The Contribution of Technikons to Human Resources Development in South Africa

Charlton Koen

Development Policy Research Unit
Working Paper 03/80

August 2003
ISBN 0-7992-2200-3

Abstract

This paper documents the phenomenal contribution that technikons have made to the development of human resources in South Africa, particularly high level human resources throughout the period of the 1990s. This is done by examining the enrolment and qualifications profile of technikons over a fifteen year period. The evidence is assembled in relation to fields for which there is a high labour demand and it further highlights the extent to which social concerns such as equity are being addressed within technikons in particular. Only through matching qualification outputs with trends in occupational demand on the labour market are institutions able to measure the relevance of specific curricular progrogrammes. On the whole, many programmes at technikons are tailored for specific niche segments within the labour market. This enables technikons to respond with greater flexibility to labour demand needs. A major challenge however is to shift the award of qualifications away from diplomas towards degrees and post-graduate qualifications.

Acknowledgements

The DPRU wishes to thank the South African Netherlands Research Programme on Alternatives in Development (SANPAD) for supporting the research on which this paper is based. In addition, Gerard Evers at the Institute for Labour Studies (IVA) at the University of Tilburg provided useful feedback on the arguments that we raised. None of these institutions are however liable for the arguments and positions adopted by the author.

Development Policy Research Unit
Tel: +27 21 650 5705
Fax: +27 21 650 5711

Information about our Working Papers and other published titles are available on our website at:
http://www.commerce.uct.ac.za/dpru/

Table of Contents

Introduction

This paper reports on the contribution made by technikons to human resources development in South Africa. Originally conceived to promote technical and vocational education, technikons have increasingly expanded their contribution to high-skill labour development by sharply increasing their enrollment and graduation output throughout the 1990s (FRD 1993, Cooper 1995a and b, FRD 1996, Kaplan 2000, Cooper and Subotzky 2001, DoE 2001, SAIRR, 2001). The extent of this expansion is phenomenal. Empirical data indicates that student numbers at technikons increased almost fourfold from 1985 to 2000 (CTP 2001, SAIRR 2001, DoE 2002). At the same time, technikons have increased their graduate output and show signs of graduating more high-level degree students. The National Plan for Higher Education (DoE 2001) indicates that technikon graduates grew by 6 300 (or 41 percent) from 1993 to 1998. The result is that South Africa increasingly relies on technikons to produce high-skill labour and to contribute to economic growth by providing a steady supply of career-focused graduates.[1]

Reasons for this are self-evident. Political change and improved access to global economic markets in the post-1990 has contributed to an increased need to produce high-level labour to modernise and make South Africa's economy more internationally competitive. Until recently, South Africa's economy was built on a low skill base in manufacturing. However, structural shifts have contributed to more capital-intensive production and rapid growth in the value added by tertiary sectors with corresponding declines in value added by the primary and secondary sectors. This has highlighted labour shortages in high skill professional and managerial occupations in science, engineering and technology (SET) fields and in accountancy and related financial spheres and stimulated growing demand for finance, management, information technology and engineering graduates (HSRC, 1999).[2] As a result, key higher education policy documents such as the Education White Paper 3: A Programme for the Transformation of Higher Education (DoE, 1997) and the National Plan for Higher Education (DoE, 2001) calls for the rapid expansion of student enrollment, increased graduation output and more career focused tertiary level education.

However, while technikon enrollment has increased, contrary to the initial role of technikons to promote technology education, enrollment patterns at technikons during the early 1990s showed a shift away from SET fields to social sciences, business and commerce (Cooper 1995a, b, FRD 1996, Kaplan 2000, Cooper and Subotzky 2001).[3] In describing the early development of this shift from 1991 to 1994 Cooper (1995b) indicates that this divergence relates to the continued poor matriculation results in science and mathematics and the perceived difficulty of SET subjects at university. Cooper further reveals that the shift in favour of business and commerce is more marked at Historically Black Technikons (HBTs) and at Technikon South Africa (TSA) where mainly black students study and states that:

> *"In terms of the technikon/ university distinction, the original conception of technikons as advanced technical education is no longer strictly applicable" (1995b: 252)*[4]

In line with this, an increasing number of technikon qualifications are also being awarded to business and commerce graduates and to graduates from the health sciences and humanities (FRD 1996, Cooper and Subotzky 2001, DoE, 2002). For example, the Foundation for Research and Development (1996: 59) indicates that:

> *'Technikons were instituted specifically to cater for the growing needs of commerce and industry and to develop technology oriented human resources, but it is the social sciences and humanities (especially the business sciences and administration) which are growing and beginning to predominate.'*

Thus, while various authors have commented positively on the growth in student numbers, others have sounded alarm bells about the efficiency of the higher education system in filling labour shortages and about the distribution of qualifications and of their implications for South Africa's human resources development. With respect to efficiency and labour demand, the National Plan for Higher Education (NPHE) highlights dropout rates of close to 20 percent for undergraduate students and comparatively low pass rates[5], especially at technikons as signs of waste and causes of high throughput cost (DoE 2001). Based on data assessing tertiary graduate employment, Cloete and Bunting (2002: 42) write that:

> *'The higher education system is not producing the numbers and types of graduates required by the labour market.'*

The Ministries of Education and Labour (2001: 26) have raised concerns about the distribution of SET students in the higher education system and about the number of matriculants with qualifications in mathematics and science. Cooper (1995a, 1995b) and Kaplan (2000) have pointed to the significantly lower levels of SET specialists being produced in South Africa compared to that qualified and employed in other middle-level countries. They also emphasise the downward change in the qualification rate of engineers. Kaplan (2000) for example notes that, while engineering degrees awarded increased from 1990 to 1993, the number of awards remained constant from 1993 to 1996. On the other hand, Wilson (2001: 20) drawing from the governments HRD Strategy document, A Better Nation for All, has written:

> *'The necessary shift to science, engineering and technical studies in the tertiary institutions is hampered by the fact that only 19 000 matriculants a year are obtaining exemptions in mathematics on the higher grade. Moreover, the conventional pyramid configuration of post-school education with a large base of students pursuing further training, a smaller number pursuing higher level technical subjects, and a yet smaller group at university is reversed in South Africa.'*

This paper comments on these issues by:

1. Examining the enrolment and qualifications profile of technikons from 1985 to 2000 by race, gender and type of institution in terms of the spread across science, engineering and technology, business and commerce and social science and humanities fields.

2. We further profile qualifications in terms of fields generated by CESM (Classification of Education Subject Matter) categories and discuss the contribution of technikons to scarce human resource fields and to fields with high labour demand.

This focus is important for several reasons. First, much of the debate about HRD contributions has focused on policy goals such as increased enrolment growth and equity patterns. As a result, CESM qualifications in SET, business and commerce and in the humanities are under-examined in

South Africa. Qualification spread is generally only discussed in terms of broad fields. Second, the development of technikons indicates that they increasingly provide high-level qualifications while also playing a crucial role in adult education and training of professionals. In this light it is important to establish what further study patterns manifest and how certificate, diploma and degree output compare. Third, the fit between demand and supply in scarce skill fields is crucial to facilitating South Africa's development and implies that we need to look more closely at the match between qualifications output and occupational demand. Fourth, equity remains a key labour market consideration. In consequence it is crucial to examine the implications of enrolment and qualification patterns at technikons for employment trajectories.

In doing this, the paper is structured as follows. Before examining what the data[6] tells us about unduplicated student headcounts and about the contribution of technikons to human resources, we provide a contextual overview of the shape, development and size of the technikon sector from the mid 1960s. This comprises of an overview of the establishment of technikons, an outline of enrollment trends by institutional type, race and gender and a description of degree changes. Next we provide data on the changing qualification profile of technikons by field of study, race and gender and examine the implications for South Africa's human resource needs. Furthermore, we highlight the thrust of the HRD strategy (DoL, 2002), discuss survey evidence on existing high level labour shortages and compare this with the qualification output of technikons.

The Shape and Development of the Technikon System

South Africa presently has 15 technikons of which 7 are historically white residential institutions and 7 historically black residential institutions with Technikon South Africa (TSA) functioning as a distance education institution. Their purpose is to provide appropriate, technological career-focused education in co-operation with commerce, industry and government at tertiary levels. While the origins of technikons can be traced to the early 1900s when technical colleges began to emerge in order to bolster the growth of the manufacturing sector, technikons differ from colleges with respect to the tertiary nature of their qualifications.

In line with this, the first concrete steps in establishing tertiary level technikons were taken in 1967 with the establishment of Colleges of Advanced Education[7] that provided a post-matriculation training for technicians/ technologists (Pittendrigh 1988, Cooper 1995b). The primary motivation for this development concerned a shortage of human resource skills in commerce and industry at this level and changing patterns in apprenticeship training associated with a decline in the number of students sponsored by industry. A second step involved Parliament reclassifying these institutions in 1979 and calling them technikons. In terms of this development, technikons were deemed to be tertiary level institutions that provided theoretical courses with a practical, work-based training component.

Regarding their establishment, by 1967 seven of these 15 institutions (Cape, Pretoria, Natal, Witwatersrand, ML Sultan and Peninsula) existed with the first four representing large white institutions and the latter two catering for Indian and Coloured artisans and technicians. Historically, technikon education provision has developed extremely unevenly along racial lines with the four leading institutions geared largely toward training relatively high skill labour in applied sciences and technology with a focus on engineering and the others concentrating on the training

of semi-skilled black labour.New technikons with similar programme orientations were established from 1968, particularly in regions that were perceived as requiring consistent supplies of skilled labour. These included:

- PE Technikon, Free State and Vaal Triangle as historically white institutions established from 1968 to 1980,
- TSA as a distance education centre established in 1980, and
- Border, Eastern Cape, Northern Gauteng, North West and Mangosuthu as historically black institutions were mainly established between 1979 and 1991.

Since these institutions were established relatively recently, a key feature of apartheid education remains a low rate of technical skills development among black South Africans that was compounded until the mid 1980s by job reservation barriers and a lack of training and job prospects. Subsequent to the establishment of the current 15 institutions, technikon qualifications changed considerably with the addition of degree courses during the 1990s signaling an increase in capacity, stature and increasing recognition that technikons were making a greater contribution to economic development and to improving the skill base of particularly African workers. Whereas technikons traditionally offered N1-3 as matriculation equivalents for the training of artisans, from the early 1970s technikons increasingly offered a 3-year National diploma for technologists and engineers, in addition to a 2-year National Certificate (NC) and National Higher Certificate (NHC). At the upper end these courses currently include a:

- 3-year National diploma (ND),
- 4-year National Higher diploma (NHD),
- B-Tech degree (introduced in 1995),
- Masters diploma in Technology,
- M-Tech degree (introduced in 1996),
- National Laureatus in Technology (doctorate introduced in 1987), and
- D-Tech degree.

The Committee of Technikon Principals (1995: 10) describes the purpose of these qualifications as follows: The National Diploma provides *"for development of a theoretical knowledge base, high order cognitive and interpersonal skills and broader practical applications, together with a real or simulated work experience, which will allow the student to embark on a career"*. By contrast, the B Tech degree provides for *"A broadening of a theoretical knowledge base and high order transferable cognitive skills with a significant emphasis on managerial skills, together with creative applications, original thought and judgement which will allow the graduate to contribute to the development of the career field"*. On the other hand, the M Tech provides for *"The execution of a developmental research project which will improve or extend the application of technology".*

Among these qualifications, it is currently especially the degrees such as B-Tech and M Tech that are currently strongly oriented towards graduating students in science, technology and engineering with the diplomas being awarded increasingly in the business, commerce and social sciences and humanities fields (CTP, 1995). This distinction relates to some of the motivations for the introduction of degree courses. Along with this, technikons have developed from institutions that traditionally prepared graduates for medium and high-level workplace positions, to increasingly supply high skill labour to industry, commerce and government with many students entering degree courses after having gained practical workplace skills and knowledge after

internship placements and actual employment.

At the same time, in addition to SET courses, technikons offer a broad range of diploma and degree courses in education, social sciences, business and commerce in fields such as Traffic and Police Management, Office Administration, Correctional Service, Public Management and Administration, Internal Auditing, Financial Information Systems. A full-list of these programs is provided in Appendix 1. As this indicates, broadly speaking, some of the qualifications in Appendix 1 are unrelated to technology education and manufacturing industries. Indeed, the range of qualifications tend to show that segmentation in the economy is linked to segmentation in program offerings and service career orientations at technikons and that some technikon programs cater for blue-collar administrative and clerical workers and 'subordinate' primary labour market employment.

In this regard it bears mentioning that a longitudinal picture of technikon programs will show that programs linked to the 'subordinate' primary labour market, rather than the 'independent' primary labour market increased during the 1990s with TSA, for example, expanding the range and scope of the certificates and diplomas it offers. Such a picture will also show increases for qualifications geared towards promoting secondary informal sector employment through small business enterprise and other programs. In this sense, the program mix shows considerable sensitivity to labour demands and shows that technikons now also function as an outlet for stimulating small service sector employment.

Enrolment Trends (1985-2000)

A growing literature exists on student enrolment patterns. This literature charts growth in student numbers at technikons from 1985 and their distribution by race, gender and field of study. The literature indicates the following patterns:

Enrolment Growth

In 1985 technikons registered close to 36 000 students. This number increased to about 93 000 by 1990 and more than doubled over the following five years to 190 000. However, after this technikons experienced much slower growth to reach close to 199000 in 2000 (FRD 1993, Cooper and Subotzky 2001, SAIRR 2001) due to a one-fifth decrease in the number of school-leavers from 1994 to 2000. Despite this, the growth helped technikons to increase their total share in higher education enrolment throughout the 1990s. Comparisons with university totals show that in 1985, 14 percent of higher education students were enrolled at technikons (FRD 1993, Cooper and Subotzky 2001). This increased to 24 percent by 1990 (FRD 1993, SAIRR 2001) to 33 percent by 1995 (FRD 1996, SAIRR 2001) and to 34 percent by 2000 (CTP 2001, SAIRR 2001) with technikons increasing student enrolment fourfold over this period (Table 1).

The importance of this growth is described in the NPHE (DoE 2001: 57) as follows:

> *'The growth in head count enrolments in technikons is significant, as it suggests that the policy goal of increasing enrolments in career-oriented programmes at the diploma level, in line with the continued need for technical skills, is being achieved. The reason for this may have less to do with the*

outcomes of policy than with changes in the external environment, in particular, (i) the opening up of the labour market, with the removal of the job reservation system, which restricted technical occupations to whites; and (ii) the fact that matriculation exemption is not a prerequisite for entry into a large number of technikon programmes.'

Table 1: Enrolment Growth Patterns in HE

	Technikons	Technikon Enrolment Share	University Share of Enrolments
		%	%
1985	36 000	14	86
1990	90 000	24	76
1995	190 000	33	67
2000	199 000	34	66

(Sources: FRD 1993, 1996, SAIRR 2001)

Enrolment by Race and Gender

Moving to enrolment by race and gender, it is clear that a fundamental transformation occurred in enrolment over this period with technikons making considerable progress in bringing about greater equity. Technikon education was traditionally the preserve of white students due to their preferential labour market status. But, rapid expansion of technikons and political change from the mid 1980s has altered their social profile.

Thus, whereas in 1985 African students comprised only 4 percent of technikon enrollees (FRD 1993), this increased to 19 percent in 1990 (FRD 1993) and to 73 percent in 2000 (SAIRR 2001). Compared to other students, the proportion of Coloured students also increased significantly from 1,5 percent in 1985 to 6 percent in 2000, while white students decreased dramatically from 86 percent in 1985 to 17 percent in 2000 and Indian students from 8 percent in 1985 to 4 percent in 2000 (FRD 1993, SAIRR 2001). In this regard, one key feature of the racial change is the current close alignment between these proportions within the technikon system and the national population totals for Africans, Coloureds, Indians and whites. In terms of the share, Africans constitute 76 percent of the national population (vs. 73 percent at technikons), whites comprise 11 percent (vs. 17 percent), Coloureds 10 percent (vs. 6 percent) and Indians 3 percent (vs. 4 percent at technikons).

Table 2 shows that while technikons have been lauded for the pace at which they have transformed their student bodies, this divergence in enrolment patterns from 1985 overlaps with an actual decline in the number of white students at technikons. Thus, whereas whites almost doubled from 1985 to 1990, by 2000 the number of white students had decreased to 1985 levels. The same trend manifested among Indians who more than doubled from 1985 to 1990 and thereafter slowly increased by close to 600 over a 10-year period. Collectively this suggests that enrolment change is associated with mixed patterns and that the study choices of white and Indian students may have changed profoundly.

Such change is evident from gender data that shows higher annual growth in female enrolments compared to male. In line with this, the data indicates that the gender profile changed sharply with females first decreasing from a third of technikon enrollees in 1985 to 29 percent in 1990 after which they increased to 34 percent by 1985 (Cooper and Subotzky 2001) and to 46 percent in June 2000 (CTP 2001). Since females currently comprise a majority among matriculants with non-exemption passes, it seems clear that many of these matriculants are entering technikons. Among these female students, Cooper and Subotzky (2001) show that especially African, Coloured and Indian female students increased at a greater rate than their male counterparts and highlights a trend towards equalising gender breakdowns.

Table 2: Enrolment Change by Race

	African	Coloured	Indian	White
1985	1 381 (4%)	559 (1.5%)	3 012 (8%)	31 177 (86%)
1990	17 452 (19%)	7 941 (9%)	7 243 (8%)	60 085 (65%)
2000	145 400 (73%)	12 362 (6%)	7 826 (4%)	33 317 (17%)

(Sources: FRD 1993, SAIRR 2001)

But, while growth has been sharp, inequalities still manifest in terms of fields of study and type of study. A 1996 FRD publication makes the following points.

1. Between 1985 and 1993 white students comprised 87 percent of enrolments for masters diplomas and Laureati, while

2. Males comprised 89 percent of enrolments for Masters diplomas and Laureati.

Analysing secondary data, Cooper and Subotzky (2001) further indicate that especially the flow of female enrolments during the 1990s coincided with increased registration of women in non-SET fields and that bifurcation occurs within fields. Thus, in commerce and business, African students tend to cluster in general education areas such as labour relations while students from other racial groups dominate areas such as cost accountancy. In this context, it is evident that the penetration of various fields by African students is uneven and that the proportion entering general subject areas is greater than for those entering more select areas. However, as we show below, this is not a general pattern since CESM (Classification of Education Study Material) data indicates that Africans now constitute a majority in SET fields such as mathematics and life and physical sciences (DoE, 2002).

Table 3: Enrolment Change by Sex

	Males	Females
	%	%
1985	67	33
1990	71	29
1995	66	34
2000	54	46

(**Sources:** FRD 1993, 1996, CTP 2001)

Enrolment by Level of Study

Of further interest, is the coincidence between the broad basing of the social composition of technikons and the enhanced prestige technikons currently receive through the upgrading of the qualifications they offer. As indicated earlier, the introduction of B Tech and M Tech degrees from 1995 onwards has boosted the image of technikons and equips them to more effectively meet South Africa's current labour needs. Along with this, it is evident that there is an increasing shift away from lower level qualifications with technikons increasingly diversifying course offerings at the upper levels and enrolling more students for higher-level skills acquisition.

But, while growth has occurred in especially B Tech enrolments, concerning the type of qualifications students enroll for, this:

1. Remains concentrated at the undergraduate diploma level, and
2. As previously indicated, has shown significant change with enrolment especially increasing in commerce and business.

Thus, whereas 93 percent of students enrolled for a certificate or a 3-year National diploma this remained the same till 1993 when according to the FRD (1996) 93 percent of technikon students enrolled at the level of first National diploma, 6 percent for a National Higher diploma(NHD) and only 1 percent at Masters and Laureatus levels (Table 4).

Table 4: Enrolment by Study Level (1990-2000)

	NC + ND level	NHD + B Tech	M + D Level
	%	%	%
1990	93	7	1
1993	93	6	1
2000	88	12	1

(Sources: FRD 1993, 1996, CTP 2001)
Note: Figures do not add up due to rounding

Cooper and Subotzky (2001) further show that this changed somewhat by 1998 as 90 percent were registered for a first certificate or National diploma registration with B Tech enrolment showing growth due to policy and infrastructure support. In line with this, FTE figures for 14 institutions (CTP, 2001) for 1999 indicate that M Tech and D Tech students comprised 0.5 percent (640) of technikon enrollees, NHD and B Tech enrollees 10 percent (13 257), National diploma students 43 percent (56 423) and certificate students 45 percent (60 665). Accordingly, since earlier secondary data for certificates and diplomas show higher enrolment by level of study, it seems clear that the rise of B Tech degrees has contributed to the decline of certificate education.

It is evident that technikons that largely concentrate on full-time studies have no or few certificate students while institutions that combine contact and distance modes or provide large full-time and part-time studies register most certificate students. Therefore, among technikon enrollees, most

Table 5: FTE Enrolled Students in 1999 by Study Level

	Certificates	National Diploma	National Higher Diploma	M + D Level
Border		3 997	34	
Cape		7 299	496	81
Eastern Cape		3 156	75	
Free State	13	4 607	244	49
ML Sultan	5 582	1 264	246	46
Mangosuthu	3 565	1 051	7	
North West		3 586	11	
Natal	-	-	-	-
Northern Gauteng	39	7 158	325	31
PE	4 982	1 132	403	109
Peninsula	5 572	1 056	332	42
Pretoria	1 539	13 008	8 571	263
TSA	32 724	5 035	1 875	15
Vaal Triangle	5	10 266	206	15
Wits	7 094	1 232	654	31
Total	60 665	56 423	13 257	640

(Source: CTP 2001)

certificate students in descending order in 2000 were enrolled at TSA, Wits, ML Sultan, Peninsula, PE, Mangosuthu, Pretoria, Northern Gauteng, Free State and Vaal Triangle with 4 institutions showing no certificate registrations. At the upper end, Pretoria enrolled 65 percent of the NHD and B Tech students and 41 percent of the M and D students, with PE Technikon and Witwatersrand technikons also showing relatively high enrolments at the upper levels (see Table 5). Examining this Table, it is clear that only 2 institutions (Pretoria and PE) have developed reasonably large M and D level programs and that four other institutions (Cape Technikon, Northern Gauteng, Peninsula and Wits Technikon) seem set to quickly increase their number of M and D level students.

The FTE data further indicates that two distinct enrollment patterns are manifest. Institutions either show large concentrations of certificate students with much smaller enrolment levels for the National diploma (Wits, TSA, Peninsula, PE, Mangosuthu, ML Sultan) or have high enrolments at the National diploma level. A further distinctive feature of these patterns is regional segmentation since these patterns overlap with distinctly different enrollment patterns for institutions situated in close proximity to each other. Illustrative of this are the differences between enrolment clusters by type of qualification between Cape and Peninsula Technikons and between Vaal Triangle and Witwatersrand Technikons.[8]

Enrolment by Field of Study

But, while the distribution of qualifications show little recent change, enrolment by field changed considerably. Apart from the shift to business and commerce and to humanities highlighted by Cooper (1995a, b) for the early 1990s, there was a later change with more students registering for SET courses from 1996.9 As can be seen from Table 6, in 1985 SET held 48 percent of students, 38 percent registered for commerce and business qualifications and 19 percent for humanities qualifications. By 1990, SET enrollees decreased to 34 percent, commerce and business increased to 41 percent and humanities students increased to 25 percent (FRD, 1993).

Table 6: Enrolment by Field of Study

	Science, Engineering, Technology	Business and Commerce	Humanities
	%	%	%
1985	48	33	19
1990	34	41	25
1996	28	30	42
2000	34	31	35

(Sources: FRD 1993, FRD 1996, DoE 2002)

Data from the DoE (2003[10]) indicate that this changed even more markedly thereafter with SET students dropping to 28 percent in 1996, but increasing thereafter to 34 percent in 2000. On the other hand, commerce and business students also decreased over this period to 30 percent in 1996 before inching up to 31 percent in 2000, with humanities students first growing to 42 percent in 1996 after which they decreased to 35 percent. This change occurred despite the number of Education students increasing from 2 percent in 1996 to 7 percent in 2000 and suggests that the SET enrolment is once more rising sharply.[11]

Indicative of the latter trend, Table 7 shows enrolment growth in SET for the 15 technikons in CESM fields from 1996 to 2000. Overall, it seems that the underlying pattern relates to employer demand since enrolment for Computer Science and Data Processing shows the most significant growth over this period. This is largely consistent with survey forecasts and highlights some overlap between student enrolment and labour market needs. While not shown in Table 6, most of this growth occurred at TSA where SET students increased from 8 percent to 24 percent with Computer Science and Data Processing students especially increasing from 2 892 to 7 922 from 1996 to 2000. Based on this TSA is responsible for 50 percent of the increase in the number of Computer Science and Data Processing students. However, since TSA provides for part-time distance students it is likely that a large part of student demand is related to skills upgrading within employment. Therefore, it can be argued that the sharp increase is probably partly indicative of the low level of investment in training by industry (see also HSRC, 2000 and DoL, DoE 2002).

Table 7: Enrolment Distribution in Science, Engineering and Technology (1996 2000)

	1996	2000
Agriculture and Renewable Resources	5 118	5 074
Architecture and Environmental Design	2 092	5 560
Computer Science and Data Processing	10 550	20 806
Engineering and Engineering Technology	22 737	24 449
Industrial Arts, Trades and Technology	647	1 381
Life Sciences and Physical Sciences	3 840	5 540
Mathematical Sciences	1 273	2 951

(Sources: DoE 2002)

Considering that the number of matriculants passing mathematics and physical science decreased by 6 000 from 1997-2000 (SAIRR 2001), measured in terms of size of enrolment, fairly steep enrolment increases also manifested in courses for which few students traditionally register such as Mathematical Sciences, Life and Physical Sciences, Architecture and Environmental Design and in Industrial Arts, Trades and Technology. But, although this is positive, the number of registering students clearly remains small.

However, while relatively small SET fields at technikons show some increases, the picture is different for Agriculture (where net job loss of 1,2 million and a decline in the sector's share of GDP has occurred since the 1970s) since enrolments remained fairly constant. On the other hand, the rate of growth among Engineering students is consistent from 1990, although the rate of increase from 1996 to 2000 is less than for previous periods. Since, this growth rate is clearly tempered by long standing reports that engineers comprise about 7 percent of emigrants and of a net migration loss among engineers it is clear that the size of this increase is unlikely to really dent current and future labour shortages among engineers.

It is also evident that technikons will potentially make a greater contribution to HRD output than universities in many of these SET areas since technikons registered more students than universities in the following fields:

1. Agriculture and Renewable Resources (5 074 at technikons vs. 3 100 at universities),
2. Architecture and Environmental Design (5 660 at technikons vs. 3 225 at universities),
3. Industrial Arts, Trades and Technology (1 381 at technikons vs. 159 at universities),
4. Computer Science and Data Processing (20 806 at technikons vs. 11 853 at universities),
5. Engineering and Engineering Technology (24 449 at technikons vs. 10 860 at universities).

The eventual contribution of these enrolment patterns was already evident during the early 1990s when the number of engineering technikon graduates already outnumbered university engineering graduates (Ibid.). In addition, comparative secondary data show that technikons now enroll a greater share of HE Mathematical and Life and Physical Sciences students and that their future contribution to limiting vacancy rates in scarce skill fields will be great. But, at the same time, it is also disconcerting that the concentration of technikon students in the Humanities (see Table 8) is in Public Administration and Social Services with 37 percent of Humanities students enrolling in this field in 2000. This is almost five times the number of university enrollees and is of concern because of the high rate of unemployment that currently characterises public sector employment due to rationalisation policies. This unemployment affects both lowly and highly educated workers and is likely to remain a structural feature of this sector since the number of estimated managerial level jobs is small and is likely to remain limited.

Table 8: Enrolment in Humanities, Health Sciences, Business and Education in 2000

Humanities and Social Science	2000
Arts, Visual and Performing	2 805
Communication	4 403
Home Economics	2 760
Language, Linguistics and Literature	5 914
Law	9 255
Libraries and Museums	750
Philosophy, Religion and Theology	27
Physical Education, Health Education and Leisure	660
Psychology	1 064
Public Administration and Social Services	20 778
Social Sciences and Social Studies	5 999
Unknown	1 555
Health Sciences and Health Care	5 073
Business, Commerce and Management Science	63 224
Education	13 340

(Source: DoE 2002)

Table 9 further shows that enrolment in the humanities decreased at 11 technikons from 1996 to 2000. Among these institutions North West recorded a 21 percent loss and TSA experienced a 25 percent decrease with other institutions showing smaller changes. This is significant, although the decreases at some institutions relate to the classification of Education programs as part of SET and Business and Commerce. Principally, it shows that technikon enrolment patterns are shifting back towards SET fields.

Table 9: Field of Study in 2000 by Institution

Technikon	Science, Engineering, Technology		Business and Commerce		Humanities	
	1996 %	2000 %	1996 %	2000 %	1996 %	2000 %
Border	27	23	35	23	38	54
Cape	52	51	27	33	21	15
Eastern Cape	19	34	39	48	42	18
Free State	34	25	42	67	24	8
Mangosutho	55	56	30	33	15	11
ML Sultan	54	48	26	27	20	25
Natal		45		35		19
Northern Gauteng	37	39	24	31	39	30
North West	13	20	28	52	59	28
Peninsula	44	43	23	26	33	31
Port Elizabeth	40	43	32	39	28	18
Pretoria	39	28	32	19	29	53
Technikon SA	8	24	29	28	63	48
Vaal Triangle	44	45	38	34	18	21
Witwatersrand	55	52	34	42	11	5
Grand Total	28	35	30	31	41	34

(Source: DoE 2002)

Programs in Education also feature as a reason for increases with Pretoria Technikon experiencing the largest enrolment growth in the Humanities due to the registration of more than 11 000 Education students. This accounts for 88 percent of the close to 14 000 enrolments in Education programs in the Humanities at technikons and highlights a markedly skew distribution of Education students among institutions. This outcome partly relates to partnership agreements. For example, according to Mabizela (2003) in 2002 Pretoria Technikon registered 12 000 headcount enrolments (89 percent of all technikon enrolments in this category) in partnerships with private institutions.

With respect to wider patterns, Free State shows rapid growth in Business and Commerce programs that corresponds to a decrease in SET enrolments, while most of the small African technikons (Border, Eastern Cape, North West) show marked growth in SET fields that also overlaps with increases in Business and Commerce at Border and North West. Indeed, it is evident that mixed patterns characterise business and commerce enrolment since this fluctuated considerably at most institutions from 1996 to 2000. This is probably a function of competition, resource crunch[12] and changing student demand. More broadly, it shows that technikon enrollment has yet to stabilise and that the future growth direction of technikon registration remains somewhat uncertain.

Enrolment by Race, Gender and Field of Study

It is relevant at this point to return to race and gender patterns and to note that HE has in the last decade undergone a massive transformation in enrolments related to changing policy and labour market conditions and to school output trends. The expected transformation require the expansion of technology enrolments at all technikons, but not all possess sufficient infrastructure to promote mass technology education, nor could the schooling system deliver the necessary output due to low enrolment rates in SET courses. As a result, enrolment patterns show mixed and uneven developments characterised by large swings in institutional enrolments over relatively short periods. But, how did this transformation proceed with respect to race and gender enrolment by field of study? And, does the evidence indicate that the shape of the future SA workforce will change by labour sector?

A summary of student enrolment patterns in different CESM fields by race and gender highlights the following trends:

1. In 2000, males comprised 64 percent of enrolments in SET (including Health Sciences) fields compared to 36 percent for females. This compared with 72 percent in 1996 and clearly shows that female enrolments in SET fields are increasing.

2. African students made up 64 percent of enrolments, whites 22 percent and Indians and Coloureds 7 percent each. This again indicates that Africans especially are making use of mobility opportunities since their share of enrolment increased from 48 percent in 1996 to 64 percent in 2000, with enrolment in SET fields dropping most significantly for whites from 36 percent in 1996 to 22 percent in 2000.

3. The gender enrolment gap in SET fields is narrowing. In 2000 African males comprised 39 percent of SET students and African females 25.3 percent. This compares with 32.3 percent for African males in 1996 and 15.6 percent for African females and indicates that enrolment of African females in SET fields at technikons increased rapidly during the late 1990s. Concomitantly, white male enrolments in SET decreased most with white males decreasing from 28 percent in 1996 to 16.2 percent in 2000. While white females also decreased in proportional terms, the net difference involved a 2 percent decrease from 8.4 percent in 1996 to 6.3 percent. This small proportional decrease also manifested among Coloured and Indian males who showed similar returns of 4.4 percent for 2000 after respectively numbering 5 percent and 6 percent in 1996. On the other hand Coloured and Indian females increased their enrolments in SET by less than 1 percent each and continue at 2.1 percent each to constitute a distinct minority among SET students countrywide.

4. African students now constitute a majority in all SET sub-fields, except Industrial Arts, Trade and Technology. Thus, enrolment increased rapidly to reach 69 percent in Engineering and Engineering Technology in 2000, 57 percent in Architecture and Environmental Design, 65 percent in Computer Science and Data Processing, 76 percent in Life Sciences and Physical Sciences, 73 percent in Mathematical Sciences. However, African students comprise only 33 percent in Industrial Arts, Trade and Technology.

In this sense, it is clear that in so far as technikons continue to provide medium and high-level labour in technology education their most significant future contribution will lie in developing these skills amongst African workers and that South Africa's continued labour force growth in SET fields will depend largely on how many African students qualify. Much the same conclusion applies in education and business and commerce where African students comprised 97 percent and 76 percent of technikon enrollees. It is also evident in sub-fields within the Humanities since whites in 2000 only outnumbered African students in two areas: Arts, Visual and Performing Arts and in Physical Education, Health Education and Leisure.

Trends in Qualifications (1985-2000)

As stated earlier, this paper examines both enrolments and qualifications. In considering what secondary data reveal about recent trends in qualifications output, we describe the patterns along two dimensions:

1. The total output and its growth patterns.

This shows the following patterns from 1985:

- From 1985 to 1991 there was a noticeable increase in the number of three-year diploma graduates at technikons from 3 538 in 1985 to 9 288 in 1991 (FRD 1993). Over this period SET graduates decreased from 70 percent (2 461) in 1985 to 44 percent (4 114) in 1991 with Business and Commerce graduates increasing from 16 percent (558) in 1985 to 37 percent (3 398) in 1991 (Ibid). A similar decrease occurred at the National Higher diploma level and among Masters diplomas where SET graduates decreased from 97 percent to 79 percent and from 100 percent to 91 percent from 1985 to 1991. In these terms, the number of qualification awards in non-SET fields at technikons already outstripped SET awards in the early 1990s.

- The total number of diplomas awarded by technikons increased from 11 469 in 1991 to 14 116 in 1993 (FRD 1996). Between 1996 and 1999 the number of three-year diploma graduates increased from 15 406 to 19 023 (CTP 2001). Most of this increase occurred between 1998 and 1999 when numbers increased by 2 350 diplomas from 16 673 to 19 023. Thus whereas enrolment figures at technikons show a general decrease from 1995 to 2000, it is of some interest that graduate output continued to show signs of expansion. This change in "scale" also applies to the National Higher Diploma (B Tech) with output increasing from 3 555 in 1996 to 4 482 in 1999 with the number of awards increasing at a constant annual rate from 1997 to 1999. Signs of increased output also exist at the upper level where M and D-level qualification awards increased from 118 in 1996 to 156 in 1999. In addition, 717 Certificates were awarded in this year.

- Overall, DoE data for 2000 indicate that 21 221 qualifications were awarded by technikons in 2000 and that the rate of growth in diplomats during the early 1990s was sustained throughout the decade. Most impressively, the 2000 output figures further indicate that B-level qualifications comprised 29 percent of output whereas these students only comprised 10 percent of enrolment. While their time-to-degree is much shorter than that for undergraduate students it nonetheless suggests high throughput rates at the degree level and suggests that technikons contribute significantly to qualification creep. The results further suggests that certificate awards had declined to 3 percent of qualifications and illustrates that a sharp shift has occurred away from certificates at technikons.

- Over the period 1996-1999, 2 large institutions (Wits and Technikon Northern Gauteng) experienced small declines in their graduate output with Natal experiencing a 16 percent decrease. On the other hand, small institutions such as Border, Eastern Cape and Mangosuthu experiences increases of more than 20 percent, while Pretoria and North-West increased their graduate output by 18 percent and 16 percent with most other institutions recording more limited growth of around 5 percent (CTP 2001). In the case of Pretoria Technikon this expansion relates principally to output of Education students at the B Tech level. This contributed to Pretoria Technikon awarding 43 percent (2 644) of all B Tech qualifications in 2000.

- Whereas most awards in the early 1990s were made to white graduates, in line with enrolment trends Africans are currently the main beneficiaries of technikon qualifications. Data for 2000 show that 60 percent of awards went to African graduates, with whites receiving 26 percent, Coloureds 7 percent and Indians 6 percent (DoE 2002). This compares with 1990 data that shows that whites received 79 percent of all qualifications compared to 6 percent for Africans and 7 percent each for Coloureds and Indians (FRD, 1996).

- Women have also increased their share of technikon qualifications. This is especially evident from B Tech qualifications since 44 percent were awarded to women graduates compared to 56 percent for males (DoE 2002). This pattern started during the 1980s with African and female diplomats showing the largest growth among technikon graduates. However output at the M and D-levels are still heavily skewed in favour of males who achieved 83 percent of these awards in 2000 (ibid). But hidden in the data also lies some good news. Thus, from an efficiency point of view, technikons in 2000 were only graduating 10 percent of their enrolled students with graduation rates for females slightly outstripping graduation rates of males.

2. Contributions to the labour market

This shows the following patterns:

- In 1998 *'Nearly 80 percent of technikon graduates obtained qualifications in applied fields: 31 percent in business, commerce and management; 24 percent in the social sciences and applied humanities and 22 percent in engineering and the applied sciences'* (DoE 2001: 56).

- In 2000, 31 percent (6 485) of all qualifications at technikons were awarded in SET fields, 25 percent were awarded in social sciences and humanities, 33 percent (6 935) were awarded in business, commerce and management sciences and 11 percent were awarded in Education. Concerning how these degrees were distributed at B Tech level, 29 percent of B Tech degrees were awarded to SET graduates, 35 percent were awarded to Education graduates, 16 percent were awarded to social science and humanities graduates and 20 percent to business, commerce and management graduates. Thus, whereas the CTP supported the expansion of degree qualifications at technikons on the grounds that this would enhance technology education, it is apparent from these results that B Tech qualifications are increasingly being awarded in non-SET fields and that technikon output is benefiting immensely at some institutions from the enrolment of non-traditional technikon students.

Table 10: Graduation by CESM Category and Race (2000)

SET	African	Coloured	Indian	White
Agriculture and Renewable Resources	190	13	2	273
Architecture and Environmental Design	392	63	63	375
Computer Science and Data Processing	519	169	176	515
Engineering and Engineering Technology	746	146	146	594
Health Care and Health Sciences	569	118	168	424
Industrial Arts, Trade and Technology	58	29	13	164
Life Sciences and Physical Sciences	306	58	55	103
Mathematical Science	49	9	7	12
Humanities and Social Science				
Arts, Visual and Performing	108	20	19	404
Communication	155	22	36	134
Home Economics	192	32	36	220
Language, Linguistics and Literature	126	27	5	57
Law	516	75	34	111
Libraries and Museums	92	1	2	12
Philosophy, Religion and Theology	8	0	0	1
PhysicalEducation, Health Education and Leisure	8	2	1	59
Psychology	34	14	2	17
Public Administration and Social Services	1 644	140	85	259
Social Sciences and Social Studies	386	54	21	152
Unknown	21	7	2	46
Business, Commerce and Management Sciences	4 372	558	322	1 549
Education	2 283	34	8	45

(Source: DoE 2002)

- Regarding the awarding of diplomas and degrees by CESM category and race, Table 10 shows equity in access partly overlaps with equity in outcomes since white graduates now only outnumber African graduates in 4 fields: Agriculture and Renewable Resources, Industrial Arts, Trade and Technology, Arts, Visual and Performing Arts and Home Economics. Table 10 further shows that technikons graduated 1 600 Engineers in 2000 and 1 400 Computer Science and Data Processors. This translates into a graduation rate (calculated as the number of graduates divided by the number of enrollees) of 7 percent for each area and implies that while this will contribute to greater equity and to growth in employment numbers, HE efficiency still needs to improve. However, considering that Africans received 46 percent of the Engineering graduates as compared to 4 percent in 1992 (FRD 1996), it is evident that much is now being invested in SET training for Africans as opposed to apartheid practices.

Conclusion

By way of a conclusion, we briefly address the HRD implications of these enrolment and qualification distributions by relating the trends we described for employment data and to vacancy rates in the economy. The current secondary information indicates that huge demand exists for information technologists, health professionals, managers, engineers, accountants and auditors and that labour demand in the social sciences and humanities are less acute. For example, the 1999 HSRC labour forecasts indicate that:

> *'High demand exists for engineering technologists who obtain a recognised B Tech or M Tech degree. A quarter of the companies employing engineering technicians experienced shortages of these skills.'*

This demand is likely to increase in the future since current employment data indicates that the South African economy show signs of sustained growth, albeit currently at low rates. This growth is spread unevenly across sectors with Financial Services and Trade responsible for most new job opportunities and with some growth in the Construction, Transport and Manufacturing sectors. In this sense, there is definitely a market for technikon graduates of all races and sexes that will likely expand with accelerated economic growth.

That technikon graduates are well placed to exploit this is clear from economic and training factors and from policy orientations. The DoE has clearly signaled that career-oriented education needs to be expanded because the market demands that graduates increasingly master technical competencies and have practical work-based experience. Technikons offer such work-based placements to graduates during their 3rd year of diploma studies by establishing internships as part of their course assessment. Technikons are further linked to serving industry by including industry representative on course, subject and program advisory committees. But, as is clear, technikon graduates are not solely equipped to join industry and business. Many exit with government public service oriented qualifications in response to perceived market needs.

The results further show that technikons are primarily responsible for promoting capacity in several scarce skill fields and that they are growing African enrolment significantly in these areas. These fields of skill include computer technologists, engineers, architecture, surveying and design and in industrial arts and trade technologists. As they in future enroll more Africans and women in these areas it is inevitable that the ratio of females to males in these professional areas will change with more equitable patterns also emerging along racial lines. That technikons have grown enrolments in these areas is encouraging since most of these areas are associated with job creation and

because the outlook for job advancement and reducing economic inequalities in these areas is great.

In addition, technikon education is clearly very diversified and caters for management level and informal sector employment as well. Thus, several technikons offer small business and entrepreneurship courses, while all offer a proliferation of management courses in recognition of the dire labour market shortage among medium and upper-level managers. As a result, the unremitting picture is of technikons promoting HRD development by enrolling large numbers of students in line with market needs and of providing practical work-based training.

But, several challenges also remain. The distribution of qualifications is heavily skewed in favour of diplomas when the greatest need is for a more highly qualified workforce that can combine theoretical knowledge and practical competencies. Thus, the number of B Tech qualifications remains low, although this is changing fast. But, this is not necessarily changing fast among technology students since a large part of the recent growth is due to an expansion of teacher qualifications at this level. It is disconcerting that several humanities and social sciences diplomats are exiting at the B Tech level.

The consequence of the enrolment and graduation trends is that South Africa is unlikely to experience a significant fall-off in labour demand for high skill professions, but that labour supply is likely to dent demand somewhat in some areas, while signs of an oversupply of labour in social service fields is also evident when graduation data for universities and technikons are combined.

References

Cloete, and Bunting, I. (2000) *Higher Education Transformation Assessing performance in South Africa*. Centre for Higher Education Transformation. Pretoria.

Committee of Technikon Heads (1995) *Technikon education for the real world*. Corporate Information Brochure. Committee of Technikon Heads.

Committee of Technikon Principals (1995) *A Framework for the introduction of degrees at technikons*. Pretoria.

Committee of Technikon Principals (2001) Profiles of South African Technikons 2000 Report. Pretoria.

Cooper, D. (1995a) "Technikons and Higher Education Restructuring" in *Comparative Education* Volume 31 Number 2 June 1995.

Cooper, D. (1995b) "The shift away from technology-oriented fields by students at the technikons." *South African Journal of Higher Education* Volume 9 Number 1.

Cooper, D and G. Subotzky (2001) *The Skewed Revolution: Trends in South African Higher Education: 1988-1998*. Cape Town. Education Policy Unit, University of the Western Cape.

Cosser, M. (2002) *From School to Higher Education.* Research Programme on Human Resources Development, Human Sciences Research Council. Pretoria. June.

Department of Education (1997) *Education White Paper 3: A Programme for the Transformation of Higher Education*. Pretoria.

Department of Education (2001) *National Plan for Higher Education. Department of Education.* Pretoria.

Department of Education (2002). *SAPSE and HEMIS Information Systems.* Pretoria.

Department of Education and Department of Labour (2002) *Human Resource Development Strategy for South Africa A Nation at Work for a Better Life for All*. Government Printers. Pretoria.

Erasmus, J. (1999b). *Labour Market trends and future workforce needs.* Economic and Social Analysis Division, Human Sciences Research Council. Pretoria. HSRC Publishers.

Foundation for Research and Development (1993) *South African Science and Technology Indicators 1993*. Directorate for Science and Technology Policy: Pretoria.

Foundation for Research and Development (1996) *South African Science and Technology Indicators 1996*. Directorate for Science and Technology Policy: Pretoria.

Kaplan, D (2000) *The Development of S&T Skills: Some empirical Evidence on the Current Situation.* Background data prepared for discussion on the development of S&T human resources, NACI Bosberaad, February 2000.

Mabizela, M (2003 Forthcoming) *Report on Public-Private Partnerships in Provision of Higher Education* Human Sciences Research Council: Pretoria.

Moleke, P. and Albertyn, L. (1999a). *First employment experiences of graduates*. Human Sciences Research Council. Pretoria: HSRC Publishers.

Pittendrigh, A (1988) *Technikons in South Africa - An Evaluative Analysis of the Factors influencing the Development of the Technikons (1967-1985) and an Assessment of their Role in Educational Change at Tertiary Level in the RSA.* Building Industries Federation (South Africa).

South African Institute of Race Relations (2001) *South Africa Survey 2001/ 2002*. Braamfontein, Johannesburg.

Statistics South Africa (2001) *October Household Surveys, 1995-1999.* Pretoria.

Statistics South Africa (2002) *Labour Force Survey February, 2001*. Statistical Release Po20210, 25 September. Pretoria.

Wilson, F (2001) "Employment, Education and the Economy" in South African Institute of Race Relations (2001) *South Africa Survey 2001/ 2002*. Braamfontein.

End Notes

[1] This is especially evident from comparative data. This shows that, in proportional terms, technikon enrolment has outstripped enrolments at universities throughout the 1990s (FRD, 1996; Kaplan, 2000, Cooper and Subotzky 2001). Survey data also shows that technikon degrees are highly valued by employers (Africa Insight 1994) and that some technikons are increasingly viewed as the first choice of matriculants (HSRC, 2002).

[2] Employment statistics from the Labour Force Survey (SSA 2002) and from the October Household Surveys (SSA, 2001) also indicate that graduates with qualifications in fields with high vacancy rates are unemployed. In consequence, it is clear that supply and demand patterns do not correlate in the labour market.

[3] It bears mentioning that this shift away from science and technology education and in favour of business and commerce was replicated at a more rapid rate at technical colleges leading to SET students comprising fewer than 20 percent of enrollees at technical colleges (DoE, DoL 2002). A further broad concern relates to a concomitant decrease in job specific training provided by employers during the 1990s.

[4] This increasing alignment is most clearly visible from the merger initiatives that mainly combine a university and a technikon. However, while merger moves will shape the future trajectory of technikons the DoE (2001) has indicated that the Ministry will continue for at least the next five years to regard "*technikons as institutions whose primary function is to provide career-oriented programmes at the diploma level.*"

[5] This varies considerably across technikons. FTE figures for 1999 indicate that pass rates were lowest at Pretoria Technikon (50.6 percent) and highest at Witswatersrand Technikon (83.4 percent) with a median of 69 percent for 13 institutions (CTP 2001). This compares with a median of 65 percent for 14 institutions for 1996 (*Ibid.*).

[6] It is important to note that the data we draw upon comes from diverse sources (FRD 1996, Kaplan 1999, Cooper and Subotzky 2001, CTP 2001; SAIRR 2001, DoE, 2003). Although this information derives from SAPSE definitions the authors do not necessarily provide the same headcount figures for particular years. In cases such discrepancies relate to institutions

updating information supplied previously. It is secondly important to note that technikon students are counted either by headcount or based on the number of courses as full-time equivalents (FTEs). Further, while headcount figures show constant increases in registration patterns, FTE figures show slower increases because of a drop in the number of courses technikon students take that probably relates to a decrease in part-time enrolments.

[7] The colleges were renamed Technikons in 1979 to capture their status as Institutes of Technology.

[8] A further distinctive feature at technikons is the fact that institutions have started to phase-out their certificates in particular fields and have replaced these with diplomas. As a result, future enrolments at the certificate level should equalize for most residential institutions.

[9] This latter increase occurred across the HE system leading to the DoE and DoL (2002: 26) describing the movement as "*in the right direction, although the growth in SET (from 24 percent in 1993 to 25 percent in 1999) is still insufficient to meet national priorities*."

[10] These totals for 1996 exclude data for Technikon Natal.

[11] Reasons for this require investigation. Cooper (1995a) earlier argued that the shift away from SET was unlikely to merely constitute a cycle since the main underlying factor was clearly the poor matriculation results and mathematics pass rates. This actually declined further in the subsequent period. Thus, although some technikons relaxed admissions requirements, reasons for the change, which corresponds with increased enrolment of African students and students doing Computer Science, requires clarification.

[12] It bears mentioning that technikons increasingly rely on part-time academic staff to fulfill their core teaching tasks and that they recruit large numbers of under-qualified and trained part-time staff annually. This particularly applies in the Business Sciences where few academic staff have senior level qualifications. One result is high staff turnover among part-time academics and change in the courses that are offered.

Appendix: Technikons Programs and Qualification Level

Science, Engineering, Technology	Qualification Level
Engineering: Cartography, Building Chemical Engineering, Civil Engineering, Computer Engineering, Construction Management and Quantity Surveying, Materials Testing, Electrical Engineering, Electromechanical Engineering, Telecommunications, Industrial Engineering, Marine Engineering, Maritime Studies, Mechanical Engineering, Airconditioning and Refrigeration, Metallurgical Engineering, Polymer Technology, Surveying, Wood Production Engineering	NC, NHC, ND, ND, B. Tech, M. Tech, D Tech
Architecture/ Building: Architecture, Building Surveying, Construction Supervision, Plumbing Technology, Town and Regional Planning	ND, B Tech, M Tech
Agriculture: Agricultural Management, Animal Health, Animal Production, Crop Production, Ecotourism Management, Equine Studies, Forestry, Game Ranch Management, Horticulture, Laboratory Animal Technology, Meat Hygiene, Mixed Farming, Nature Conservation, Parks and Recreation, Rural Development and Extension, Turfgrass Management, Veterinary Technology, Landscape Technology	ND, B Tech, M Tech
Life and Physical Sciences: Analytical Chemistry, Beauty Technology, Biotechnology, Economic Geology, Electron Microscopy, Fire Technology, Geotechnology, Metalliferous Mining, Meteorology, Microbiology, Mining Surveying, Nuclear Technology, Oceanography, Optical Dispensing, Paint Technology, Plastics Technology, Pulp and Paper Technology, Textile Technology, Water Care Laboratory Technology Mathematical Technology, Food and Nutrition, Ceramics Technology, Explosives Technology	ND, B Tech B Tech, M Tech
Computer Science: Computer Data Processing	ND, B Tech
Health Sciences: Dental Assisting Ambulance and Emergency Care, Chiropractic, Clinical Technology, Dental Technology, Environmental Health, Health Service Administration, Homeopathy, Medical Technology, Nursing (Oncology, Community, Critical Care, Research based), Pharmacy, Podiatry, Public Health, Radiography, Somatology, Sports Administration and Marketing, Sport and Exercise Technology, Sport Management	NC ND, B Tech
Business and Commerce	
Management, Administration, Marketing: Legal Assistance, Small Business Management, Accounting, Banking, Economic Management Analysis, Real Estate, Commercial Administration, Secretarial Business, Secretarial Offi ce Administration, Municipal Management, Prison Management, Public Administration, Registration of Deeds Accountancy, Cost and Management Accountancy, Government Finance, Internal Auditing, Local Government Finance, State Accountancy and Finance, Clothing Management, Contact Center Management, Commercial Practice, Company Administration, Cost and Management Accounting, Credit Management, Financial Information Systems, Housing Development and Management, Economics, Human Resource Management, Industrial Relations, Labour Relations, Local Government Finance, Logistics, Management, Marketing and Sales, Materials Management, Organisational Leadership, Organization and Work, Packaging Management, Personnel Management, Pharmaceutical Marketing, Policing, Post Office Administration, Printing Management, Production Management, Property Development and Management, Purchasing Management, Security Management, Traffic Safety Management, Transport Economics, Retail Business Quality, Business Administration	NC, ND ND, B Tech, M Tech B Tech, M Tech

Humanities	
Art and Design: Ceramic Design, Clothing Design, Film and Video Technology, Fine Art, Graphic Design, Industrial Design, Interior Design, Jewellery Design, Photography, Textile Design	ND, B Tech
Communication: Sports Reporting, Versatile Broadcasting, Webmaster Business Communication, Film and Video Technology, Information Technology, International Communication, Journalism, Language Practice, Motion Picture Production, Public Relations, Tourism Management	NC ND, B Tech
Food and Catering: Food, Food and Clothing Technology, Food Service Management, Hotel Management	ND, B Tech
Performance Art: Ballet, Dance Drama, Fashion, Fine Art, Light Music, Music Theatre, Opera, Performing (Entertainment) Arts	ND, B Tech
Other: Adult Basic Education, Archival Studies, Library and Information Services, Public Relations Management Tourism, B Ed (General Education and Training Specialization), B Ed (Further Education and Training: Specialisation), Child and Youth Development, Police Administration, Business Law, Media Law	NC, ND, B Tech