 2009). In a range of sectors and for example in finance, FDI was linked to market-development motives. Market-development motives result in new marketing techniques and products with positive effects on learning efficiency levels (Gelb and Black, 2004a). FDI in the telecommunication sector also was market-seeking, although predominantly of an M&As type, given prevailing barriers to operation in South Africa in that sector. This type of FDI also occurred in the food and beverages sector, according to Asafo-Adjei (2007). Market share increased after entry in many sectors, but not in the IT sector, because of technological spillovers onto the domestic market in the IT sector (TIPS 2009:19).

In South Africa there is resistance against privatisation of State-owned enterprises, because of the view that foreign investment causes job losses and lack of control. For example, LNM, a global partner, took control over Iscor, while Iscor shared business, marketing, technology and skills with LNM. Iscor's relevant trade union put forward a case of job losses, although this has not been proved and LNM was renamed Mittal SA (TIPS 2009:19).

There is a view that FDI can cause both job losses and lack of control. With control of the market comes the exclusion of smaller players to production. Mittal for example was unwilling to supply to

small domestic firms the required carbon steel which small companies eventually had to import. Eventually Mittal was found guilty of non-competitive practices by the South African Competition authorities on this issue. The Mittal Steel Group acquired Arcelor steel in 2006 and is currently the world's largest single steel producer with a global market share of about 9%. This raises questions with regard to the influence of some firms operating in South Afirca (TIPS 2009:19).

TNCs can also trigger a loss of knowledge-based improvement opportunities. Gastrow (2009:22) indicated that between 1999 and 2006, R&D specialisation and design in the automotive sector were increasingly being done by affiliates outside South Africa. High barriers to entry protected a few, large TNCs to perform R&D. There was thus a long-term decline in the use of locally adapted technologies and local R&D activity.

7.1.2 Motives for entry

The business environment in emerging markets is correlated with the mode of entry (Bhaumik *et al*. 2003). Where local firms operating in the sector have been available, a joint venture or outright acquisition has been favoured on the grounds that this was a cheaper and faster way into the market and also brought in local expertise and know-how. Conversely, greenfields investments have been pursued primarily in sub-sectors where there has been no domestic capacity. A South African firm which already uses licensed technology from the prospective investor gets involved because this reduces transaction costs for the prospective investor with commonality in equipment and processes used. Joint ventures are created primarily to circumvent policy regulations or domestic ownership, while the local partner has little or no influence on the subsidiary that is formed and may also not have the capacity to absorb the transfer of technology and skills (Estrin and Meyer 2004b:337).

It could be expected that much FDI into developing countries would take the form of outsourcing manufacturing to low-cost suppliers and exploiting location specific assets (such as natural resources) in developing countries. Research, however, has found that FDI to developing countries is more 'market-seeking' and thus aimed at supplying the domestic market in the host country (Estrin and Meyer 2004b:323).

According to Gelb and Black (2004a), three-quarters of FDI is rather 'market-seeking' and most FDI is small, as the average firm size of foreign affiliates in South Africa is not large (76 medium number of workers in South Africa companies). However, FDI in the primary sector expanded into South Africa since 1999 and FDI thus could have had a positive impact on employment, given the large size of firms in mining. Notwithstanding, FDI overall seems to have a minimum impact on job creation. Manufacturing is for instance related to high level skills, while unskilled labour needs to be absorbed in South Africa (TIPS 2009).

Furthermore, the literature (Robbins and Morris 2007) indicates the importance of proximity for innovation and technology transfer. The ease of technological transfer depends on a TNC's location decisions of critical functions. Toyota's research hub with process and product technology for instance was in Belgium, while only limited R&D and local purchasing facilities were placed in South Africa. Toyota felt it could best access an appropriate milieu in support of its production and innovation strategy. Maskell et al. (1998:51) pointed out that "firms become competitive, and retain their competitiveness, by conceiving and implementing strategies which utilize – directly or indirectly – a number of valuable traits and properties of their place of location: the ones that enable them to earn a profit when faced with otherwise similar competitors elsewhere."

8. Conclusions

The BRICS countries are important engines for world growth and they account for a growing share of global output. South Africa, as one of the BRICS economies, has one of the most sophisticated business environments in sub-Saharan Africa and has established a highly favourable context for FDI. Strong state institutions fostering relative political and economic stability have been key in attracting foreign investors and maintaining growth. However, slow liberalisation of the South African telecommunications market, a pause in privatisation, high levels of crime, and the relative poor quality of the South African education system will continue to constitute significant structural problems that will blemish the attractiveness of the country's business environment over the longer term. Although a weakened power sector has recently contributed in denting South Africa's image as a top investment destination, the recent loan from the World Bank could turn this around going forward.

Positive is that Southern Africa remains the leading recipient of FDI inflow in Africa and the government of South Africa views FDI as a means to drive growth, to improve international competitiveness, and obtain access to foreign markets. The policy framework in South Africa provides incentives for investors and the major international banks have a presence in the country. South Africa also recorded a steady increase in investment in R&D and South Africa had spent more than most other middle or low-income countries on R&D, outpacing India in 2006-07. The proportion devoted to R&D by research institutes and by HEIs is high by international standards. Furthermore, the need for fast product development and absorption of product changes in South Africa has translated into comparatively high levels of R&D in the automotive sector.

According to the Global Innovation Index, South Africa ranks first in Africa and 51st among 132 countries. South Africa displayed strong innovative capabilities in the automotive industry, healthcare, bio-technology and aerospace. Foreign enterprises, however, still work mostly separately from domestic enterprises on innovation of potential high commercial value. The challenge for South Africa is more funding, skills development, private sector R&D, more integration of the fragmented science and technology system, and technology transfer offices at universities to stimulate innovative cooperation.

M&A is the predominant mode of entry into South Africa, as South Africa has a mature industrial and institutional structure and a more developed market than other developing economies. The advantage for South Africa is that *acquisitions* have more direct technological spillovers than greenfield or joint venture entry modes, because it can lead to capacity building in *existing* firms that have the absorptive capacities that enable them to increase technological know-how and become more competitive in future opportunities. Since the Behr Group for example acquired its South African operation the South African subsidiary increasingly became important in the development of a worldwide spare parts business by supplying heat exchangers.

The M&A investments in South Africa are primarily directed at manufacturing and services firms that are already established and efficient. Efficiency-seeking and greenfield investment could lead to the creation of new businesses that increases employment opportunities, gross domestic investment and competition in the host market that could be a stimulus for improvement in technology and skills development in local firms. However, Greenfield FDI can also lead to crowding out of local firms that use traditional labour intensive methods of production.

South Africa's FDI inflows improved since 2007 after the negative FDI inflows of 2006 to amount to US$ 3.2 billion in 2009. Low labour costs; a relatively solid physical infrastructure and

transparent, clear guidelines to foreign investors with regards to setting up operations in the country created a favourable investment climate to investors. Despite a relatively open economy, FDI, however, tend to be composed of a few large transactions rather than a steady stream of inward investment.

South African authorities are strong supporters of FDI, but investments in South Africa are still insufficient to sustain growth. The limited data available in South Africa also suggests that the spillover effects from FDI flows are likely to be mixed. FDI overall seems to have a minimum impact on job creation. Manufacturing is for instance related to high level skills, while unskilled labour needs to be absorbed in South Africa. Three-quarters of FDI is rather 'market-seeking' and most FDI is small, as the average firm size of foreign affiliates in South Africa is not large. Further research is required to determine the impact of acquisitions and greenfield investment in emerging markets by taking into account the technological gap, quality of resources in the local firms, and the regulatory and institutional framework.

Although developing countries are increasingly becoming important for FDI flow to South Africa, developed countries, especially the UK, are responsible for most FDI inflow to the country. However, with FDI in agriculture generally on the rise worldwide, there are indications that South-South investment in agricultural production is also on the increase. South Africa has for example enjoyed some Indian investment and more recently Brazilian investment, but investment of South African origin in Brazil is still far more than Brazilian investment here. Trade with Brazil suggests that real opportunities for the IBSA trilateral development initiative are in the food and beverage, as well as energy sector. Transfer of technology is one area with great potential for FDI flow between emerging economies, especially in renewable energy and biofuels.

Some sectoral export incentives are especially of relevance to investors. The country has potential and with industry-specific policies, as in the automotive sector, an environment can be created where South African companies increasingly obtain access to international markets and technology. The AIS is an example where investment can create more jobs. South Africa has a predominantly young workforce and the demographic dividend can drive economic growth if policies are put in place to support local firm development. Local resources can be strengthened through FDI spillovers and education of the young population can improve absorptive capacities. Specific industries and location of FDI need to be a focus of future research.

Policy-makers further need to develop their FDI strategies in the context of regional trade policies, as research has indicated that local familiarity, experience with emerging markets and integration into regional trading blocs plays an important role in the FDI process. Countries in SADC and beyond see South Africa as providing a measure of a functioning NSI which can offer capabilities also to them. Increased FDI flow to South Africa and the region can contribute to economic growth that is necessary for employment creation and increased equality, but then FDI needs to increase with a steady flow, as opposed to only a big investment here and there and the type of FDI should lead to increased local employment. Creating more special economic zones in South Africa could further contribute to more employment creation. Government involvement is thus required to create a stable, conducive environment, but this needs to be balanced with market freedom to stimulate innovation.

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The South African education and training systems

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Table of contents

1. Introduction

The South African Schools Act (SASA) (1996) makes provision for two types of schools in the system – public and independent schools (SAQMEC 2005). Both types of schools follow the same curriculum and adhere to minimum standards set by the Department of Education. Whilst public schools are funded by the State, independent schools provide their own funding although their access to State subsidies is not precluded.

The public school structure is organized according to a broad National Qualifications Framework (NQF) that was adopted by Act of parliament in 1999. The key objective of the NQF was to create a seamless and integrated education system which would encompass learning outcomes from formal, informal and vocational sectors including the early childhood development (ECD), general education and training (GET), further education and training (FET) and higher education (HE).

Through recognition of prior learning (RPL), credits obtained from one sector can be carried over to another and this enables learners to progress through the system by following different paths. For example, learners can switch from the Adult Basic Education and Training ABET informal path to any of the formal sector phases (Foundation, Intermediate and Senior Phase), and vice versa, and still progress to FET provided they accumulate the required number of credits.

There are three broad bands in the system – GET, FET and HE. FET is offered by formal schools as well as private providers and non-governmental organizations (NGO's).

2. Gross enrolment ratios

The Gross Enrolment Rate (GER) is a crude measure of participation. It shows how many children of any age are in school, compared to the number of children of an age that should be in school. It measures the capacity of schools to accommodate the population. The GER for primary schooling is measured by dividing the total primary school enrolment (Grades 1 – 7) by the population of 7 – 13 year olds. The GER for secondary schooling (Grades 8 – 12) is calculated by dividing the total secondary school enrolment by the population of 14 – 18 year olds.

The administrative (education) data used for the calculations of the GER in this section accounts for public and independent ordinary schools. Table 1 shows the national gross enrolment ratio in primary and secondary schooling for 2006 and 2007. Primary education coverage has been extensive since the 1980s and has until recently accommodated far more learners than the actual school going age population – largely in the form of under and over-age learners. The natural saturation of the system, the education department policy to limit under-age enrolment in Grade 1, as well as the reduction of excessive repeating of grades were expected to bring stability to enrolment.

Although South Africa has near universal enrolment in the primary phase a small proportion of the population is not accommodated within the schooling sector. As mentioned above a GER exceeding 100% is usually an indication of grade repetition and the presence of over aged learners.

Table 1: Gross enrolment ratios: public and independent schools, 2006-2007

		2006			2007		
		Gr. 1-7	**Gr. 8-12**	**Total**	**Gr. 1-7**	**Gr. 8-12**	**Total**
National	**Female**	100	95	98	98	92	95
	Male	104	87	97	100	84	94
	Total	102	91	98	99	88	94

Source: General Household Survey 2008
Note: Corresponding age group for grades 1-7 is 7-13; Corresponding age group for grades 8-12 is 14-18

2.1 Net Enrolment Ratio by Level (NER)

This section will consider the enrolment within education institutions by age. The table below is using international unadjusted intervals to look at the proportion of the population in each age category attending an educational institution.

Most of the focus of this paper is on primary, secondary and tertiary attendance of educational institutions and the NER will only consider age groups 5 to 30 years of age. More than 80% of the population aged 5 to 19 is attending an educational institution, with nearly 100% of the age group 10 to 14 years attending an education institution, which is near universal attendance.

The age group 20 – 24 years is used as a proxy for measuring higher education attendance and is considered to be in either a further or higher education institutions in the process of completing a first degree. Nearly a quarter of South Africans are enrolled in higher education institutions according to the General Household Survey 2008.

Table 2: Net enrolment ratios: age groups

	Attending an Education Institution	
Age Group Education	**Yes %**	**No %**
00-04	17	83
05-09	89	11
10-14	99	1
15-19	82	18
20-24	24	76
25-29	6	94

Source: General Household Survey 2008

The age groups within the General Household Survey were adapted to reflect the corresponding age groups in primary and secondary phases in South Africa. For example the NER for primary schools is calculated by dividing the total number of the pupils aged 7 – 13 attending primary school from grade 1 to 5 by the total population aged 7 – 13. The NER for secondary enrolment is calculated by dividing the total number of learners aged 14 – 18 who are in secondary school, by the total population aged 14 – 18. This ratio is theoretically more accurate than the gross enrolment ratio. The net level enrolment ratio is also used to estimate the number of children not enrolled, by subtracting NER from 100.

The information in Table 3 confirms that South Africa's primary education has reached near universal enrolment with 98% of the 7-13 year olds attending an education institution. Secondary enrolment indicates that 89% of learners aged 14 – 18 (grades 8 -12) are attending an educational institution, whether an ordinary public or independent school or a public or independent Further Education and Training College.

Near universal enrolment in secondary education in South Africa is hampered by high repetition and dropout rates in Grades 10 to 12, the FET phase, particularly in public ordinary schools.

Table 3 also shows that 33% of the population aged 19 – 23 reported being enrolled in an education institution, and a very small proportion, 6%, aged 24 – 30 years of age is enrolled in an education institution. Of the 33% aged 19 – 23 years, 64% are still in a public or independent school, 22% are in a Higher Education Institution, 12% in a college and the rest in other education programmes such Adult Basic Education and Training.

Table 3: Net enrolment ratios: age group corresponding with schooling phases

Age Group Education	Attending an Education Institution	
	Yes %	No %
0-6	33	67
7-13 (Grades 1-7)	98	02
14-18 (Grades 8-12)	89	11
19-23 (Secondary/Tertiary?)	33	66
24-30	6	94
31+	2	98
Total	34	66

Source: GHS 2008

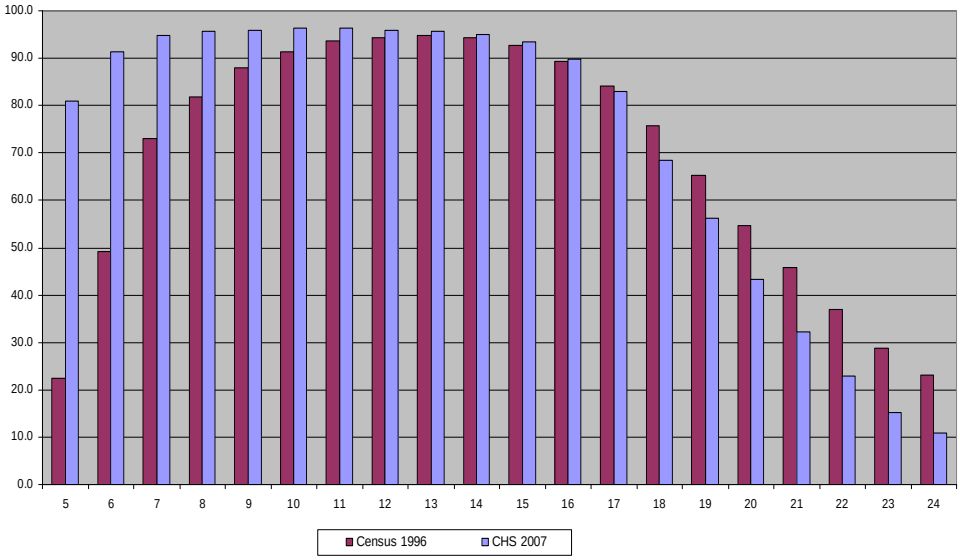
2.2 Age-specific enrolment ratio

The Age-specific enrolment ratio (ASER) is an indicator of coverage or participation used to measure the extent of coverage of an educational programme through comparing children enrolled in school with the school age population. These figures are used for assessing how far a country has succeeded in bringing to school all those who have the right to attend.

According to UNESCO's *Education Indicators: Technical Guidelines*, the ASER at each level of education should be based on total enrolment in all types of schools and education institutions, including public, private and all other institutions that provide organised educational programmes. The enrolment and population data should refer to the same data. Further, it must be ensured that the enrolment data covers all levels of education to avoid excluding some members of the age cohort.

Age-specific enrolment figures reveal a fairly consistent pattern - sustained high enrolment rates of 95% or above until about age 15 or 16, following which enrolment falls quite sharply as expected to about 50% by age 19. This pattern is so consistent that there can be little doubt that there is almost universal school enrolment until age 16. There is no clear evidence of changes in age-specific enrolment patterns over the past decade.

Figure 1: Attendance at educational institutions



Source: Census 1996 and Community Survey 2007, StatsSA

The ASER is a preferred measure to apply when calculating the participation of learners within a specific age within the education sector. Though the ASER is used to observe the degree of participation of pupils for one specific age it does not indicate where these pupils are enrolled within the education system.

3. Tertiary enrolments in technical subjects (i.e. natural science, mathematics, computing, and engineering) and the Harbison-Myers index

3.1 Harbison-Myers index

Harbison-Myers developed a fairly simple composite index to distinguish among countries in terms of four levels of human resources development which were labelled as follows: Level 1, underdeveloped; Level II, partially developed; Level III, semi advanced; and Level IV, advanced. The composite index which was the basis for slotting seventy-five countries into four level is simply the arithmetic total of (1) enrolment at second level of education as a percentage of the group 15 to 19, adjusted for length of schooling and (2) enrolment at the third level of education as a percentage of the age group 20 to 24, multiplied by a weight of 5. According to Harbison and Myers (1964) higher education should be weighed more heavily than second-level in such an index.

The composite index provides a rank of the seventy-five countries for which Harbison-Myers were able to composite data on most of the various indicators. South Africa received a rank of 40.0 and was labeled as a semi advanced country. The specific ranking according to Harbison-Myers is the result of the particular composite index they used and they make no claim of precision.

The most important indicators of human resource development fall into two general categories (Harbison-Myers 1964): (1) those which measure a country's stock of human capital, and (2) those which measure the gross or net additions to this stock, or more precisely, the rate of human capital formation over a specified period.

The high level labour force indicators i.e. teachers, engineers, and physicians and dentists in Table 4 is expressed as per 10 000 of the population in order to match up to the 1964 indicators provided by Harbison and Myers (1964). The number of teachers at both the primary and secondary levels has doubled as a consequence of the population growth rate and demand for education. The information on engineers was sourced from the Engineering Council of South Africa's website and refers only to engineers registered with the council. In 2008/09 South Africa had 4.3 engineers to every 10 000 people, and 8.8 physicians/dentists for every 10 000 people.

Table 4: Harbison-Myers Human Resource Development Index

South Africa	Composite Index	Per capita GNP, U.S. dollars	Percent population in agriculture	Stock of high-level manpower			Measure of educational development: enrolment ratios				Orientation of higher education: per cent enrolled		Expenditure on education, per cent of national income	Per cent age group 5-14
				Teachers 1st and 2nd levels	Engineers, scientists per 10,000 pop.	Physicians, dentists per 10,000 pop.	1st level unadjusted (2007)	1st and 2nd level adjusted (2007)	2nd level unadjusted (2007)	3rd level unadjusted (2008)	In science and technology (2008)	In humanities, law and arts (2008)		
1964	40.0	395	47	45.6	Na	5.7	62	64	25.0	3.0	Na	Na	3.1	24.3
2008				85.7	4.3	8.8	99	94	88	17	28	72	5.3	21.6

3.2 Mathematics education

Internationally, inadequate education is one of the most powerful determinants of poverty and unequal access to educational opportunity is a strong correlate of income inequality. Skills demands are rising in step with the accelerating introduction of new technologies and the shift toward a knowledge and information based economy. Today, fewer jobs are available to those people with lower levels of education or training and this trend is likely to continue into the future.

The provision of quality education is essential if the school system is to contribute effectively to human resource development. School education provides an important foundation for the skills needed by individuals to make the transition to further and higher education or into employment, as well as to function constructively in society (Shindler 2008).

The recent Global Competitiveness Report 2009 – 2010 highlighted the poor quality of education in the South Africa. The country scored 2.7 for the quality of primary education, 2.7 for the quality of the education system on the whole, and 2.1 for the quality of mathematics and science education, on a scale where 1 denotes a poor education system and 7 denotes an excellent education system.

Table 5: Selected South African education indicators, Global Competitiveness Report 2009-2010

Rank	Indicator	Score	Scale
107	Quality of primary education	2.7	1=poor; 7=excellent-among the best in the world | 2008-2009 weighted average
119	Quality of the educational system	2.6	1=not well at all; 7=very well | 2008-2009 weighted average
133	Quality of mathematics and science education	2.1	1=poor; 7=excellent-among the best in the world | 2008-2009 weighted average

Source: Global competitiveness report 2009-2010

The crisis of skills shortages in South Africa is attributed to a decline in the numbers of learners pursuing mathematics and science subjects, especially in the previously disadvantaged communities (Bantwini and Reddy, 2009). Even with the increase in learner enrolment and teacher numbers at the ordinary schooling level, South Africa currently faces one of the gravest threats to its future prosperity – a serious shortage of skilled people to drive the growing economy.

This shortage derives largely from the fact that many South African school-leavers lack basic skills in mathematics, science and English language, and are therefore not able to pursue further education opportunities in medicine, scientific research, engineering, information technology or accounting, nor in a host of other occupations requiring technical training.

In light of the significance of mathematics to education in general, it is not surprising that the former education system had deemed training in mathematics irrelevant (Wilcox 2004). Although Apartheid education did extend schooling amongst Africans, it kept spending to a minimum. Thus we are left with shortages in school facilities, material resources, and, in particular, a shortage of skilled mathematics and science teachers (Wilcox 2004). As in any other country, South Africa is still faced with the immense task of adequately educating its population. More than half of South Africa's mathematics and science teachers are unqualified, according to the Concerned Mathematics Educators (CME). In 2006 there were fewer higher-grade mathematics and science passes than in 2005.

The Trends in Mathematics and Science Study (TIMSS) 2002/03 tested Grade 8 learners in mathematics and science competencies. South African learners performed very poorly in this study, scoring the lowest average marks in both mathematics and science of all the other countries that participated in the study.

South Africa participated in the SACMEQ II study between 2000 and 2002, which assessed the reading and mathematics achievement of about 42 000 Grade 6 learners in more than 2 250 schools in 14 countries in east and southern Africa. An analysis of the mean reading and mathematics scores by provinces confirms the high inequality in education across provinces in South Africa (Shindler 2008). The Western Cape, Gauteng and KwaZulu-Natal were the only provinces which had mean scores in both reading and mathematics that were higher than the overall mean score of 500 for all participating countries.

4. Tertiary enrolments in technical subjects (i.e. natural science, mathematics, computing, and engineering).

The UNIDO 2002-2003 report uses two measures to capture the creation of high-level skills: the number of students enrolled at the tertiary level in all subjects and the number enrolled at the tertiary level in technical subjects (defined as mathematics, computing, engineering and pure science). These two measures use population as the deflator (unlike the Harbison-Myers index, which uses the relevant age group as the deflator).

South Africa's ranking by tertiary enrolment in technical subjects dropped from 44 (1985) to 56 (1998), because its share of tertiary enrolment in technical subjects dropped from 22% in 1985 to 17% in 1998.

Table 6: Ranking by tertiary enrolment in technical subjects, 1985 and 1998

Rank by technical enrolment as share of population		**Economy**	**Share of population (percent)**		**Number (thousands of people)**	
1985	1998		1985	1998a	1985	1998a
44	56	South Africa	0.22	0.17	68.9	68.1

Source: UNIDO (2002)

The tables below will look at the enrolment of Human and Natural Sciences at higher education institutions based on results from the analysis of Higher Education Management Information Systems data for the years 2006 to 2008.

Table 7 shows the proportion of total HEI enrolment for the years 2006 to 2007. Enrolment has remained constant with Human Sciences having the highest share of HEI students, 72%, and Natural Sciences constituting 28% of total HEI enrolment. Tertiary enrolment in technical subjects has increased substantially since 1998.

As mentioned above the increase in both the humanities and natural sciences has caused enrolment in general to remain constant with no gains being shown in the proportion of learners in either the humanities or natural sciences.

Table 7: Natural and Human Sciences enrolment as a percentage of total HEI enrolment, 2006 to 2008

Sciences		**Year**		
		2006	**2007**	**2008**
Natural Sciences: (SET)		29%	28%	28%
Human Sciences	**Business and Commerce**	30%	30%	29%
	Education	13%	14%	16%
	Other Humanities	28%	28%	27%
	Unknown	0%	0%	0%
Total		100%	100%	100%

Source: Higher Education Management Information Systems database

The table below looks at enrolment of specific SET disciplines such as Mathematical Sciences, Computer and Information Sciences, and Engineering and Engineering Technologists enrolment as a proportion of total HEI enrolment. Enrolments in these disciplines are quite low when compared to enrolment in the Humanities, Table _, with no real substantial improvement detected.

Mathematical Sciences and Computer Sciences had increasing learner enrolment from 2006 to 2008 while the opposite is true for Engineering. Between 2006 and 2008 enrolment in Mathematical Sciences increased by 11% and between 2007 and 2008 enrolment increased by 1%. During the same period enrolment in Computer Sciences increased by 3% and 8% respectively. Engineering enrolment declined by 4% between 2006 and 2007 and with 5% between 2007 and 2008.

Table 8: Selected science disciplines as a percentage of total HEI enrolment

2nd-Order CESM Category	Year		
	2006	2007	2008
Mathematical Sciences	2%	2%	2%
Computer Sc. and Data Proc.	5%	4%	4%
Engineering and Eng. Tech.	8%	8%	8%
Total	100%	100%	100%

Source: Higher Education Management Information Systems database

5. The proportion of science to engineering enrolments

5.1 Engineering

Research on the engineering profession and education of engineering professionals found a number of disconcerting trends (Roodt and Breier 2009). South Africa has only 473 engineers per million population while Japan, which cohosted the World Cup in 2002 along with South Korea, has 3 306 per million. Even compared to other upper-middle-income (developing countries), like Chile (1 460 engineers per million citizens) and Malaysia (1 843 engineers per million citizens) South Africa is vastly undersupplied.

There are many factors contributing to the South African situation, including the status and image of the engineering professions in relation to other, more lucrative careers, the shortage of Grade 12 school leavers who meet the criteria to gain entry to engineering degree programmes and the high quality of engineering education (Du Toit and Roodt 2009).

The good news, in the local context, is that the demand for engineers in South Africa is strong and will continue to increase. In fact, the fundamentals are such that few would probably contradict the assertion that engineering could well be poised to emerge as the profession of the next decade (Engineering News, 19 February 2010).

According to Garrun (The Star, Business Report 2010) the demand for engineering skill is robust and interest among secondary school leavers is stronger than it has been for years. Garrun (The Star, Business Report 2010) further argues that companies are prepared to invest in engineering

development and that there are relatively good prospects of a strong project pipeline for some years to come (The Star, Business Report 2010).

Even though there is a high demand from industry for engineers and a significant interest from school leavers in the discipline, capacity constraints hinder the increased supply of engineers into the workplace. Some of the key capacity constraints are: the quality of mathematics and science knowledge of matriculants applying to study engineering at university; poor science and mathematics teaching; a lack of educational and training capacity and mentorship to ensure that this new wealth of talent is truly converted into a national asset.

The skills shortage is further exacerbated by the following issues (Garrun, The Star, Business Report 2010):

- a severe shortage of suitably qualified and experienced engineers, technologists, designers and technicians;
- the average age of available candidates was between 45 and 50 years of age;
- in 2008, 600 000 students sat for the Grade 12 examinations and less than two percent of these obtained the minimum admission requirements for engineering and other science subjects ;
- according to the DoL's Scarce Skills List over 34 000 additional engineers, technologists, draughtsperson and technicians are required between 2008 and 2010; and
- for every engineer, there needs to be three technologists, and for every technologist, three technicians – nine technicians for every engineer

This is illustrated in Table 9 which shows that the number of registered Professional Engineers has remained literally unchanged over the past 6 years. There has been an increase in the number of registered Professional Engineering Technologists, Professional Certified Engineers and Professional Engineering Technicians but these a relatively small numbers.

Table 9: Number of registered engineers

	2003	2004	2005	2006	2007	2009
Professional Engineers	14 687	14 728	14 754	14 745	14 503	14 476
Professional Engineering Technologist	2 537	2 522	2 617	2 710	2 856	3 244
Professional Certified Engineer	792	793	803	819	932	998
Professional Engineering Technician	395	800	1 094	1 289	1 499	1 887
Total	18 411	18 843	19 268	19 563	19 790	20 605

Source: Engineering Council of South Africa (ECSA)

Engineers and scientists per 10 000 population is referred to in Harbison and Myers (1964) as an important measure of a strategic part of the high-level manpower category. The ratio of engineers to 10 000 of the population has gradually increased from 3.8 per 10 000 of the population in 2003 to 4.3 per 10 000 of the population in 2008-2009, Table 10.

Table 10: Engineers per 10 000 of the population

	2003	2004	2005	2006	2007	2009
Professional Engineers	3.1	3.1	3.1	3.1	3.0	3.0
Professional Engineering Technologist	0.5	0.5	0.5	0.6	0.6	0.7
Professional Certified Engineer	0.2	0.2	0.2	0.2	0.2	0.2
Professional Engineering Technician	0.1	0.2	0.2	0.3	0.3	0.4
Total	3.8	3.9	4.0	4.1	4.1	4.3

Source: Engineering Council of South Africa (ECSA)

Roodt and Breier (2009) assert that there has been considerable growth in the number of engineering professionals in employment, but many of these professionals are working in the financial and business services sectors where they are unlikely to be using their technical skills.

The growth in employment of professionals in this country shows the strong demand for their services. The fact that there are still repeated claims of shortages in certain key fields, such as civil engineering, indicates that the educational institutions are not managing to produce sufficient graduates and/or the graduates are not being employed in these fields (Roodt and Breier 2009).

There are numerous reasons for the slow rate of growth in the production of engineering graduates. Given the equity targets, it is a matter of great concern that there is still a very small pool of black matriculants who qualify for entrance to an engineering programme. Throughput rates are low: about 60% in university engineering programmes, 55% for technologists and 40% for technicians (Roodt and Breier 2009).

In the engineering professions themselves a key issue is the lack of experienced professionals to mentor new graduates, widely attributed to transformation policies which have led to the departure of many experienced white professionals. Many have left the country as there is a great demand for engineering skills internationally. In 2005, 74% of engineers and technologists and 71% of technicians were under the age of 40; 13% of technologists and 20% of technicians were aged between 40 and 49 and only 13% of engineers and technologists and 9% of technicians were above 50. This has a major impact on the transfer of skills, many of which can only be acquired tacitly and on-the-job from experienced mentors (Roodt and Breier 2009).

5.2 Barro and Lee measure

Discussions of educational attainment often focus on average years of schooling. However, estimates of average years of schooling require assumptions about the number of years of schooling a particular level of attainment represents. This has resulted in discrepancies between estimates from different sources. Furthermore, average years of schooling can give a misleading picture of overall educational attainment, especially if a large tertiary-educated segment of the population skews the average upward. Arguably, a population's educational attainment is better summarised by its educational attainment profile, which is the distribution of people at different levels of educational attainment. For example, the educational attainment profile shows the percentage of the population that has at least an upper secondary education.

Table 12 shows the highest level of schooling attained for people 15 and 25 years of age and over respectively. The high proportion of secondary non completion rate for the population aged 15 and over can be attributed to the following: 2,5 million young people aged 18 to 24 are neither working

nor in an kind of education or training; most have dropped out of school early, only 46% stayed in school long enough to write matric, of whom 60% passed and 28% of them have a matric certificate.

Table 11: Highest level of schooling attained for people 15 years and 25 years and over, respectively

Level of Education	Highest level of schooling attained for people 15 years and over		Highest level of schooling attained for people 25 years and over	
	Frequency	Percent	Frequency	Percent
No schooling	2 541 923	7.7	2 430 054	10.5
Less than primary completed	4 320 324	13.1	3 471 782	15.0
Primary completed	2 147 384	6.5	1 442 796	6.3
Secondary not completed	13 444 868	40.7	7 649 390	33.1
Secondary completed	7 226 627	21.9	5 133 219	22.2
Tertiary	2 999 371	9.1	2 664 699	11.5
Other	288 539	0.9	249 485	1.1
Unspecified	45 434	0.1	36 874	.2
Total	33 014 470	100	23 078 301	100.0

Source: General Household Survey 2008

Educational attainment can also be expressed by average years in formal education for those who have successfully attained a given education level (e.g. for those who do not complete lower secondary education, only the years in primary school are counted). In this case, educational attainment is calculated by summing the proportion of the population that have attained each education level as a percentage of the weighted typical duration of each ISCED level. For example, if 50% of the population receive a university degree and the weighted typical duration of this type of programme is 3 years, educational attainment (expressed in average years) would be 1.5 years. These average years are summed together for each different level of education (e.g. secondary school, university) to calculate the average number of years of successfully completed formal education.

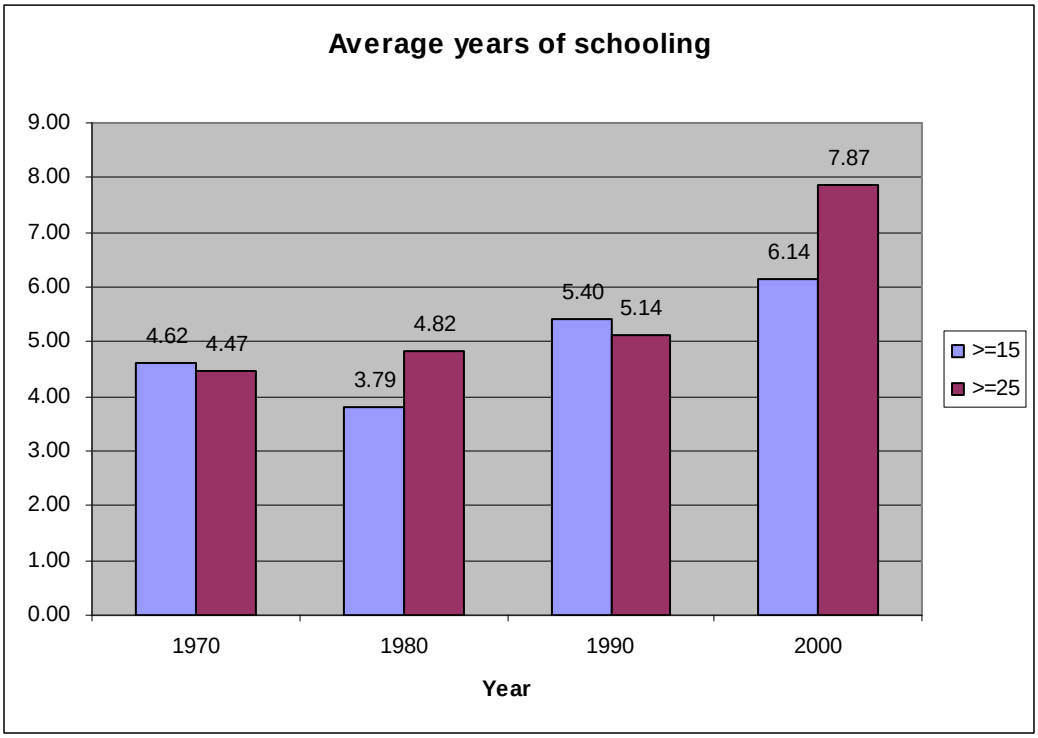
Average years of schooling of adults is defined as the years of formal schooling received, on average, by adults over age 15. Figure 1 shows the average years of schooling for the South African population aged 15 years and over and aged 25 years and over for selected years. It was calculated using the methodology proposed by Barro-Lee (2000). The average years of schooling for the population aged 25 years and older shows a gradual increase from 1970 to 2000, with the greatest increase from 1990 to 2000 of more than 2 points.

The incorporation of the population aged 15 to 24 years of age in the category 15 years and older demonstrates a drop in the average years of schooling when comparing the two categories. This can be attributed to the high dropout rate of this age group in secondary schooling. South Africa was ranked 51st out of 100 countries in 2000, based on the calculation of the average years of schooling.

At university level, one-third of students graduate within four years of enrolling. About 35% o students drop out of degree studies, 52% out of certificate or diploma studies and 70% out of distance higher education.

At further education and training (FET) colleges, almost 50% of students drop out, and of those who remain only 57% pass.

Figure 2: Average years of schooling for years 1970, 1980, 1990 and 2000



Source: Barro-Lee Data Set www.worldbank.org/html/prdmg/grthweb/ddbarle2.htm

Perry and Arends (2004) calculated that the average number of learner effort for a learner to reach Grade was 60% more than the minimum 12 years in 2000. Using 2003 education data, Shindler (2008) calculated that it took an estimated 24.5 learner-years' effort to reach Grade 12, 104 % more than the minimum 12 years needed. This was attributed to learners repeating and/or dropping out of the school system. This indicates a huge waste of human and material resources in the secondary education system.

5.3 Incidence of training in firms

The Department of Labour commissioned the HSRC in 2007 to conduct the National Skills Survey (NSS) of 2007 (NSS2007). The aim of the NSS was to investigate the propensity of enterprises to extend their skills development activities; to establish how enterprises are buying into and responding to the NSDS; and to consider the working relationship between enterprises and Sector Education and Training Authorities (SETA).

Over the four year period between 2003 (NSS 2003) and 2007, there was a doubling of training exposure for permanently employed workers in South African private sector workplaces. The authors of the document ascribed the sharp rise in training activity to a combination of positive effects brought about by key policy levers in the National Skills Development Strategy, namely the

levy-grant scheme and supporting legislation, and to strong positive action among employers who were also responding to local and global economic challenges, i.e. the main drivers of increased training was market competition.

The impression is that the improvement in training rates was driven less by the SETAs as service providers and driven more by a combination of the compliance requirements of the levy grant system and the realisation among enterprises that training in response to economic signals would serve their own quality and competitive imperatives.

McGrath and Paterson (2008) argued that the South African enterprise training system has continued to strengthen and evolve in the period from 2003 to 2007 and that many of the National Skills Development targets were met. They provide evidence of continued growth in training activity, and this has been reflected in the form of wider participation. Much of the growth appeared to be occurring in medium and small enterprises, and in turn the very small and micro enterprises (VSME) studies showed that considerable training is also taking place in the smallest enterprises, particularly where the definition of training is made broad enough to identify training activity of a less formal kind.

In contrast to the results of the National Skills Survey, the World Bank in its recent Enterprise Survey done in conjunction with South Africa's Department of Trade and Industry painted a gloomy picture of an economy held back by serious skills shortages but business doing little to remedy the situation unless forced to by unions. According to the Enterprise Surveys, South African firms are less likely to provide formal training to their workers than their peer group counterparts. In the 2008 sample, about 46 percent of firms were providing training, compared to more than 67 percent of firms in Brazil, Chile, Thailand, and China. Moreover, there was no significant change in South Africa in the incidence of training between the 2003 and 2008 surveys. The profile of firms that provide training also remained unchanged between the two surveys. In 2008, as in 2003, larger firms were more likely to provide training than smaller ones, and exporters were more likely to do so than non-exporters. The likelihood of training was also greater where the unionization rate was higher.

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