A Profile of Postgraduate Higher Education and the Academic Research Community in South Africa

Prepared for the
National Advisory Council on Innovation

by the
Centre for the Study of Higher Education
(formerly the Education Policy Unit)
University of the Western Cape

December 2003

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Acknowledgements

This report is the collaborative output of the Centre for the Study of Higher Education (CSHE), formerly the Education Policy Unit at the University of the Western Cape, and the Centre for Research on Science and Technology (CREST) at the University of Stellenbosch - formerly the Centre for Inter-disciplinary Studies (CENIS).

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Andre Burness, Data Manager at the CSHE, provided invaluable assistance by preparing the required databases and tables.

Data for this analysis were kindly provided by the Department of Education's Higher Education Management Information System office, the National Research Foundation and a variety of parastatal organisations, higher education institutions and private sector corporations.

All these collaborative and supportive efforts are gratefully acknowledged.

Executive Summary

This report, commissioned by the National Advisory Council on Innovation (NACI), provides a profile of the postgraduate subsector of HE and the HE research community in South Africa with a view to informing policy-makers and stakeholders of key trends and issues. Postgraduate education and HE research form a pivotal part of the national science and innovation system and therefore have a key role to play in contributing towards national development. It is therefore important to track and analyse trends in these domains.

Constructing the profile has been constrained by the unavailability of complete and reliable data regarding some aspects of the inquiry. It is hoped that this report will form the basis of future and more comprehensive profiles. Despite these data limitations, the profile presents a comprehensive and informative account of the postgraduate subsector and the HE research community.

The key findings of the study are summarised as follows:

Public and private enrolments, graduations and graduation rates

- The postgraduate subsector comprised about 95 000 headcount enrolments in 2001, the vast majority of which were concentrated in the universities. Between 1995 and 2001, significant increases occurred in university masters enrolments (to 35% of the total) and to a lesser extent at the honours level (to 29%). Doctoral enrolments increased modestly but only constituted 7%. This meant that 59% of postgraduate enrolments were at the level of honours and below in 2001. Technikon enrolments also grew but from very low base levels.
- Regarding field of study, the overall postgraduate ratio was skewed towards the Humanities, Social Sciences and Education (56%), with SET (26%) and BC (19%) relatively low.
- Not surprisingly, the overall distribution of postgraduate enrolments among the existing institutional types was highly uneven. The HAIs dominated in all fields, accounting for 70% of all university postgraduates and 80% of technikon postgraduates.
- The merger process will impact significantly on the ratio of postgraduate to undergraduate enrolments where new institutional types will be created by the combination of an HAI and an HDI. In all such cases, the effect will be to average out the ratio by lowering the HAI ratio and raising the HDI one. One of the key stated purposes of the merger process is to distribute resources, capacity and opportunities for postgraduate study and research more equitably between HAIs and HDIs. The extent to which this is actually achieved over time constitutes an important aspect of the future monitoring and evaluation of policy implementation.
- The distribution of postgraduate enrolments by race shifted markedly between 1995 and 2001, especially at the technikons. Africans enrolments in universities increased from 34% of the total to 49%, and in technikons from 8% to 42%. Correspondingly, the proportion of white postgraduates in universities declined from 54% to 38% in technikons from 87% to 45%.
- The distribution of postgraduate enrolments by gender also showed distinctive change between 1995, when women university students made up 44% of the total and 2001, when they constituted the majority (51%). In the technikons, the proportion of women rose from 18% to 39% over this period.

- Greater race and gender equity was achieved in relation to overall enrolments. However, black students and women were still under-represented in key fields and at the higher qualification levels. Achieving greater equity at these levels of disaggregation remains a central challenge of HE transformation.
- Non-South African students comprised about 9% total postgraduate enrolments in 2001, the vast majority of in universities and mostly from the SADC region. They formed 20% of university doctoral enrolments and 12% of masters. This has significant implications for policy and planning in HE and HRD, especially in relation to the SADC Protocol. A key consideration is whether such students return to the country of their nationality, stay in South Africa or emigrate to another country to better their work prospects.
- The data on private postgraduate enrolments are sketchy. Among 86 institutions registered with the DoE in 2001, it is estimated that there were about 3 500 postgraduate enrolments, which represented approximately 4% of total reported enrolments in private institutions of about 85 000. Very few were at the doctoral level, with the majority in masters programmes and in MBAs. However, these figures certainly represents a substantial overcount due to duplicate registrations in private and public institutions, the blurring of FE and HE, and inaccurate counts. It is estimated that private HE proper enrolments amount to about 15 000 to 18 000 headcounts, of which between 4% - 9% (at most around 1 700) are at the postgraduate level.
- Meeting the innovation needs of the science system and the rapidly changing labour market entails not only the attraction of sufficient numbers of enrolments in the required fields and qualification levels, but retaining students to reduce dropouts, and satisfactory success and graduate rates to ensure as economical and efficient time-to-degree as possible. The HE system produced about 25 000 graduates in 2001, mostly from the universities and most at the level of honours and below (73% in 2001). Only about 800 doctorates were produced, while the number of masters and honours graduates increased considerably between 1995 and 2001. Postgraduate graduations were overwhelmingly in the HAUs – over 80% of doctorates and masters and about 70% of honours.
- Regarding field of study, a growth was evident in SET graduates (to 23% of the total) and in Business/Commerce (also to 23%), while those in Humanities and Social Sciences declined (to 30%) and Education (to 24%). These patterns are welcome shifts towards the NPHE goals of a ratio of 40:30:30 in HSS/Education, SET and BC respectively.
- Regarding race, while white students dominated among graduants, their proportion declined between 1995 and 2001 from 56% to 48% while that of Africans increased from 32% to 41%. Similar increases were evident among women postgraduate graduates. However, whites and men continued to predominate at the higher qualification levels, with Africans under-represented. The further disaggregation of graduate output by gender and qualification level reveals further unevenness, with black women graduates concentrated in the lower qualification levels and fields still generally associated with the gender and race division of labour shaped by apartheid society. Nonetheless, over time, graduate output is becoming more equitable at all qualification levels in relation to race and gender.
- All recent major policy documents identify increased efficiency in graduate output as a necessary complement to increased participation rates in meeting the current demand for high-level skills.
- Significant numbers of postgraduates are taking long periods to complete their degrees. The main constraining factors include the demands of employment and workload; financial problems; the quality of supervision; and the availability of library material. Current overall graduation rates are well below the NPHE benchmarks. Considerable variation in graduation rates among fields of study and across the historical institutional types, with HDIs lagging behind HAIs in this regard. From these trends, it is clear that

considerable improvements are necessary at all qualification levels and in all historical institutional types if the NPHE benchmark targets are to be met.

- Concern has been expressed regarding the increase of coursework masters and the possible dilution of the research component of these degrees. In addition, the optimal curricular balance between generic research and academic skills, and specific specialised, in-depth 'content' knowledge is the subject of ongoing deliberation, framed by the 'disciplinary' and 'credit accumulation and transfer' discourses. Caution has also been expressed that shifting teaching programs towards inter-disciplinarity without a solid foundation of disciplinary training may prove counter-productive – especially in a developing country context such as ours where the quality of disciplinary training is often shaky. The key challenge is to pursue an ever closer match between postgraduates and the requirements of the world of work. This will require greater interaction between employers and educators and continuing review of the optimum mix of specific generic skills and knowledge.

The funding of research and postgraduate education

- A fundamental precondition for achieving the required quality, extent and equitable distribution of postgraduate education and research output is, of course, the provision of adequate funding.
- NRF funding for research in 2001 provided just under R114 million to about 1 600 grant holders, at an average of about R 70 000. Over time, fewer researchers have been funded with larger allocations. This is undoubtedly linked to the policy to support rated scientists. Four subject areas – Biology, Engineering, Physical Sciences, and Mathematical Sciences – received the majority of funding. University researchers received the bulk of funds and on average about 1,5 times the amount of technikon researchers. In 2001 HAIs accounted for 80% of grant holders and 78% of grant holder funding. 81% of funds in 2001 were granted to white researchers 79% to men, though the proportion allocated to women in growing.
- Regarding postgraduate funding, the NRF provided just over R45 million in 2001 to 2 500 students at an average of R 18 326. Support in Engineering declined from 26% to 12% in 2001 and that in Biology increased from 31% to 37% and in Physical Sciences from 17% to 22% between 1996 and 2001. Recipients are predominantly South African university students at HAIs. The race and gender distribution of NRF students, though still dominated by whites, reflects a trend towards greater representivity.
- The Medical Research Council, the second largest funding agency of academic research and scholarship, provided about R 800 000 in masters and doctoral scholarship s in 2001 to about 51 recipients at an average of R15 000 for masters and R20 000 for doctorates.
- A snap survey of selected other sources of postgraduate funding (other research councils, parastatals, HE institutions, some government departments and other agencies) revealed that considerable funding is available from these sources. While this initial survey was incomplete and the data not verified, indications are that over R200 million in additional postgraduate funding was available from this select group alone – far larger than the NRF and MRC together. The National Student Financial Aid Scheme at this point funds only undergraduate studies.

HE scientific output, productivity and research capacity

- Taking the extent of scientific output as an indicator, the findings of this report provide clear evidence that the overall contribution of the HE system towards national development and innovation has remained static during the period under review. The

research output of the HE system as a whole, as measured in SAPSE publications units, showed no growth between 1995 and 2001 and in fact actually decreased slightly over this six-year period. All but two of the top research universities produced fewer research outputs in 2001 than in 1995.

- Clearly, if the HE system is to contribute effectively towards national development as the principal scientific knowledge producer, the reasons behind these trends will have to be urgently identified so that effective strategies can be implemented to remedy the current situation.
- A further key finding is that research capacity in the HE system is dominated by five universities. Further that while the HDIs and technikons showed modest increases in output over the six-year period, research output was overwhelmingly dominated by HAIs and in particular the HAUs which produced about 90% of publications units in 2001. Whites and males with higher qualifications levels at universities dominated research output. This might compromise the capacity of HDIs to provide a vibrant research culture for black postgraduate students.
- Research productivity was also static and in fact declined slightly between 1995 and 2001. Again, only two institutions showed increases in this regard over the period. The reasons for these patterns and the lack of overall improvement in scientific productivity are not clear and should be investigated as part of future research. Institutions high in overall output did not necessarily score highly in productivity. HAUs were significantly more productive than HDUs.
- A gradual aging of publishing academics at HE institutions is evident in terms of which more articles are being produced by authors 50 years and older, and fewer by authors younger than 50.
- Among universities, the distribution of publications by field of study, remained almost unchanged, with output mainly in the Natural Sciences (33-35%), followed by the Medical and Health Sciences (21-23%), Arts and Humanities (20-24%), and the Social Sciences (13%-14%). Technikon output shifted towards the Natural Sciences (47%), Social Sciences (22%) and Engineering Sciences (17%).
- The merger process will impact significantly on research outputs and productivity, where new institutional types will be created by the combination of an HAI and an HDI. As with undergraduate/postgraduate ratios, the effect will be to average out the ratio by lowering HAI outputs and productivity and raising that of HDIs. The merging of different institutional research cultures will be complex. For these reasons, following the course of the mergers from the perspective of the impact on research culture and scientific output and productivity constitutes another important future policy research topic.
- The HE system comprised about 15 000 academic staff members in 2001. This was overwhelmingly dominated by whites and males at the higher qualifications levels, While the overall system has become more representative in time, the rate and extent of change has been far slower than that of student enrolments and graduations. In 2001, whites constituted 69% of academics and Africans just 20%. Likewise, regarding gender, women remain under-represented at the senior levels, forming only 39% of all academics but only 19% of professors in 2001 (which is relatively high in international terms). However, this was up from 33% in 1995, indicating a constant but slow improvement in overall gender equity over time. Higher ranking academics were concentrated in the universities, as compared to the new comprehensives and the technikons.

Additional issues

- The findings suggest that postgraduate involvement in HE research projects is reasonably high (overall nearly 50% of respondents in the study). This is highest when:

  - The project falls within the natural sciences, or involves activities that span both the natural and the medical and health sciences
  - The research experience of the project leader is greater than the average of experience of others in his/her sector
  - The research is initiated or driven by a funding agency, a tender or contract
  - The project has substantial funding, coming from THRIP, industry and those science councils with a agency function
  - There is collaboration with industry/business or the science councils
  - The project beneficiary is an entity with clear organisational boundaries, such as a specific firm, agency or interest group or firm, i.e. the research is commissioned and there is a clear research contract.
- The findings suggest that conditions can be created to encourage more postgraduate involvement. Funding agencies could stipulate conditions and create opportunities that could lead to even greater involvement of postgraduate students in university and technikon research. This would undoubtedly strengthen research capacity building in HE.
- Finally, several recent policy documents address the three key issues of research collaboration (as a means of building capacity), and the responsiveness and nature of research (which are central to enhancing the relevance of research to development priorities). These formulations, though framed as broadly normative policy objectives, constitute important statements of intent against which subsequent implementation can be assessed. Their implementation and impacts therefore constitute important themes in the ongoing monitoring, evaluation and research in this regard.

Conclusion

The overall picture emerging from this profile is that the postgraduate sector and academic research community shows considerable strengths and potential on the one hand, but also formidable weaknesses, unevenness and problem areas on the other. Clearly, to fulfil its role in producing the next generation of researchers for the HE system and the labour market, the postgraduate subsector will have to expand in the required fields and especially at the upper levels, producing graduates more efficiently and equitably, and better prepared for the requirements of the changing labour market. Likewise, research output and productivity will have to improve considerably. Various strategies and policies have been developed by the government and other key agencies to address these and other problems. The ongoing monitoring, evaluation and research of these to ascertain their effectiveness and impact will be important to improve HE's vital contribution to national development and to greater equity in the science and innovation system.

1. Introduction and background

This report emanates from a commission by the Executive Head: Secretariat of the National Advisory Council on Innovation (NACI) to the Centre for the Study of Higher Education (CSHE - formerly the Education Policy Unit) at the University of the Western Cape to create a profile of key aspects of the current state of postgraduate higher education (HE) and the academic research community in South Africa.

This educational subsector forms a significant component of the innovation system in South Africa. The aim of this profile is, accordingly, to provide an informative profile and analysis of postgraduate HE and the academic research community for policy-makers and analysts. The intention is to provide an accessible, user-friendly profile of the current postgraduate and HE research system, an analysis of key trends and implications of the emerging HE policy framework for postgraduate HE and research.

In operationalising this project, a central consideration was the availability of up-to-date, reliable and complete data – a ongoing obstacle for policy-makers, researchers and analysts. This report represents a first attempt at gathering the available data. It is envisaged that this initial overview will provide the basis for a more extensive ongoing, possibly annual review.

The profile of the postgraduate HE subsector and the academic research community presented here comprises the following elements:

- Public and private postgraduate headcount enrolments and graduations;
- The funding of postgraduate education and HE research by the National Research Foundation (NRF) and other sources;
- The research capacity of the system in terms of scientific output, scientific productivity and the profile of academic staff; and
- Additional considerations:
  - postgraduate participation, throughput and graduation rates
  - coursework versus dissertation masters
  - disciplinarity and inter-disciplinarity
  - postgraduate involvement in research
  - research capacity development and management
  - the quantity and quality of research outputs
  - research focus.

Throughout the analysis, equity concerns are addressed by examining the distribution of the above elements of postgraduate HE and research: a) by the race, gender and nationality of postgraduate students and academic staff; and b) by the current historical institutional types and, where data are available, the proposed merged institutions. All enrolment and academic staff figures are headcounts.

To track longitudinal trends, data for the years 1995, 1998 and 2001 are provided. However, some of the 1998 enrolment and graduation data were not complete and could not be utilised. In some instances where 1995 and 2001 data were incomplete, data from other years were used. Data were obtained from a variety of sources:

- the Department of Education's SAPSE (South African Post-Secondary Education) data and Higher Education Management Information System;
- the National Research Foundation;
- CREST's SAKnowledgebase of research outputs;
- additional studies previously undertaken by CREST and the CSHE; and
- a snap survey of selected parastatal organisations, higher education institutions and private sector corporations.

The report is organised as follows. First, an account of public and private postgraduate enrolments is provided. This is followed by a discussion of public postgraduate graduation patterns, including graduation rates, and other key issues such as the issues of coursework vs dissertation degrees and disciplinarity and inter-disciplinarity. Then the funding of research and postgraduate education is examined, focusing on the NRF and other sources. Next, the research capacity, scientific output and productivity of the HE system is discussed, including an analysis of the HE academic staff complement. This is followed by an examination of key research policy issues: capacity development, the quantity and quality of research, research management and research focus. A summary of the findings and a conclusion ends the report.

2. Public and private postgraduate enrolments

2.1 The size and shape of public postgraduate enrolments by qualification level

In order to meet the innovation needs of the science system and to provide adequately for the changing labour market, the HE system must attract and graduate sufficient numbers of students in the required range of fields and qualification levels. For this reason, pursuing the optimal size and shape of the postgraduate subsector is vital. For the purposes of this report, the size of the subsector is examined here in terms of headcount enrolment numbers and its shape in terms of the distribution of these enrolments by qualification levels and field of study. Equity concerns are addressed through the analysis of the distribution of enrolments and graduations by race, gender, nationality, historical institutional type and, where data are available, the new institutional types arising from the merger process.

Table 1: University and technikon postgraduate headcount enrolments by qualification level, 1995 and 2001

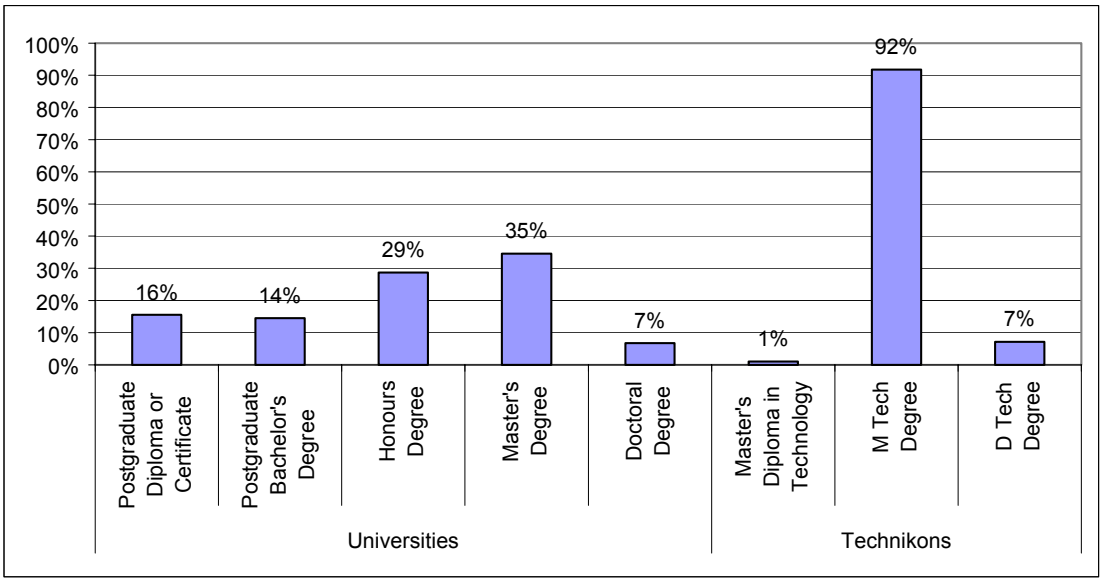
	Qualification Level	1995		2001	
Universities	Postgraduate Occasional	342	0%		0%
	Postgraduate Diploma or Certificate	10 128	14%	14 350	16%
	Postgraduate Bachelor's Degree	14 766	21%	13 356	14%
	Honours Degree	18 270	26%	26 495	29%
	Master's Degree	21 880	31%	31 924	35%
	Doctoral Degree	4 986	7%	6 238	7%
	Sub-total	70 372	100%	92 363	100%
Technikons	Postgraduate (Occasional)	0	0%		0%
	Master's Diploma in Technology	471	80%	26	1%
	M Tech Degree	96	16%	2 362	92%
	Laureatus in Technology	8	1%	0	0%
	D Tech Degree	17	3%	185	7%
	Sub-total	592	100%	2 573	100%
Total		70 964		94 936	

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. However, as there were no postgraduate enrolments in 1996 (the closest available data) at the Border and Eastern Cape Technikons and only 23 at Peninsula Technikon, the 1995 data presented here is not significantly erroneous, despite the missing data.

- As is evident from Table 1, the South African postgraduate subsector comprised just under 95 000 student enrolments in 2001, up from approximately 70 000 in 1995. This represents a 134% increase over the period.
- Although the vast majority of enrolments in 2001 were concentrated in the universities (92 363 out of the total of 94 936 or 97%), technikon enrolments increased from a very low base of 592 (1% of total postgraduates) in 1995 to 2 573 (3%) in 2001.
- In 2001, the 92 363 university postgraduate enrolments comprised 22% of the total of 428 648 university enrolments, with the remaining 336 285 at the undergraduate level (not shown here). The university undergraduate/postgraduate ratio was therefore 78:22. The 2 573 technikon postgraduate enrolments constituted just 1% of the total of 224 327 technikon enrolments (not shown here), with 221 754 at the undergraduate level. The technikon undergraduate/postgraduate ratio was therefore 99:1.

- In the universities, significant increases were apparent in masters enrolments from 21 880 (31% of the university postgraduate enrolment total) in 1995 to 31 924 (35%) in 2001, and to a lesser extent in honours from 18 270 (26%) to 26 495 (29%).
- University doctoral enrolments also increased, but much more moderately (from 4 986 to 6 238). Together with greater increases in the lower qualification levels, this meant that there has been no increase in the proportion of doctorates in the system since 1995 (7%).
- The increase in technikon enrolments were predominantly at the M Tech level (from 96 in 1995 to 2 362 in 2001). In 1995, 80% of technikon postgraduate enrolments were in the Masters Diploma in Technology (80%) which has been superseded by the M Tech degree. A modest increase was evident in D Tech enrolments off a very low based of 17 in 1995 to 185 in 2001.

Figure 1: Proportion of university and technikon postgraduate headcount enrolments by qualification level, 2001



Source: DoE (2001a) HEMIS.

- Figure 1 graphically depicts the shape of university and technikon postgraduate enrolments in 2001 by qualification level.
- In the universities, postgraduate enrolments were concentrated at the masters and honours levels (35% and 29% of the universities' total respectively), with a further 16% at the certificate level and 14% at the postgraduate bachelor's degree. Doctoral enrolments amounted to 7% of the universities' total.
- Postgraduate enrolments in the technikons were overwhelmingly concentrated at the M Tech level, with 1% at the diploma level and 7% at the D Tech level.

2.2 The shape of public postgraduate enrolments by field of study

The distribution of enrolments and graduates by field of study is a key aspect of HE's contribution to the nation's innovation system, human resource development and labour market requirements. Recognising this, a central goal of the National Plan for Higher Education (DoE, 2001b) is to shift the (then) current combined undergraduate and postgraduate enrolment ratio of the three main field of study clusters (science, engineering and technology, business/commerce, and humanities and social science) of 25:26:49 to

30:30:40. Given the goal of increased participation and the important role of the humanities and social sciences in development (particularly in inculcating adaptive generic skills), pursuing the desired ratios should not imply reducing humanities and social science enrolments, but increasing the others.

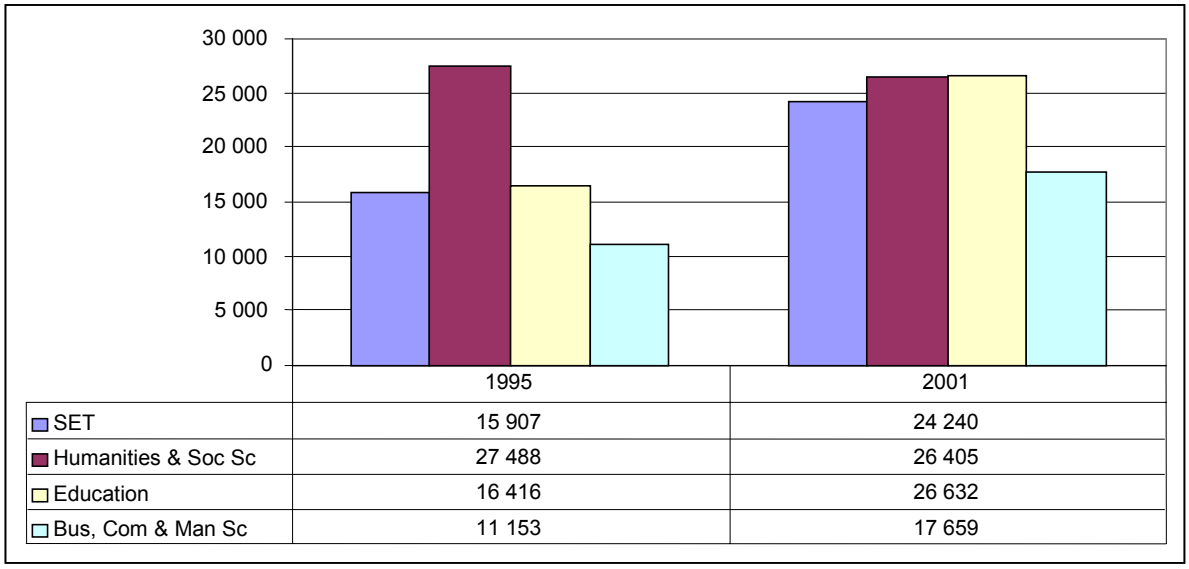
Table 2: National Plan target ratios, and ratios of undergraduate and postgraduate headcount enrolments by broad field of study, 2001

		SET	BC	HSS/Ed
NPHE target ratios		30%	30%	40%
Undergraduate headcount enrolments, 2001	Universities	22%	22%	56%
	Technikons	31%	48%	21%
	Total	26%	33%	42%
Postgraduate headcount enrolments, 2001	Universities	25%	19%	56%
	Technikons	40%	19%	42%
	Total	26%	19%	56%
Total headcount enrolments, 2001	Universities	26%	33%	42%
	Technikons	26%	19%	56%
	Total	26%	31%	44%

Source: DoE (2001a) HEMIS. Note: SET = Science, Engineering and Technology; BC = Business, Commerce and Management Sciences; HSS/Ed = Human and Social Sciences and Education.

- Table 2 shows wide variation in the ratio of Science, Engineering and Technology (SET): Business, Commerce and Management Sciences (BC): Human and Social Sciences and Education (HSS/Education) enrolments among both undergraduates and postgraduates in the universities and technikons.
- Significantly, in relation to the NPHE target of 30:30:40, the ratio of total headcount enrolments in 2001 was 26:31:44. This indicates that the distribution of overall enrolments is skewed towards HSS/Education, with enrolments in BC just above target but that an increase in the number of SET enrolments is required.
- The university undergraduate ratio was especially skewed towards HSS/Education (56%) while that of technikons towards BC (48%).
- The overall postgraduate ratio was also skewed towards HSS/Education (56%), with SET (26%) and especially BC (19%) low.
- The university postgraduate ratio was similarly skewed towards HSS/Ed. (56%) but technikon postgraduates in SET (40%) and HSS/Ed. (42%) were especially high.

Figure 2: Postgraduate headcount enrolments by broad field of study, 1995 & 2001



Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Figure 2 shows that the overall size and shape of postgraduate enrolments by field of study had shifted markedly between 1995 and 2001.
- In 1995, the majority of postgraduates was concentrated in HSS (27 488 or 39%) with a further 16 416 (23%) in Education. The combined HSS/Education field comprised 43 904 enrolments (62% of the 1995 total).
- By 2001, the HSS/Education cluster had risen to 53 037 (56%), made up of 26 405 (28% – a slight decline of about 1 000 from 1995) in HSS and 26 632 in Education (28% – a considerable increase of about 10 000).
- Significantly, the number of SET enrolments increased over the period from 15 907 (22%) to 24 240 (26%) and that of Business/Commerce from 11 153 (16%) to 17 659 (19%).

Table 3: Distribution of university and technikon postgraduate headcount enrolments by field of study, 1995 and 2001

	Field of Study	1995		2001	
Universities	Science, Engineering & Technology	15 543	22%	23 216	25%
	Humanities & Social Sciences	27 432	39%	25 939	28%
	Education	16 394	23%	26 028	28%
	Business, Commerce & Management Sc.	11 002	16%	17 181	19%
	Subtotal	70 372	100%	92 363	100%
Technikons	Science, Engineering & Technology	363	61%	1 024	40%
	Humanities & Social Sciences	56	9%	466	18%
	Education	22	4%	604	23%
	Business, Commerce & Management Sc	151	25%	479	19%
	Subtotal	592	100%	2 573	100%

Source: DoE, HEMIS (2001) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Table 3 disaggregates the distribution of postgraduate enrolments by field of study among the universities and technikons in 1995 and 2001.

- Noteworthy is the rise in the number of SET enrolments in the universities from 15 543 (22% of the university postgraduate total) to 23 216 (25%), in BC from 11 002 (16%) to 17 181 (19%) and in Education from 16 394 (23%) to 26 028 (28%). There was a corresponding decline in HSS from 27 432 (39%) to 25 939 (significantly down in percentage terms to 28%).
- In absolute terms, technikon postgraduate enrolments in all fields remained very low relative to the universities despite increases from 1995 levels in HSS, BC and Education. In all fields, technikon postgraduate enrolments amounted to no more than 1% of the totals.
- The ratio of these enrolments changed significantly over the period from 61% to 40% in SET, from 13% in HSS/Education combined to 41% and from 25% in BC to and 19%. This means that the proportion of technikon enrolments in SET had dropped significantly to less than half of total postgraduate enrolments by 2001.

2.3 Public postgraduate enrolments by field of study and qualification level

Another key aspect of postgraduate enrolments to consider is their distribution by field of study *and* qualification level. Against the benchmark of the target ratios identified in the National Plan for Higher Education (see Table 2 in Section 2.2 on Page 5 above), examining changes between 1995 and 2001 in the range and level of postgraduate enrolments provides some insight into the extent to which the HE system is succeeding in producing the spectrum of postgraduates required to meet innovation and labour market needs.

Table 4: Distribution of university postgraduate headcount enrolments by field of study and qualification level, 1995 & 2001

Year	Qualification Level	SET		HSS		Education		BC		Total	
1995	PG Occasional	185	54%	90	26%	35	10%	32	9%	342	100%
	PG Diploma/Certificate	1 066	11%	1 441	14%	6 187	61%	1 434	14%	10 128	100%
	PG Bachelor	563	4%	6 910	47%	7 097	48%	196	1%	14 766	100%
	Honours	3 341	18%	9 179	50%	324	2%	5 425	30%	18 270	100%
	Masters	8 156	37%	7 709	35%	2 235	10%	3 781	17%	21 880	100%
	Doctorate	2 232	45%	2 102	42%	517	10%	135	3%	4 986	100%
Total		15 543	22%	27 432	39%	16 394	23%	11 002	16%	70 372	100%
2001	PG Diploma/Certificate	1 926	13%	2 979	21%	6 678	47%	2 767	19%	14 350	100%
	PG Bachelor	853	6%	2 465	18%	9 761	73%	277	2%	13 356	100%
	Honours	3 811	14%	7 964	30%	6 332	24%	8 387	32%	26 495	100%
	Masters	13 501	42%	10 299	32%	2 603	8%	5 521	17%	31 924	100%
	Doctorate	3 124	50%	2 232	36%	654	10%	228	4%	6 238	100%
Total		23 216	25%	25 939	28%	26 028	28%	17 181	19%	92 363	100%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).
Note: The low number of education honours enrolments in 1995 was due to the fact that the B Ed at the time, a postgraduate bachelors qualification, constituted an honours-level programme. This has been replaced by the B Ed (Hons). Currently, the B Ed is a 4-year undergraduate initial teacher training programme.

- Table 4 shows that the overall distribution of university postgraduate enrolments by field of study in 2001 (25% in SET, 28% in HSS; 28% in Education and 19% in BC) varies widely at the different qualification levels and showed some important changes since 1995.
- Over this period, the overall ratio of university doctoral enrolments shifted positively in relation to the NPHE targets. The proportion in SET increased encouragingly from 45% to 50%. In HSS, despite an increase in absolute numbers (from 2 102 to 2 232), their

proportion declined from 42% to 36% – in keeping with the NPHE target, and in Education, despite a small increase in absolute numbers, the proportion remain static. The very low proportion in BC reflects the fact that very few professionals in this field proceed beyond the MBA to the doctoral level.

- A similar pattern was evident among university masters students, with a sharp rise in SET from 8 156 to 13 501 (37% to 42%), an increase in HSS numbers (from 7 709 to 10 299) but a (healthy) decline in proportion (from 35% to 32%) and likewise in Education from 10% to 8%. Masters enrolments in BC increased from 3 781 to 5 521, with their proportion static at 17%.
- Against these trends, SET honours enrolments rose only minimally (from 3 341 to 3 811) while their proportion dropped from 18% to 14%. Those in HSS declined dramatically from 9 179 to 7 964 (50% to 30%).

Table 5: Distribution of technikon postgraduate headcount enrolments by field of study and qualification level, 1995 & 2001

Year	Qualification Level	SET		HSS		Education		BC		Total	
1995	Masters Diploma in Technology	268	57%	53	11%	18	4%	132	28%	471	100%
	M Tech	77	80%	1	1%	0	0%	18	19%	96	100%
	Laureatus in Technology	4	50%	0	0%	4	50%	0	0%	8	100%
	D Tech	14	82%	2	12%	0	0%	1	6%	17	100%
Total		363	61%	56	9%	22	4%	151	25%	592	100%
2001	Masters Diploma in Technology	16	62%	7	27%	0	0%	3	12%	26	100%
	M Tech	885	37%	437	19%	592	25%	448	19%	2 362	100%
	D Tech	123	66%	22	12%	12	6%	28	15%	185	100%
Total		1 024	40%	466	18%	604	23%	479	19%	2 573	100%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Besides noting the increases in absolute numbers in all fields between 1995 and 2001, the numbers in technikon postgraduate enrolments in 1995 preclude drawing any reliable trends.
- However, it is noteworthy that in 2001, the highest proportion of all qualification levels was in SET.

2.4 Public postgraduate enrolments by new institutional type

The current restructuring of the institutional landscape will have a profound effect on the overall shape of HE in South Africa, and in turn on the postgraduate subsector. Within the scope of this report, it has not been possible to create the required databases and to analyse all aspects of this. However, some indications of the distribution of postgraduate enrolments across the new institutional types created by the merger process can be provided.

Table 6: Distribution of public postgraduate enrolments by new institutional type, 2001

			Total PG Enrolments	Proportion of Total Institutional Enrolments	Proportion of Total HE PG Enrolments
Universities	Unmerged	UCT	5 553	30%	6%
		Univ. of the Free State/Vista (Bloem.)	6 949	39%	7%
		University of Pretoria/Vista (Mamelodi)	10 381	23%	11%
		Rhodes	1 056	21%	1%
		University of Stellenbosch	8 258	40%	9%
		UWC	2 473	24%	3%
		Wits	6 307	31%	7%
	Total		40 977	30%	43%
	Merged	Potch./Univ. of N. West/Vista (Sebokeng)	10 266	34%	11%
		UDW/University of Natal	10 379	30%	11%
		Fort Hare/Rhodes University (E. London)	652	9%	1%
		University of the North/Medunsa	1 997	20%	2%
	Total		23 294	29%	25%
Total			64 271	29%	68%
Technikons	Unmerged	Free State Tech/Vista (Welkom)	268	3%	0%
		Vaal Triangle Technikon	64	0%	0%
	Total		332	1%	0%
	Merged	Cape Tech/Peninsula Tech	228	1%	0%
		DIT/Mangosuthu Tech	395	2%	0%
		Pretoria Tech/Northern Gauteng/N. West	1 057	2%	1%
	Total		1 680	2%	2%
Total			2 012	2%	2%
Comprehensives	Unmerged	Venda	436	7%	0%
		Zululand	1 671	26%	2%
	Total		2 107	17%	2%
	Merged	RAU/Wits Tech/Vista (E. Rand & Soweto)	6 787	19%	7%
		UPE/PE Tech/Vista (Port Elizabeth)	3 843	11%	4%
		Unitra/Border Tech/E. Cape Tech	555	4%	1%
	Total		11 185	13%	12%
	Distance	Unisa/Tech SA/Vista (Distance Ed.)	15 181	7%	16%
Total			28 473	9%	30%
Grand Total			94 756	15%	100%

Source: HEMIS, 2001. Note There is a slight discrepancy between the figures presented in this table (total of 94 756) and those in previous tables (total of 94 936), due to the calculation of enrolments in the new institutional types.

- Two aspects of the distribution of postgraduate enrolments among the new institutional types are shown in Table 6.
- First, wide variation was evident in the ratio of postgraduate enrolments to total institutional enrolments. Among the unmerged universities the postgraduate component of enrolments ranged from 40% at Stellenbosch to 24% at UWC and (surprisingly perhaps) 23% at Pretoria (due to large numbers of distance education undergraduate enrolments in education and the incorporation of Vista Mamelodi) and 21% at Rhodes. It is interesting to note that the incorporation of Vista Bloemfontein into the University of the Free State had the effect of lowering its postgraduate/undergraduate ratio from 46%:54% (by far the highest in the system) to 39%:61%. UCT and Wits were around 30% each.

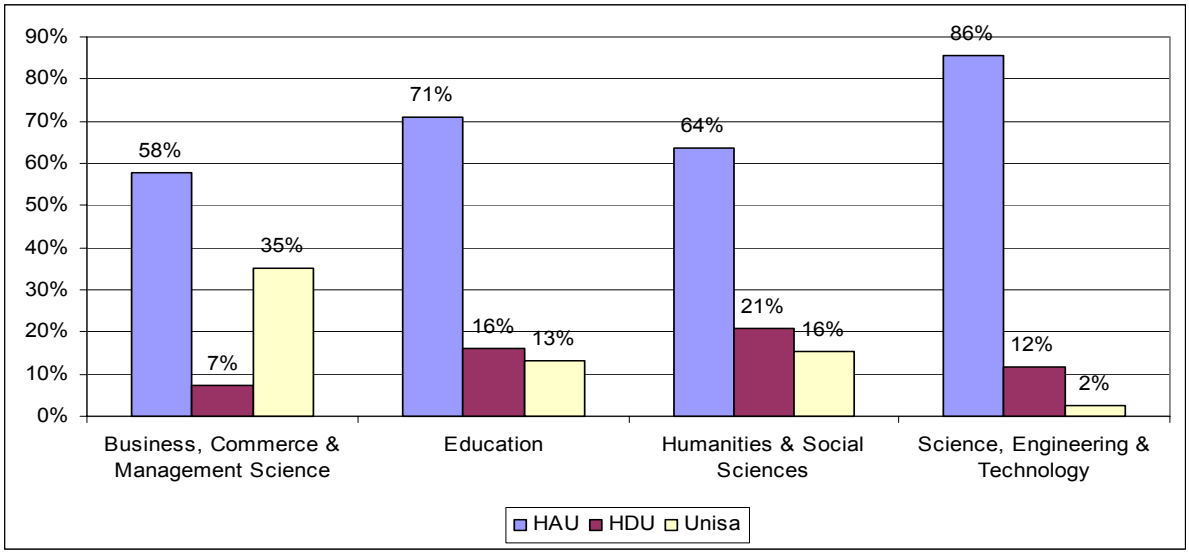
- Among the merged institutions, the postgraduate component of enrolments ranged from 34% at Potchefstroom/Northwest to 30% at UDW/Natal, to 20% at North/Medunsa and just 9% at Fort Hare/Rhodes E. London. As a result of the merger between Potchefstroom and the Northwest, the ratio of the former dropped from 39% to 34%, while that between UDW and Natal had minimal impact in this regard.
- Not unexpectedly, the proportion of postgraduate enrolments at the technikons remained very low, ranging from 1% to 3%.
- A similarly wide variation was evident among the new comprehensives, ranging from 26% at Zululand to 11% at UPE/PE Technikon, 7% at Venda and 4% at Unitra/E Cape and Border Technikons. The merger process lowered the ratio at RAU markedly from 31% to 19% in the merged institution, the newly named University of Johannesburg, and that of UPE from 15% to 11% in the new Port Elizabeth comprehensive.
- Secondly, Table 6 indicates the distribution of postgraduate enrolments among the new institutional types. The majority of postgraduate enrolments (68%) were found in the universities, while 30% were at the comprehensives and just 2% at technikons. Among the individual institutions, high proportion of total postgraduates were clustered at Pretoria, Potch./Northwest and UDW/Natal were (11% each) and at Stellenbosch (9%). Among the comprehensives, RAU/Wits Technikon had 7% and UPE/PE Tech 4%.

Part of the stated purpose of the merger process is to distribute resources, capacity and opportunities for postgraduate study and research more equitably between HAIs and HDIs. It remains to be seen whether actual outcomes will match the desired goals. This forms an important aspect of future monitoring and evaluation of policy implementation.

2.5 Public postgraduate enrolments by field of study and historical institutional type

As mentioned, within the timeframe of producing this report, it was not possible to analyse further aspects of postgraduate enrolment patterns in terms of the new institutional landscape. Accordingly, these aspects are now briefly addressed in terms of the historical institutional types a key and ongoing concern regarding equity. The overall distribution of postgraduate enrolments in this respect was highly uneven. Not surprisingly, the historically advantaged institutions dominated in all fields, with the majority of enrolments in these institutions (70% of all university postgraduates and 80% of technikon postgraduates).

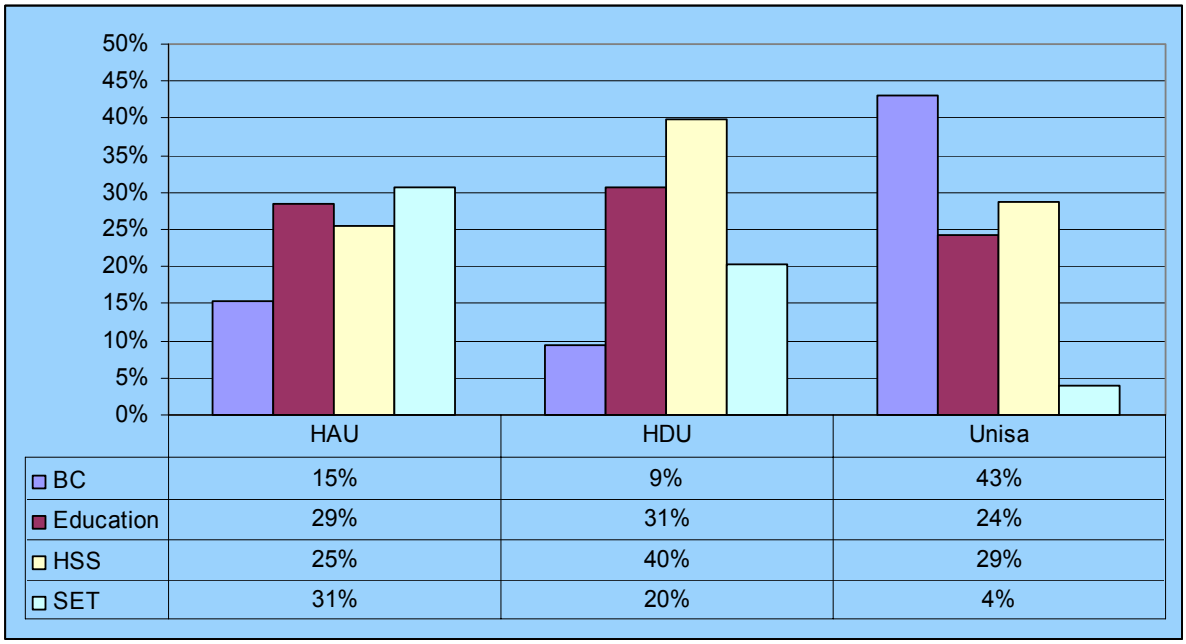
Figure 3: Distribution of university postgraduate headcount enrolments by field of study and historically institutional type, 2001



Source: DoE (2001a) HEMIS.

- Regarding enrolments by field of study across the historical advantaged and disadvantaged universities, the proportion of SET postgraduate enrolments in HAUs (86%) was especially high. Unisa had a relatively high proportion of Business/Commerce enrolments (35%) and very low SET enrolments (2%).
- Correspondingly, the proportion of postgraduate enrolments at HDUs was low (15% of total postgraduates). This was especially so in BC (7%), SET (12%) and even in the traditional fields associated with the original apartheid-linked function of the HDUs, namely Education (16%) and HSS (21%). These figures suggest that a large proportion of HDU undergraduates who pursue postgraduate study in these fields do so at HAUs.

Figure 4: Distribution of university postgraduate headcount enrolments by historically institutional type and field of study, 2001

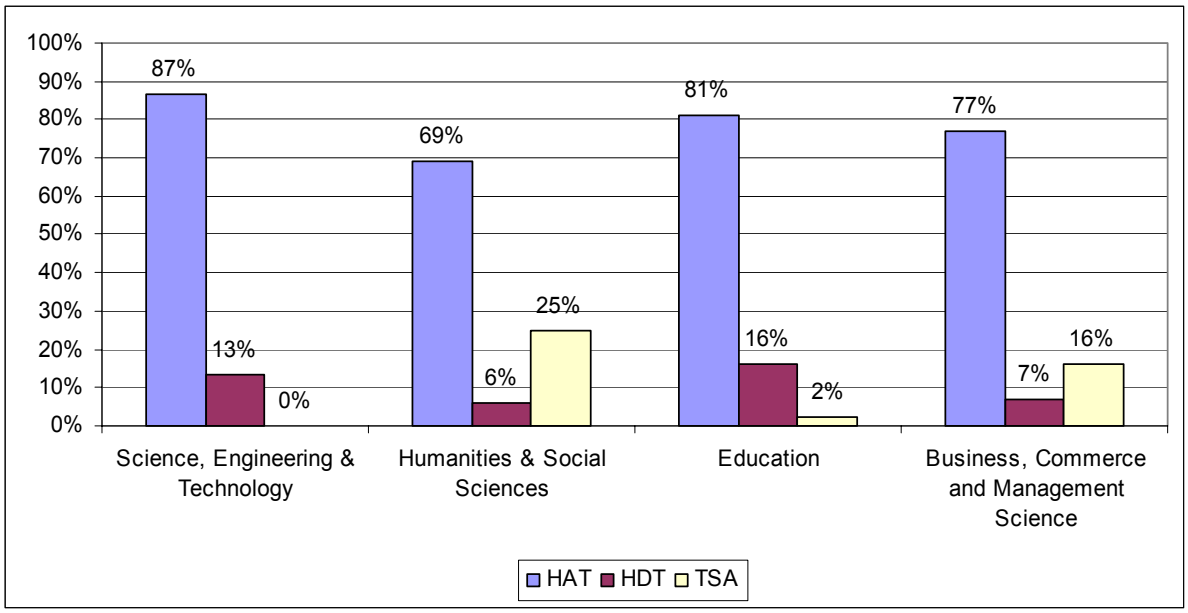


	HAU	HDU	Unisa
BC	15%	9%	43%
Education	29%	31%	24%
HSS	25%	40%	29%
SET	31%	20%	4%

Source: HEMIS, 2001

- From Figure 4 above indicates the unevenness of the distribution of postgraduate enrolments in the historical institutional types in 2001. These distributions should be read in relation to the NPHE target ratios of HSS/Education (40%), SET (30%) and Business/Commerce (30%) – see Table 2 in Section 2.2 on Page 5 above.
- In the HAUs, the majority of postgraduate enrolments were in the combined HSS/Education field (54%, made up of 25% in HSS and 29% in Education) with 15% in BC and a high 31% n SET.
- In the HDUs, the concentration of postgraduate enrolments in HSS/Education was even more pronounced (71%, made up of 31% in Education and a very high 40% in HSS), with only 9% in BC and 20% in SET.
- At Unisa, interestingly, while the majority of postgraduate enrolments were also in HSS/Education (53%, made up of 24% in Education), a considerable proportion (43%) were in Business/Commerce, and only 4% in SET.

Figure 5: Distribution of technikon postgraduate headcount enrolments by field of study and historically institutional type, 2001

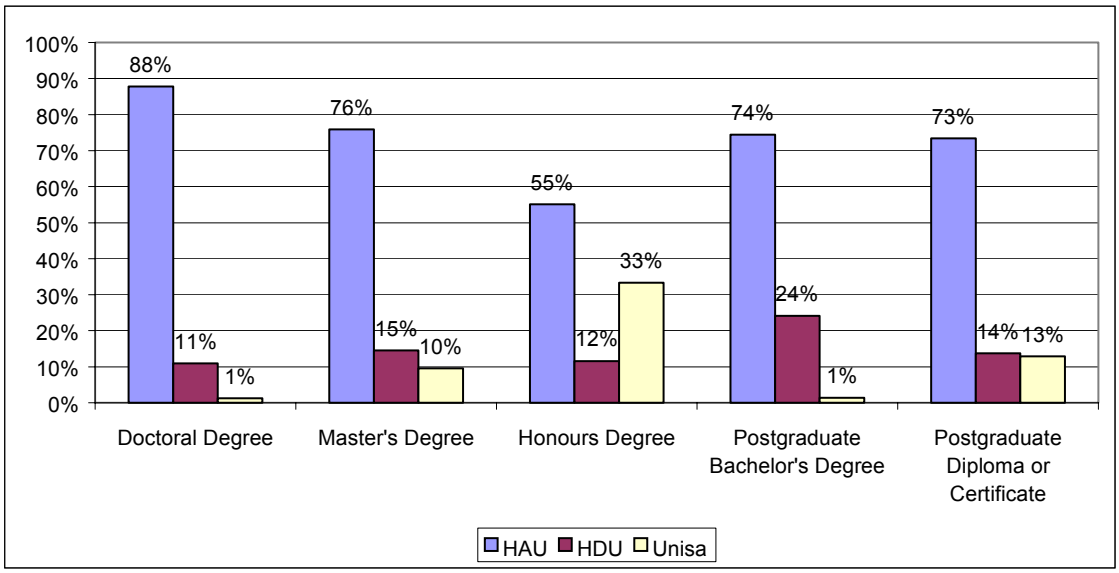


Source: DoE (2001a) HEMIS.

- A similar, and indeed even more extreme picture of domination of postgraduate enrolments by the historically disadvantaged institutions was evident in the technikons.
- The vast majority of postgraduate enrolments in all fields were concentrated in the HATs (80% of the technikon postgraduate total). This was especially so in SET (87%), Education (81%) and BC (77%).
- Correspondingly, HDTs accounted for a relatively low proportion of postgraduate enrolments: 11% overall, 16% of Education, 13% of SET, 7% of BC, and 6% of HSS.
- TSA had just 8% of the total and 25% of HSS and 16% of BC postgraduate enrolments.

2.6 Public postgraduate enrolments by qualification level & institutional type

Figure 6: Distribution of university postgraduate headcount enrolments by qualification level and institutional type, 2001



Source: DoE (2001a) HEMIS.

Table 7: Distribution of university postgraduate headcount enrolments by qualification level and institutional type, 1995 and 2001

	1995			2001		
	HAU	HDU	Unisa	HAU	HDU	Unisa
Doctoral Degree	84%	7%	10%	88%	11%	1%
Masters Degree	79%	10%	11%	76%	15%	10%
Honours Degree	43%	14%	43%	55%	12%	33%
Postgraduate Bachelor's Degree	39%	22%	39%	74%	24%	1%
Postgraduate Diploma/Certificate	37%	34%	29%	73%	14%	13%
Grand Total	56%	17%	28%	70%	15%	15%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Figure 6 illustrates the highly uneven distribution of postgraduate among the historical institutional types at all qualification levels in 2001. However, some significant changes from 1995 were evident, as is clear from Table 7 .
- At the doctoral level, 88% of enrolments in 2001 were at HAUs (up from 84% in 1995), with only 11% at HDUs (but up from 7% in 1995) and 1% at Unisa (markedly down from 10%).
- Likewise, in 2001 76% of masters, 55% of honours (up from 43% in 1995), 74% of postgraduate bachelors were concentrated at HAUs, with correspondingly low enrolments at HDUs and Unisa. However, between 1995 and 2001 the proportion of masters enrolments at HDUs increased from 10% to 15%.
- Noteworthy was the decline at Unisa in the proportion of postgraduate bachelors (from 39% to 1%) and postgraduate diplomas/certificates (from 29% to 13%) over the period.

- As a result of these patterns and the substantial increases in the proportions of postgraduate bachelors and diplomas/certificates at the HAUs over the period, 70% of the total postgraduate university enrolments in 2001 (64 785 out of 70 372) were clustered in the HAUs, up from 56% in 1995.

Table 8: Distribution of technikon postgraduate headcount enrolments by qualification level and institutional type, 1995 and 2001

	1995			2001		
Qualification Level	HAT	HDT	TSA	HAT	HDT	TSA
D Tech Degree	94%	0%	6%	90%	8%	2%
Laureatus in Technology	100%	0%	0%	0%	0%	0%
M Tech Degree	92%	1%	7%	79%	12%	9%
Masters Diploma in Technology	92%	3%	5%	100%	0%	0%
Grand Total	92%	2%	6%	80%	11%	8%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- The distribution of technikon postgraduate enrolments was similarly skewed towards HATs, with 92% (546 out of a total of 596) in 1995 in these institutions, and 80% (2 069 out of a total of 2 573) in 2001. Correspondingly, only 2% were enrolled in HDTs in 1995, which rose sharply to 11% (294) in 2001.
-
- Figure 6 illustrates the highly uneven distribution of postgraduate among the historical institutional types at all qualification levels in 2001. However, some significant changes from 1995 were evident, as is clear from Table 7 .
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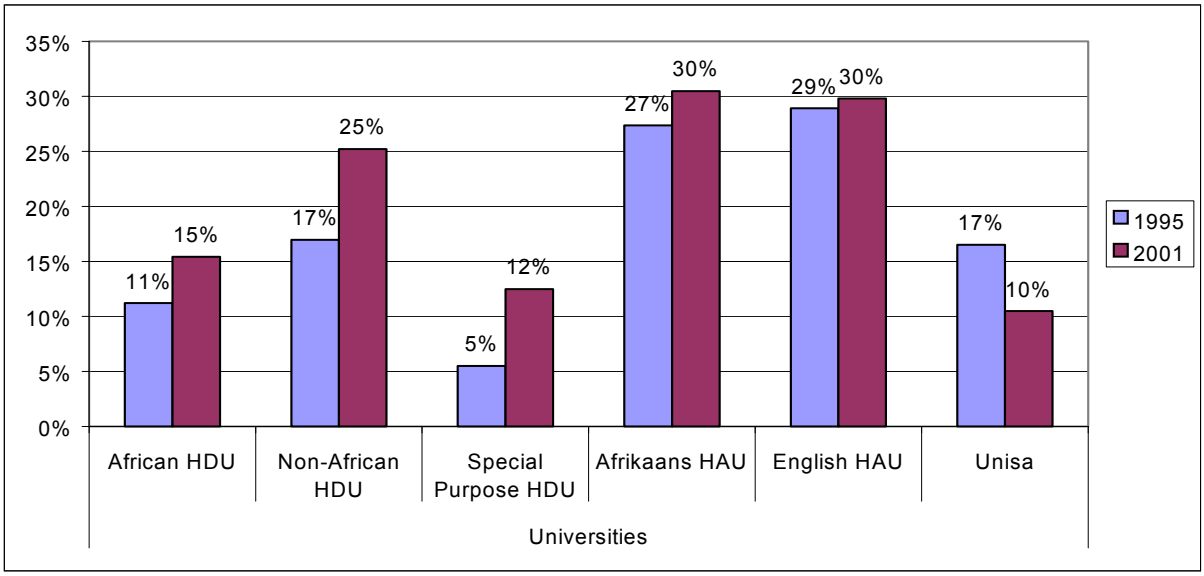
- Table 8 shows that 90% of D Tech enrolments were at HATs (though this was down from an overwhelming 94% in 1995). The entire 1995 enrolment at the Laureatus level (now superseded by the D Tech) were at HATs. Correspondingly, the proportion of D Tech enrolments at HDTs rose from 0% to 8% (though the absolute numbers here were very low – from none to just 15).
- M Tech enrolments were heavily clustered at the HATs in 1995 (92%) with a minute proportion at the HDTs (1%). By 2001, this had shifted to a still considerable majority (79%) concentrated in HATs, but with the HDT proportion rising to 12% and TSA marginally from 7% to 9%.

Figure 7: Proportion of postgraduates of total headcount enrolments in universities, 1995 & 2001



Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Another indicator of the skewed institutional distribution of postgraduate enrolments is the wide variation in the ratio of undergraduate/postgraduate enrolments among the historical institutional types.
- Figure 7 indicates that much lower proportions of postgraduate enrolments were evident in the historically disadvantaged universities. However, between 1995 and 2001 these had all increased, especially at the non-African HDUs (UWC and UDW), from 17% to 25% of total enrolments and the special purpose HDUs (Medunsa and Vista), from 5% to 12%.
- At the English and Afrikaans HAUs, the proportion of postgraduate enrolments reached 30% in 2001. However, at Unisa this declined from 17% to 10% over this period.

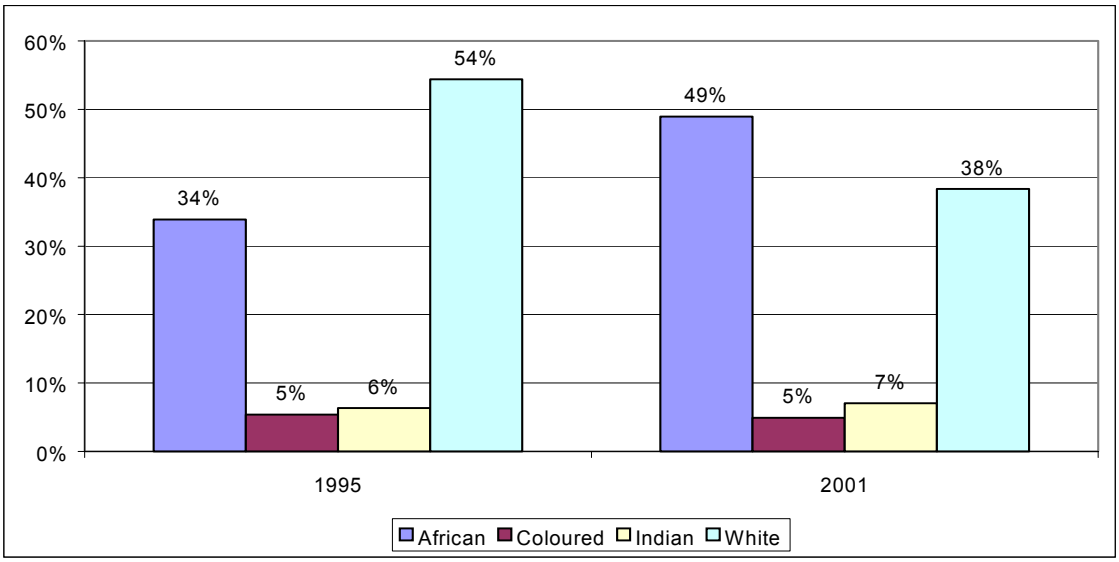
2.7 Public postgraduate headcount enrolments by race

In the South African context, postgraduate education and training cannot be separated from equity considerations. This is so for both political and practical reasons. Pursuing equity is not only intrinsically right, but also constitutes a practical imperative because conditions of inequality and social exclusion also significantly shape the skills formation and economic growth trajectories of nations. Simply put, without broadening access, the nation's human resources development and scarce skills requirements cannot be met. However, development priorities cannot be achieved simply by increasing equity of access. Equity of success, in terms of throughput and graduate output is vital to avoid the revolving door syndrome and to improve the internal efficiency of the HE system. As a result of prevailing patterns of socialisation, apartheid-generated social and educational discrimination and the ensuing racial division of labour, the pool of potential black and women postgraduates remains limited.

The strategic answer is, of course, to build developmental capacity through affirmative action initiatives while pursuing development outcomes. This hugely challenging process is analogous to constructing a car while hurtling towards a destination. Finding the appropriate mediating practices here underlies the 'equity-development' tension, an ongoing issue in policy debates. It requires greater understanding of the inter-relatedness of race, gender, class and other socio-economic factors and institutional dynamics which shape access to, and success in postgraduate studies. Informed by this, a range of supportive mechanisms is

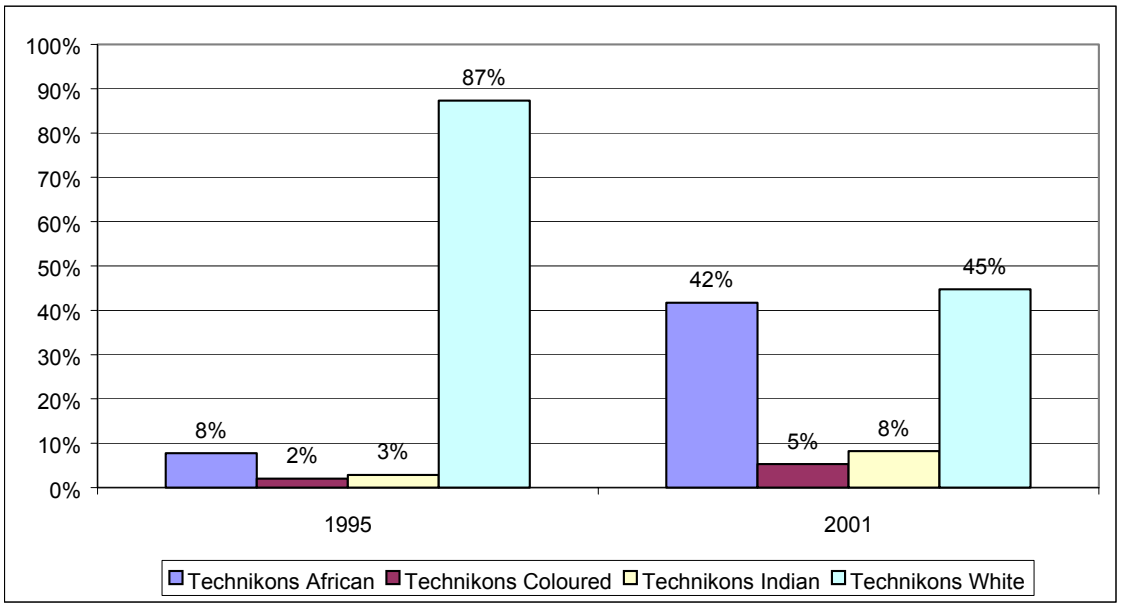
required to link equity of access to equity of success. Regarding greater access and success in postgraduate education, a much richer theoretical and empirical research approach is required – one that draws together appropriate quantitative and qualitative research to provide more primary data, the pooling of data and longitudinal studies (Koen 2003). This forms a key element of future research in this area. With these considerations in mind, the race/gender profile of postgraduate enrolments is briefly examined.

Figure 8: University postgraduate headcount enrolments by race, 1995 and 2001



Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

Figure 9: Technikon postgraduate headcount enrolments by race, 1995 and 2001



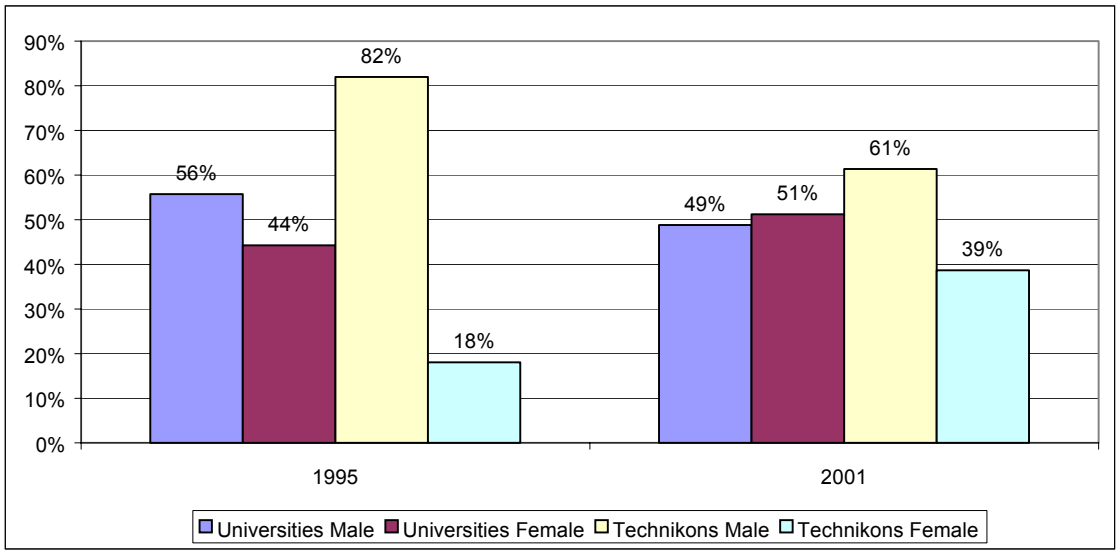
Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- The distribution of postgraduate enrolments by race shifted noticeably between 1995 and 2001, more dramatically at technikons, as **Error! Reference source not found.** and Figure 9 graphically illustrate.
- In 1995, Africans constituted 34% of the university total. By 2001, this increased to almost half (49%), while the proportion of whites declined from 54% to 38% over the period. The proportions of Coloured and Indian university students remained almost unchanged.
- In 1995, 87% of all technikon postgraduates were white and only 8% African. By 2001, this had changed markedly with Africans comprising 42% and whites only 45%. The

proportion of Coloured and Indian students also increased from 2% and 3% in 1995 to 5% and 8% in 2001 respectively.

2.8 Public postgraduate enrolments by gender

Figure 10: University and technikon headcount enrolments by gender, 1995 and 2001



Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- The distribution of postgraduate enrolments by gender also showed distinctive change between 1995 and 2001, as Figure 10 shows.
- In 1995, women university students made up 44% of the total. By 2001, they constituted the majority (51%).
- In the technikons, men students comprised an overwhelming 82% in 1995. By 2001, this had declined to 61%, with the proportion of women rising from 18% to 39% over this period.

2.9 Public postgraduate enrolments by race and qualification level

A key indicator of equity in the postgraduate subsector is the distribution of the four race groups across the various qualification levels. This highlights the importance of disaggregating data. Greater race and gender equity has been achieved in relation to overall enrolments. However, black students and women are still under-represented in key fields and at the higher qualification levels. Achieving greater equity at these levels of disaggregation remains a central challenge of HE transformation.

Table 9: Distribution of university postgraduate headcount enrolments by race and qualification level, 1995 & 2001

Year	Qualification level	African	Coloured	Indian	White	Total
1995	Postgraduate Diploma/Certificate	53%	7%	8%	33%	100%
	Postgraduate Bachelors	54%	7%	7%	33%	100%
	Honours	31%	5%	6%	58%	100%
	Masters	20%	5%	6%	69%	100%
	Doctoral	11%	3%	5%	81%	100%
Total		34%	5%	6%	54%	100%
2001	Postgraduate Diploma/Certificate	56%	4%	6%	34%	100%
	Postgraduate Bachelor	82%	3%	1%	14%	100%
	Honours	50%	5%	8%	37%	100%
	Masters	38%	6%	9%	47%	100%
	Doctoral	28%	5%	7%	60%	100%
Total		50%	5%	7%	38%	100%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- As is evident from Table 9, the distribution of postgraduate enrolments by race across the various qualifications levels is highly uneven. However, positive changes are apparent in this regard between 1995 and 2001, with the proportion of white students declining and that of Africans increasing significantly at all the higher levels.
- In 1995, white students formed the vast majority at the key doctoral and masters levels: 81% and 69% respectively. By 2001, the white proportion had dropped to 60% and 47% respectively. Conversely, the African proportion increased from 11% to 28% at the doctoral level and from 20% to 38% at the masters level over this period. The proportion of Coloured and Indian students at these levels also saw moderate increases.
- A similar pattern was evident at the honours and postgraduate bachelors levels. By 2001, Africans formed 50% of honours enrolments (up from 31% in 1995), while whites comprised only 37% (down from 58%). By 2001, Africans dominated the postgraduate bachelors enrolments (82%, up from 54% in 1995) and to a lesser extent postgraduate diploma/certificate enrolments, with white students forming only 14% and 34% at these levels respectively in 2001.

Table 10: Distribution of technikon postgraduate headcount enrolments by race and qualification level, 1995 & 2001

Year	Qualification level	African	Coloured	Indian	White	Total
1995	Masters Diploma in Technology	9%	2%	3%	86%	100%
	M Tech	5%	2%	2%	91%	100%
	Laureatus in Technology	0%	13%	0%	88%	100%
	D Tech	0%	0%	0%	100%	100%
Total		8%	2%	3%	87%	100%
2001	Masters Diploma in Technology	23%	12%	4%	62%	100%
	M Tech	44%	5%	8%	42%	100%
	D Tech	12%	6%	8%	74%	100%
Total		42%	5%	8%	45%	100%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Changes at the technikons were even more dramatic in the period under review, with huge increases in the proportion of Africans and sharp declines in that of whites. The

low absolute numbers in 1995 should be borne in mind when considering the 1995 percentages.

- In 1995, all 17 enrolments at the D Tech level were white. Of the 185 D Tech enrolments in 2001, 12% were African, 6% were Coloured, 8% were Indian, with whites still dominating at 74%.
- African enrolments at the M Tech level increased astronomically from 5 (5%) in 1995 to 1 044 (44%) in 2001, with moderate increases in the proportion of Coloured and Indian students as well. Conversely, the proportion of white students at the M Tech level dropped dramatically from 91% to 42%, less than that of Africans.
- A similar trend was apparent at the Masters diploma level, where the proportion of white students declined from 86% to 62% over the period, and that of Africans increased from 9% to 23%.

2.10 Public postgraduate enrolments by gender and qualification level

The other key indicator of equity in the postgraduate subsector is the distribution of women across the various qualification levels.

Table 11: Proportion of women postgraduate headcount enrolments by qualification level, 1995 & 2001

	Qualification level	1995	2001
Universities	Postgraduate Diploma/Certificate	56%	55%
	Postgraduate Bachelor's	48%	63%
	Honours	46%	56%
	Masters	37%	43%
	Doctoral	32%	39%
	Grand Total	44%	51%
Technikons	Masters Diploma in Technology	19%	19%
	M Tech	18%	39%
	Laureatus in Technology	25%	0%
	D Tech	0%	34%
	Grand Total	18%	39%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Typical of the overall pattern of gender inequities in HE, women constituted greater proportions of enrolments at the lower qualification levels and smaller proportions of those at the higher levels. However, a positive shift towards gender balance was evident between 1995 and 2001.
- Table 11 shows that women comprised the majority (56%) of university postgraduate certificate and diploma enrolments in 1995, and almost half of postgraduate bachelors (48%) and honours (46%). However, they formed only 37% and 32% of masters and doctoral enrolments respectively.
- By 2001, however, they formed the majority in the lower three levels in universities, and 43% of masters (though this was up from 37% in 1995), but only 39% of doctoral enrolments (up from 32% in 1995).
- In the technikons, women were more highly underrepresented, forming below a quarter at all levels in 1995. However, by 2001 they formed 39% of M Tech enrolments (substantially up from 18%) and 34% of D Techs (up from 25% of the Laureatus in 1995).

A final consideration regarding equity is the distribution of postgraduate enrolments by race *and* gender.

Table 12: Distribution of postgraduate headcount enrolments by race and gender, 1995 & 2001

	1995		2001	
	Male	Female	Male	Female
African	53%	47%	46%	54%
Coloured	57%	43%	51%	49%
Indian	50%	50%	51%	49%
White	58%	42%	52%	48%

Source: DoE, HEMIS (2001a) and SAPSE (1995). Note: No 1995 data available for the University of the Northwest, Natal Technikon, Peninsula Technikon, Border Technikon and Eastern Cape Technikon. (See note to Figure 1).

- Table 12 shows that already by 1995, overall postgraduate enrolments of African and Indian women had reached greater levels of equity, forming 47% and 50% of African and Indian postgraduate enrolments respectively. Coloured and white women were at that stage more under-represented, forming only 43% and 42% of their groups respectively.
- By 2001, African postgraduate women students were in the majority (54%) while the other groups had all almost reached parity.

2.11 Public postgraduate enrolments by nationality

Another important aspect of the postgraduate system is the extent to which non-South African students are enrolling at South African universities and, as a consequence, the extent to which the South African postgraduate system is contributing towards regional development and capacity-building. This is of special significance in relation to the Southern African Development Community (SADC) protocol on HE which call for certain measures towards the alignment and integration of key elements of HE systems within member states. However, without the availability of data regarding the employment patterns of graduates, it is not possible to determine the extent to which graduates are returning to their home countries or are finding greater opportunities for employment and/or ones that more attractive and lucrative in South Africa. It would also be important to know how these students are being financed: whether they are being supported by their own governments (as is the case with Botswana), whether they are receiving institutional scholarships or are self-financing.

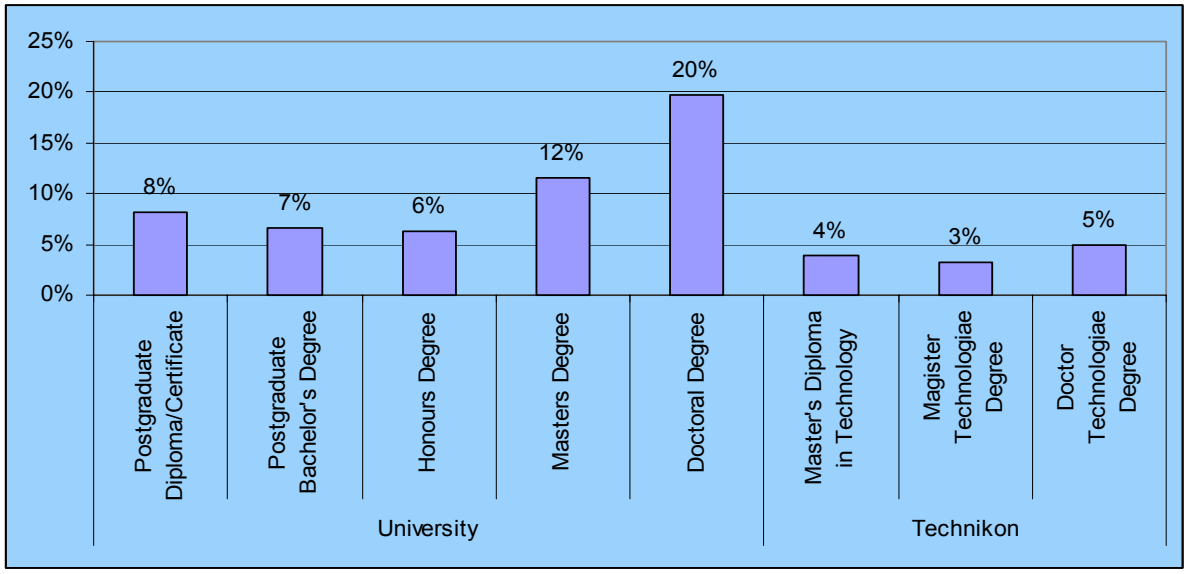
Table 13: Postgraduate university and technikon headcount enrolments by nationality (country of permanent residence), 2001

Country of permanent residence		University		Technikon		Total	
		No	%	No	%	No	%
South African		83 701	91%	2 487	97%	86 188	91%
Non-South African	SADC	4 056	4%	34	1%	4 090	4%
	Other Africa	1 468	2%	19	1%	1 487	2%
	Asia	455	0%	6	0%	461	0%
	Europe	958	1%	14	1%	972	1%
	North America	202	0%			202	0%
	South America	33	0%			33	0%
	Australia and Oceania	27	0%	1	0%	28	0%
	Unknown	1 463	2%	12	0%	1 475	2%
Non-South African Total		8 662	9%	86	3%	8 748	9%
Grand Total		92 363	100%	2 573	100%	94 936	100%

Source: DoE (2001a) HEMIS. Note: Nationality is defined here in terms of country of permanent residence.

- From Table 13, it is evident that non-South African students comprised 9% or 8 748 out of the total of 94 936 postgraduate enrolments in 2001. The vast majority of these were concentrated in the universities (8 662 or 99% of non-South African enrolments – see Table 14 below).
- Most of the non-South African postgraduate students were from the SADC region (4 090 or 47% of non-South African enrolments, comprising 4% of total postgraduate enrolments). This has implications for funding. In terms of the SADC protocol, SADC students pay the same fees as South African students.

Figure 11: Proportion of non-South African postgraduate enrolments of total enrolments by qualification level, 2001



Source: DoE (2001a) HEMIS.

- Figure 11 shows that non-South African postgraduate students formed relatively high proportions total postgraduate enrolments at the key doctoral (20%) and masters (12%) levels in the universities. This was much less so in the technikons (5% and 3% respectively). The fact that one in five university doctoral students in South African HE institutions is not a South African has significant implications for policy and planning in

HE and HRD. A key consideration is whether such students return to the country of their nationality, stay in South Africa or emigrate to another country to better their work prospects.

Table 14: Distribution of non-South African university and technikon postgraduate headcount enrolments by qualification level, 2001

University/Technikon	Qualification Level	No	%
University	Postgraduate Diploma/Certificate	1 182	14%
	Postgraduate Bachelor's	890	10%
	Honours	1 679	19%
	Masters	3 676	42%
	Doctoral	1 235	14%
University Total		8 662	99%
Technikon	Masters Diploma in Technology	1	0%
	M Tech	76	1%
	D Tech	9	0%
Technikon Total		86	1%
Grand Total		8 748	100%

Source: DoE (2001a) HEMIS.

- Table 14 shows that over half (56%) of non-South African postgraduate enrolments were at the masters (42%) and doctoral levels (14%), and that most of the technikon enrolments were at the M Tech level. A further 19% were enrolled at honours level, 10% in postgraduate bachelors programmes and 14% in postgraduate diplomas and certificates.
- The underlying data (not shown here) indicates that 59% (5 163) on non-South African postgraduate enrolments were African. The majority of these (2 916 or 56%) were from SADC countries and a further 1 367 (26%) were from other African countries. About half (49%) of Indian enrolments were from Asian countries and 43% of white students were from European countries.
- The 1995 figures (not shown here), though incomplete, indicate approximately 3 500 non-South African postgraduate in that year. This suggests a significant increase over this period, with non-South African postgraduate enrolments doubling since then.

2.12 Private postgraduate enrolments

Given the various acknowledged shortcomings of the public HE sector, it is widely accepted that it alone cannot address the current skills shortage and the range of labour market and human resource development needs of the nation to drive national development and innovation in an increasingly knowledge-driven society. The expansion of private HE is a global phenomenon, generated on the one hand by the social demand for better, different and more HE and on the other by the increasing penetration of the market into HE provision. South Africa is no exception. For these reasons, the 1997 Education White Paper 3 on Higher Education Transformation recognised the complementary role of the private HE sector in contributing to national development by 'expanding access to higher education, in particular, in niche areas, through responding to labour market opportunities and student demand' (DoE 1997: section 2.55).

The available data[1] indicate just over 30 000 undergraduate and postgraduate headcount enrolments in 2001 in programmes certificated by the registered institution (classified as 'own certification' in the analysis below) and a further 55 428 undergraduate and postgraduate headcount enrolments were reported in programmes certificated by other, mostly South African public institutions (classified as 'other certification' below). However, the reported total of approximately 85 000 enrolments in the 86 reporting institutions certainly represents an overcount of the sector, due to dual registration of private and public enrolments, the blurring of further and higher education in private institutions, inaccurate reporting of headcount and full-time equivalent (FTE) enrolments and most importantly, the fact that many of these headcounts are enrolments in short-cycle courses. As a result, FTEs in privately provided programmes are likely to be significantly lower. However, reliable sector-wide FTE enrolment figures are not available. When they are, they will provide a much more reliable estimate of the size and shape of the private sector. In addition, some enrolled students are inactive and therefore should be technically classified as 'dropouts', further reducing the reported enrolments. An estimate of the core of the private HE sector proper is approximately 15 000 to 18 000 total headcount enrolments (Subotzky, 2003b).

The vast majority of the approximately 85 000 reported enrolments were at NQF Level 6 and below (undergraduate HE degrees, diplomas and certificates as well as further education programmes), with approximately 2 500 masters and just 32 doctoral enrolments. Consequently, the main contribution of private HE to human resources development is at the lower HE and training qualification levels and especially so at the intermediate further education and training skills levels. However, while postgraduate enrolments are low in comparison to public universities, the significance of the private postgraduate sector lies in the fact that masters enrolments in private institutions exceed those in public technikons.

[1] No comprehensive data on the private sector as a whole are available. The only current sources are the data submitted to the DoE as part of their registration (see Subotzky, 2002 for details) and the recently released report on private provision by the Higher Education Quality Committee of the CHE (CHE, 2003a). The outline presented here is drawn from Subotzky (forthcoming) which is based on data submitted by 86 private institutions which were registered on 15 December 2001. It should be carefully noted that these data do not represent the sector as a whole, but only a snapshot of the subset of institutions reporting at that time.

Table 15: Estimated postgraduate headcount enrolments in private higher education institutions by NQF level and field, 2001

NQF level	NQF field	Own Certification		Other Certification		Total	
		No	%	No	%	No	%
Level 6: (PG Bachelors)	03: Business, Commerce	180	6%		0%	180	5%
Level 7: (Masters, Honours & PG diplomas/ certificates)	02: Culture & Arts	39	1%		0%	39	1%
	03: Business, Commerce	2 162	77%	454	7%	2 616	73%
	05: Education, Training & Dev.	14	0%		0%	14	0%
	06: Manufact., Engin.& Techn.	17	1%		0%	17	0%
	07: Human & Social Studies	348	12%	81	1%	429	12%
	09: Health Sc. & Social Services	6	0%	238	4%	244	7%
	11: Services	22	1%		0%	22	1%
Level 7 Total		2 608	93%	773	12%	3 381	94%
Level 8: (Doctoral)	07: Human & Social Studies	19	1%	13	0%	32	1%
Grand Total		2 807	100%	786	100%	3 593	100%
Total enrolments		30 229		55 428		85 657	
% Postgraduate		9%		1%		4%	

Source: Subotzky (forthcoming).

- Table 15 shows an estimated total of 3 593 postgraduate enrolments in the 86 reporting private institutions. However, there may be an element of overcount due to duplicate registrations in private and public institutions and inaccurate counts.
- As is apparent, total reported postgraduate enrolments (3 593) represent approximately 4% of total reported enrolments in private institutions (85 657). However, the reported postgraduate enrolments in 'own' certificated programmes (2 807 formed 9% of the total of 30 229 and those in 'other' certificated programmes (786) only 1% of the total of 55 428. This indicates partnerships among private institutions and between private and public ones are overwhelmingly at the undergraduate level and that very little collaboration is occurring at this stage at the postgraduate level.
- It may therefore be estimated that of the private HE proper enrolments of about 15 000 to 18 000 headcounts, between 4% - 9% (at most about 1 700) are at the postgraduate level.
- The underlying data (not shown here) indicate that all Level 8 (doctoral) enrolments were in the subfield of theology.
- At Level 7 (postgraduate diplomas, honours and masters degrees), the overwhelming majority (77% of enrolments at this level) were, unsurprisingly, in business, mainly in MBAs. The only other substantial enrolments were in health (7% in a postgraduate diploma in family medicine) and human and social studies (5% in masters and honours programmes).
- At Level 6, there were 180 enrolments in what were described as postgraduate diplomas. In addition, there were 5 910 B Ed enrolments, all certificated at two public Afrikaans-medium institutions. However, these have not been included here as they are deemed to be part of the new 4-year undergraduate initial teacher training programme.
- The underlying data (not shown here) reveal that, of the 2 807 'own' enrolments (that is, in programmes certificated by the registered institution), 786 (8% of total postgraduates) were enrolled in the three transnational institutions who reported in 2001, all of which were in MBA programmes.

Regarding race, no separate data were available for postgraduate enrolments. Of the total of private undergraduate and postgraduate enrolments, Africans comprised 44% of total enrolments in 'own' programmes (i.e. those certificated by the registering institution),

whites 33%, Coloureds 8% and Indians 10%. Non-South Africans, whose race was unknown, comprised 4% of this total. Africans formed 47% of South African nationals, Coloureds 9%, Indians 10% and whites 34%. Black students (66% when non-South Africans are excluded), and Africans in particular, thus formed a greater proportion of enrolments than whites, indicating a fairly deracialised private sector and countering assumptions that the private sector is elitist in a racial sense. However, we do not know the class structure of private enrolments or the extent to which scholarships and bursaries are being provided to widen both undergraduate and postgraduate access, not only racially, but also in relation to economically disadvantaged students.

However, as in the public sector, the distribution of enrolments by race across the NQF fields and qualification levels was uneven. In local institutions, white students dominated in health (84%) and in culture and arts (73%). African students, by contrast, comprised 97% of enrolments in the security field, 63% in science and 52% in education. African and coloured students were highly under-represented in the transnational institutions, making up only 24% and 4% of the total respectively.

3. Public postgraduate graduations

As mentioned in the previous section, meeting the innovation needs of the science system and providing adequately for the rapidly changing labour market entails not only the attraction of sufficient numbers of enrolments in the required fields and qualification levels, but retaining students to reduce dropouts, and satisfactory success and graduate rates to ensure as economical and efficient time-to-degree as possible.

This section of the report examines prevailing patterns of public postgraduate graduations[2]. This is done in terms of the overall number of graduations, and their distribution according to historical institutional type[3], race and gender, field of study and qualification levels. Thereafter, graduation rates are briefly discussed, again by disaggregating in terms of the above variables. The section ends by drawing from recent research and policy analysis to reflect on key aspects of the postgraduate sector: participation and throughput rates, coursework versus dissertation programmes, and disciplinarity and inter-disciplinarity.

3.1 Postgraduate graduations by qualification level

Table 16: Postgraduate enrolments and graduates by qualification level, 1995 & 2001

		1995				2001			
	Qualification Level	Enrolments		Graduates		Enrolments		Graduates	
Universities	PG Occasional	342	0%						
	PG Diploma or Cert.	10 128	14%	4 736	22%	14 350	16%	4 862	20%
	PG Bachelor's Degree	14 766	21%	4 455	21%	13 356	14%	3 137	13%
	Honours Degree	18 270	26%	7 747	36%	26 495	29%	9 984	40%
	Subtotal – Hon & below	43 506	61%	16 938	79%	54 201	59%	17 983	73%
	Master's Degree	21 880	31%	3 848	18%	31 924	35%	6 055	24%
	Doctoral Degree	4 986	7%	679	3%	6 238	7%	784	3%
	Subtotal – M & D	26 866	38%	4 527	21%	38 162	42%	6 839	27%
	Universities Sub-total	70 372	100%	21 466	100%	92 363	100%	24 822	100%
Technikons	Master's Dipl. in Techn.	471	80%	52	49%	26	1%	6	2%
	M Tech Degree	96	16%	53	50%	2 362	92%	223	91%
	Laureatus in Techn.	8	1%	2	2%				
	D Tech Degree	17	3%			185	7%	17	7%
	Technikons Sub-total	592	100%	107	100%	2 573	100%	246	100%
Total		70 964		21 573		94 936		25 068	

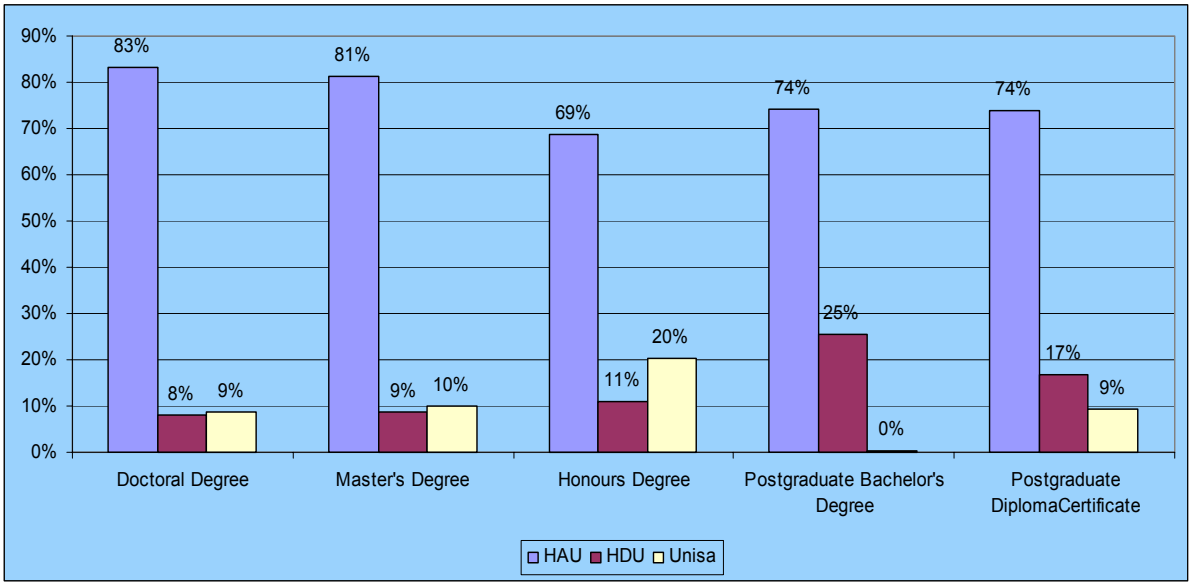
Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- Table 16 compares postgraduate enrolments and graduates in 1995 and 2001 by qualification level. In 1995, just under 71 000 postgraduate students were enrolled and 22 000 graduated, and in 2001 this had risen to approximately 95 000 enrolments and 25 000 graduates. The vast majority of both enrolments and graduates were at the universities.

[2] No reliable and complete data on private graduations and graduation rates were available.
[3] It was not possible within the scope of this report to obtain complete graduation data relating to the restructured institutional landscape.

- University postgraduate enrolments were clustered at the level of honours and below (61% in 1995 and 59% in 2001). Graduations were even more concentrated at these levels (79% in 1995, but dropping to 73% in 2001).
- While the number of university doctoral enrolments rose from 4 986 to 6 238 between 1995 and 2001, they constituted 7% of postgraduate university enrolments, and doctoral graduates 3% of graduations in both years under review. This indicates that although there were more doctoral students in the system, the throughput rate over this period was static. In total, the HE system produced only 801 doctorates in 2001: 784 doctorate from universities and 17 from technikons in 2001.
- The number of proportion of masters and honours postgraduate graduates rose between 1995 and 2001, from 3 848 (18%) to 6 055 (24%) and from 7 747 (36%) to 9 984 (40%) respectively. The number and proportion of postgraduate bachelor's degrees dropped – possibly the result of reduced enrolments in Education.
- Technikon graduates were overwhelmingly concentrated at the masters level.

Figure 12: Distribution of university postgraduate graduations by qualification level and historical institutional type, 2001



Source: HEMIS, 2001.

- Regarding the distribution of postgraduate graduations by historical institutional type, Figure 12 graphically depicts the overwhelming concentration at all levels in the HAUs in 2001. At the key doctoral and masters levels, 83% and 81% of graduates were from HAUs, with only 8% and 9% at HDUs respectively. At the honours levels, though still dominant, the HAUs had a lower proportion of graduates (69%) and the HDUs and Unisa higher (11% and 20% respectively).

Table 17: Distribution of technikon postgraduate graduations by qualification level and historical institutional type, 1995 & 2001

	1995				2001			
	HDT		HAT		HDT		HAT	
D Tech Degree					2	12%	15	88%
Laureatus in Technology			2	100%				
M Tech Degree	40	75%	13	25%	17	8%	206	92%
Master's Diploma in Technology	4	8%	48	92%			6	100%
Grand Total	44	41%	63	59%	19	8%	227	92%

Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- While the low absolute numbers of postgraduate graduates prevent drawing inferences, it is clear that by 2001, the vast majority of postgraduate graduations were at the HATs, In 1995 a sizeable 44 graduates emerged from HATs, but only 19 in 2001. It is not clear why this reduction occurred.

3.2 Postgraduate graduations by field of study

As mentioned, the distribution of the graduate output of the HE system with regard to field of study is crucial to its contribution to societal needs. This section of the report examines the number and proportion of graduates in the various fields, comparing this with the distribution of enrolments where appropriate.

Table 18: Distribution of university and technikon postgraduate graduations by field of study, 1995 & 2001

	CESM Group	1995		2001	
Universities	Science, Engineering & Technology	3 806	18%	5 700	23%
	Humanities & Social Sciences	7 642	36%	7 455	30%
	Education	6 353	30%	5 920	24%
	Business, Commerce & Management Sc.	3 665	17%	5 748	23%
	Subtotal	21 466	100%	24 822	100%
Technikons	Science, Engineering & Technology	62	58%	175	71%
	Humanities & Social Sciences	19	18%	12	5%
	Education	0	0%	13	5%
	Business, Commerce & Management Sc.	25	24%	47	19%
	Subtotal	107	100%	246	100%
Total	Science, Engineering & Technology	3 868	18%	5 874	23%
	Humanities & Social Sciences	7 661	36%	7 466	30%
	Education	6 353	29%	5 933	24%
	Business, Commerce & Management Sc.	3 691	17%	5 795	23%
	Subtotal	21 573	100%	25 068	100%

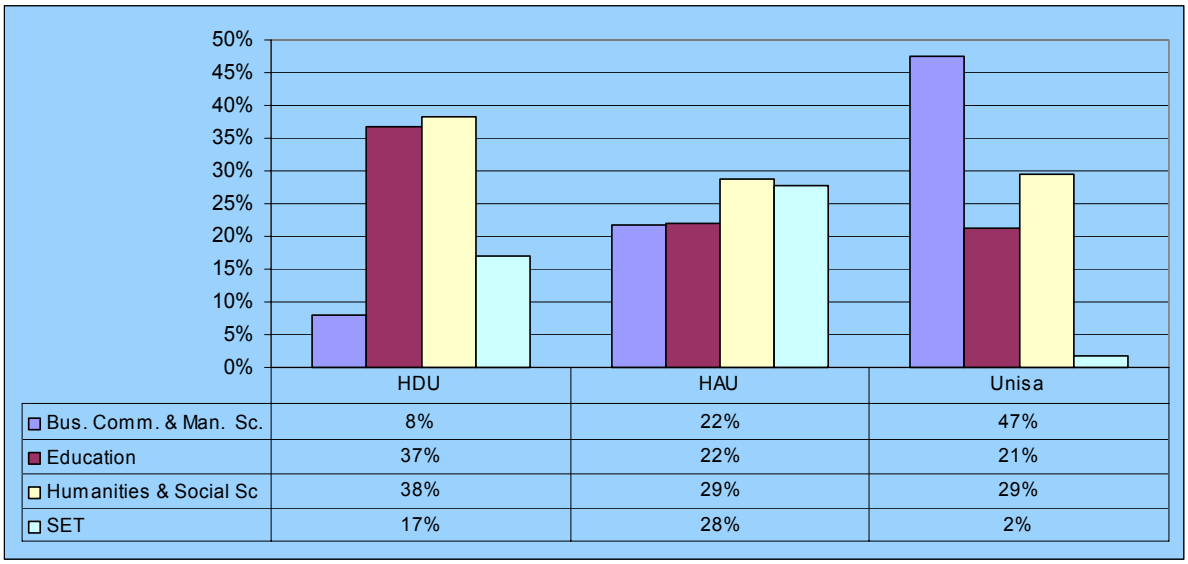
Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- Table 18 shows the shifting shape of postgraduate output by field of study between 1995 and 2001.
- A growth in total SET graduates was evident, from 3 868 (18% of total postgraduate graduates) to 5 874 (23%) and in Business, Commerce and Management Sciences (BC) from 3 691 (17%) to 5 795 (23%), while the number and proportion in the Humanities and Social Sciences (HSS) declined from 7 661 (36%) to 7 466 (30%) and those in

Education declined from 6 353 (29%) to 5 933 (24%). The combined proportion of Humanities, Social Sciences and Education thus dropped from 65% to 53%. These patterns are welcome shifts towards the NPHE goals of a ratio of 40:30:30 in HSS/Education, SET and BC respectively.

- Due to the concentration of postgraduate graduates in the universities, the proportional distribution of university graduates and that of the total were almost identical. Among the technikons, increases in the number and proportion of SET graduates were evident from 62 (58%) to 175 (71%) between 1995 and 2001.

Figure 13: Distribution of university postgraduate graduations by field of study and historical institutional type, 2001

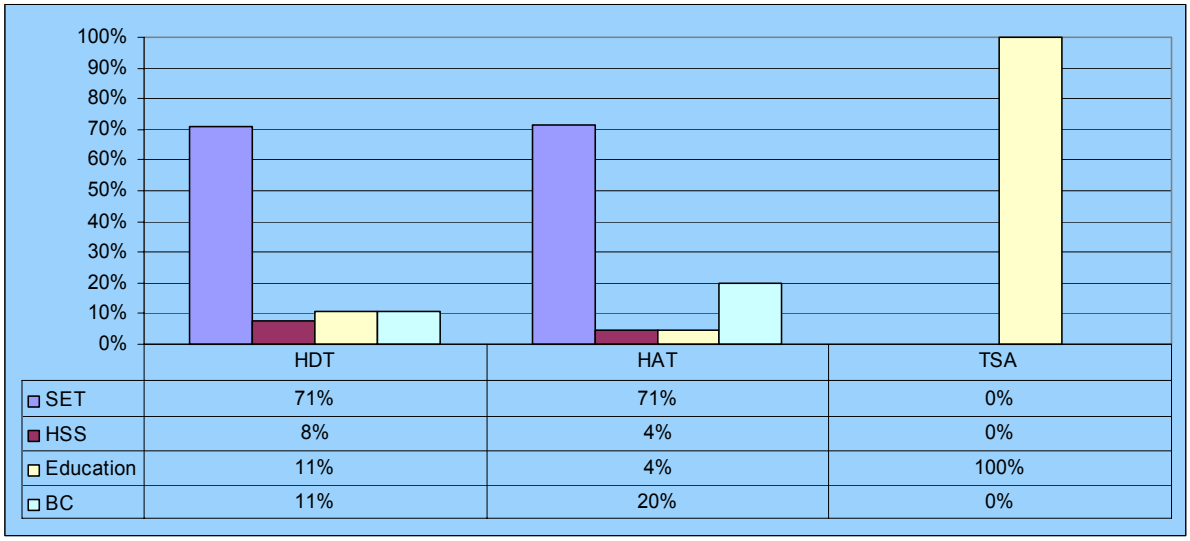


	HDU	HAU	Unisa
Bus. Comm. & Man. Sc.	8%	22%	47%
Education	37%	22%	21%
Humanities & Social Sc	38%	29%	29%
SET	17%	28%	2%

Source: HEMIS, 2001.

- Figure 13 highlights the wide variations in the distribution of postgraduate graduations across the historical advantaged and disadvantaged universities by field of study.
- In the HDUs, the vast majority (75%) of graduates in 2001 were clustered in the combined HSS/Education field (37% in Education and 38% in HSS), with only 8% in Business and Commerce and 17% in SET. By comparison, 71% of HDU postgraduate enrolments were in HSS/Education (see Table 2, Section 2.2 on page 5), with 9% in BC and 20% in SET. This suggests that the enrolment profile presents slightly better distribution in relation to the NPHE targets.
- The distribution of postgraduate graduations in HAUs was much more even across the four field of study groups. However, the majority of graduates were still in the combined HSS/Education field (51%), with 22% in Business and Commerce and 28% in SET. The majority of Unisa's postgraduate graduations were in the field of Business and Commerce, with only 2% in SET. As with the HDUs, enrolments in the HAUs shows a slightly better distribution in relation to NPHE targets, with 54% in HSS/Education, 15% in BC and 31% n SET.

Figure 14: Distribution of technikon postgraduate graduations by field of study and historical institutional type, 2001



	HDT	HAT	TSA
SET	71%	71%	0%
HSS	8%	4%	0%
Education	11%	4%	100%
BC	11%	20%	0%

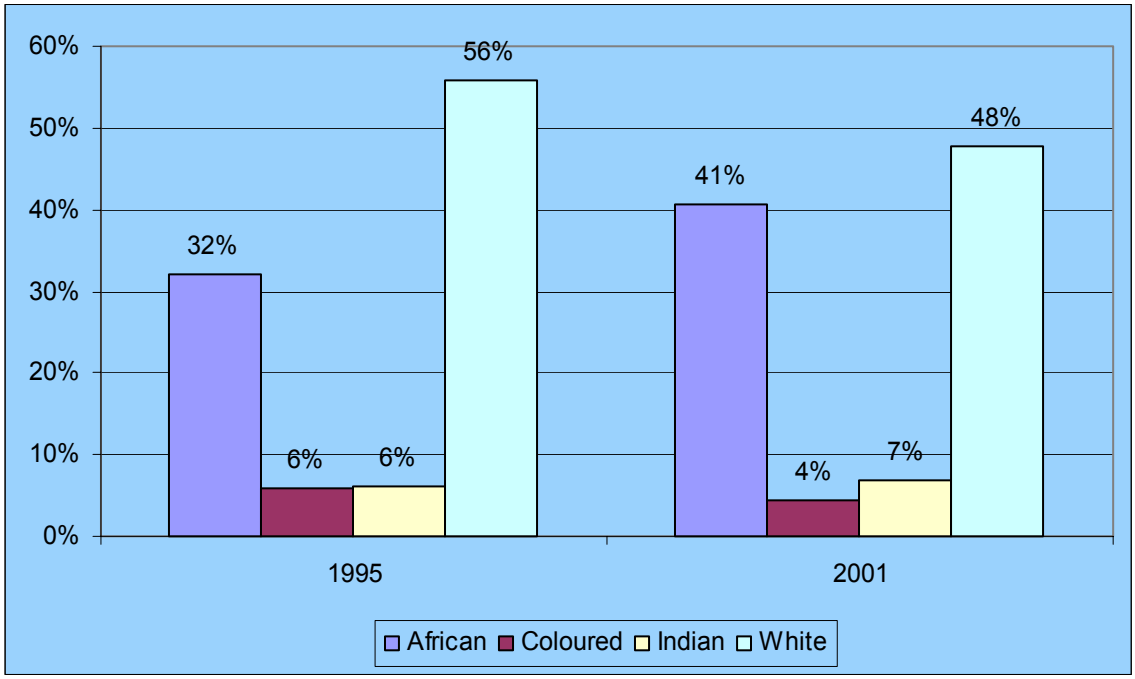
Source: HEMIS, 2001.

- As is evident from Figure 14, the variation in the distribution of postgraduate graduations among the historically advantaged and disadvantaged residential technikons was not as wide as that in the university sector. The proportion of graduations in SET was identical (71%), with a higher proportion in the HATs in BC (20% vs 11%) and correspondingly higher proportions in the HDTs in HSS (8% vs 4%) and in Education (11% vs 4%).

3.3 Postgraduate graduations by race

Pursuing race and gender equity, it has been repeatedly stressed, is essential not only to fulfil the ideals of the new democracy, but also to provide the required number and diversity of enrolments and graduates to meet the development needs of the nation. For this reason, it is important not only to increase equity of access in terms of enrolments, but also equity of success in terms of graduate output. This is discussed in more detail in the following section. Here, the graduate output is examined by race and gender.

Figure 15: Distribution of postgraduate graduations by race, 1995 & 2001



Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- Figure 15 shows the dominant position of white students among postgraduate graduates. However, between 1995 and 2001 their proportion declined from 56% to 48% with a corresponding increase in the African proportion from 32% to 41% over this period.
- The proportion of Coloured graduates declined from 6% to 4% while that of Indians increased minimally from 6% to 7%.

Table 19: Distribution of university and technikon postgraduate graduations by race, 1995 & 2001

	Race	1995		2001	
Universities	African	6 867	32%	10 070	41%
	Coloured	1 260	6%	1 103	4%
	Indian	1 337	6%	1 693	7%
	White	12 002	56%	11 878	48%
	Unknown			78	0%
	Subtotal	21 466	100%	24 822	100%
Technikons	African	40	37%	39	16%
	Coloured	2	2%	13	5%
	Indian	3	3%	26	11%
	White	62	58%	168	68%
	Subtotal	107	100%	246	100%
Total	African	6 907	32%	10 109	40%
	Coloured	1 262	6%	1 116	4%
	Indian	1 340	6%	1 719	7%
	White	12 064	56%	12 046	48%
	Unknown		0%	324	1%
	Subtotal	21 573	100%	25 068	100%

Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- Among the universities, the number and proportion of African graduates rose from 6 867 (32%) in 1995 to 10 070 (41%) in 2001 while that of whites declined from 12 002 (56%) to 11 878 (48%) in 2001. The lower white graduate output is the result of a decline in white enrolments in the late 1990s. These have subsequently increased and the number of white graduates can therefore be expected to rise after 2001.
- Coloured university graduates showed a small decline, while that of Indians showed an increase.
- Among the technikons, African graduates remained static around 40, but there proportion of total graduates dropped from 37% to 16% as a result of increases in the number and proportion of Coloured, Indian and white graduates over the period.
- The proportion of university graduates was very similar to that of enrolments in both 1995 when the proportion of university enrolments was 34% African, 5% Coloured, 6% Indian and 54% white. Greater variation between the proportion of enrolments and graduates was evident in 2001. In that year, the proportion of enrolments was 49% African, 5% Coloured, 7% Indian and 38% white. This indicates greater equity of access in terms of enrolments over time. As indicated above, the key issue is to increase equity of success. It will therefore be important to monitor progress in this regard longitudinally.
- A greater variation between enrolments and graduates was also evident in the technikons in 1995, where whites constituted an overwhelming 87% of postgraduate enrolments. By 2001, the gap between the proportion of enrolments and graduates was minimal.

Table 20: Proportion of postgraduate graduations by race and qualification level, 1995 & 2001

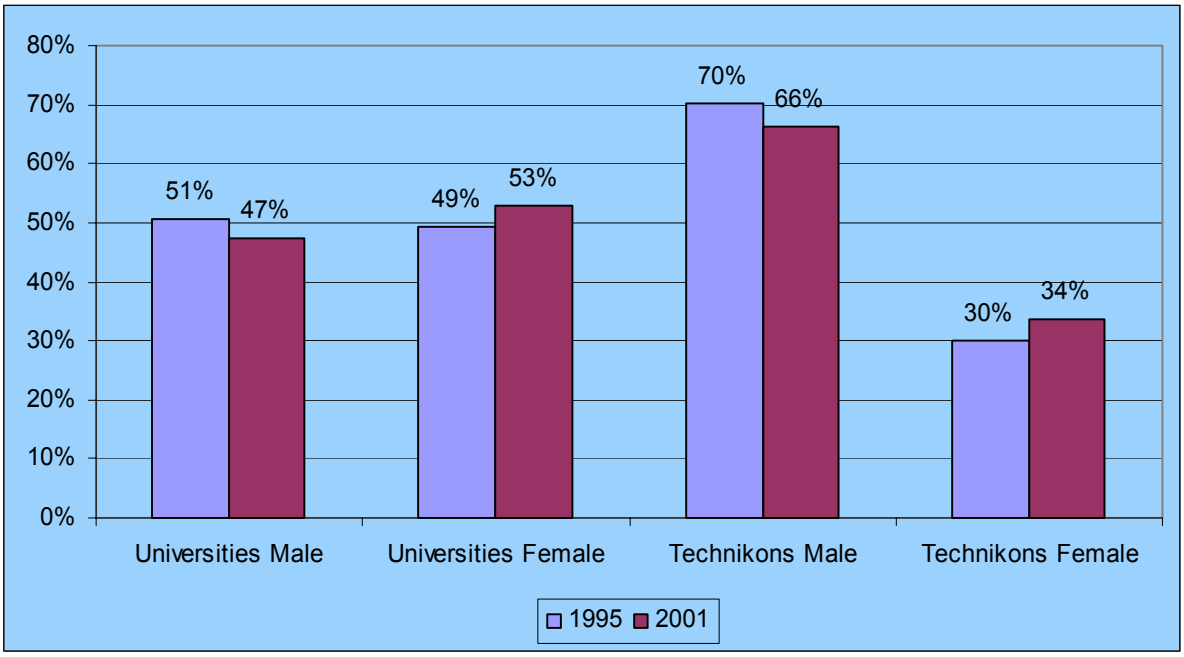
Year	Qualification Level	African	Coloured	Indian	White	Total
1995	Postgraduate Diploma/Certificate	47%	7%	7%	39%	100%
	Postgraduate Bachelor Degree	49%	9%	9%	34%	100%
	Honours Degree	24%	5%	5%	66%	100%
	Master's Degree	15%	4%	5%	76%	100%
	Doctoral Degree	6%	4%	3%	87%	100%
Total		32%	6%	6%	56%	100%
2001	Postgraduate Diploma/Certificate	47%	4%	8%	40%	100%
	Postgraduate Bachelor's Degree	73%	4%	2%	20%	100%
	Honours Degree	36%	4%	8%	52%	100%
	Masters Degree	29%	5%	6%	59%	100%
	Doctorate Degree	21%	3%	5%	70%	100%
Total		41%	4%	7%	48%	100%

Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- The disaggregation of the distribution of graduates by race and qualification level reveals further disparities hidden within the aggregated data presented above.
- Table 20 shows that while Africans formed 32% of total graduates in 1995, they constituted only 6% of doctoral graduates, 15% of masters and 24% of honours. By contrast, they were in the majority at the postgraduate bachelors and diploma/ certificate levels (49% and 47% respectively). Correspondingly, while whites formed 56% of the total, they dominated among doctorates (87%), masters (76%) and honours (66%). Both Coloured and Indian graduates were under-represented at the higher qualification levels, but much less so than Africans.
- The figures for 2001 showed a similar pattern, with Africans under-represented at the doctoral, masters and honours level and whites over-represented at these levels. Africans formed the vast majority of postgraduate bachelors graduates (73%), probably in Education.
- Noteworthy is the fact that the proportion of African graduates rose sharply at all levels above postgraduate diploma/certificate between 1995 and 2001, notably from 6% to 21% at the doctoral level, from 15% to 29% at the masters level and from 24% to 36% at the honours level. Correspondingly, the proportion which white graduates constituted dropped from 87% to 70% among doctorates, from 76% to 59% among masters and from 66% to 52% among honours graduates. Thus, over time, graduate output is becoming more equitable at all qualification levels in relation to race.

3.4 Postgraduate graduations by gender

Figure 16: Distribution of university and technikon postgraduate graduations by gender, 1995 & 2001



Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- The proportion of university women graduates increased from 47% to 53% between 1995 and 2001 (Figure 16). While gender parity has been achieved at this aggregate level, the detailed examination of these graduate figures show that women are still under-represented at the higher qualification level and in certain key fields.
- Greater overall gender disparity was evident in the technikons, where women graduates represented just 34% of the total in 2001. This was, however, an increase from 30% in 1995.

Table 21: Proportion of women of university and technikon postgraduate graduations by qualification level, 1995 & 2001

	Qualification Level	1995	2001
Universities	PG Diploma/Certificate	59%	57%
	PG Bachelor Degree	51%	59%
	Honours Degree	49%	56%
	Master's Degree	39%	43%
	Doctoral Degree	31%	37%
	Grand Total	49%	53%
Technikons	Masters Diploma in Technology	13%	33%
	M Tech Degree	45%	35%
	Laureatus in Technology	50%	0%
	D Tech Degree	0%	18%
	Grand Total	30%	34%

Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- The further disaggregation of graduate output by gender and qualification level reveals further unevenness, with black women graduates concentrated in the lower qualification levels and fields still generally associated with the gender and race division of labour shaped by apartheid society.
- Table 21 reveals that at the universities, women were in the majority at the lower qualification levels but under-represented at the doctoral and masters levels. However, their proportion of the total rose between 1995 and 2001 at all levels above the postgraduate diploma/certificate, notably at the doctoral level (from 31% to 37%), at the masters level (from 39% to 43%) and at the honours level (from 49% to 56%).
- Among the technikons, the small absolute numbers of graduates means that caution should be exercised in inferring trends in percentage terms. However, increases in the absolute numbers of women at the doctoral level were evident (from 0 to 3) and at the masters level (from 24 to 78), despite the fact that their proportion dropped from 45% to 35% due to a considerable increase in the absolute number of male graduates at this level between 1995 and 2001.

Table 22: Proportion of postgraduate graduations by race and gender, 1995 & 2001

	1995		2001	
Race	Men	Women	Men	Women
African	49%	51%	45%	55%
Coloured	52%	48%	50%	50%
Indian	42%	58%	48%	52%
White	53%	47%	49%	51%
Total	51%	49%	47%	53%

Source: SAPSE, 1995 and HEMIS, 2001. Note: No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon.

- Finally, the disaggregation of postgraduate graduations by race *and* gender shows that in 1995, Coloured and white women were slightly under-represented but that by 2001, women in all race groups were in the majority.
- From these trends, it is clear that women graduates are becoming more representative at all qualification levels and in all race groups over time.

3.5 Participation and throughput rates in public postgraduate education

The *National Plan for Higher Education* (NPHE – DoE, 2001b), following on from all recent major policy documents, identifies increased efficiency in graduate output as a necessary complement to increased participation rates in meeting the current demand for high-level skills. Expanding participation without improving efficiency is counterproductive in several ways. First, the required outputs for human resources development will not be adequately met. Greater equity is not only an intrinsic good, but is also instrumental in increasing the graduate pool. Second, the Treasury will clearly not allocate additional resources for HE in the midst of ongoing inefficiencies. It would, as the Plan argues, be futile to advocate for the allocation of additional resources to facilitate the expansion of HE "unless the inefficiencies in graduate outputs are addressed satisfactorily" (DoE, 2001b: 23). Third, as already mentioned, achieving greater access for disadvantaged students without improving their success will not materially advance the cause of equity.

The NPHE identifies what it considers to be five key policy goals and strategic objectives central to achieving the overall aim of transforming the HE system. One of its strategic

objectives is to "sustain and promote research". To meet this strategic objective, one of five priorities is "to increase outputs of postgraduates, particularly masters and doctoral graduates". Recognising the importance of greater systemic efficiency this, the NPHE stipulates that "over the next five to ten years the priority must be to improve the efficiency of graduate outputs from the system" (DoE, 2001b: 23).

To this end, the NPHE establishes the following graduation rate benchmarks[4]:

Table 23: National Plan for Higher Education: graduation benchmark rates

Qualification level		Typical current graduation rate	NPHE benchmark graduation rate	
		Contact	Contact	Distance
Undergraduate	Up to three-year degree	20%	25%	15%
	4-year or more degree	16%	20%	10%
Postgraduate	Up to honours	45%	60%	30%
	Masters	20%	33%	25%
	Doctoral	15%	20%	20%

Source: DoE, 2001b.

According to the NPHE (DoE, 2001b: 76), achieving these benchmarks should translate, over the next five years, in a minimum increase of 10 000 graduates per year, to reach a minimum total of 100 000 graduates per annum. The NPHE further proposes that, at a minimum, over the next five years:

- At least 6% of the annual output of graduates (i.e. 6 000 of the minimum target of 100 000) must be masters graduates; and
- At least 1% of the annual output of graduates (i.e. 1 000 of the minimum target of 100 000) must be doctoral graduates.

The NPHE also proposes specific funding mechanisms and strategies to increase participation rates and a profile of postgraduates that reflects the demographic reality of South African society. These mechanisms and strategies include:

- The negotiated funding of student places at HEIs[5], taking into account past institutional performance in enrolling and graduating masters and doctoral students, in particular, black and women students;
- Linking the funding of student places and full-time equivalent enrolments of institutions to the numbers of masters and doctoral produced, and in particular, black and women students;
- Providing some scholarships for postgraduate students; and

[4] Graduation rates are calculated as a proportion derived from dividing graduates by headcount enrolments of the same year. Although rough, these provide reasonable proxies for detailed cohort studies, which are not available. The rate is affected by the number of new intakes, dropouts and the throughput rate – the number of years taken to complete. The NPHE benchmark figures were derived from reviews of student cohort models involving a combination of retention rates, drop-out rates and graduation rates over a five-year period by which typical graduation rates in South African institutions were identified. From this, typical graduation rates in South African institutions were derived. (See Ministry of Education (2001) for a detailed explanation of how these were derived and for further details of graduation rate targets.) The tables by which the graduation rates are calculated do not allow contact and distance enrolments to be differentiated (which the NPHE benchmarks do).

[5] The Ministry will only fund student places in specialised postgraduate programmes on the basis of a common regional teaching platform (DoE, 2001b: 92).

- Supporting the intake of foreign students at the postgraduate level by treating them as South African students for subsidy purposes and facilitating the streamlining of the procedures for the obtaining of study permits.

The NPHE further recommends that institutions must indicate in their three-year "rolling plans" the strategies and timeframes they have in place to:

- Improve their graduate outputs at the masters and doctoral level;
- Redress imbalances in black and female enrolments in masters and doctoral programmes, in particular, in business and commerce and science, engineering and technology; and
- Recruit masters and doctoral students from the rest of Africa, in particular, the SADC, as well as other developing countries.

The *National Research and Development Strategy* (DST, 2002) identifies "Human Capital and Transformation" as one of its key operational strategic objectives that involves increasing investment in South Africa's science base.

Strategies proposed to achieve the "Human Capital and Transformation" goals include:

(i) increasing graduate and postgraduate participation in SET, especially of women and other designated groups;
(ii) establishing global and regional SET networks that include postgraduate training; and
(iii) establishing new technology missions and Centres of Excellence that will attract young researchers to sustainable careers in SET, thus increasing participation and throughput rates of postgraduates.

Hunter (2001) indicates that the annual completion rates of doctoral students at the University of Stellenbosch varied between 11% and 14% and those of masters students varied between 21% and 24%. This is below the NPHE benchmark. Further, the number of students who did not complete their masters studies increased from 1 968 in 1991 to 2 859 in 1999 – an increase of 45% (Mouton & Hunter, 2001).

Other research (Koen, 2000) indicates that the annual completion rate among the full-time and part-time UWC masters intake between 1995 and 1998 was 17% and 9% among full-time and part-time PhD students respectively. Among those who were still studying, 64% had completed their coursework, but struggled with their mini-thesis, with others withdrawing completely. In other cases, several thesis students interrupted their studies.

These results are corroborated by another study (Koen, 2001) where 51% of NRF-supported masters students took between two and three years, with a further 18% taking a third year, and another 18% 5 years or longer (Table 24 below). Similarly, at doctoral level, 61% indicated that they took longer than three years, with 39% revealing that they took 5 years and longer.

Table 24: Time to completion for a sample of NRF recipients of masters and doctoral scholarships, 1991-1996

Time to completion	Masters	Doctoral
2 years	31%	
3 years	20%	36%
4 years	18%	25%
5 years	16%	20%
6 years	2%	11%
More than 6 years		8%

Source: Koen (2001)

Asked to indicate the main reasons for not completing postgraduate studies over the prescribed periods, respondents in the NRF scholarship recipient study (Koen 2001) highlighted structural rather than personal factors from among 16 items (Table 25 below). In order of frequency, the four main factors they identified are:

- The effect of employment and workloads on completion time;
- Financial problems;
- The quality of supervision; and
- The availability of library material at particular institutions.

Specifically, the following issues were identified:

- 53% identified employment related factors involving either taking up employment (19%) or the demands of employment (34%) as key elements impacting on their completion.
- 16% attributed their delayed completion to their workload being too great (this includes work-related demands), 14% cited poor supervision, 11% detailed financial problems and 5% referred to the limited availability of library resources.
- In addition, 12% indicated that the quality of teaching, length of courses, motivation levels, requiring a break from studies, personal problems and the degree of commitment to their studies affected the time it took to complete their studies.

Table 25: Factors that affect time-to-completion of masters and doctoral students

Factors	%
Demands of Employment	34%
Taking up Employment	19%
Workload too Great	16%
Poor Supervision	14%
Financial Problems	11%
Limited Library Resources	5%
Personal Problems	5%
Quality of Teaching	2%
Degree of Commitment to Studies	3%
Low Motivation Levels	2%
Require a Break from Studies	0,4%
Length of Course	0,3%
Wrong Field of Study	0,3%
Lack of Support from Staff	0,2%
Need a Break from Education	0,1%
Insufficient Academic Progress	0,1%

Source: Koen, 2001.

These patterns highlight the enormous challenges facing HE institutions in meeting government strategies and targets to increase participation and graduation rates. From these findings, it is clear as Koen (2003: 12) argues that "South African higher education institutions are poorly placed to indicate how they will respond to the efficiency indicators the government has put before them". This, then, is a major aspect of policy and practice which will need careful and sustained attention.

3.6 Graduation rates

Following the preceding discussion, this section of the report briefly examines postgraduate graduation rates. It does so in relation to qualification level (in comparison with the NPHE benchmark targets), field of study and historical institutional type.

Table 26: Postgraduate university graduation rates by qualification level and historical institutional type, 1995 & 2001, as compared to NPHE targets

Qualification Level	1995				2001				Typical Current	NPHE benchmark	
	HAU	HDU	Unisa	Total	HAU	HDU	Unisa	Total	Contact	Contact	Distance
PG Dipl./Cert.	63%	48%	24%	47%	34%	41%	24%	34%	45%	60%	30%
PG Bachelor's	40%	35%	17%	30%	23%	25%	5%	23%			
Honours	60%	47%	23%	42%	47%	35%	23%	38%			
Master's	18%	16%	13%	18%	20%	11%	20%	19%	20%	33%	25%
Doctoral	13%	10%	17%	14%	12%	9%	87%	13%	15%	20%	20%
Total	34%	37%	20%	31%	28%	24%	23%	27%			

Source: SAPSE, 1995 and HEMIS, 2001, Ministry of Education (2001). Notes: 1) No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon. 2) The typical current figures are derived from 3-year averages (see Footnote 4 above). 3) The 1995 and 2001 data do not distinguish between contact and distance.

- Table 26 indicates the wide variety of provides an overview of the range of graduation rates among the universities[6] at the different qualification levels and historical institutional types. The reference point for interpreting these is the benchmarks and typical current graduation rates provided in the NPHE.
- At the doctoral level, the 1995 graduation rates varied from 10% in the HDUs to 13% in HAUs and 17% at Unisa. In 2001, these had all declined slightly[7]. These were all below the typical current rate of 15% and well below the NPHE benchmark of 20%.
- At the masters level, a similar variation in 1995 was evident, ranging from to 13% at Unisa, 16% at the HDUs and 18% in the HAUs. In 2001, an improvement in the HAUs and Unisa to 20% occurred, but the graduation rate in the HDUs declined to 11%. Again, this was well below the NPHE benchmark of 33% for contact and 25% for distance education.
- Finally, at the level of honours and below, a general decline is apparent between 1995 and 2001, the reasons for which are unclear but may be linked to the decline in Education graduation rates (see Table 27 below).
- In all cases, except the lower PG qualifications of diplomas, certificates and postgraduate bachelors, the graduation rates of the HDUs lagged behind those of the HAUs, followed by Unisa which performing less well than the HDUs in this regard. It is interesting to note, nonetheless, that the overall graduation rate for HDUs in 1995 was above that of HAUs.
- From these trends, it is clear that considerable improvements are therefore necessary at all qualification levels and in all historical institutional types if the NPHE benchmark targets are to be met.

Table 27: Postgraduate university graduation rates by field of study and historical institutional type, 1995 & 2001

Field of Study	1995				2001			
	HAU	HDU	Unisa	Total	HAU	HDU	Unisa	Total
Business, Commerce & Management Sc.	41%	42%	25%	33%	40%	21%	25%	33%
Education	43%	49%	26%	39%	22%	29%	20%	23%
Humanities & Social Sciences	34%	32%	13%	28%	32%	23%	23%	29%
Science, Engineering & Technology	26%	17%	13%	24%	26%	20%	10%	25%
Total	34%	37%	20%	31%	28%	24%	23%	27%

Source: SAPSE, 1995 and HEMIS, 2001, Ministry of Education (2001). Notes: 1) No 1995 data available for the University of the Northwest, Technikon Natal, Peninsula Technikon and Eastern Cape Technikon. 2) This table does not distinguish the different qualification levels.

- Table 27 shows considerable variation in graduation rates among the four fields of study groups and across the historical institutional types[8].
- It can be seen that the overall graduation rate in SET is generally lower than in the other fields in both 1995 and 2001, although there was a marked declined in Education over this period from 39% to 23%. This may account for the decline in graduation rates for the lower qualification level and at the HDUs identified in Table 26 above. Other than

[6] The low absolute numbers of postgraduate enrolments and graduations in the technikons preclude the calculation of meaningful graduation rates.

[7] The 2001 Unisa figure of 87% reflects 68 recorded doctoral graduates in that year as against 78 doctoral enrolments. This outlier figure reflects a large number of graduates in that year relative to a small number of enrolments, which had declined radically from 475 in 1995 and 294 in 1998. This meant that a large number of doctoral students happened to graduate in a year in which enrolments were reduced, thus raising the graduation rate for that year.

[8] It should be noted carefully that the variation in graduation rates at the different qualification levels is not taken into account in this table. For this reason, these figures should not be read in relation to the NPHE benchmarks but only relative to one another.

this decline, the rates did not changed much over the period, with only minimal improvements in HSS and SET. The graduation rate for HSS at the HDUs also declined over the period.

3.7 Coursework vs dissertation programmes[9]

Another key issue in considering the postgraduate subsector and its funding is the ongoing debate around the utility and value of coursework vs dissertation masters and, to a lesser extent in South Africa, coursework doctoral programmes. The value of coursework programmes lies in their provision of specifically tailored content to educate and train graduates in ever-deepening specialized fields and, increasingly, in areas of inter-disciplinary studies (see below). The underlying aim of the coursework approach is to prepare students better for the world of work and to deal with the growing complexity and inter-relatedness of contemporary social and technological problems.

Against this, however, continual concern has been expressed about the negative impact of reducing the research element of masters and doctoral programmes. This is particularly so with regard to the increasing trend towards expanding the proportion of coursework in masters programmes (in some cases comprising up to 60% or 75% of mark allocations), with even smaller research components making up the rest in the form of long assignments and mini-dissertations. This concern is built on the understanding that research-based higher degrees, and in particular the doctorate, constitute a process of academic socialisation into the community of high-level scholarship. To this end, students are 'initiated' through the process of developing the required combination of generic research and academic skills, and specific specialised, in-depth 'content' knowledge.

This issue is far from resolved and is the subject of ongoing deliberation as a central, and perhaps *the* central concern of curriculum development. The key challenge is to pursue an ever closer match between postgraduates and the requirements of the world of work. This will require greater interaction between employers and educators and continuing review of the optimum mix of specific generic skills and knowledge.

The key challenge for curriculum development in addressing labour market and development needs in the new knowledge society is, as Schwartzman (2002: 12) argues, "not with quantitative targets for specific professions, but with the general need to provide society with the proper combination of specialized, generic and 'transferable' skills". Finding this balance remains, however, highly elusive. Employers tend to overemphasize specialized competence above generic high-level competence "which is a platform for any specialized competence" (Cloete & Bunting, 2001: 46). Instead, these authors argue, for skills to remain adaptable, they cannot be too context specific "or else the knowledge economy will not prosper" (ibid: 47-8). The inculcation of concrete skills precludes the "kind of adaptability required by an economy characterized by ever-changing cognitive demand" and, without a solid platform of knowledge processing, leaves the student stranded in the particularity of those skills.

In South African curriculum debates, the pursuit of this balance is reflected in two contending positions, framed by the 'disciplinary' and the 'credit accumulation and transfer' discourses (Ensor, 2002: 273). The latter arises from the advocacy in recent HE policy documents for a 'high skills, high growth' economic development path, aimed at

[9] The following two sections draw from Subotzky (2003a).

rapid integration into the global world economy. The principle instrument for this is the National Qualifications Framework (NQF), aimed at fostering mobility across the education and training system through credit accumulation and transfer. This rests on the notion of equivalence of knowledge forms and a series of shifts: from subject-based content knowledge to student-based generic skills; from courses to credits; from disciplinary curricula to outcomes-based modularised inter-disciplinarity curricula; and from disciplinary-based departments to inter-disciplinary programmes, inspired by the Mode 2 thesis (see next section for a discussion of this). As Ensor (ibid) shows, the tension between these discourses has persisted throughout the South African HE policy process, and has led to the current review of the NQF. In tracking some institutional attempts to gear programmes to the world of work, Ensor concludes that despite the re-organization and re-packaging of these programmes, most remain firmly discipline-based and do not constitute integrated inter-disciplinary curricula. However, the unintended result of the restructuring is less portability and flexibility of student choice in the system than before. In some cases, the process was so extreme that core disciplinary majors were decimated – a situation that had to be rapidly rectified. This is an example, among many others in recent educational policy development, of progressive intentions leading to unanticipated and even counterproductive outcomes.

These perspectives indicate that far more efforts are required to determine the optimal mix of knowledge and skills required in the new knowledge-driven workplace. The task, Ensor argues, is to find common ground between the disciplinary knowledge and transferable skills positions, thereby addressing the shortcomings of each and combining disciplinary coherence and depth of learning with flexible entry and exit opportunities (and inter-disciplinary relevance, it may be added). This remains, as indicated earlier, the principle curricula challenge in preparing graduates, and especially postgraduates, for the labour market and thereby in ensuring their effective contribution to national development priorities.

3.8 Disciplinarity and inter-disciplinarity

Closely linked to this issue is the question of the appropriate emphasis on disciplinarity and inter-disciplinarity. At the heart of this matter is the question of what kind of knowledge graduates need to have in order for HE to more effectively fulfil its multiple purposes in relation to instrumentally meeting the professional and vocational needs of the economy and labour market on the one hand, and the wider civic, democratic and intrinsic formative function of HE on the other (see Muller, 2000).

After the publication of the 1997 White Paper on higher education transformation, which strongly advocated a programme-based (rather than an institutionally-based) approach to HE provision, many South African institutions undertook the restructuring of their academic programmes and structures. This was guided by the widely-held assumption that inter-disciplinarity was the key to preparing graduates adequately for the new knowledge society and for solving pressing socio-economic and technical problems. This follows the global proliferation of new organizational and epistemological modes of knowledge production, which has manifested in the shift from 'disciplinary' to 'problem-solving' or 'strategic' research, increasingly conducted in transient teams of multi-disciplinary specialists. Although various accounts of this shift have emerged (Etzkowitz, et al, 1998; Rip & Marais, 1999; Rip, 2000), the notion of 'Mode 2' knowledge production (Gibbons et al, 1994; Gibbons, 1998) had a major impact in South African policy debates. Gibbons argued that for institutions to achieve contemporary relevance, they must produce Mode 2 knowledge through developing partnerships and alliances, thus

becoming more 'porous'. They should adjust from being *producers* of mainly disciplinary knowledge to being creative *reconfigurers* of knowledge into inter-disciplinary combinations in order to solve complex problems.

At the time of the 1994 National Commission, the idea of Mode 2 knowledge production carried an attractive, cutting-edge appeal. This led to the rapid (and often rather uncritical) adoption of this notion as the normative foundation of inter-disciplinary programmes and the high-skills path which were seen as the key to ensuring relevance to development needs (Cloete et al, 1997; Scott 1997; Subotzky, 1999; Kraak 2000). Following initial optimism, Gibbons' version of Mode 2 and its role in fostering development was critiqued with more circumspection (Jansen 2000; Muller 2000; Muller and Subotzky 2001)[10]. It was seen as ambiguous in relation to whether Mode 2 should *replace* Mode 1 disciplinary knowledge or should be an *adjunct* to it (Muller, 2000). While Gibbons and his co-authors would hastily affirm the latter, their account remains equivocal in this regard. It has led to several cases in which inter-disciplinary problem-solving curricula have supplanted traditional disciplinary-based curricula. Shifting patterns in knowledge *production* was thus unquestioningly adopted into the realm of knowledge *acquisition*.

Inquiry-rich curricula have a long history and many evident benefits. However, the cautionary concern here is that shifting teaching programs towards inter-disciplinarity without a solid foundation of disciplinary training may prove counter-productive – especially in a developing country context such as ours where the quality of disciplinary training is often shaky. This runs the risk of setting graduates up for failure by expecting them to contribute to development priorities by means of innovative problem-solving Mode 2 activity without ensuring prior competence and capacity – which depends on thoroughly grounded discipline-specific knowledge and skills (Muller and Subotzky, 2001).

[10] Preliminary findings of research, in which the authors are involved, into patterns of knowledge production in South Africa show that in most cases of innovative organizational forms of knowledge production, there is evidence of strong continuity between Mode 1 and Mode 2 activities - both in knowledge production and dissemination (teaching). From the cases studied, a broader, richer typology than the dichotomous Gibbons one has emerged.

4. The funding of postgraduate studies and research

A fundamental precondition for achieving the required quality, extent and equitable distribution of postgraduate education and research output is, of course, the provision of adequate funding.

This section of the report provides an overview of the available data on this. It focuses on data received from the NRF and includes comments on the patterns of NRF funding derived from recent research on NRF masters and doctoral scholarship recipients (Koen 2001). Two other studies provide additional perspectives: a study of UWC masters and doctoral retention rates (Koen, 2000) and an examination of University of Stellenbosch masters and doctoral time-to-completion (Hunter, 2001; Mouton & Hunter, 2001). In addition, the findings of a snap survey of non-NRF sources of postgraduate funding – parastatals, HE institutions and private corporations – are presented. Finally, a brief note on the National Student Financial Aid Scheme and its implications for postgraduate study is included.

4.1 The National Research Foundation

The National Research Foundation (NRF) is the government's national research and postgraduate funding agency. It was established in 1999 after amalgamation of the former Centre for Science Development (CSD) and Foundation for Research Development (FRD). Whereas the CSD supported research in the social sciences and humanities only, and the FRD research in the natural sciences and engineering, the mission of the NRF was reformulated as follows:

> to support and promote research through funding, human resource development and the provision of the necessary research facilities, in order to facilitate the creation of knowledge, innovation and development in all fields of the natural and social sciences, humanities and technology. (NRF: http://www.nrf.ac.za/profile)

The fact that the NRF became operational in 1999 poses a problem for the comparison of data for the years 1995, 1998 and 2001. Different data management and classification systems were used by the CSD and FRD, resulting in data not being extractable or not being available. For instance, the data for student support received from the NRF contains only one record of funding for 1995 in the social sciences and humanities. This invariably skews the picture of research support for that year.

Apart from data extraction challenges, cognisance needs to be taken of policy changes in the national steering of research, as these also impact upon data comparability. For instance, in 1996 the FRD launched a portfolio of directed, as opposed to open themes. Directed themes comprised a series of programmes based upon perceived national goals. The open themes, on the other hand, consisted of a series of programmes within which researchers could obtain funding for their own research interests. Before 1996, however, research of a non-directed or open nature (organised within a so-called "core programme") preponderated.

Whereas the NRF initially adopted the division of directed and open themes, in 2001 it introduced nine focus areas in an attempt to align individual research activities even more closely to national goals. The focus areas serve as steering mechanisms and are

the only areas within which the NRF finances research through its Research and Innovation Support Agency (RISA). Apart from managing these focus areas, RISA also oversees specific institutional and development programmes (e.g. Technikon Programme), the Technology and Human Resources for Industry Programme (THRIP), as well as the Innovation Fund.

The analysis of the data in this section of the report focuses exclusively on support by RISA, excluding THRIP and the Innovation Fund. The structure of this section is as follows: first NRF grant holder support is examined, followed by an analysis of support to postgraduate students and post-doctoral fellows.

4.1.1 NRF grant holder support

Since the focus of this report is on academic funding, we first consider the number of NRF grant holders (i.e. academics) at universities and technikons as a percentage of all grant holders.

Table 28: NRF grant holders in higher education as percentage of total, 1995, 1998 & 2001

Sector	1995		1998		2001	
	No.	%	No.	%	No.	%
SA higher education	4 196	86%	1 682	91%	1 598	91%
Other (national & international)	660	14%	175	9%	167	9%
Total	4 856	100%	1 857	100%	1 765	100%

Source: For this and all subsequent tables and figures: data supplied by the NRF and the MRC, unless otherwise stated.

- NRF funding is largely directed towards academic research (Table 28). In 1995, 86% of all NRF grant holders were based at South African universities and technikons, and by 1998 the figure was 91%.
- Moreover, the stark decline in the number of grant holders between 1995, 1998 and 2001 indicates that the NRF (as the CSD and FRD in 1995 but amalgamated in 2001) shifted abruptly towards the funding of fewer researchers.
- However, Table 29 shows that the amount of funding did not decline over this period. In fact, while the number of grant holders in HE dropped significantly from 4 196 in 1995 to 1 598 in 2001, the average size of grant holder funding dramatically improved from just below R18 000 in 1995 to over R71 000 in 2001.
- Thus fewer researchers have been funded with larger allocations. This is undoubtedly to a large extent linked to the implementation of the policy of the NRF (and the former FRD) to rate scientists in the natural sciences and engineering in the early 1990s.

Table 29: Summary statistics of NRF grant holders in the higher education sector, 1995, 1998 & 2001

	1995	1998	2001
Number of grant holders	4 196	1 682	1 598
Total amount	R74 884 550	R115 420 307	R113 957 511
Average amount per grant holder	R17 847	R68 621	R71 313

- Regarding the distribution of NRF grant holders at universities and technikons, Figure 17 below shows that university researchers comprised 74% of all NRF grant holders in HE

in 1995, but received 91% of total NRF allocations. Thus, in 1995 university researchers received, on average, significantly more NRF money than researchers at technikons.

Figure 17: Distribution of NRF grant holders and monetary value of grants by higher education sector 1995, 1998 & 2001

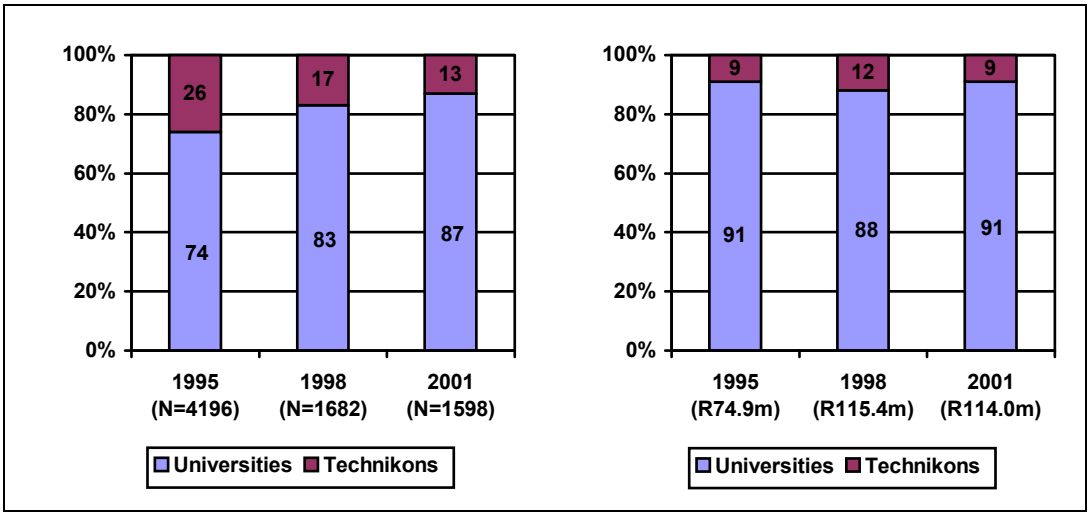
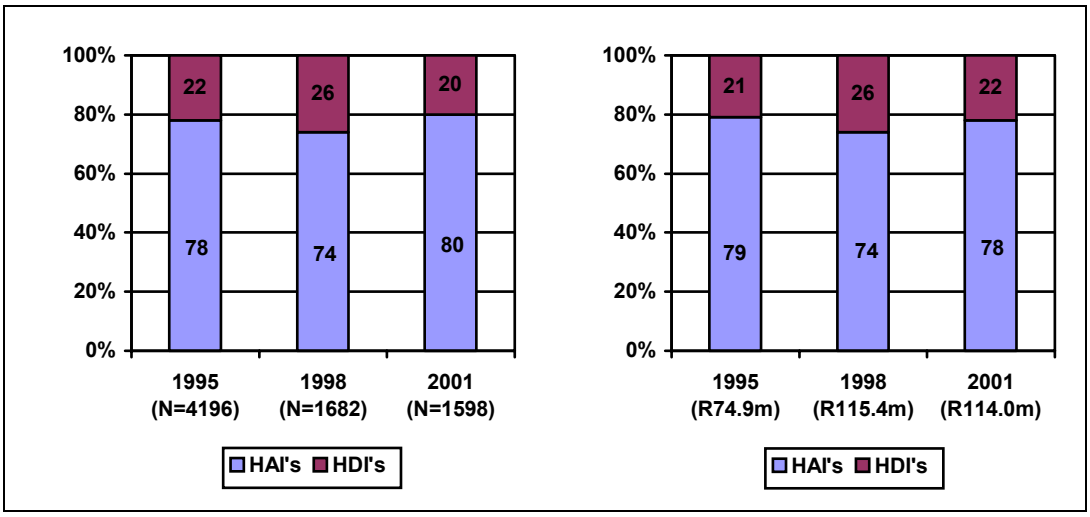


Table 30: Average funding of NRF grant holders at universities and technikons 1995, 1998 & 2001

	Year	Number of grant holders	Total amount (R)	Mean funding (R)	Median funding (R)
Universities	1995	3 109	67 850 584	21 824	9 000
	1998	1 393	102 028 021	73 243	41 000
	2001	1 387	103 269 104	74 455	50 000
Technikons	1995	1 087	7 033 966	6 471	2 700
	1998	289	13 392 286	46 340	24 000
	2001	211	10 688 407	50 656	31 000

- Table 30 indicates that in 1995 university researchers received, on average, 3,4 times more NRF research funding money than technikon researchers (21 824/6 471 = 3.4) – a ratio that dropped to 1.5 in 2001 (74 455/50 656 = 1.5).

Figure 18: Distribution of NRF grant holders and monetary value of grants by historical institutional type, 1995, 1998 & 2001



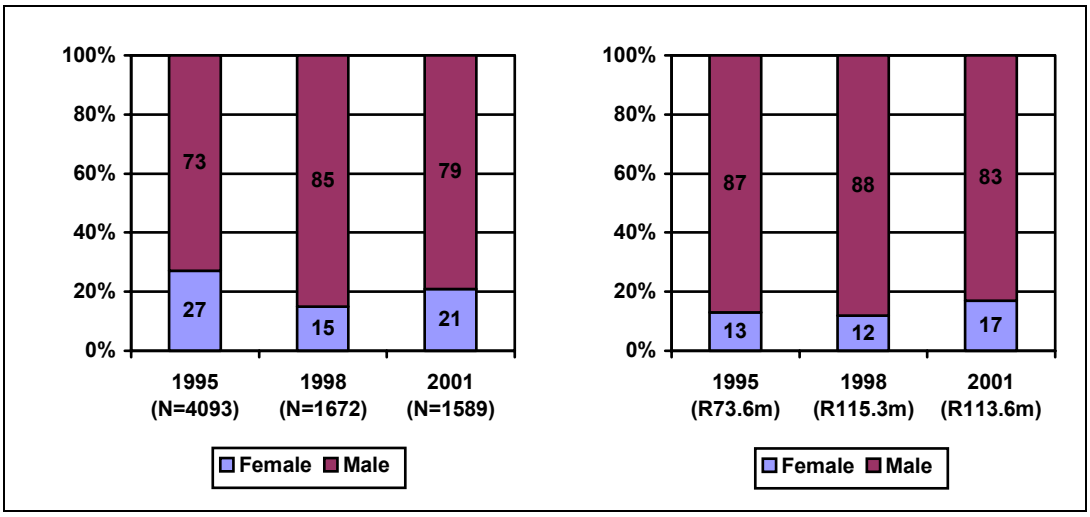
- Figure 18 presents the distribution of NRF grant holders, and the monetary value of the grants, by historical institutional type. No marked differences are apparent between the two sets of stacks. In 1995, HAIs accounted for 78% of grant holders and 79% of grant holder funding, in 2001 they accounted for 80% of grant holders and 78% of grant holder funding.

Table 31: Distribution of NRF grants in higher education by subject area, 1995, 1998 & 2001

Subject area	1995		1998		2001	
	No.	%	No.	%	No.	%
Agriculture & Forestry	199	5%	113	7%	112	8%
Biology	991	25%	495	31%	463	32%
Earth & Marine	208	5%	111	7%	80	6%
Engineering	1 131	28%	270	17%	184	13%
Health	204	5%	54	3%	70	5%
Mathematical Science	483	12%	133	8%	136	9%
Physical Sciences	636	16%	339	21%	272	19%
Social Sciences	92	2%	40	3%	101	7%
Technology	37	1%	36	2%	26	2%
Total	3 981	100%	1 591	100%	1 444	100%

- Table 31 classifies NRF grants into nine subject areas. Four subject areas – Biology, Engineering, Physical Sciences, and Mathematical Sciences – clearly received the majority of funding.
- While Engineering ranked first in 1995 (with 28% of grants), it dropped to third position in 1998 (17% of grants) and 2001 (13% of grants).

Figure 19: Distribution of NRF grant holders in higher education and monetary value of grants by gender 1995, 1998 & 2001

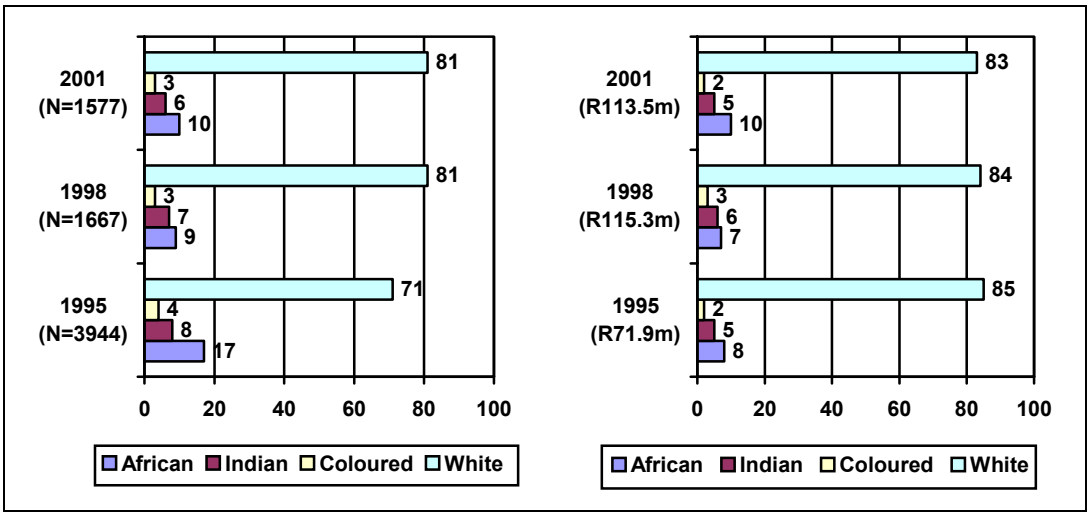


- NRF grant holders in the HE sector are predominantly men, who comprised 73% of the total in 1995 and 79% in 2001 (Figure 19). However, comparing the figures for 1998 and 2001, it appears that the position of women is improving – both in terms of their share of grants (from 15% to 21%) and share of funding (from 12% to 17%).
- Female grant holders are nevertheless at a disadvantage as their share of grants is markedly smaller than their share of funding (e.g. 27% of grants versus 13% of funding in 1995, and 21% of grants versus 17% of funding in 2001). Female grant holders receive, on average, less funding than their male counterparts (Table 32).

Table 32: Average funding of NRF grant holders in higher education by gender 1995, 1998 & 2001

Gender	Year	No. of grant holders	Total funding (R)	Mean funding (R)	Median funding (R)
Women	1995	1 096	9 756 505	8 902	6 000
	1998	255	13 485 496	52 884	30 500
	2001	327	19 724 785	60 320	39 000
Men	1995	2 997	63 868 756	21 311	8 000
	1998	1 417	101 830 197	71 863	40 000
	2001	1 262	93 853 542	74 369	49 160

Figure 20: Distribution of NRF grant holders in higher education and monetary value of grants by race, 1995, 1998 & 2001



- As far as race is concerned, NRF grant holders in HE are still predominantly white, comprising 71% of grant holders in 1995 and 81% in 2001 (Figure 20). White grant holders also received 85% and 83% of NRF funds in 1995 and 2001 respectively.
- In 1995 whites' share of funding (85%) was significantly greater than their share of grants (71%) – i.e. they received, on average, significantly higher funding. However, the gap has since decreased (81% versus 83% in 2001).

Table 33: Distribution of NRF grant holders in higher education by race/gender group, 1995, 1998 & 2001

Race	Gender	1995		1998		2001	
		No.	%	No.	%	No.	%
African	Women	204	5%	18	1%	22	1%
	Men	474	12%	130	8%	136	9%
Indian	Women	120	3%	18	1%	21	1%
	Men	200	5%	97	6%	76	5%
Coloured	Women	45	1%	7	0%	8	1%
	Men	99	3%	46	3%	35	2%
White	Women	679	17%	212	13%	271	17%
	Men	2 082	53%	1 139	68%	1 006	64%
Total		3 903	100%	1 667	100%	1 575	100%

Table 34: Distribution of monetary value of NRF grants in higher education by race/gender group, 1995, 1998 & 2001

Race	Gender	1995		1998		2001	
		R 000	%	R 000	%	R 000	%
African	Women	932	1%	642	1%	1 023	1%
	Men	4 466	6%	7 897	7%	10 253	9%
Indian	Women	905	1%	957	1%	1 390	1%
	Men	2 937	4%	5 714	5%	4 704	4%
Coloured	Women	402	1%	199	0%	359	0%
	Men	1 297	2%	3 007	3%	2 132	2%
White	Women	7 306	10%	11 688	10%	16 915	15%
	Men	53 269	75%	85 165	74%	76 565	68%
Total		71 513	100%	115 269	100%	113 342	100%

- Table 33 and Table 34 provide a detailed breakdown of NRF grants and monetary values by race/gender group.
- White males dominated in 2001 in terms of the number of grants received (64%). They increased their share of funding by 11% over the 6-year period between 1995 and 2201. However, their contribution dropped by 4% over the 3-year period between 1998 and 2001 (Table 33).
- The share of funds allocated to white males has been declining since 1995, from 75% of total NRF funds in 1995 to 68% in 2001 (Table 34).
- White females form the second largest group receiving NRF grants and funding in HE. They received 17% and 15% of grants and funding respectively in 2001.

4.1.2 NRF support to masters and doctoral students and post-doctoral fellows

This section presents data[11] on two modes of NRF student support: students benefiting from bursaries and scholarships, and students benefiting in some way or the other from grant holder support (e.g. through grant holder linked bursaries and assistantships).

[11] Except for the first two tables below, which include 1995 figures, data in all subsequent tables and figures are provided for the years 1996, 1998 and 2001. This is because the 1995 data from the NRF are obviously incomplete, as they show no entries for the bursary programme and only one record for the social sciences (Table 36). For these reasons, the 1996 data is used instead in comparison to 1998 and 2001. Unless otherwise stated, "students" include both masters and doctoral students as wells as post-doctoral students.

Table 35: Distribution of NRF-supported students by programme type, 1995, 1996, 1998 & 2001

Programme type	1995		1996		1998		2001	
	No.	%	No.	%	No.	%	No.	%
Bursary and Fellowship Programme	0	--	92	7%	234	12%	227	9%
Open Research Programme/Core Programme	337	100%	241	18%	343	17%	0	--
Directed Themes/Focus Areas	0	--	859	63%	1 196	60%	1 803	72%
Institutional Research Development/ Technikon Programme	0	--	174	13%	227	11%	454	18%
Specific Development Programmes	1	0%	0	--	0	--	15	1%
Total	338	100%	1 366	100%	2 000	100%	2 499	100%

Table 36: Distribution of NRF-supported students by subject area, 1995, 1996, 1998 & 2001

Subject area	1995		1996		1998		2001	
	No.	%	No.	%	No.	%	No.	%
Agriculture & Forestry	9	3%	82	7%	113	7%	132	8%
Biology	104	31%	387	31%	605	37%	612	37%
Earth & Marine	31	9%	69	6%	97	6%	95	6%
Engineering	66	20%	332	26%	311	19%	195	12%
Health	0		32	3%	34	2%	71	4%
Mathematical Science	27	8%	106	8%	112	7%	103	6%
Physical Sciences	97	29%	216	17%	318	20%	370	22%
Social Sciences	1	0%	17	1%	17	1%	71	4%
Technology	1	0%	21	2%	24	2%	26	2%
Total	336	100%	1 262	100%	1 631	100%	1 675	100%

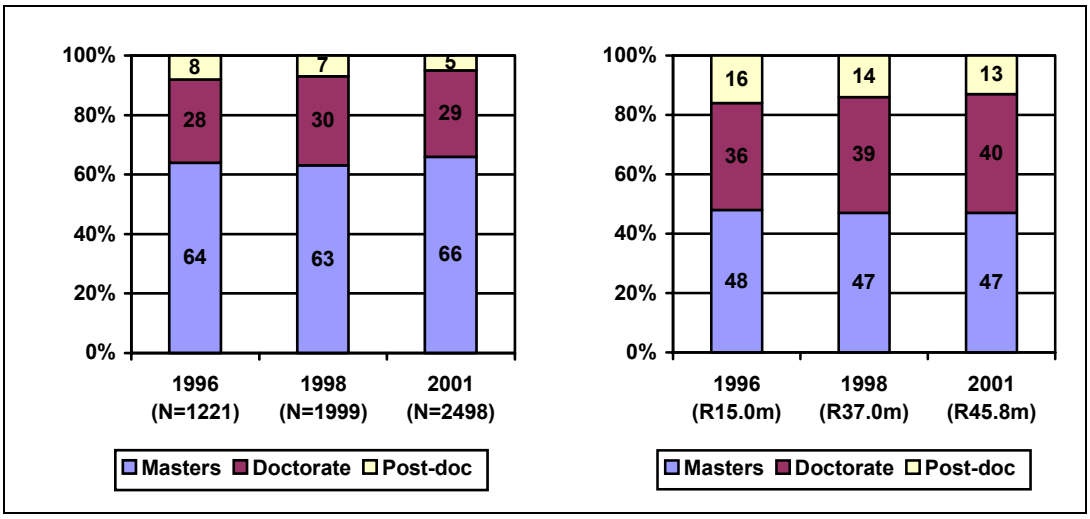
- Table 36 reveals a consistent decline in student support in Engineering (from 26% of all student support in 1996 to only 12% in 2001). The shift is increasingly towards support in Biology (31% in 1996 and 37% in 2001) and Physical Sciences (17% in 1996 and 22% in 2001).

Table 37: Summary statistics of students supported by NRF, 1996, 1998 & 2001

	1996	1998	2001
Number of students supported	1 366	2 000	2 499
Total amount	R15 803 069	R37 000 374	R45 795 913
Average amount per student	R11 569	R18 500	R18 326

- Table 37 shows that, between 1996 and 1998, the average size of funding per student increased by almost R7 000. However, since 1998 the average size of funding has remained constant at about R18 000 per student. A recent announcement by the NRF has indicated that these values have been increased (see Table 43 on page 59 below for details).

Figure 21: Distribution of NRF-supported students and monetary value of support by qualification level, 1996, 1998 & 2001

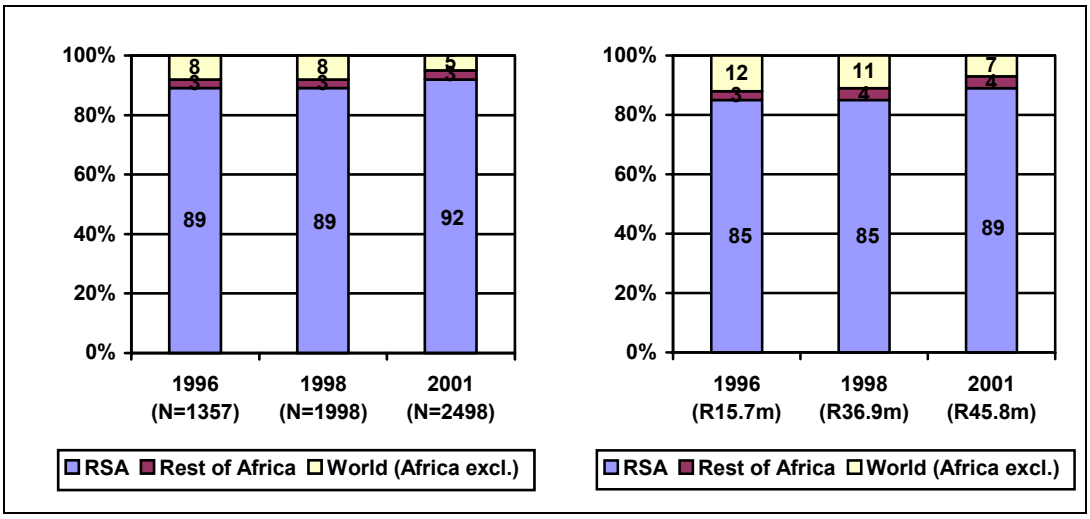


- Figure 21 provides a breakdown of NRF support for students by type of support.
- Noteworthy is the consistency over the six-year period. There was no significant shift in funding category. The difference between the number of grant holders and amount of funding received is obvious given the higher bursary values for doctoral and post-doctoral students.
- A more detailed breakdown is presented in Table 38 below.

Table 38: Average NRF support for student by qualification level, 1996, 1998 & 2001

	Year	Number of students supported	Total amount (R)	Average amount per student (R)
Masters	1996	777	7 252 491	9 334
	1998	1 254	17 326 125	13 817
	2001	1 646	21 294 326	12 937
Doctorate	1996	348	5 436 265	15 621
	1998	611	14 537 659	23 793
	2001	733	18 514 050	25 258
Post-doctorate	1996	96	2 363 258	24 617
	1998	134	5 133 590	38 310
	2001	119	5 983 536	50 282

Figure 22: Distribution of NRF-supported students and monetary value of support by citizenship, 1996, 1998 & 2001



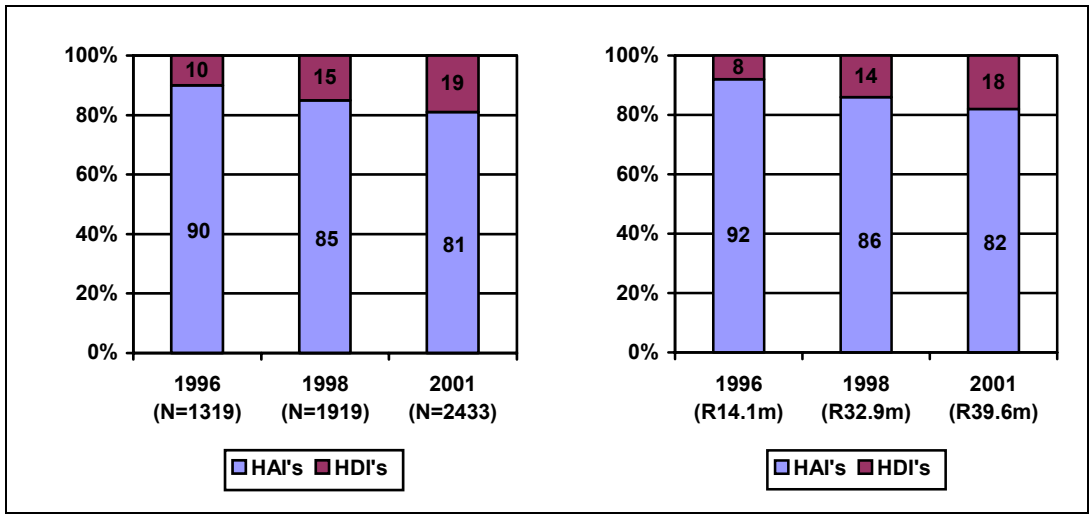
- Figure 22 and Table 39 examine the citizenship and institutional and affiliation of NRF recipients.
- It can be seen that the overwhelming majority of NRF-supported students are South African citizens (89% in 1996 and 92% in 2001).
- As a result, students who are South African citizens also receive the vast majority of funding (85% in 1996 and 89% in 2001).
- Figure 22 shows further that students from the rest of Africa constitute only about 3% of NRF-supported students.

Table 39: Distribution of NRF-supported students by sector, 1996, 1998 & 2001

Sector	1996		1998		2001	
	No.	%	No.	%	No.	%
SA universities	1 170	86%	1 834	92%	2 243	90%
SA technikons	149	11%	85	4%	190	8%
SA science councils	5	0%	9	1%	6	0%
SA government/NGO	5	0%	14	1%	12	1%
International	35	3%	58	3%	48	2%
Total	1 364	100%	2 000	100%	2 499	100%

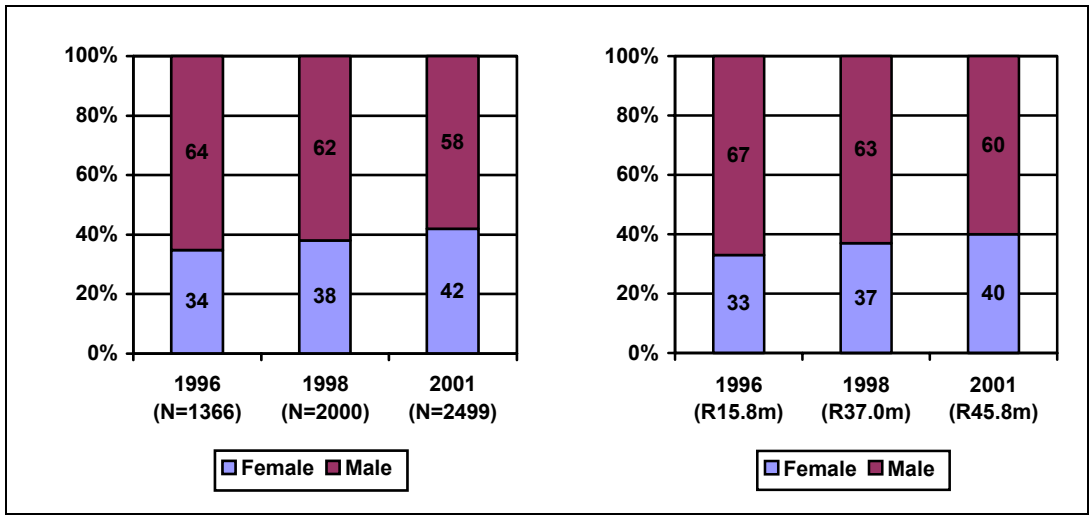
- NRF-supported students who receive NRF support are almost exclusively affiliated to the South African HE sector (97% in 1996 and 98% in 2001 – Table 39). Within the HE sector, the majority of students are at universities as compared to technikons.

Figure 23: Distribution of NRF-supported students and monetary value of support by historical institutional type, 1996, 1998 & 2001



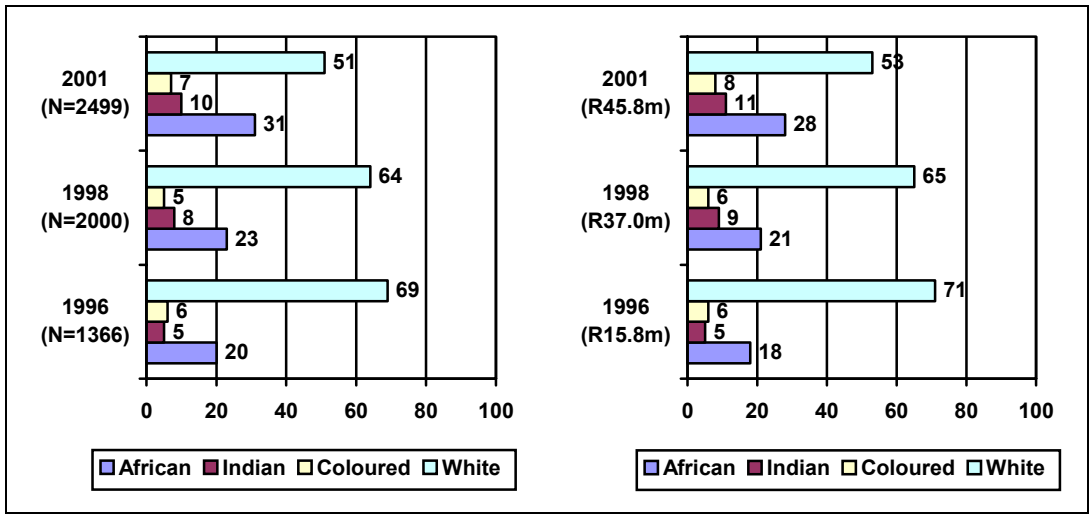
- Regarding the historically advantaged and historically disadvantaged institutions (HAIs and HDIs), the proportion of HDI students supported by the NRF increased from 10% in 1996 to 19% in 2001 (Figure 23). The vast majority of recipients, however, are still at HAIs.
- The distribution of funds allocated to students at HAIs and HDIs shows a similar pattern.

Figure 24: Distribution of NRF-supported students and monetary value of support by gender, 1996, 1998 & 2001



- Figure 24 shows a positive trend towards gender equity. Although still in the minority, the number of female grantees increased from 34% in 1996 to 42% in 2001.
- Similar increases in the amount of funding received by female students are evident – from 33% to 40%.

Figure 25: Distribution of NRF-supported students and monetary value of support by race, 1996, 1998 & 2001



- The race distribution of NRF students also reflects a trend towards greater representivity. In 1996, 69% of NRF-supported students were white, but in 2001 this had decreased to 51%.
- Concomitantly, the share of white grant holders of NRF funds dropped from 71% in 1996 to 53% in 2001.
- Coupled with this, the African proportion of recipients increased from 20% to 31% between 1996 and 2001, with a similar improvement in their share of funding – from 18% to 28%.

Table 40: Distribution of NRF-supported students by race/gender group, 1996, 1998 & 2001

Race	Gender	1996		1998		2001	
		No.	%	No.	%	No.	%
African	Women	78	6%	158	8%	299	12%
	Men	192	14%	298	15%	483	19%
Indian	Women	24	2%	54	3%	114	5%
	Men	45	3%	106	5%	139	6%
Coloured	Women	34	3%	41	2%	83	3%
	Men	46	3%	67	3%	100	4%
White	Women	325	24%	501	25%	566	23%
	Men	622	46%	775	39%	715	29%
Total		1 366	100%	2 000	100%	2 499	100%

Table 41: Distribution of monetary value of NRF student support, by race/gender group, 1996, 1998 & 2001

Race	Gender	1996		1998		2001	
		R 000	%	R 000	%	R 000	%
African	Women	828	5%	2 557	7%	4 485	10%
	Men	2 046	13%	5 265	14%	8 521	19%
Indian	Women	255	2%	1 090	3%	2 046	5%
	Men	594	4%	2 083	6%	2 742	6%
Coloured	Women	408	3%	832	2%	1 587	4%
	Men	484	3%	1 236	3%	2 172	5%
White	Women	3 711	24%	9 380	25%	10 082	22%
	Men	7 478	47%	14 557	39%	14 161	31%
Total		15 803	100%	37 000	100%	45 796	100%

- Table 40 and Table 41 combine the information contained in Figure 24 and Figure 25 by considering the distribution of NRF students and funds across race/gender groups.
- These tables show that among whites, the decline in the share of students and funds is much steeper for white males than for white females, although the share of both groups declined between 1996 and 2001.
- Among black recipients, the share of both males and females have increased, although much more so for Africans than for Indians or coloureds.

Table 42: Distribution of NRF-supported students by race/gender group and qualification level, 1996, 1998 & 2001

Race	Gender	1996		1998		2001	
		Masters	Doctoral	Masters	Doctoral	Masters	Doctoral
African	Women	6%	4%	9%	7%	15%	6%
	Men	15%	7%	16%	15%	20%	19%
Indian	Women	2%	1%	2%	4%	5%	4%
	Men	2%	4%	5%	5%	5%	6%
Coloured	Women	3%	2%	3%	1%	3%	4%
	Men	4%	1%	4%	3%	4%	4%
White	Women	25%	26%	24%	27%	21%	26%
	Men	42%	54%	38%	39%	26%	32%
Total		100% (N=777)	100% (N=348)	100% (N=1254)	100% (N=611)	100% (N=1646)	100% (N=733)

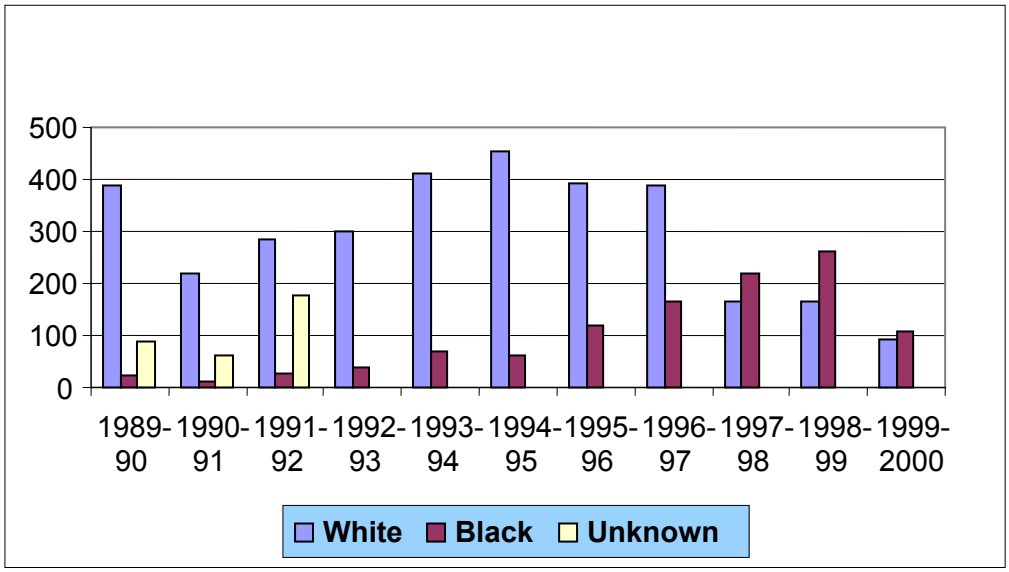
- Table 42 analyses the distribution of NRF-supported students by race/gender category, and qualification level (masters or doctorate).
- At the masters level a substantive decline was evident among white male grant holders from 42% of masters students in 1996 to 26% in 2001. This constituted a negative change of 16%.
- Correspondingly, a large increase in African female grantholders occurred from 6% of masters students in 1996 to 15% in 2001, constituting a positive change of 9%.
- At the doctoral level, support for white male students declined from 54% of doctoral students in 1996 to 32% in 2001 – a negative change of 22%.
- A corresponding increase in support for African male students was evident from 7% of doctoral students in 1996 to 19% in 2001 – a positive change of 12%.

4.1.3 Patterns of NRF funding allocations for postgraduate study

Another study of NRF funding recipients (Koen 2001) corroborated the fact that the distribution of NRF scholarship awards is heavily weighted in favour of university students, who received close to 96% of all awards for the period 1993/94 to 1998/99 with just 4% made to technikon students. Only 45 awards were made to technikon students for honours-level study, 43 at masters level and 15 at doctoral level in 1998/99, compared to more than 1 000 awards at all three levels to university students in 1998/99. Since almost all applicants from technikons were successful, it is clear that very few applications are being received from technikons.

Awards to black students have increased sharply since 1989. In 1989/90, 387 awards were made to white applicants for full-time masters degrees and only 25 to black applicants. In 1992/3, 301 awards were made to white applicants and 40 to black applicants. In 1996/7, whites received 390 but only 165 in 1997/8. By contrast, the number of awards to blacks increased from 167 in 1996/7 to 220 in 1997/8, and up to 260 in 1998/9.

Figure 26: NRF scholarship awards for full-time masters study by race, 1989-2000



Source: NRF (2000c).

The overall decline in NRF scholarship awards evident in Figure 27 is principally the result of changes in the award categories and values. These are set out in Table 43 below. This resulted in the award of fewer scholarships of greater value. In addition the advent of other new grant categories, such as the supervisor scholarship award, resulted in the redistribution of resources from the old categories to new ones.

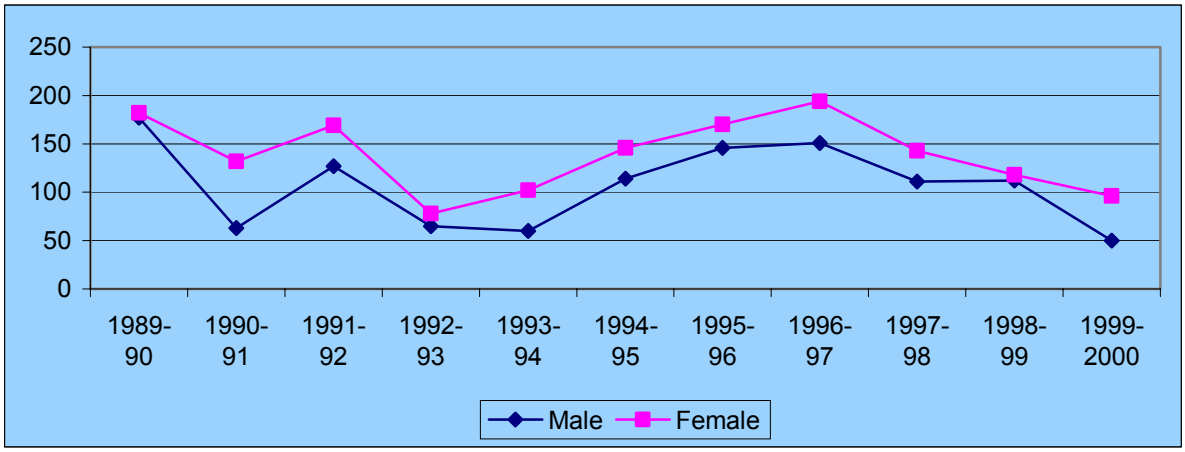
Table 43: Type and value of NRF scholarship grants past and current

Type	Past value	Value from 2001
Honours degree (full-time)	R 6 000 pa	R 8 000 pa
Masters degree (full-time)	R 9 000 pa	R 14 000 pa
Masters degree (part-time)	R 5 000 pa	R 6 000 pa
Honours/Masters Package (3 years continuous)		
Masters/Doctoral Package (5 years continuous)		
Doctors degree (full-time)	R13 000 pa	
Doctors degree (part-time)	R 6 000 pa	
Prestigious and Equity Scholarships for Masters study		R 33 000 pa
Prestigious and Equity Scholarships for Doctoral study		R 50 000 pa

Source: NRF (2000d).

As can be seen from Figure 27, the distribution of part-time masters awards by gender showed greater equity. This may partly be due to the fact that women students choose part-time study to accommodate domestic responsibilities. White females receiving substantially more awards for part-time study than whites males over the period from 1989/90 to 1999/2000, with the result that females constituted the majority of part-time masters scholarship recipients throughout the 1990s (1 430 compared to 1 076 awards made to males over this period).

Figure 27: NRF scholarship masters by dissertation part-time recipients by gender, 1989 - 2000



Source: NRF (2000c).

NRF records (NRF, 2000a) show that few students receive allocations for full-time study at the doctoral level. In 1999/2000, 67 (30%) university students received allocations for full-time doctoral studies (mainly African males and white females) as opposed to 155 (70%) university students who received funding for part-time studies.

4.2 The Medical Research Council

Apart from the NRF, the Medical Research Council (MRC) is the second largest funding agency of academic research and scholarship in the country. The agency function of the MRC, as this science council's name implies, is restricted to research support in the health and medical sciences. There are basically two ways in which the MRC finances research. The first is through its university and technikon-based research programmes, which involve joint undertakings between the MRC and HE institutions in the form of centres, units or

groups that are organised around prominent scholars. The university and technikon-based research programmes also allow for self-initiated research projects. Although self-initiated research is an important component of MRC funding, it will not be presented here as no data was received from the MRC in this regard.

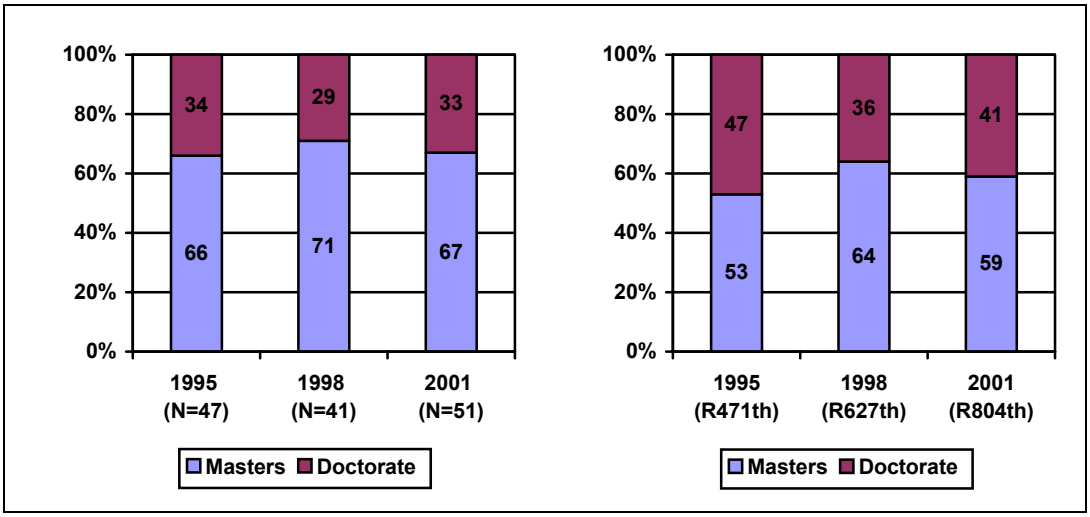
The MRC did provide data on bursaries and scholarships. The latter constitutes its second leg of research support to universities and technikons, but is not restricted to the HE sector[12]. This mode of support is concerned mostly with research capacity building, as it involves funding to postgraduate students and post-doctoral scholars, as well as various groups of researchers in training (Table 44).

Table 44: MRC support for postgraduate students and researchers in training by programme type, 1995, 1998 & 2001

Programme type	1995		1998		2001	
	No.	%	No.	%	No.	%
Local masters and doctoral scholarships	47	100%	41%	56%	51	47%
Local post-doctoral scholarships			1%	1%	9	8%
Overseas doctoral and post-doctoral scholarships			4%	6%	7	6%
Post-intern and post-BCHD scholarships			7%	10%	9	8%
Research training internship programme			17%	23%	20	18%
Allied health prof. research training scholarships					7	6%
Senior research training fellowships			3%	4%	6	6%
Total	47	100%	73%	100%	109	100%

This section of the report focuses on the MRC's local masters and doctoral scholarship programme, as this was the only programme type for which data were available for all three years under review.

Figure 28: MRC scholarships for local M&D and their monetary value by qualification level, 1995, 1998 & 2001



- Figure 28 shows that throughout the period under review, the majority of MRC scholarships (66%-71%) were allocated to masters students.

[12] For instance, research trainees within the research training internship programme are appointed as MRC employees.

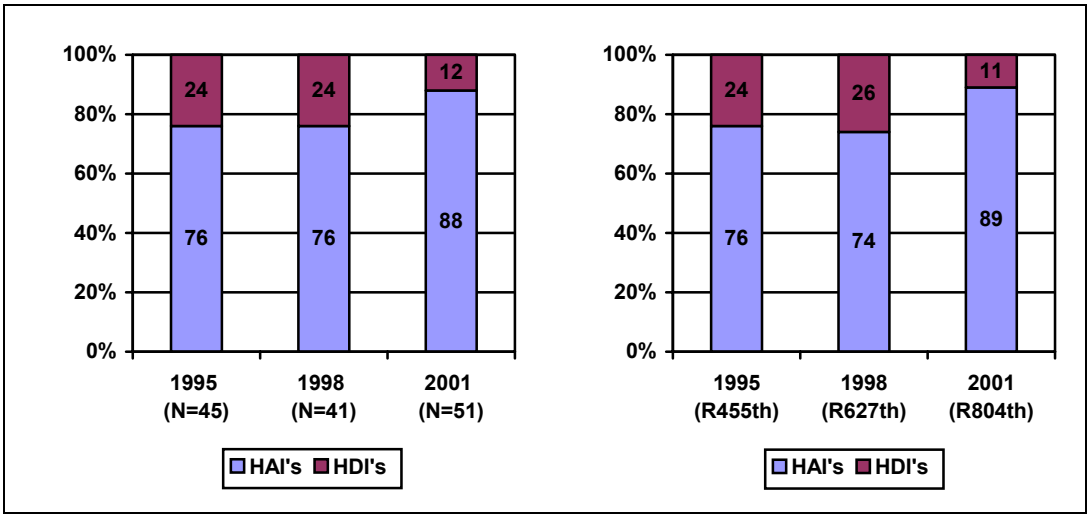
- Masters students' share of funding, however, was markedly less than their share of scholarships[13]. In 2001, they received 67% of MRC scholarships but only 59% of funding. The obvious explanation is that the average Rand value of masters scholarships is significantly lower than that of doctoral scholarships, as can be seen in Table 45 below.

Table 45: Average value of MRC scholarships by qualification level, 1995, 1998 & 2001

Level	Year	Number of scholarships	Total amount (R)	Average funding per scholarship (R)
Masters	1995	31	248 000	8 000
	1998	29	404 300	13 941
	2001	34	476 650	14 019
Doctoral	1995	16	222 500	13 906
	1998	12	222 900	18 575
	2001	17	327 600	19 271

Note: the total amount of MRC funding for masters and doctoral scholarship presented here is less than that presented in Table 46 below which amounts to R1,6 million for 2003.

Figure 29: MRC scholarships for local M&D and their monetary value by historical institutional type, 1995, 1998 & 2001



- The analysis of MRC scholarship by historical institutional type reveals that the majority of masters and doctoral scholarships (almost 90% in 2001) was received by students at HAIs (Figure 29). This also applies to the distribution of funding.

[13] In this regard, it should be noted that fewer health professionals pursue doctoral studies than in other fields.

Figure 30: MRC scholarships for local M&D and their monetary value by gender, 1998 & 2001

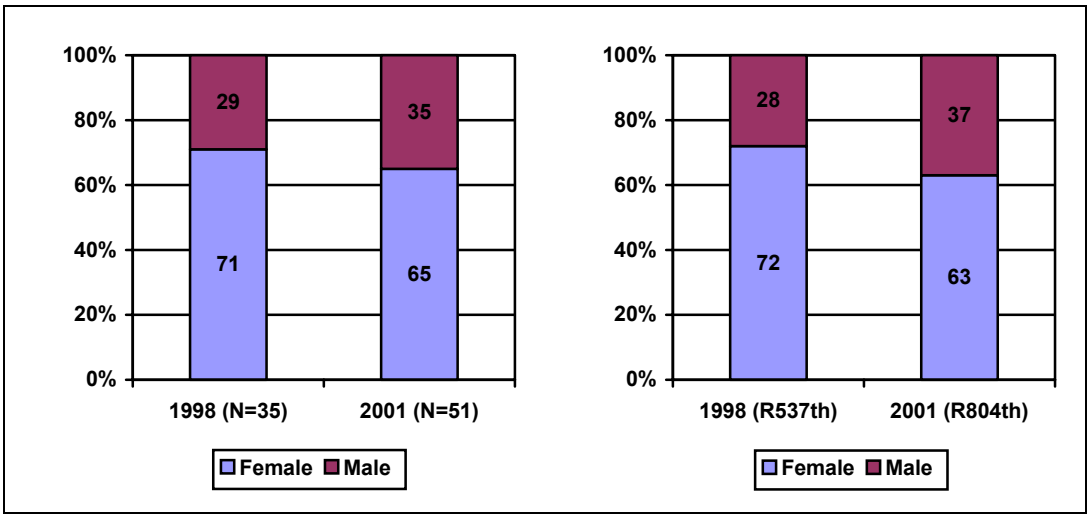
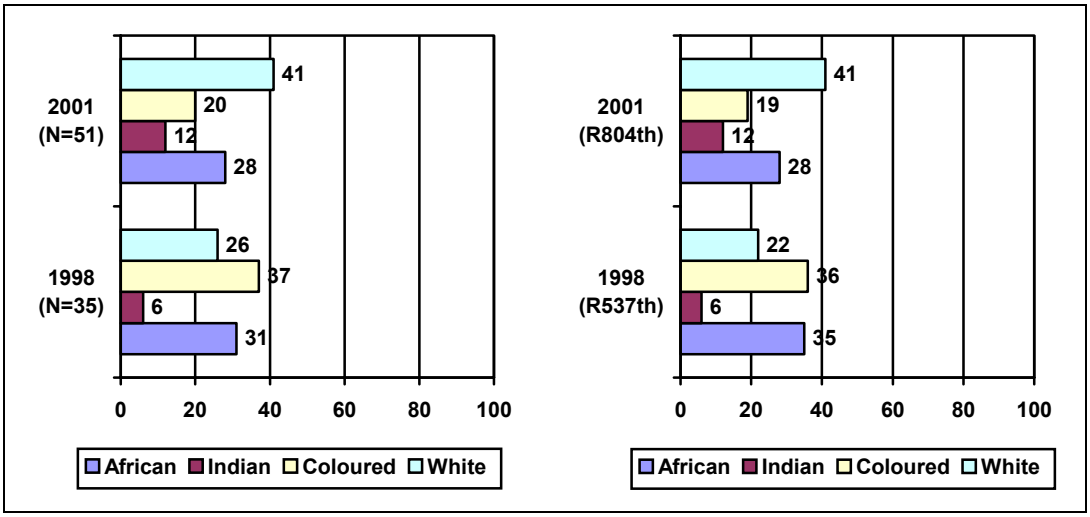


Figure 31: MRC scholarships for local M&D and their monetary value by race, 1998 & 2001



- The analyses by gender and race are not without problems as the MRC dataset contains demographic information for only two scholars in 1995. Hence, the gender and race comparisons presented here in Figure 30 and Figure 31 are based on data for 1998 and 2001 only.
- Figure 30 and Figure 31 show that although male M&D scholars received a larger share of bursaries and funding in both 1998 and 2001, the position of female scholars improved, with their share of funding increasing from 28% in 1998 to 37% in 2001.
- Over this period, white scholars received significantly more local M&D scholarships than (41% of scholarships in 2001 versus 26% in 1998), as well as a larger share of funding (41% of funding in 2001 versus 22% in 1998). Coloured scholars received significantly less funding over this period.

4.3 Other sources of postgraduate funding

An important element in profiling the postgraduate sector is the extent of other non-NRF funding for postgraduate studies. However, there is no known source of reliable and complete data on this at present. For the purposes of this report, an indication of postgraduate funding provide by selected non-NRF sources is presented. This is based on a snap survey of selected other research councils, parastatals, HE institutions, some government departments and other agencies conducted by the Centre for the Study of Higher Education as part of this study[14].

Among the private sector corporations, it is noteworthy that SACOB, Anglo Platinum, Gold Fields, Gensec, Transnet and PHP Billiton no longer offer postgraduate funding. Some of these organisations focus on research funding. The Chamber of Mines also no longer provides direct funding for postgraduate education and now supports an organisation called Careerwise. Denel is currently finalizing a plan to offer postgraduate funding next year. Telkom and Natal University were not willing to provide data for confidentiality reasons. De Beers provides scholarships only to students who received undergraduate funding from the company and whose topics are relevant to the company.

While the amounts presented may not be reliable and represent only part of non-NRF funding sources, they indicate that substantial postgraduate funding is available from other sources. Table 46 shows that these sources for which data were available provided just over R207 million a year, with Eskom alone making R120 million available. Significantly, the Department of Labour allocates just under R20 million per annum to postgraduate funding. Anecdotally, it appears that many smaller private companies offer employees funding for both undergraduate and postgraduate study on condition that recipients commit themselves to the company at least for a period equivalent to the period of their studies.

The snap survey showed that many organisations and institutions approached for information found it difficult to produce accurate and up-to-date figures on their postgraduate funding. In some cases, no central office exists with the result that such funding appears to be largely unco-ordinated. Inquiries were often referred from the proverbial 'pillar to post' within some organisations.

In order to provide a more accurate future picture of the postgraduate sector and its funding, it will be important to undertake a more systematic survey of the extent and types of postgraduate and to track trends and changes longitudinally. As part of this, all possible sources could be identified. There are indications that municipal authorities, development assistance and other donors agencies provide substantial funding. Another important aspect of future research on this would be the development of a workable typology of the different kinds of postgraduate funding in order to provide an aggregated overview.

[14] It should be carefully noted that the data presented here represent only those non-NRF sources who responded to the request for data by the time of writing. The data shown are based on what was supplied by the organizations and institutions concerned and have *not* been further verified. Information was obtained on the total amount of postgraduate funding and the level of qualification (honours, masters, doctoral and post-doctoral). It was not possible at short notice to obtain data on field of study and distribution by gender and race. This would be an important element of future research on this topic. The categories of funding (scholarships, bursaries, etc) were not uniform among the various sources and could not therefore be aggregated. Most of the data relate to the year 2003, although there cannot be certainty about this. In particular, a possible duplication in the amounts presented here might arise from the fact that scholarship or bursary funding by companies is also listed by HE institutions as an external funding source. It should also be noted that some of the figures relate to post-doctoral fellowships. For these reasons, the data presented here should be regarded as indicative.

Table 46: Selected sources of non-NRF funding for postgraduate studies

Source	Type	Amount	Total
Eskom	PG Studies (university)	45 000 000	120 000 000
	MSc Programme for black engineers	4 000 000	
	CEO Programme MSc in Engineering Management for Women	15 000 000	
	Fulltime M and D in Robotics and Nuclear Programmes	5 000 000	
	Masters and doctorates (technikons)	35 000 000	
	Employees (postgraduate studies)	16 000 000	
UDW	Council Scholarships	220 000	960 000
	Graduate assistantships	740 000	
Rhodes	Bursaries	161 685	6 197 344
	Loans	229 000	
	Scholarships	5 806 659	
University of Cape Town	Departmental scholarships	11 794 667	21 628 470
	Research associateships	416 000	
	Research scholarships: local and international	1 379 100	
	General scholarships	5 616 203	
	Health Sciences scholarships	457 500	
	Scholarships for inter-study	1 965 000	
University of the Witwatersrand	Honours scholarships	73 000	12 106 091
	Master scholarships	180 725	
	PhD	543 500	
	Merit awards	11 308 866	
Sasol	Bursaries	1 800 000	4 200 000
	Scholarships	2 400 000	
Medunsa	University assistance (tuition waiver)	2 000 000	2 000 000
Technikon Pretoria	M Tech	924 210	1 281 090
	D Tech	356 880	
University of the Free State	Academic merit bursaries	830 000	7 891 986
	PHD awards (only masters with distinction)	530 000	
	Postgraduate awards based on excellent UG results 2002	6 531 986	
Mintek	Masters	421 200	662 400
	PHD	241 200	
Medical Research Council	Masters	925 000	1 660 000
	PhD	735 000	
Port Elizabeth Technikon	Bursary allocations by Technikon to 44 Masters and 31 PHD	750 000	750 000
Potchefstroom University	Honours	2 062 368	6 725 118
	Masters	1 938 000	
	Doctoral	1 212 500	
	Post-doctoral	221 230	
	Merit bursary	1 074 020	
	Distinction bursary	217 000	
Claude Harris Leon Foundation	Postdoctoral fellowships	1 890 000	1 890 000
DoL Scarce Skills Scholarships	Doctoral	3 598 000	19 220 000
	Masters	7 054 000	
	Honours	8 568 000	
Total			**207 172 499**

Source: Survey of sources conducted by the Centre for the Study of Higher Education, 2003.

4.4 National Student Financial Aid Scheme (NSFAS)

The National Student Financial Aid Scheme, the principal government and donor funded strategy to increase participation in and access to HE, does not provide financial support for postgraduates. The assumption underlying this policy is that postgraduates are regarded as part of institutions' research capacity which makes them worthy of institutional support. In addition, the National Research Foundation is seen to be the main government-supported form of funding for postgraduate research-based studies.

For the purposes of this report, however, it is important to recognised the important role of NSFAS as expanding financial support for increasing numbers of financially needy previously disadvantaged undergraduate students. This, in turn, provides the foundation for a larger and more equitable future postgraduate subsector. For this reason, some comments on the extent and distribution of NSFAS awards are made here.

Between 1991 and 2002, the scheme has assisted over 263 000 students with more than 580 000 separate awards of loans (40% of which can be converted into bursaries). These awards were worth approximately R3 billion and were funded mainly from the fiscus. A total of 457 748 Africans (93% of all recipients) have received assistance over this period, 18 552 Coloureds (4%), 9 633 Indians (2%) and 5 876 whites (1%). The principal fields of study of recipients were Business and Commerce (38%), Arts (16%), Engineering and Information Systems (12%), Science and Computer Science (12%). Loan recovery to the end of 2001 amounted to about R355 million.

According to a current review of NSFAS, key areas of the scheme are being reconsidered, including the eligibility criteria and the targeting of priority fields and levels.

5. The higher education system: Research capacity and productivity

5.1 Introduction

This section of the report presents an overview of the research capacity of the HE system in terms of research output, research productivity and the academic staff of HE institutions.

Research output, as defined by the number of peer reviewed scientific publications per academic institution, is generally accepted as an indicator of the research capacity and knowledge base within the HE system in South Africa. A measure of scientific productivity is derived by dividing the number of publications in any institution by its academic staff complement to produce an output per staff ratio.

Some initial comment is warranted about the relationship between scientific output and scientific productivity. In considering HE publications, the focus often falls exclusively on the extent of scientific output – in other words, the quantity of research produced. However, it is also important to consider the notion of scientific productivity, which incorporates the size of the pool of knowledge producers – in other words, how much is being produced by individual academics and the institutions in which they are located.

As will be apparent in the analysis which follows, discrepancies can arise between an institution's output and productivity. This was especially the case with the University of Pretoria, which had the highest output in 2001 but did not rank among the first six universities with regard to productivity. In the South Africa context, as has been noted throughout, the two key policy imperatives regarding research output relate to development and equity: research must contribute effectively to national development priorities and the opportunities and capacities to conduct research must be equitably distributed. This is particularly important given the historical institutional imbalances inherited from apartheid.

For these reasons, it is important to reflect on the relationship between individual and institutional output and productivity and, in particular, the conditions under which scientific productivity can be expected to be highest. A high outcome on scientific productivity can be expected when:

1. Research publications are more or less evenly produced by all academic staff at an institution; and/or
2. An institution has an established component of high-calibre scientists, and/or a number of research units of good standing, with sufficient levels of output to compensate for the lack of publishing activities among the rest of the academic staff.

It is reasonable to assume that for most HE institutions with an established research culture, the second condition best summarises current practice. The existence of these two conditions for optimal scientific productivity raises an important question as to best strategies to be adopted to strengthen scientific productivity. Should the shift be towards attracting and encouraging all (or at least the majority of) academics to scientific publishing (option 1), or should the approach be more selective, i.e. concentrating on academics with the greatest publishing potential (option 2)? The first favours equity, the second the development priority.

The first would imply greater investments in general research capacity building initiatives, together with strong (financial) incentives for research. The latter would mean channelling research and project funds primarily to established researchers with good publication records. Since established researchers attract large numbers of postgraduate students, one would argue that the selective approach has the added advantage of indirectly building research capacity among masters and doctoral graduates, who, as we have seen, are the ones who primarily contribute to publication activities. Given the need for expanding the reservoir of research expertise and given the imperatives of equity, the answer to this ongoing conundrum (which, as indicated, is at the heart of the equity-development tension) lies in simultaneously favouring established researchers while continuing to encourage and to provide supportive opportunities for a wider pool of academics to publish and conduct research. The correlation between higher qualifications and publishing also shows that there should be some direct investment in graduates completing their doctorates. Our publication output will increase automatically if we have more doctorates in the system.

Given that only institutional level data are available, scientific productivity can only be approached in the context of this report with the institution as the unit of analysis. Scientific productivity was therefore defined above as the ratio of SAPSE publications to the number of academic staff at any institution.

In charting a mediating strategy between the general and selective approach, it is important to recognise that the relationship between HE research and teaching is a complex one (see EPU, 1997 for a full discussion of these issues). Ideally, new research should inform teaching practices. Correspondingly, teaching should serve as a primary means of transmitting insights gained by research. While research output remains the cornerstone of academic assessment and reward, not all academic staff are (or should be expected to be) oriented equally towards conducting independent research. Some will (rightly) see their primary identity and role as teachers or managers/administrators. This is especially so in HDIs where research opportunities and time are reduced by the need to offset the underpreparedness of students from widespread poor schooling backgrounds through intensive formal and informal academic development efforts. The 1997 EPU study found that many academics are sincerely dedicated to teaching and mentoring students and construct their primary identity and role in these terms. In addition, in the life of the individual academic, research activities often follow cyclical patterns, with periods of more focused research activities and periods of none. However, even in these cases, teaching and other academic activities should nonetheless be supported by ongoing scholarship. In addition, the link between teaching and research can be bridged through encouraging academics who prioritise their teaching function to conduct research related to their teaching and learning activities. Research opportunities and time are also constrained the pressures and burdens arising from the current multiple HE policy transformation initiatives and encroaching managerialism. Academics perceive increasing bureaucratic inroads into academic life as a result.

For these reasons, taking the institution as the unit of analysis in measuring scientific productivity should be approached cautiously. This having been said, it is equally important to note that the distribution of research capacity and opportunity remains highly uneven. As a result, the prospects for many academics who would like to increase their output continue to be inhibited by the complex pattern of institutional dynamics and socialisation into the academic profession, which are embedded in the cultures of particular institutions, and which are overdetermined by broader social forces related to the interface of race, gender, class, age and locality.

In the light of these considerations, the pattern of some academic staff members being more productive in research than others is not surprising and will persist. From Table 48 below, it is apparent that even in the most productive institutions, the average number of SAPSE publication units per academic staff member is under one per year. This is by no means exclusively a South African phenomenon.

The appropriateness of the measure of scientific productivity adopted here also bears comment. Overall output is related to the number of academic staff, which in the SAPSE system is defined as both instructional and research professionals. Ideally, to gain another indication of productivity, it would be preferable to factor out instructional activities and to allow only for research activities. For this purpose, FTE research staff figures would be needed, but these are currently unavailable, they have been collected as part of the 2001/2002 R&D Survey exercise and will only be available in 2004. Also, the previous R&D Survey of 1997/98 provides no breakdown of FTE staff by individual institution in the HE sector. Suffice to say that in this report, the measure of scientific productivity indicates the number of research output by the *potential pool* of knowledge producers.

Two data sources were used to examine trends in scientific publications at South African universities and technikons. The first, the South African Post-Secondary Education (SAPSE) database, contains all publication units[15] recognised for subsidy purposes by the Department of Education. The vast majority of units in SAPSE are scientific articles that have been published in accredited journals, but it also contains a small component of books and refereed reports (about 5% of total). The SAPSE data, although informative in its breakdown of publication units by HE institution, gives no breakdown in terms of author demographics such as gender, race, age, highest qualification obtained and scientific discipline. The latter is necessary within the context of policy inputs for skills development and equity and transformation concerns.

To address the need for author-specific information, and to cover all public sector scientific publications (i.e. not only publications by HE institutions but also those by science councils, national research facilities and government), the Centre for Interdisciplinary Studies (CENIS) – since renamed the Centre for Research on Science and Technology (CREST) – embarked on a long-term database project, known as SA Knowledgebase in 1999. This project aims to generate a comprehensive information system of South African science. It covers all known South African articles published in SAPSE accredited journals and in journals recognised by the Institute for Scientific Information (ISI). The database currently[16] contains information on about 82 000 articles by South African authors between 1990 and 2001, of which 55 000 (or 67%) are linked to an institution (HE and other). Moreover, about 45 000 articles (i.e. 55% of the total SA Knowledgebase and 82% of articles with a known institutional affiliation) are linked to the HE sector in specific.

This section of the report is organised as follows. First, an overview of scientific output in the HE sector with reference to the SAPSE data is presented. Thereafter, scientific productivity is discussed, drawing on SAPSE figures by academic staff complements. Then a breakdown of publication units in terms of demographic data is provided in order to track equity trends, drawing from data extracted from SA Knowledgebase. Thereafter, a profile of academic staff in South Africa's HE institutions is provided and the issue of postgraduate

[15] "Publication units" refer to fractional counts used to account for multiple authorship, e.g. if an article has two authors, each author is granted 0.5 publication units.
[16] As on 7 July 2003.

involvement in research is briefly examined. Finally, some key policy issue and implications relevant to the research capacity of the HE system are briefly discussed. These include: research capacity development, the quality and quantity of research outputs, research management and research focus.

5.2 Overview of scientific output in the higher education sector

5.2.1 Scientific output by universities and technikons

Table 47 presents the scientific output of individual universities and technikons in terms of their SAPSE research publications units for 1995, 1998 and 2001.

Table 47: SAPSE research output for individual universities and technikons, 1995, 1998 & 2001

SECTOR	1995	1998	2001
Universities	5438.17	5029.10	5310.70
Pretoria	749.92	754.68	882.21
Witwatersrand	788.79	656.02	709.52
Cape Town	702.32	601.07	652.18
Stellenbosch	589.20	528.82	589.58
Natal	555.33	510.82	499.89
Unisa	406.57	315.76	333.93
Rand Afrikaans	316.40	306.94	310.95
Free State	298.15	265.80	293.42
Rhodes	174.56	211.74	210.16
Potchefstroom	171.41	155.61	186.69
Western Cape	144.21	133.77	157.98
Port Elizabeth	82.37	99.54	126.69
Durban-Westville	126.67	124.47	106.53
North	71.56	84.52	98.08
Vista	48.97	58.93	51.42
Zululand	45.07	55.88	43.37
Medunsa	52.26	38.33	31.00
Transkei	40.91	80.95	15.17
Venda	0.00	0.00	11.43
North-West	51.08	8.91	0.50
Fort Hare	22.42	36.54	0.00

Technikons	61.62	132.47	153.45
Pretoria	16.80	17.06	40.65
Port Elizabeth	6.92	17.99	21.54
Natal	7.21	17.90	20.12
ML Sultan	0.00	5.06	17.40
Cape	14.91	17.18	12.61
Vaal Triangle	0.00	3.00	8.94
Free State	7.22	14.68	8.49
Witwatersrand	1.00	15.17	7.40
Peninsula	2.50	8.65	7.30
Northern Gauteng	0.00	3.00	6.00
Eastern Cape	0.00	0.23	1.00
Mangosuthu	0.23	0.00	1.00
North-West	0.00	2.00	1.00
Border	0.00	0.00	0.00
South Africa	4.83	10.55	0.00
TOTAL HE	5499.79	5161.57	5464.15

- The universities' SAPSE output dropped from 5 438 publications units in 1995 to 5 029 in 1998 but rose again to 5 311 in 2001, which was however still below the 1995 level. Noteworthy is the fact that the nation's top ranking universities with regard to research output – with the exception of Pretoria and Rhodes but including the top two HDIs in this regard (UWC and UDW) – all experienced declines in output between 1995 and 1998. Most of these institutions subsequently increased output by 2001, with the exception of Natal, but in most cases did not reach their 1995 levels of output.
- The reasons for these fluctuations remain speculative and should be systematically investigated as part of future research in this area. In part, it may be the result of increases in consultancies, donor-funded and commissioned research, especially arising from HE-industry partnerships and linkages, which do not often produce academic publication outputs. Another reason is that some authors do not bother to report SAPSE publications output as the financial reward to individual authors is minimal in the case of some institutions. In comparison to lucrative commissioned and donor-funded research opportunities, it is simply not worth the effort to report and claim SAPSE publications subsidies. This is especially the case in multi-authored publications which are increasingly more prevalent, particularly in the natural and health sciences.
- HDUs, other than UWC and UDW, saw increases in output between 1995 and 1998, though from a low base, with most showing further increases between 1998 and 2001.
- The output of technikons more than doubled from 62 to 153, representing a 149% growth rate over this period. As a result, the contribution of technikons to the total SAPSE output increased from 1.1% in 1995 to 2.8% in 2001 (Figure 32). The faster growth rate for technikons can primarily be ascribed to significant increases in the number of scientific publications at four institutions (Table 47): three of them historically advantaged (Natal, Port Elizabeth and Pretoria) and one historically disadvantaged (ML Sultan).
- Among individual institutions, wide fluctuations were evident. For example, in 1995, Cape Technikon and Pretoria Technikon ranked highest in terms of research output, with outputs of 14.9 publication units at Cape Technikon and 16.8 at Pretoria Technikon. By 2001, however, SAPSE output for Cape Technikon had dropped to 12.6 publication units, whereas Pretoria Technikon still dominated the sector with a significant 40.7 units.
- Among the universities, only three institutions showed a consistent increase in the number of publications between 1995 and 2001, namely the Universities of the North,

Port Elizabeth and Pretoria (Table 47). Of these, the growth rate of the University of Port Elizabeth was highest: 53.8% growth between 1995 to 2001, as compared to 37.1% growth for the University of the North and 17.6% for the University of Pretoria.

- These overall trends meant that the research output of the HE system as a whole, as measured in SAPSE publications units, actually decreased over the last 6 years – from 5 499 to 5 464. Clearly, in order for the HE system to fulfil its purpose as the key contributor to the nation's scientific research output, the precise reasons for these trends will have to be identified and a range of effective strategic responses to them implemented.

Figure 32: Contribution of universities and technikons to total SAPSE research output, 1995, 1998 & 2001

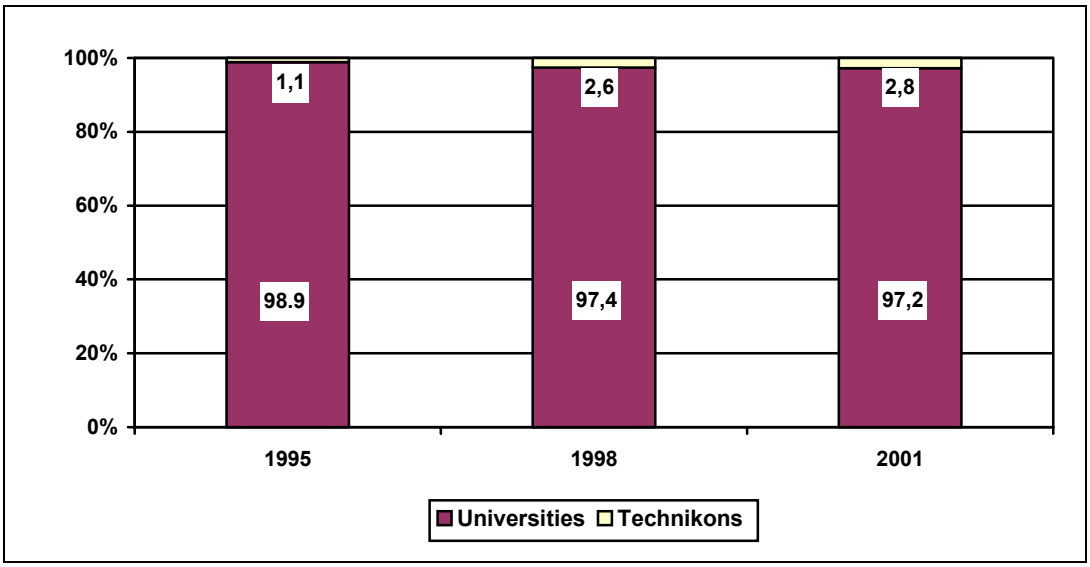
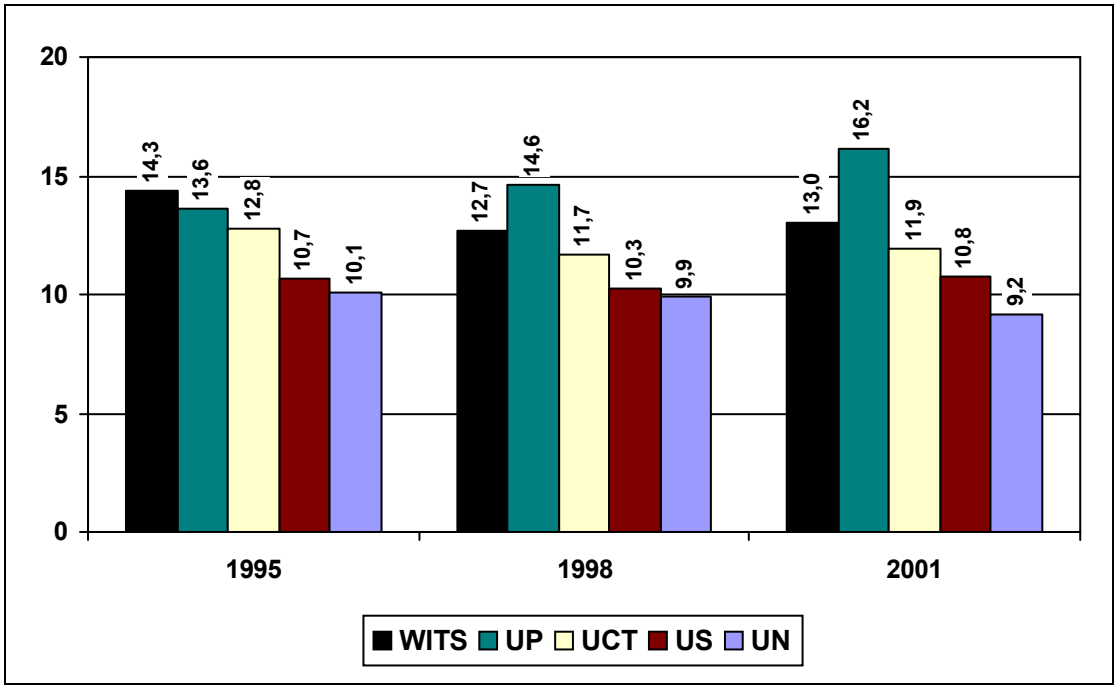
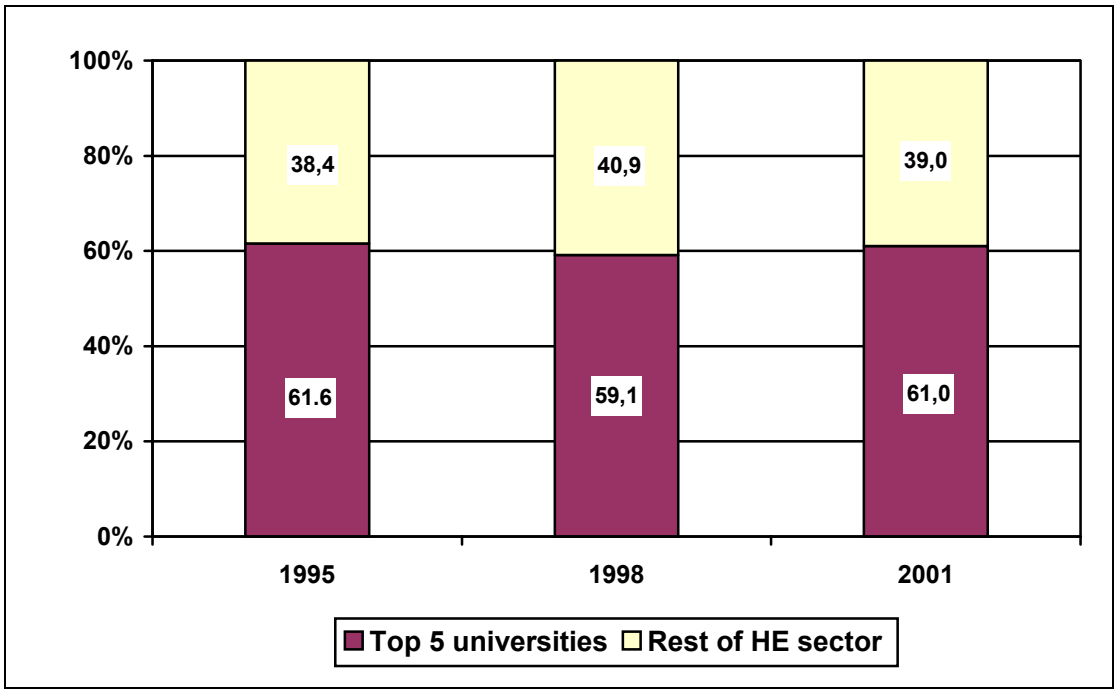


Figure 33: Contributions of the five most publishing universities to total SAPSE research output, 1995, 1998 & 2001



- Five universities dominate in terms of scientific output, as measured in terms of SAPSE publications units: the Universities of Cape Town, Natal, Pretoria, Stellenbosch and Witwatersrand (Figure 33). In 1995, Witwatersrand ranked highest with 14.3% of all SAPSE publications, and Pretoria a close second with 13.6%. In 2001 the order was reversed, with Pretoria accounting for 16.2% of all SAPSE publications and Witwatersrand for 13% and the order of the next three remaining the same.

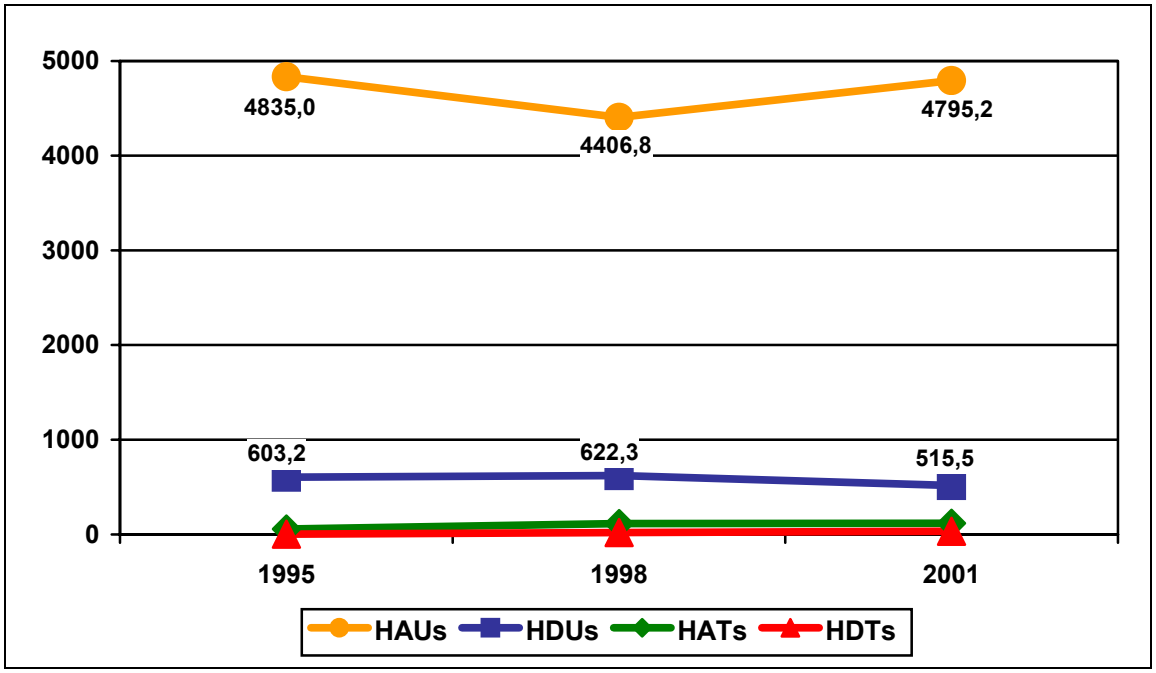
Figure 34: Combined contribution of the five highest publishing universities to total SAPSE research output, 1995, 1998 & 2001



- The concentration of research capacity in the five highest publishing universities is clearly evident from Figure 34. Just under two-thirds (that is between 59% and 62% across the three years under review) of the total SAPSE output was produced in the top five universities in this regard.

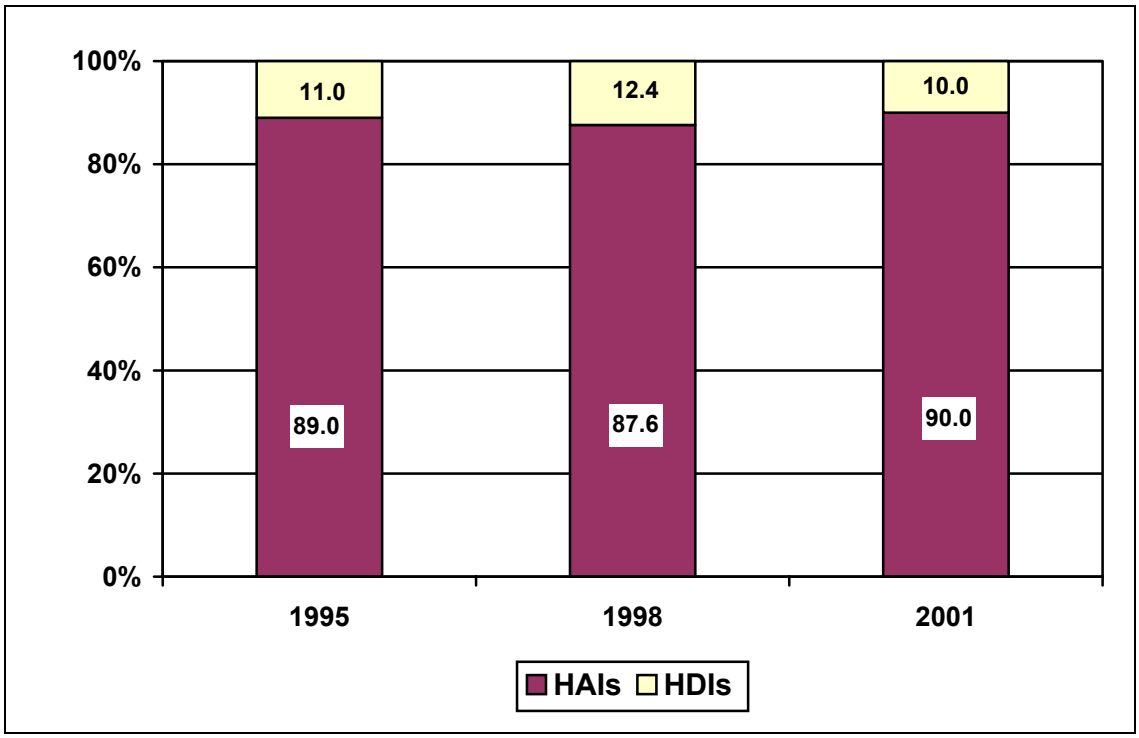
5.2.2 Scientific output by historically advantaged and historically disadvantaged institutions

Figure 35: SAPSE research output by historically institutional type, 1995, 1998 & 2001



- Figure 35 graphically illustrates the enormous gap in scientific output between HAUs and HDUs. In 1995, HAUs produced about 8 times the publications output of the HDUs.
- The gap in fact widened between 1998 and 2001. Output at HAUs increased from 4 407 to 4 795, whereas that of HDUs declined from 622 to 516. HDUs' contribution to the total number of scientific publications in the university sector varied between 11% for 1995, 12% for 1998 and 10% for 2001.
- The difference in SAPSE output between HATs and HDTs was almost negligible compared to that between HAUs and HDUs (Figure 35). The HAI/HDI distinction, as far as scientific output is concerned, is therefore a better descriptor of the university sector.
- Nonetheless, more scientific publications were produced by HATs than HDTs across the three year-points – from 58.9 and 2.7 publication units for HATs and HDTs in 1995, to 119.8 and 33.7 publication units for HATs and HDTs in 2001.
- Moreover, a consistent upward trend in scientific output for both HATs and HDTs is apparent. This growth is however much faster in the case of HDTs, as their contribution to the total scientific output in the technikon sector increased from 4% in 1995 to 22% in 2001. This signals a decline in the proportion of the HATs' contribution, from a dominant position in the technikon sector in 1995 to contributing just more than three-quarters of SAPSE output in 2001.

Figure 36: Contribution of HAIs and HDIs to total SAPSE research output, 1995, 1998 & 2001



- HDUs and HDTs, in combination, account for between 10% and 12% of all SAPSE output over for the period under review (Figure 36).

5.3 Overview of scientific productivity in the higher education system

5.3.1 Scientific productivity of universities and technikons

As already mentioned, while the extent of scientific output of HE institutions in terms of the absolute number of publication units is a vital element in HE's contribution to development, it is also important – especially in ranking institutions – to consider scientific productivity, that is controlling for the size of the institution's academic staff component. This is a particularly pertinent consideration given the differences in size, capacity, resources, infrastructure, location, historical function, programmatic mix and other key variables impacting on research output at the various institutions.

To provide a sense of institutional scientific productivity, Table 48 presents the number of academic staff per institution and a measure of institutional scientific productivity are provided in , as well as the number of SAPSE publications per academic staff member.

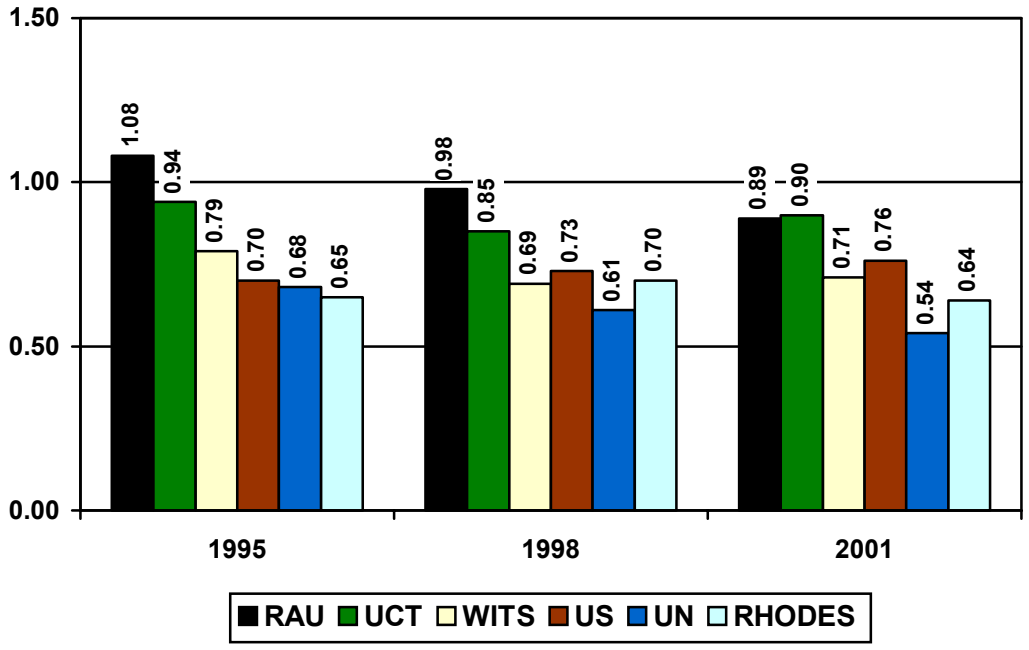
Table 48: SAPSE research output per academic staff member at universities and technikons, 1995, 1998 & 2001

SECTOR	Academic staff			Productivity: SAPSE output per staff		
	1995	1998	2001	1995	1998	2001
Universities	11 065	11 035	11 043	0.49	0.46	0.48
Cape Town	749	705	*727*	0.94	0.85	0.90
Rand Afrikaans	294	314	348	1.08	0.98	0.89
Stellenbosch	837	723	774	0.70	0.73	0.76
Witwatersrand	993	947	1000	0.79	0.69	0.71
Rhodes	267	304	330	0.65	0.70	0.64
Pretoria	1269	1381	1452	0.59	0.55	0.61
Natal	816	832	925	0.68	0.61	0.54
Port Elizabeth	241	236	242	0.34	0.42	0.52
Free State	581	534	578	0.51	0.50	0.51
Potchefstroom	457	479	481	0.38	0.32	0.39
Western Cape	457	413	406	0.32	0.32	0.39
South Africa	1225	1231	1066	0.33	0.26	0.31
Durban-Westville	421	412	367	0.30	0.30	0.29
Medunsa	296	192	164	0.18	0.20	0.19
North	491	558	*525*	0.15	0.15	0.19
Zululand	271	294	252	0.17	0.19	0.17
Vista	596	659	622	0.08	0.09	0.08
Transkei	213	*220*	226	0.19	0.37	0.07
Venda	203	240	269	0.00	0.00	0.04
Fort Hare	228	201	129	0.10	0.18	0.00
North-West	*160*	*160*	160	0.32	0.06	0.00
Technikons	3000	3449	3570	0.02	0.04	0.04
Port Elizabeth	232	249	267	0.03	0.07	0.08
Pretoria	434	433	496	0.04	0.04	0.08
Natal	251	302	302	0.03	0.06	0.07
Free State	115	142	142	0.06	0.10	0.06
ML Sultan	199	261	270	0.00	0.02	0.06
Cape	259	303	314	0.06	0.06	0.04
Peninsula	158	191	206	0.02	0.05	0.04
Northern Gauteng	154	240	210	0.00	0.01	0.03
Vaal Triangle	202	288	309	0.00	0.01	0.03
Mangosuthu	96	111	57	0.00	0.00	0.02
Witwatersrand	342	*369*	396	0.00	0.04	0.02
Eastern Cape	*126*	106	146	0.00	0.00	0.01
North-West	45	88	92	0.00	0.02	0.01
Border	*129*	105	152	0.00	0.00	0.00
South Africa	258	261	211	0.02	0.04	0.00
TOTAL HE	14065	14484	14613	0.39	0.36	0.37

Note. Staff figures in italics signify that the HEMIS database contains no data. In such cases a figure was estimated by averaging the figures for the remaining years.

- Table 48 shows that the technikon sector produced, on average, one publication for every 50 academic staff members in 1995 (1/50 = 0.02) and one for every 25 academics in 1998 & 2001 (1/25 = 0.04).
- The two most productive technikons in 2001 were Port Elizabeth and Pretoria, with about 1 publication for every 12 academic staff members (output/staff ratio = 0.08).
- Comparing scientific productivity (Table 48) with scientific output (Table 47) is revealing. As far as scientific output is concerned, the technikons of Pretoria, Port Elizabeth, Natal and ML Sultan recorded the largest output in 2001. But in terms of productivity, Free State Technikon was on a par with Natal and ML Sultan, with an output/staff ratio of 0.06 in 2001.
- In the university sector, the average output per academic staff member ranged between 0.46 and 0.49 over the three years under review. This translates into about one publication for every two academic staff members.
- Lastly, Table 48 shows a consistent, upward trend in scientific productivity for only two universities, namely Port Elizabeth (from 0.34 publications per academic staff member in 1995 to 0.42 in 1998 and 0.52 in 2001) and Stellenbosch (from 0.70 publications per academic staff member in 1995, to 0.73 in 1998 and 0.76 in 2001). As a result, the overall productivity of the HE system dropped from .49 in 1995 to .46 in 1998, after which it recovered to .48 2001, which however was still below the 1995 level. The reasons for these fluctuations and the lack of overall improvement in scientific productivity are not clear and should be investigated as part of future research.

Figure 37: Number of SAPSE publications per academic staff member at the six most productive universities, 1995, 1998 & 2001



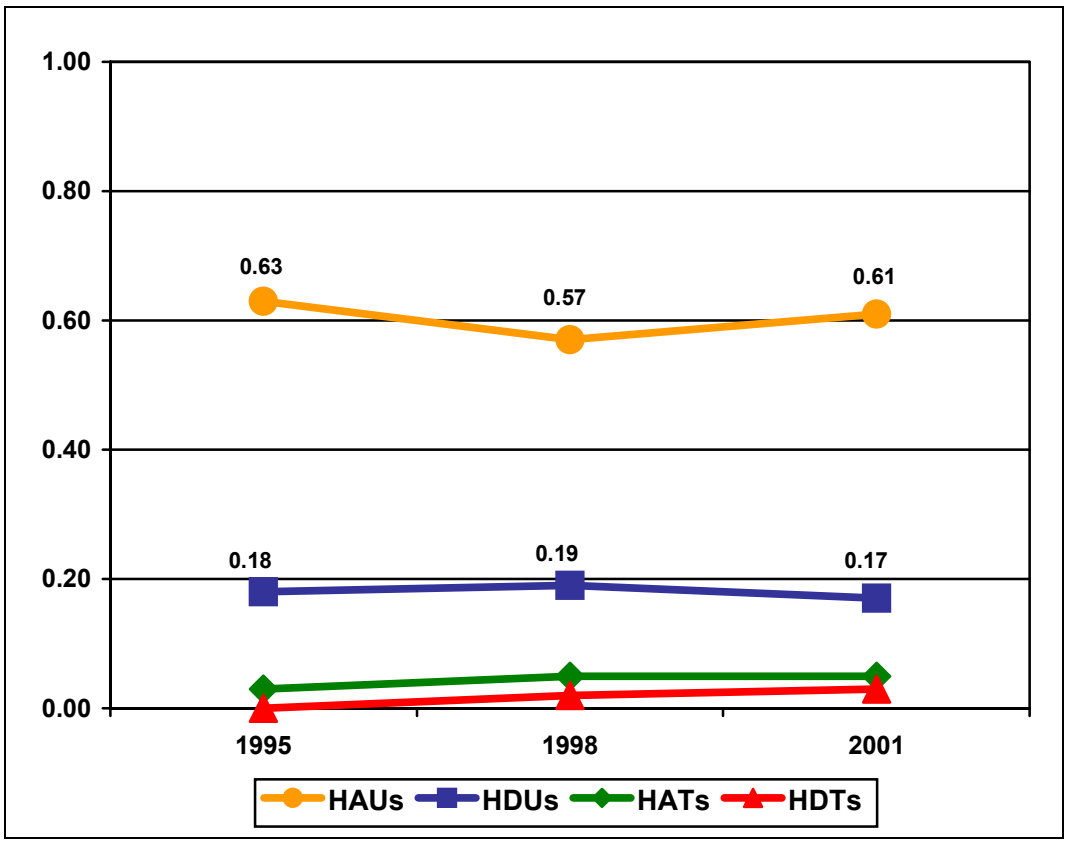
- As can be seen in Figure 37, RAU was the most productive in these terms in both 1995 and 1998 with close to one article per academic. However, while remaining very high, its productivity appears to be declining from 1.08 in 1995 to .098 in 1998 and to .89 in 2001. UCT attained the highest productivity in 2001 with .90 publications units per academic staff member. However, this was below its 1995 figure of .94. Whether RAU's scientific productivity was actually surpassed by that of UCT in 2001 may be questioned

as the UCT's academic staff component for 2001 presented in Table 48 is an estimate derived from the average for 1995 and 1998.

- Most striking about Figure 37 is that while the University of Pretoria ranked first in overall scientific output (Figure 33), it does not rank among the top six universities in the country with regard to scientific productivity. Smaller universities such as Rand Afrikaans and Rhodes emerge as amongst the most productive. Rhodes, as can be seen, outperformed the University of Natal in both 1998 and 2001 in this regard.

5.3.2 Scientific productivity of historically advantaged and historically disadvantaged institutions

Figure 38: Number of SAPSE publications per academic staff member by historical institutional type, 1995, 1998 & 2001



- Figure 38 shows that, as was the case with scientific output, differences between the HATs and HDTs with regard to scientific productivity are not significant. The HATs reported .05 articles per academic staff in 1998 and 2001, and the HDTs .03 articles per academic staff in 2001.
- However, the difference in scientific productivity is significant between the historical institutional types within the university sector. The HAUs reported on average around .6 articles per academic staff, compared to just under .2 articles per 100 academic staff for HDUs (Figure 38).

5.4 Disaggregation of scientific output by author and publication demographics

5.4.1 Methodological considerations concerning SA Knowledgebase

Although SA Knowledgebase contains roughly equal number of records of publication units for 1995, 1998 and 2001 (7 082, 6 600 and 6 877 – Table 49), it was decided for the purposes of this report not to use data for 2001 but to report on figures for 2000 instead. The reason is that fewer of the 2001 records provide details of the number of articles by institution and by author demographics. For instance, in 1995 and 1998 about 41-42% of articles in SA Knowledgebase can be disaggregated by HE institution and gender[17]. The corresponding percentages for 2000 and 2001 are 37% and 21%, making the data for 2000 more comprehensive than the 2001 data. The same argument applies to the rest of the demographic variables, i.e. race, age, qualification and discipline, as is apparent from Table 49.

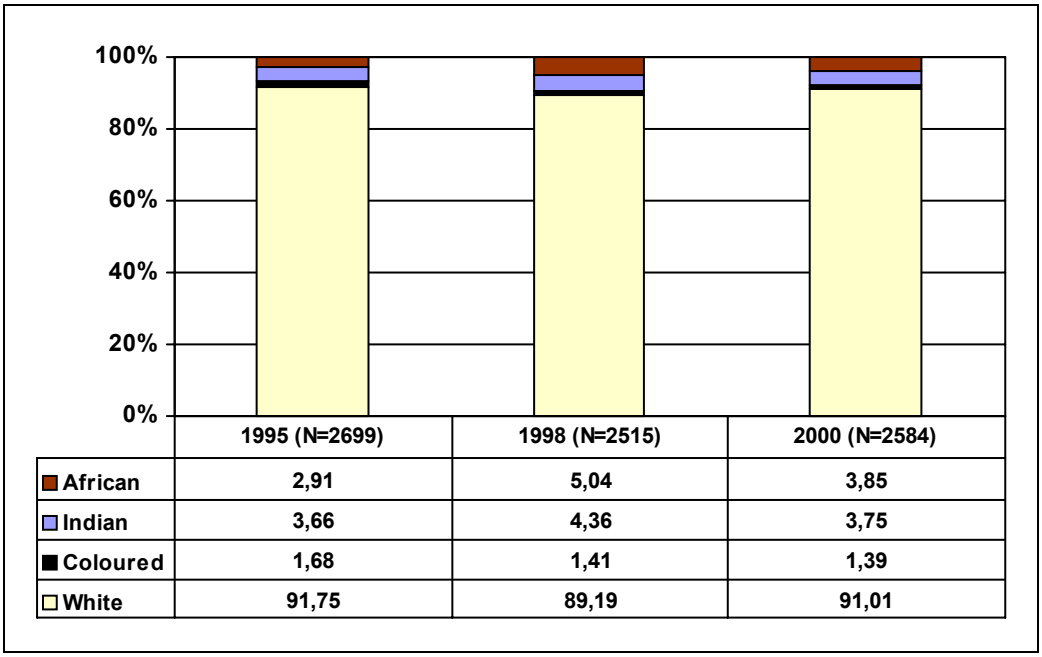
Table 49: Publications in SA Knowledgebase by subsets of known demographic variables, 1995, 1998, 2000 & 2001

	Number of publication units and % of total in SA Knowledgebase			
	1995	1998	2000	2001
Total number of publication units in SA Knowledgebase	7082 100%	6600 100%	7445 100%	6877 100%
Subset 1: Institution and gender of author known	2940.07 41.5%	2710.73 41.1%	2745.17 36.9%	1430.12 20.8%
Subset 2: Institution and race of author known	2698.65 38.1%	2515.36 38.1%	2584.47 34.7%	1367.99 19.9%
Subset 3: Institution and age of author known	2504.74 35.4%	2255.31 34.2%	2269.18 30.5%	1208.20 17.6%
Subset 4: Institution and highest qualification of author known	2671.69 37.7%	2386.87 36.2%	2445.11 32.8%	1268.94 18.5%
Subset 5: Institution and discipline of journal known	4389.53 62.0%	3946.98 59.8%	3627.06 48.7%	1855.43 27.0%

[17] The remaining 58-59% represent cases where either the institution or the gender of the author is unknown, or both, or where the author is employed outside the higher education system (e.g. in the science councils or government).

5.4.2 Scientific output by race

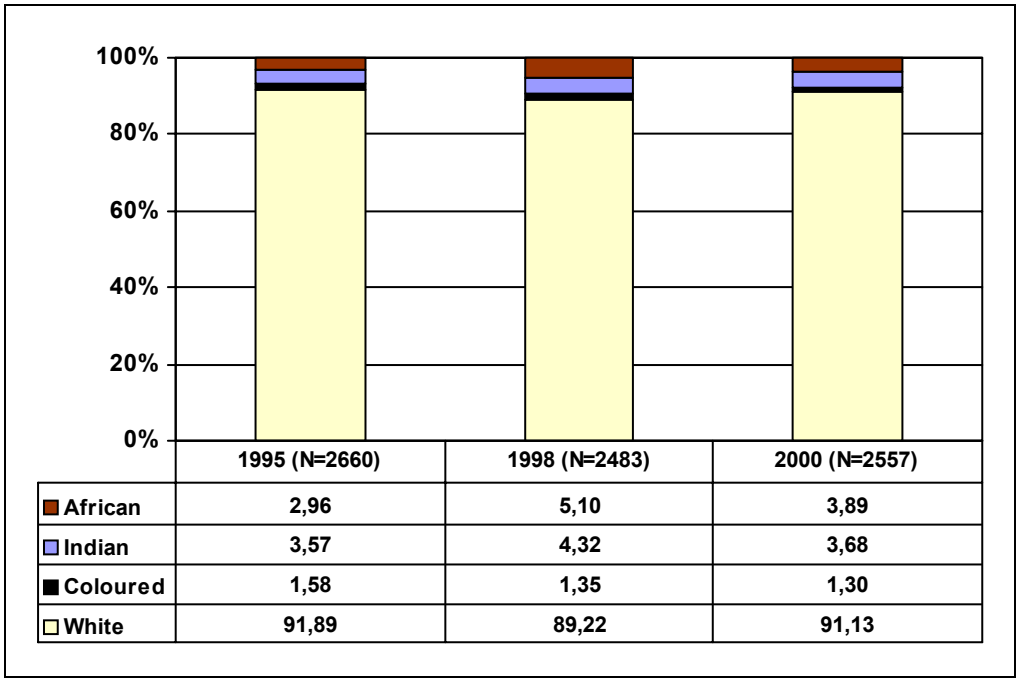
Figure 39: Distribution of HE publications by race, 1995, 1998 & 2000



	1995 (N=2699)	1998 (N=2515)	2000 (N=2584)
African	2,91	5,04	3,85
Indian	3,66	4,36	3,75
Coloured	1,68	1,41	1,39
White	91,75	89,19	91,01

- Figure 39 shows that about 89-92% of articles in SA Knowledgebase, for which both institution and race are known, can be attributed to white authors.

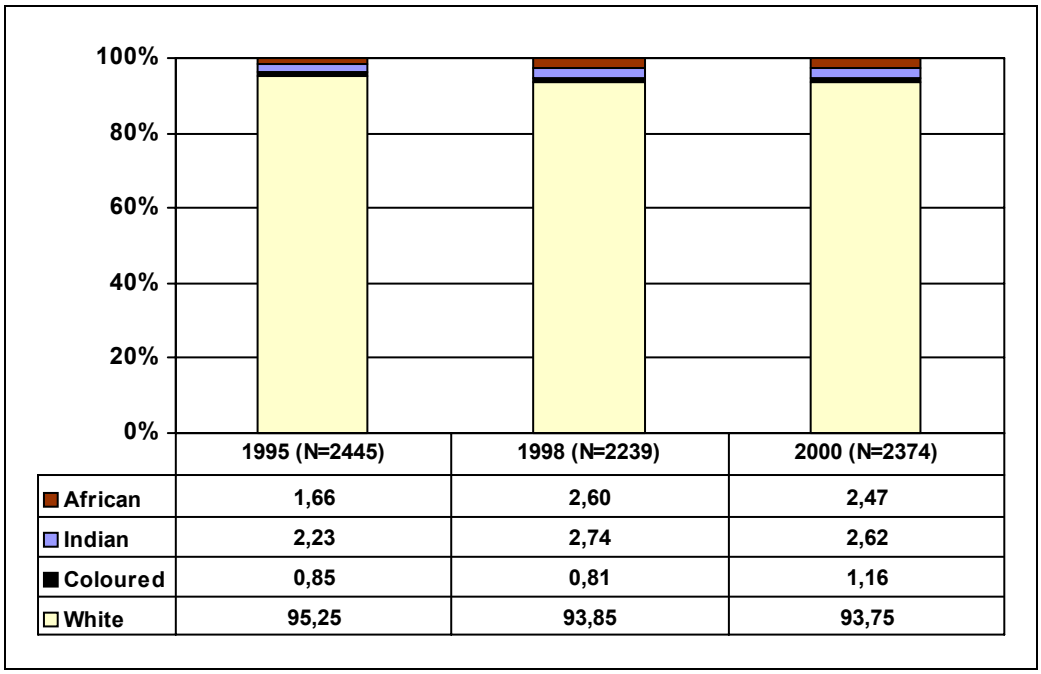
Figure 40: Distribution of university publications by race, 1995, 1998 & 2000



	1995 (N=2660)	1998 (N=2483)	2000 (N=2557)
African	2,96	5,10	3,89
Indian	3,57	4,32	3,68
Coloured	1,58	1,35	1,30
White	91,89	89,22	91,13

- The distribution of scientific output by race in the universities (Figure 40) was very similar to that of the overall HE system (Figure 39), as universities accounted for the vast majority of scientific output in the HE sector.

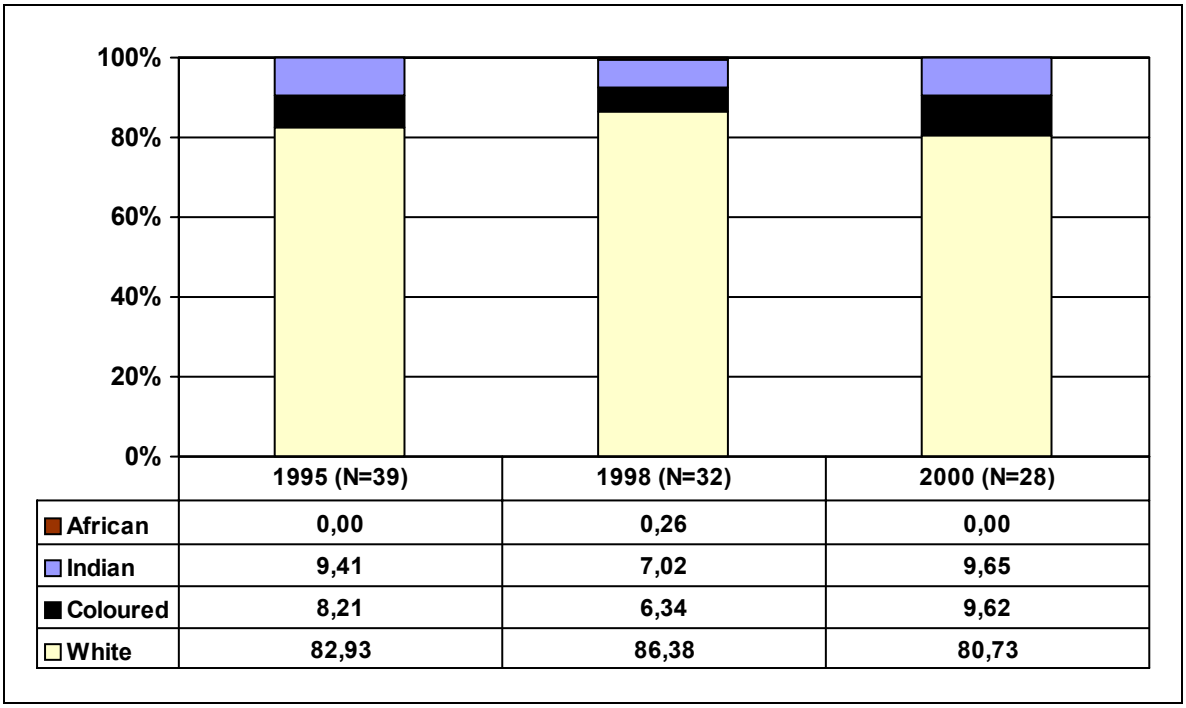
Figure 41: Distribution of publications in historically advantaged institutions by race, 1995, 1998 & 2000



	1995 (N=2445)	1998 (N=2239)	2000 (N=2374)
African	1,66	2,60	2,47
Indian	2,23	2,74	2,62
Coloured	0,85	0,81	1,16
White	95,25	93,85	93,75

In HAIs, about 94-95% of all publications were by white authors over the period under review (Figure 41).

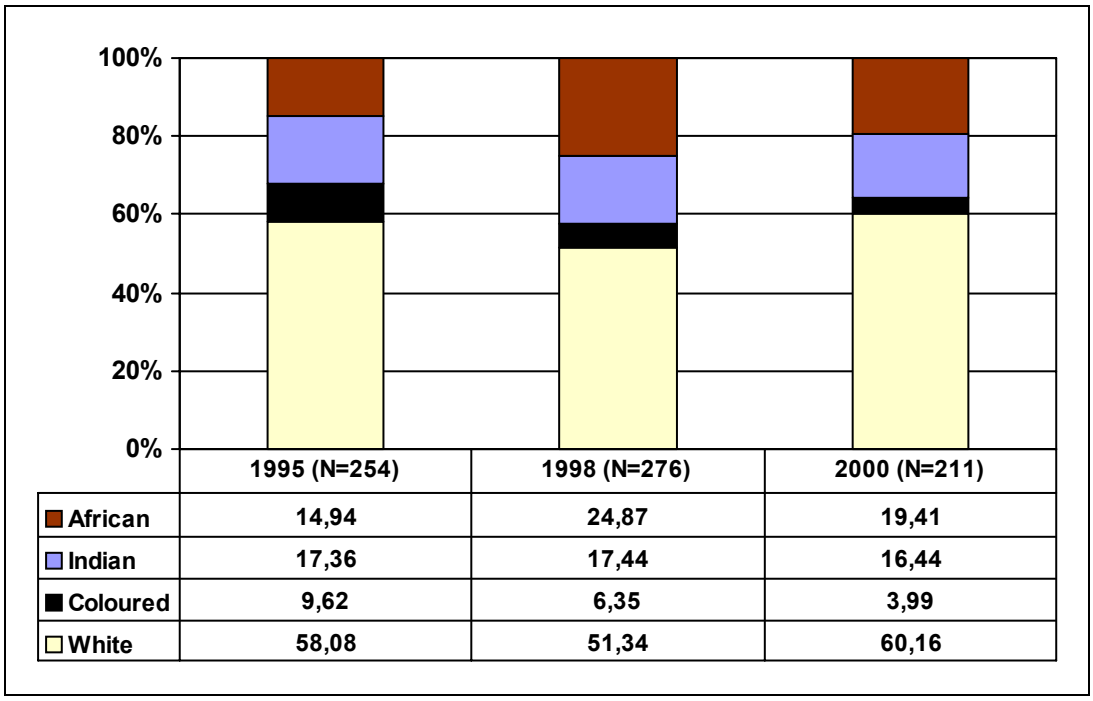
Figure 42: Distribution of technikon publications by race, 1995, 1998 & 2000



	1995 (N=39)	1998 (N=32)	2000 (N=28)
African	0,00	0,26	0,00
Indian	9,41	7,02	9,65
Coloured	8,21	6,34	9,62
White	82,93	86,38	80,73

- White authors also dominated the output in technikons (Figure 42), but less so than in universities. About 81-86% of technikon authors were white, followed by almost equal percentages (on average about 8-9%) of Indian and Coloured authors. The contribution by African authors in technikons was almost zero.

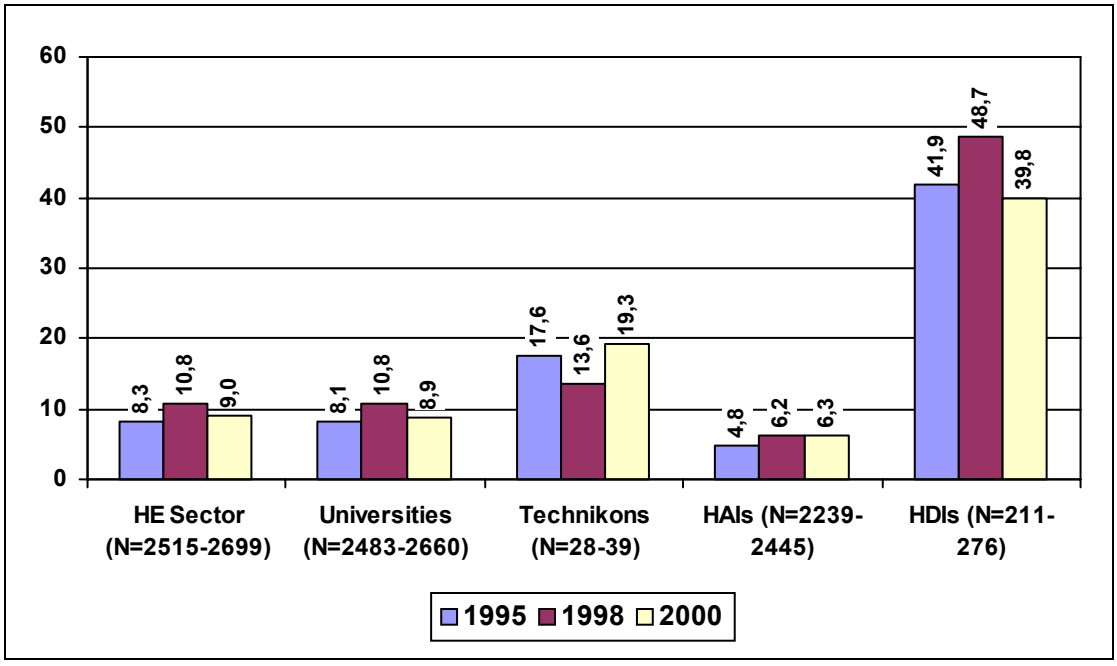
Figure 43: Distribution of publications in historically disadvantaged institutions by race, 1995, 1998 & 2000



	1995 (N=254)	1998 (N=276)	2000 (N=211)
African	14,94	24,87	19,41
Indian	17,36	17,44	16,44
Coloured	9,62	6,35	3,99
White	58,08	51,34	60,16

- African authors only feature significantly in HDIs where their contribution was about 15-25% of all publications in 1995, 1998 and 2000 (Figure 43). White authors were still in the majority, contributing to, on average, about 57% of publications.
- While almost 46% of academics at HDIs in 1995 were white, they produced 58% of publications (Figure 43). As a result, white academics' contribution to scientific output at HDIs was disproportionately higher than academics of the other race groups.

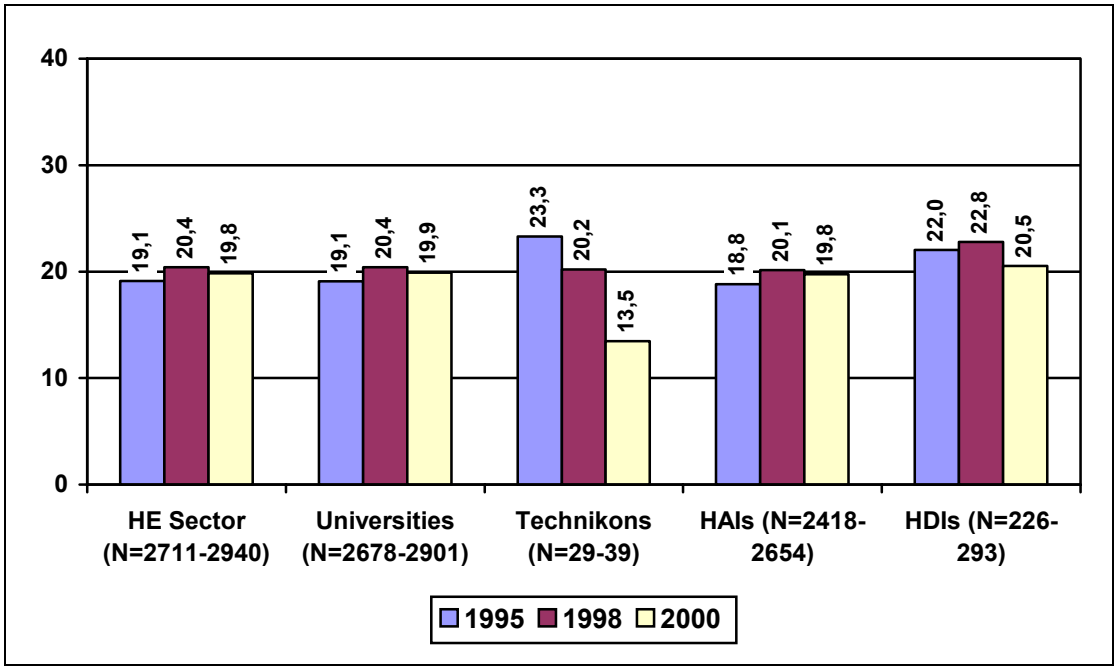
Figure 44: Percentage of publications in SA Knowledgebase attributable to African authors, 1995, 1998 & 2000



- Although the race distribution of scientific production at HDIs is slightly more representative of the demographics of the country, this finding must be read against the fact that the HDIs make a very small contribution to overall scientific output in the HE sector.
- Figure 44 shows that a far higher proportion of articles could be attributed to African authors in the HDIs (from just under 40% to just under 49% over the three years) than in the other institutional types. In the HE sector as a whole, African authors contributed around 8% and 11%.

5.4.3 Scientific output by gender

Figure 45: Percentage of publications in SA Knowledgebase attributed to female authors, 1995, 1998 & 2000

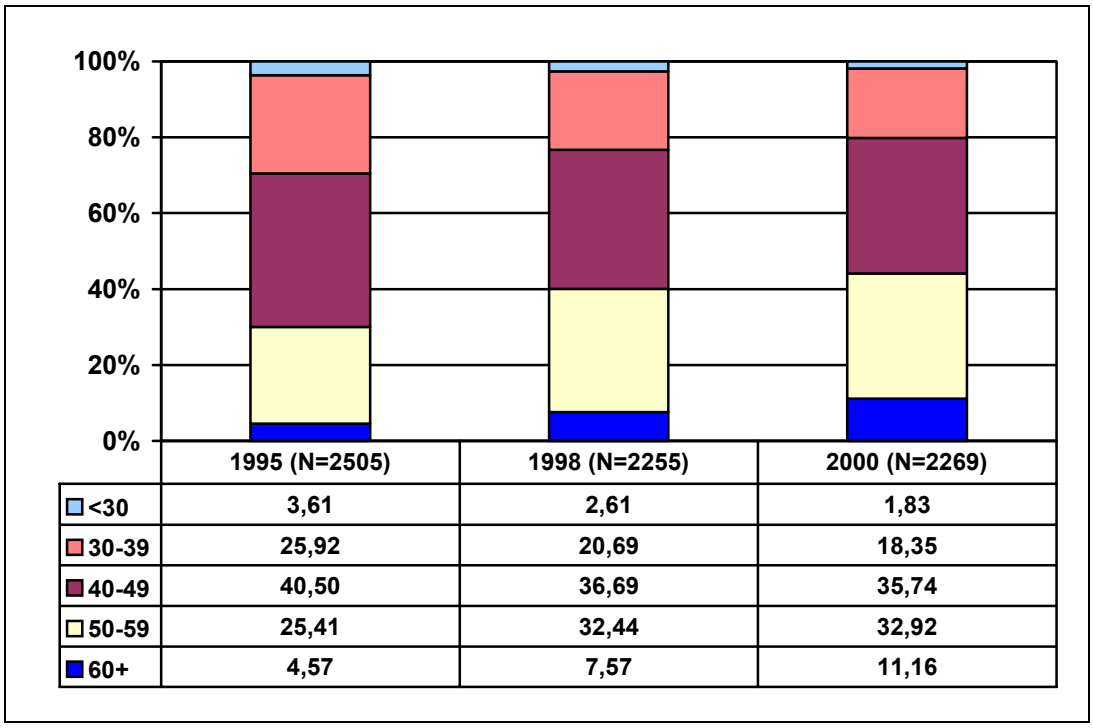


- Of the articles in SA Knowledgebase for which both the institution and gender are known, about 20% could be ascribed to female authors (Figure 45).
- In the technikon sector, just over 23% of articles in 1995 were by female authors. In 2000 this dropped to 13.5%. In the case of HDIs, closer to 22-23% of articles were by female authors in 1995 and 1998, although the 2000 figures were approaching 21%.

5.4.4 Scientific output by age group

Understanding trends in the age characteristics of publishing academics at HE institutions is of critical importance in analysing the future sustainability of the knowledge base. The key question is whether the HE system producing younger academics that will maintain the levels of scientific output in the future. Figure 46 presents the number of scientific publications in the HE sector by age group for the three years under review.

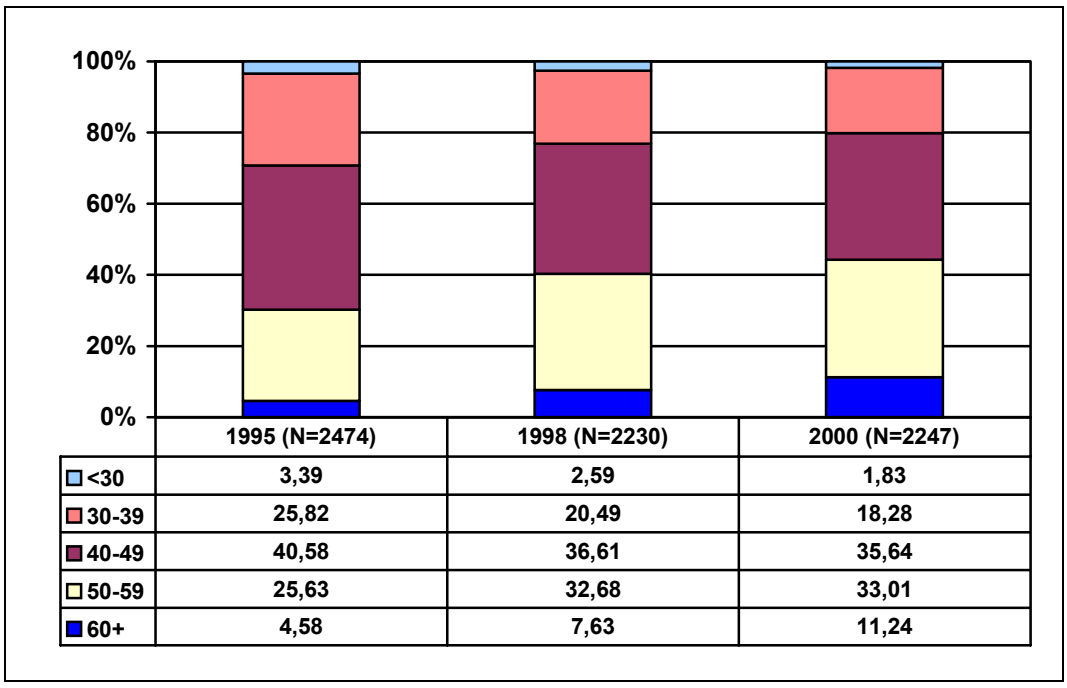
Figure 46: Distribution of HE publications by age group, 1995, 1998 & 2000



	1995 (N=2505)	1998 (N=2255)	2000 (N=2269)
<30	3,61	2,61	1,83
30-39	25,92	20,69	18,35
40-49	40,50	36,69	35,74
50-59	25,41	32,44	32,92
60+	4,57	7,57	11,16

- Figure 46 shows a consistent decline in the percentage of authors in the three "younger" age group (<30 years; 30-39 years; and 40-49 years), and, concomitantly, an increase in the two "older" groups (50-59 years and 60+ years). This implies a gradual aging of publishing academics at HE institutions in terms of which more articles are being produced by authors 50 years and older, and fewer by authors younger than 50.

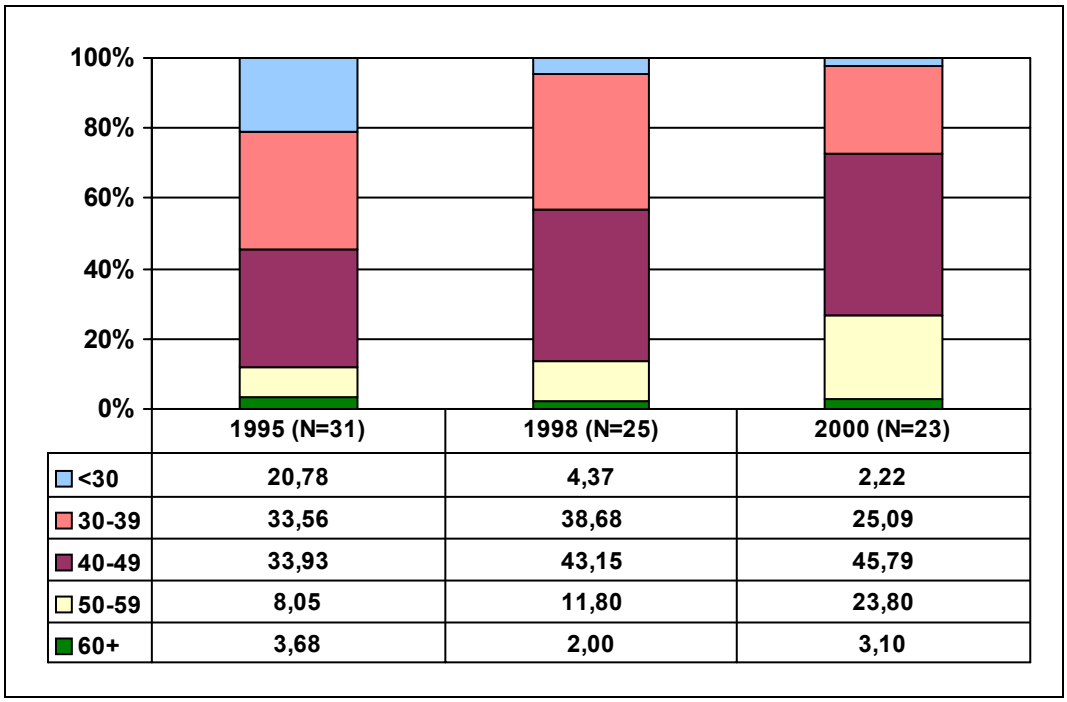
Figure 47: Distribution of university publications by age group, 1995, 1998 & 2000



	1995 (N=2474)	1998 (N=2230)	2000 (N=2247)
<30	3,39	2,59	1,83
30-39	25,82	20,49	18,28
40-49	40,58	36,61	35,64
50-59	25,63	32,68	33,01
60+	4,58	7,63	11,24

- This pattern of aging applies to the entire university sector (Figure 47), as well as among HAIs separately (Figure 49).

Figure 48: Distribution of technikon publications by age group, 1995, 1998 & 2000



	1995 (N=31)	1998 (N=25)	2000 (N=23)
<30	20,78	4,37	2,22
30-39	33,56	38,68	25,09
40-49	33,93	43,15	45,79
50-59	8,05	11,80	23,80
60+	3,68	2,00	3,10

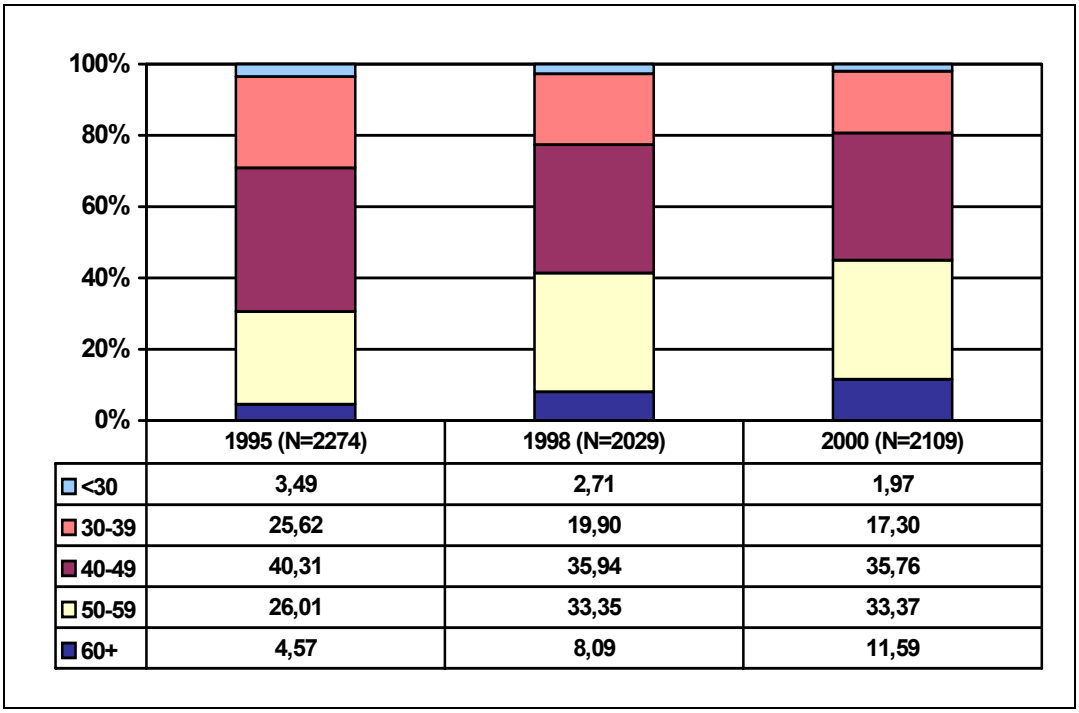
A gradual ageing of the publishing academic workforce is also evident among the technikons (

- This pattern of aging applies to the entire university sector (Figure 47), as well as among HAIs separately (Figure 49).

Figure 48) and HDIs (Figure 50), but with the following notable differences:

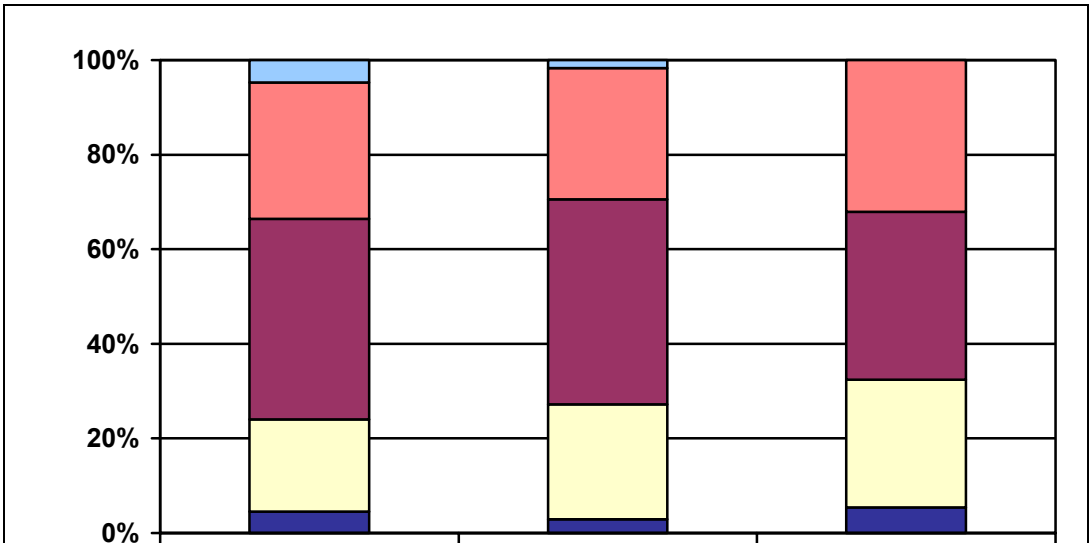
- Among the technikons, the decline in publications by authors younger than 30 years (from 21% to 4%) between 1995 and 1998 is much steeper than among universities. Also, a decline in the percentage of authors in the 30 to 39 years age group occurred only between 1998 and 2000, whereas for universities this occurred throughout the three-year period under review. In addition, an increase was evident in the number of publishing authors in the 40 to 49 years age group among technikons, whereas universities recorded a consistent decline in this regard.
- A possible explanation relates to the fact that a research culture in the technikon sector is a very recent phenomenon. Many of the academics at technikons (especially those in the first three age groups) are also engaged in postgraduate studies. Assuming that successfully completed degrees generally generates publications (regularly or irregularly), one can expect the output by technikon staff in the first three age groups to be still relatively high. It should be noted that the analysis of technikon output is based on a small absolute number of publications (23-31 publications), which may distort the data.

Figure 49: Distribution of publications in historically advantaged institutions by age group, 1995, 1998 & 2000



	1995 (N=2274)	1998 (N=2029)	2000 (N=2109)
<30	3,49	2,71	1,97
30-39	25,62	19,90	17,30
40-49	40,31	35,94	35,76
50-59	26,01	33,35	33,37
60+	4,57	8,09	11,59

Figure 50: Distribution of publications in historically disadvantaged institutions by age group, 1995, 1998 & 2000

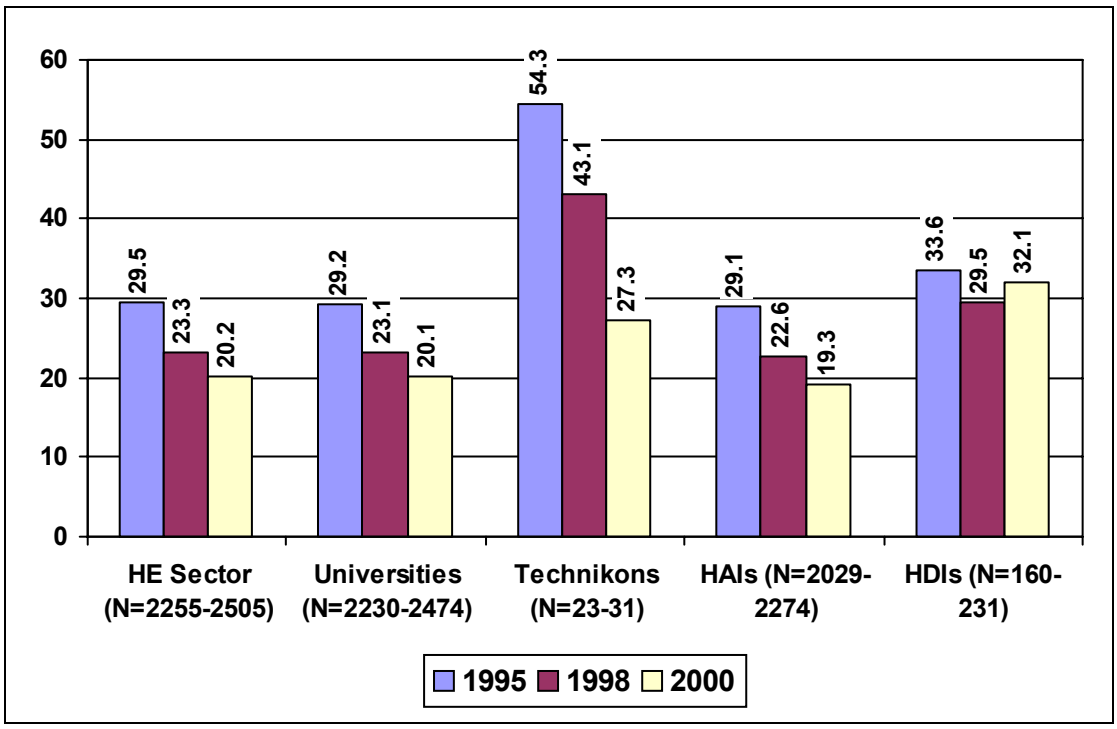


	1995 (N=231)	1998 (N=227)	2000 (N=160)
<30	4,75	1,69	0,00
30-39	28,83	27,77	32,08
40-49	42,36	43,35	35,50
50-59	19,54	24,30	27,01
60+	4,51	2,90	5,41

- Among HDIs, more academics in the 30-39 years age group published in 2000 than in 1995 (Figure 50). Exactly the opposite occurred in the HAIs (Figure 49). This trend may

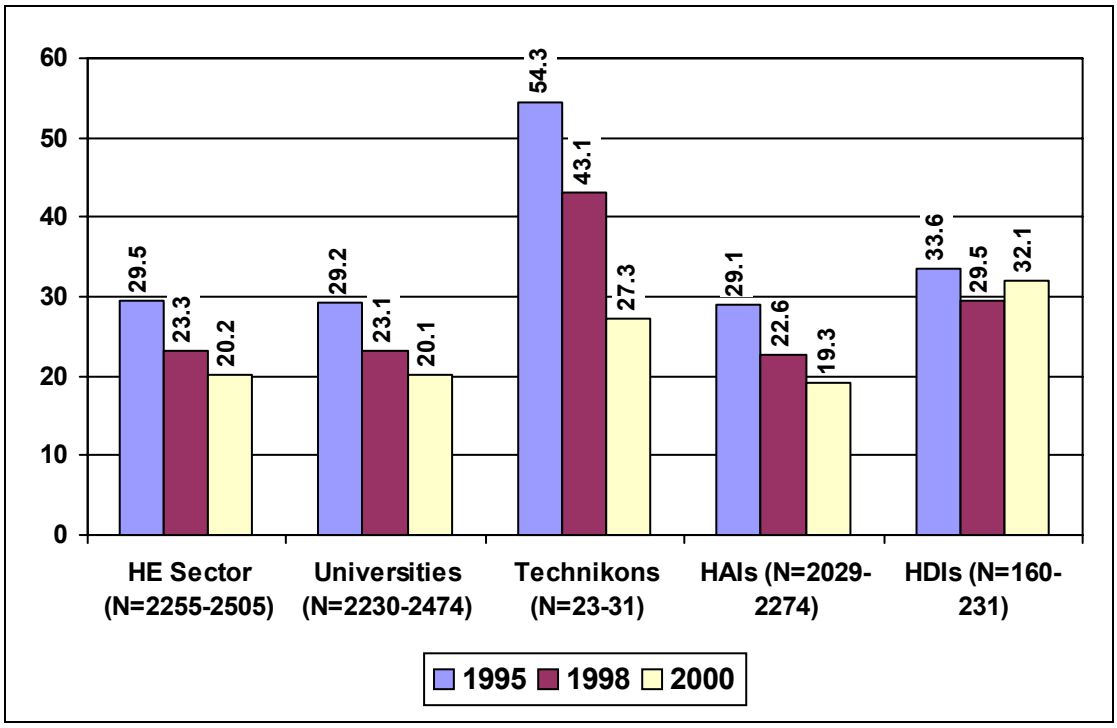
also be explained by the developing research culture in HDIs. Aging is nevertheless evident in the HDIs, if one compares the percentages of publishing academics in the older age groups for 1995 and 2000 from which it is apparent that these groups produced higher proportions of total publications.

Figure 51: Percentage of publications in SA Knowledgebase that are attributable to authors younger than 40 years, 1995, 1998 & 2000



- A different perspective on the aging phenomenon emerges from the comparison between the percentages of publications produced by academics younger than 40 years to that produced by academics older than 40 years. This is evident in Figure 51.
- As can be seen, in 1995 the technikons had a much younger publishing academic community than the universities (54% versus 29% of "young" authors). By 2000, however, the distance had narrowed to a mere 7%, with both universities and technikons experiencing a significant drop publications by "young" authors, although a sharper decrease is apparent among technikons than universities.
- Among HDIs, the percentage of "young" authors remained constant at about 30-34% over the three-year period.

Figure 52: Percentage of publications in SA Knowledgebase that are attributable to authors younger than 40 years, 1995, 1998 & 2000



- A different perspective on the aging phenomenon emerges from the comparison between the percentages of publications produced by academics younger than 40 years to that produced by academics older than 40 years. This is evident in Figure 51.
- As can be seen, in 1995 the technikons had a much younger publishing academic community than the universities (54% versus 29% of "young" authors). By 2000, however, the distance had narrowed to a mere 7%, with both universities and technikons experiencing a significant drop publications by "young" authors, although a sharper decrease is apparent among technikons than universities.
- Among HDIs, the percentage of "young" authors remained constant at about 30-34% over the three-year period.

Table 50: Academic staff by age and rank, 1995 and 2001

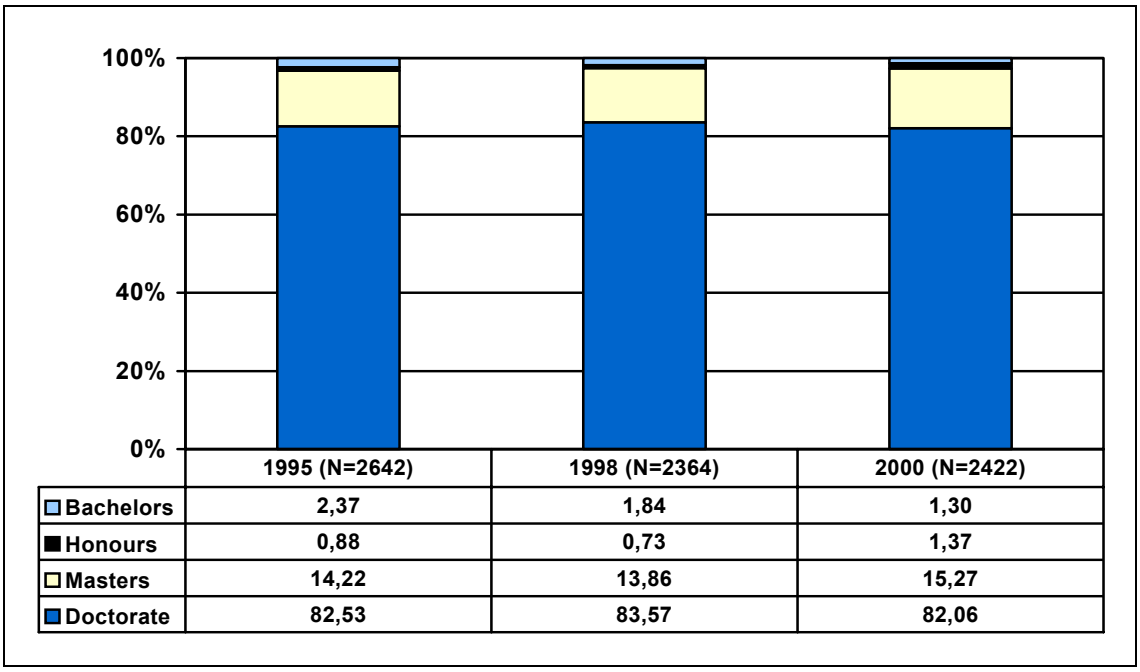
		Professoriate		Senior Lecturer		Lecturer		Junior and other		Total No	Total %
Year	Age Group	No	%	No	%	No	%	No	%		
1995	Under 25 Years	1	0%	0	0%	73	1%	100	10%	174	1%
	25 – 34	79	2%	524	14%	1 966	36%	504	50%	3 073	22%
	35 – 44	893	25%	1 509	40%	2 111	39%	227	23%	4 740	35%
	45 – 54	1 626	46%	1 271	34%	956	18%	126	13%	3 979	29%
	55 – 59	693	20%	338	9%	219	4%	31	3%	1 281	9%
	60-69	234	7%	112	3%	59	1%	12	1%	417	3%
	70 Years and Over	3	0%	2	0%	6	0%	0	0%	11	0%
1995 Total		3 529	100%	3 756	100%	5 390	100%	1 000	100%	13 675	100%
2001	Under 25 Years	0	0%	2	0%	105	2%	147	11%	254	2%
	25 – 34	95	3%	536	14%	2 092	36%	610	46%	3 333	23%
	35 – 44	845	23%	1 390	37%	2 148	37%	327	24%	4 710	32%
	45 – 54	1 661	46%	1 322	35%	1 223	21%	201	15%	4 407	30%
	55 – 59	753	21%	380	10%	233	4%	38	3%	1 404	10%
	60-69	290	8%	139	4%	77	1%	17	1%	523	4%
	70 Years and Over	1	0%	3	0%	0	0%	0	0%	4	0%
2001 Total		3 645	100%	3 772	100%	5 878	100%	1 340	100%	14 635	100%

Source: SAPSE, 1995; HEMIS, 2001. Note: 1) No 1995 data were available for the universities of the North West, Western Cape, Natal, Transkei, Venda, North and Border, Technikon and Technikon. Data from 1996 were used for these institutions instead. 2) No 2001 data were available for the University of the North and UCT. Data from 1999 were used for these institutions instead.

- The previous tables and figures approached the issue of the aging of the professoriate from the perspective of scientific output and productivity. Table 50 presents the available data on academic staff which show some, but not significant change between 1995 and 2001 in this regard. The proportion of professors in the 45-54 age group remained static (46%), while the number and proportion of those in the 55-59 and 60-69 groups increased slightly. Similar small increases were evident among senior lecturers.
- Among the new institutional types, a slightly higher proportion of older academics was evident in the universities (48% are older than 45) than in technikons and comprehensives (35% and 41% respectively). This aspect of the HE workforce should be monitored in future to track trends.

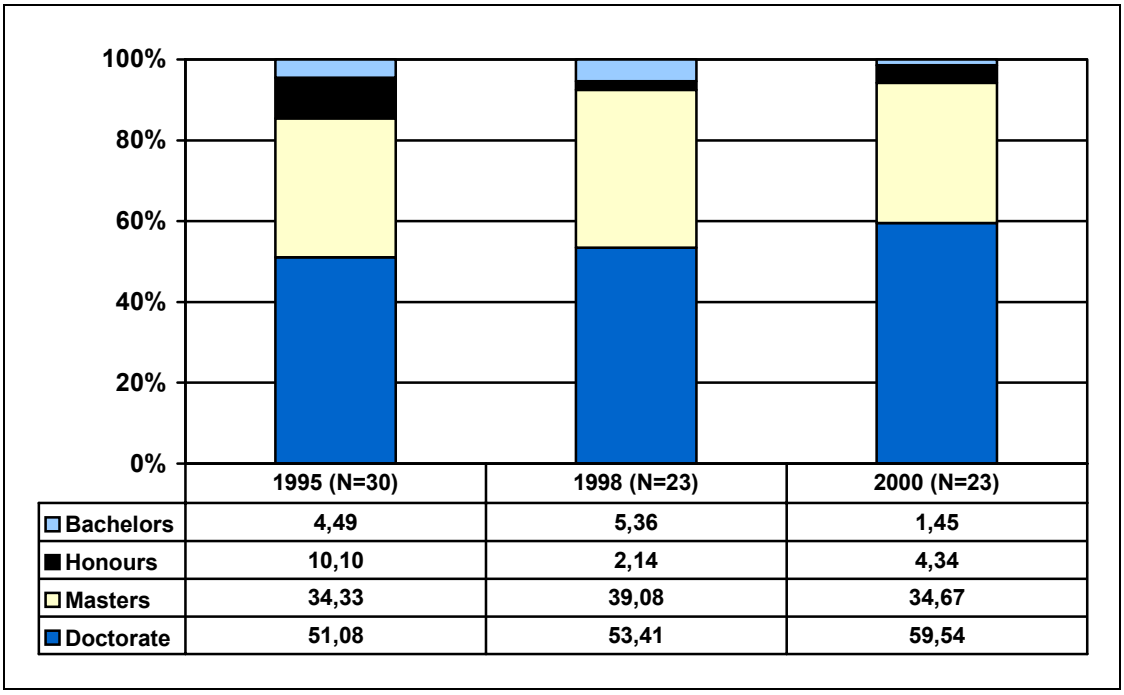
5.4.5 Scientific output by highest qualification[18]

Figure 53: Distribution of university publications by highest qualification, 1995, 1998 & 2000



	1995 (N=2642)	1998 (N=2364)	2000 (N=2422)
Bachelors	2,37	1,84	1,30
Honours	0,88	0,73	1,37
Masters	14,22	13,86	15,27
Doctorate	82,53	83,57	82,06

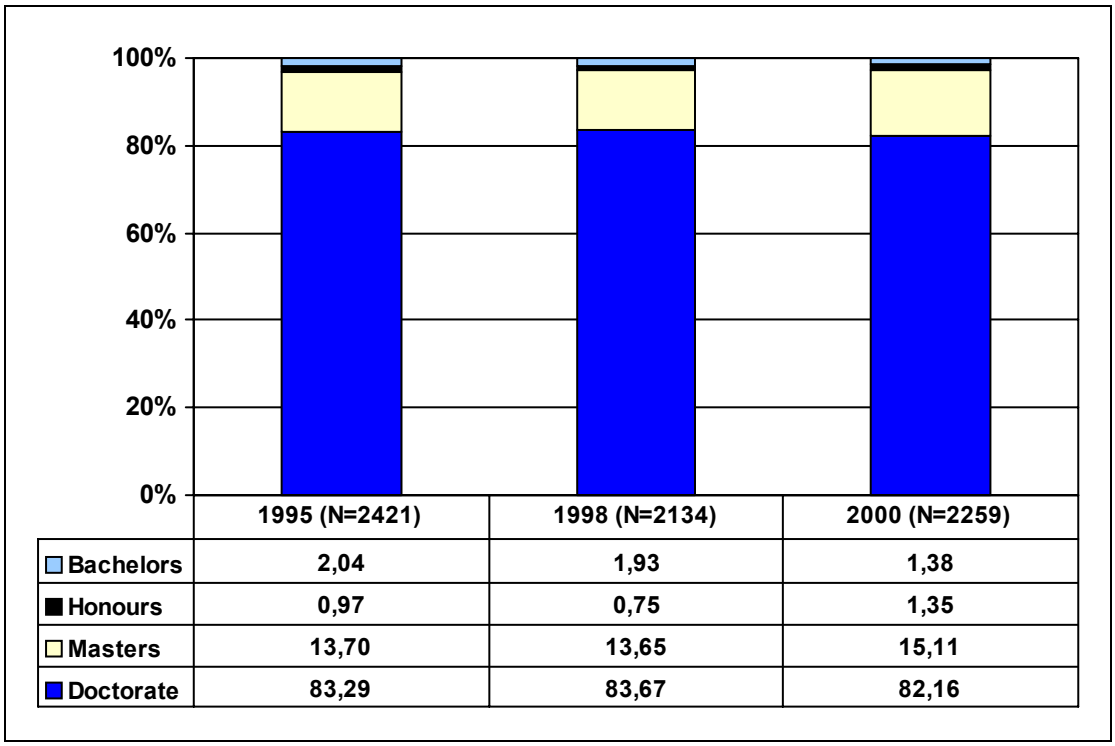
Figure 54: Distribution of technikon publications by highest qualification, 1995, 1998 & 2000



	1995 (N=30)	1998 (N=23)	2000 (N=23)
Bachelors	4,49	5,36	1,45
Honours	10,10	2,14	4,34
Masters	34,33	39,08	34,67
Doctorate	51,08	53,41	59,54

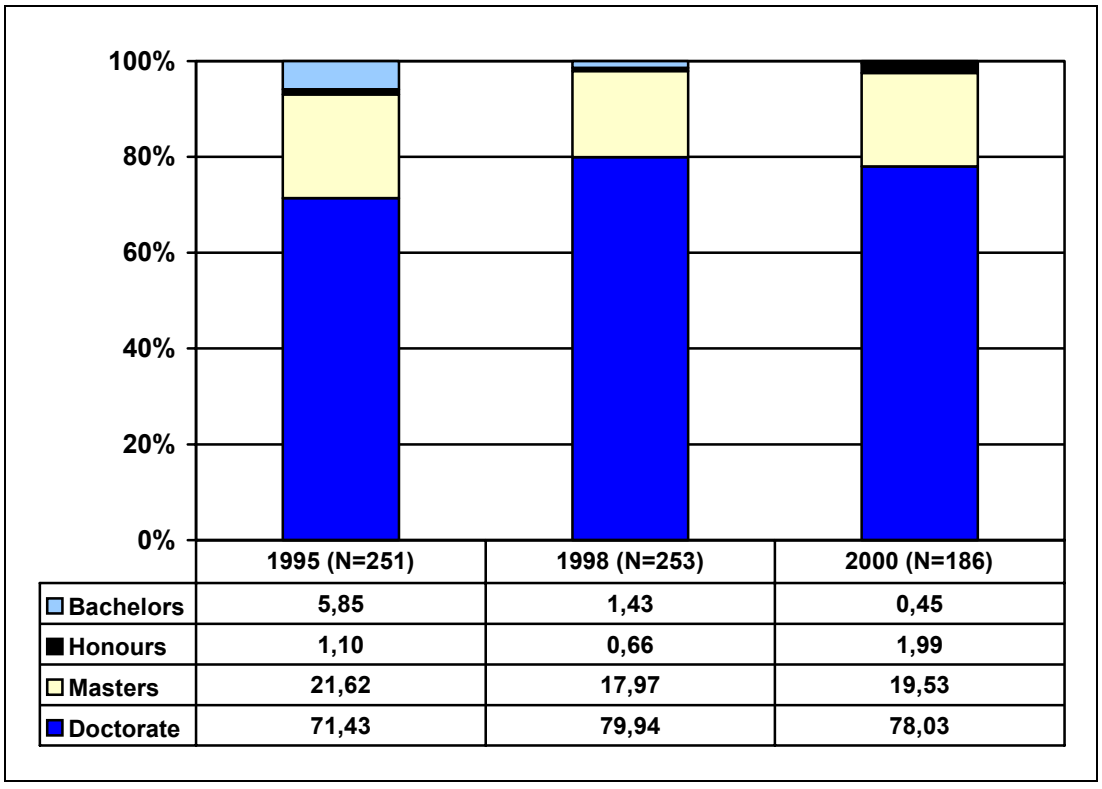
[18] It should be noted that the qualification levels used in SA Knowledgebase (bachelors, honours, masters and doctorate) do not necessarily indicate authors' highest qualification *at the time at which they published*. They simply represent the *most recent information* available on the authors' highest qualification. Nonetheless, Figure 53 to Figure 56 provide valuable insights into the relationship between authors' qualifications and their publications rates in the four institutional clusters: universities, technikons, HAIs and HDIs.

Figure 55: Distribution of publications in historically advantaged institutions by highest qualification, 1995, 1998 & 2000



	1995 (N=2421)	1998 (N=2134)	2000 (N=2259)
Bachelors	2,04	1,93	1,38
Honours	0,97	0,75	1,35
Masters	13,70	13,65	15,11
Doctorate	83,29	83,67	82,16

Figure 56: Distribution of publications in historically disadvantaged institutions by highest qualification, 1995, 1998 & 2000



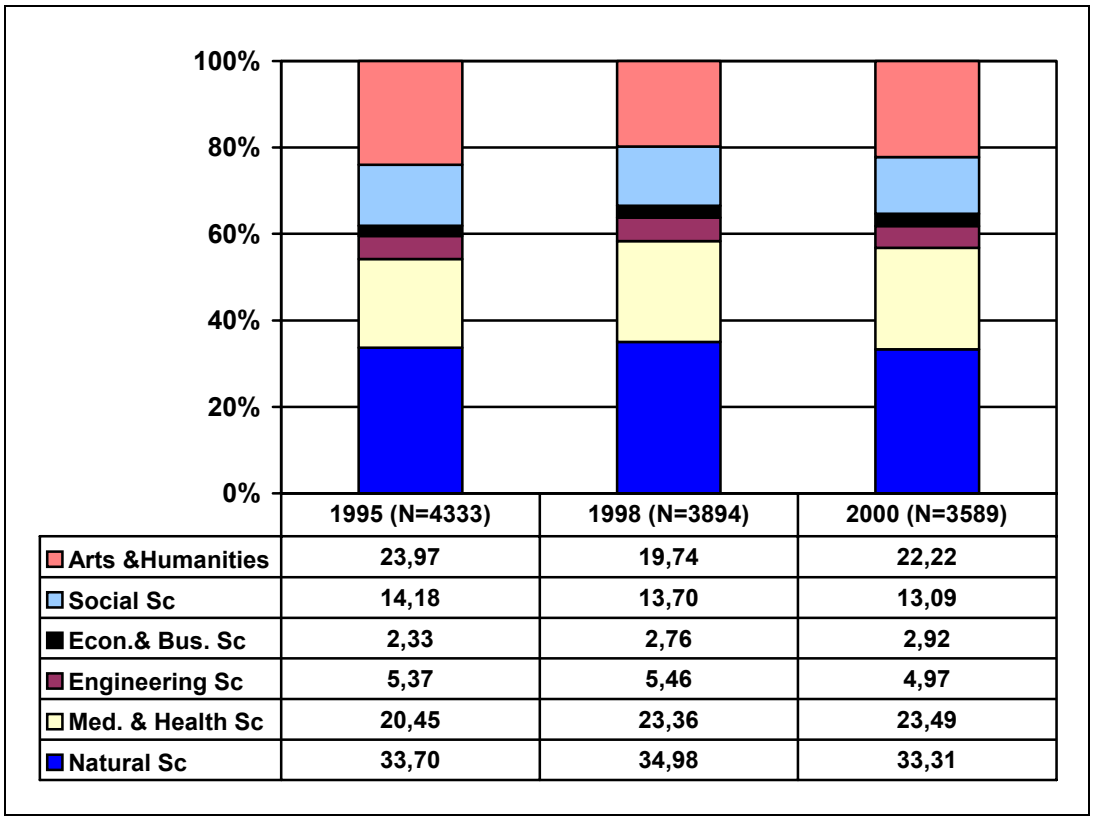
	1995 (N=251)	1998 (N=253)	2000 (N=186)
Bachelors	5,85	1,43	0,45
Honours	1,10	0,66	1,99
Masters	21,62	17,97	19,53
Doctorate	71,43	79,94	78,03

- Figure 53 and Figure 54 show that between 82% and 84% of publications in universities and HAIs can be attributed to academics that currently have a doctorate, followed by 14-15% to academics with a masters degree.
- As may be expected, in the technikons and HDIs, where research capacity building is largely in process, greater proportions of publications were produced by authors with masters degrees, as can be seen in Figure 54 and Figure 56. In technikons, only 50-60% of authors have doctorates (vs between 82% and 84% at universities), while 34-39% have a masters degree. Compared to universities, technikons have a larger percentage of authors with honours degrees (almost 10% versus 1% in 1995, and 4% versus 1% in 2000). Among HDIs, the percentage of authors with masters degrees ranges between 18% and 22%, and those with doctorates between 71% and 80%.
- Not surprisingly, then, scientific publishing is highly correlated with the author's possession of an advanced postgraduate degree.

5.4.6 Scientific output by science field of journal

Another important aspect HE research output concerns the distribution of publications by field of study. This has a direct bearing on the extent to which HE research is contributing to national development and innovation needs. While it is not possible to match HE research output precisely with external needs, examining the range of HE publications by field of study is nonetheless informative. For the purposes of this report, given the availability of data, field of study is interpreted here in terms of the science field of the journals in which HE research was published.

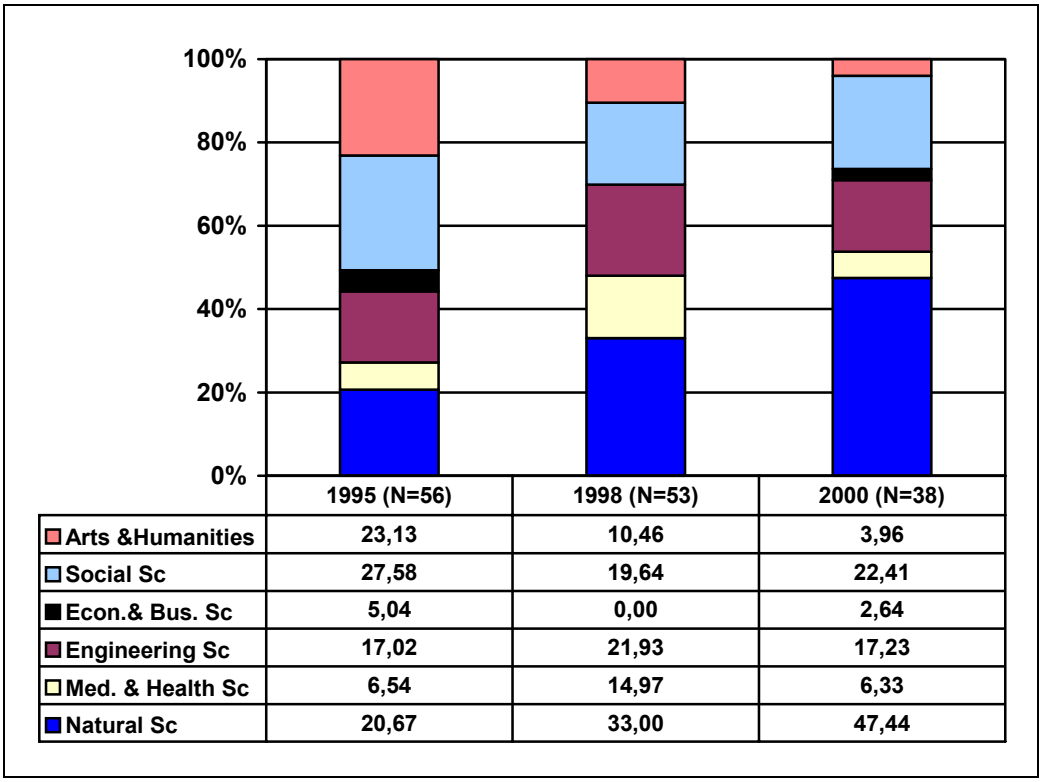
Figure 57: Distribution of university publications by field of study, 1995, 1998 & 2000



	1995 (N=4333)	1998 (N=3894)	2000 (N=3589)
Arts &Humanities	23,97	19,74	22,22
Social Sc	14,18	13,70	13,09
Econ.& Bus. Sc	2,33	2,76	2,92
Engineering Sc	5,37	5,46	4,97
Med. & Health Sc	20,45	23,36	23,49
Natural Sc	33,70	34,98	33,31

- Among the universities, the distribution of publications by field of study, defined in terms of the science field of the journal, remained almost unchanged for 1995 and 2000 (Figure 57).
- University research output was published mainly in the Natural Sciences (33-35%), followed by the Medical and Health Sciences (21-23%), Arts and Humanities (20-24%), and the Social Sciences (13%-14%). From this it can be seen that a third of university publications occur in the combined Arts and Humanities and Social Sciences (HSS) field.
- Relatively few publications were in journals in the Economics and Business field (2%-3%) and in Engineering Sciences (4%-5%).

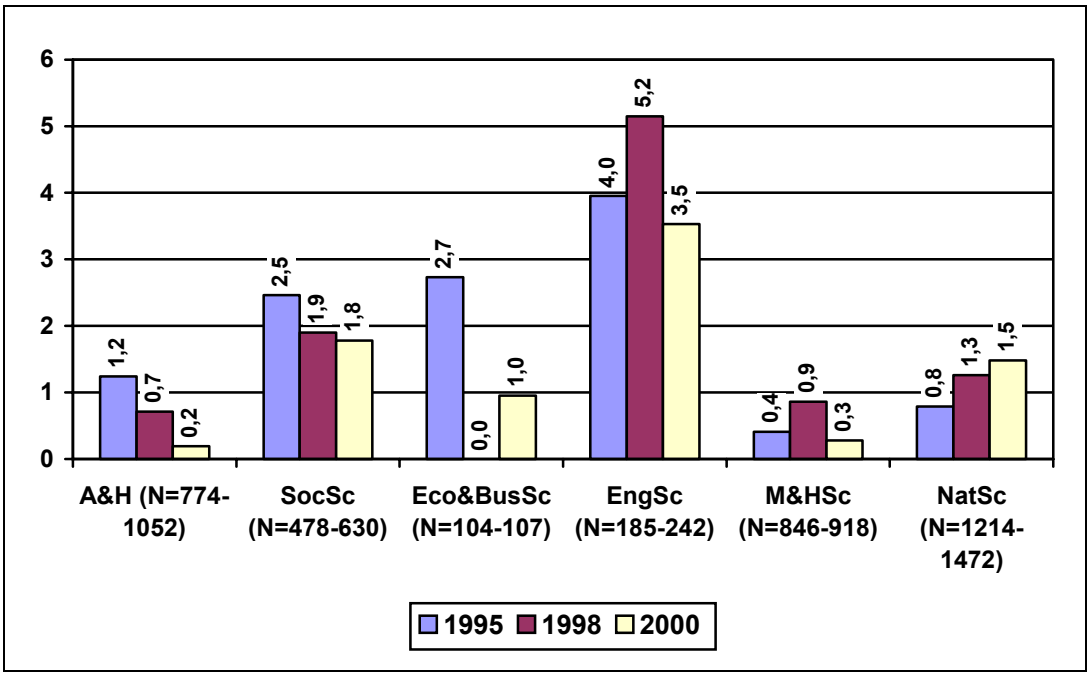
Figure 58: Distribution of technikon publications by field of study, 1995, 1998 & 2000



	1995 (N=56)	1998 (N=53)	2000 (N=38)
Arts &Humanities	23,13	10,46	3,96
Social Sc	27,58	19,64	22,41
Econ.& Bus. Sc	5,04	0,00	2,64
Engineering Sc	17,02	21,93	17,23
Med. & Health Sc	6,54	14,97	6,33
Natural Sc	20,67	33,00	47,44

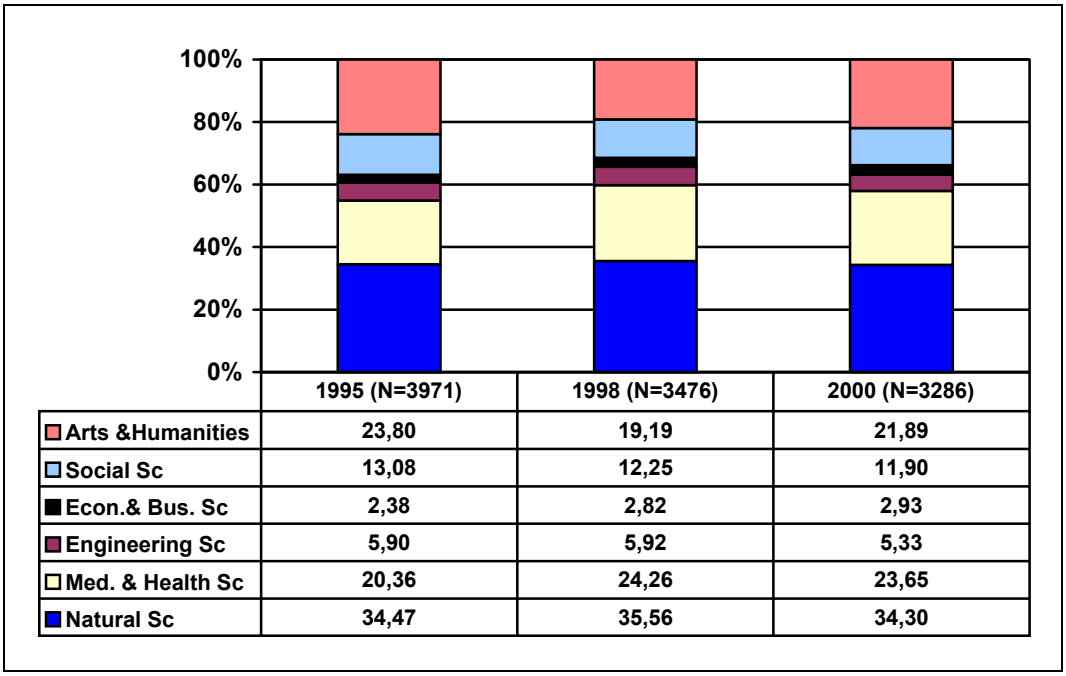
- The distribution of technikon research outputs by field (Figure 58) changed between 1995 and 2000.
- In 1995, publications were mainly in the Social Sciences (28%), Arts and Humanities (23%) and Natural Sciences (21%). In 2000, however, they had largely shifted to the Natural Sciences (47%), Social Sciences (22%) and Engineering Sciences (17%).

Figure 59: Technikons' contribution to HE publications by field of study, 1995, 1998 & 2000



- Figure 59 shows that the contribution of technikons to the total HE scientific output is generally very modest. It amounted, at most, to just over 5% in Engineering Sciences in 1998. On the other hand, technikons made no contribution to publications in Economic and Business Sciences in 1998.

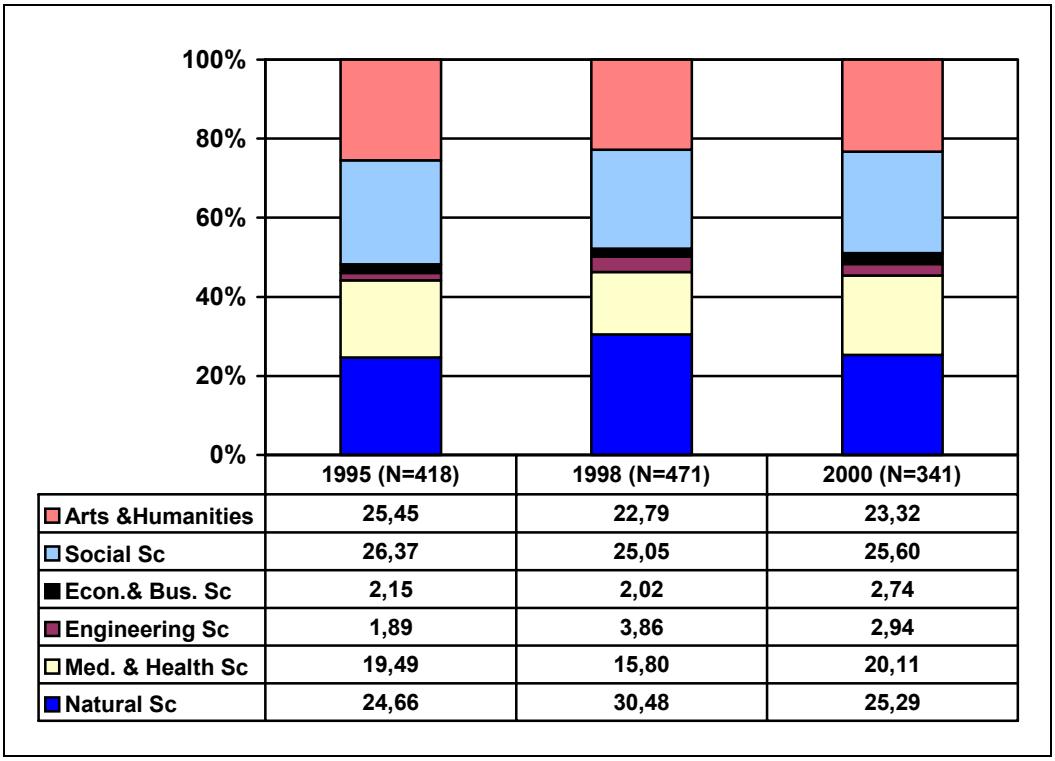
Figure 60: Distribution of publications in historically advantaged institutions by field of study, 1995, 1998 & 2000



	1995 (N=3971)	1998 (N=3476)	2000 (N=3286)
Arts &Humanities	23,80	19,19	21,89
Social Sc	13,08	12,25	11,90
Econ.& Bus. Sc	2,38	2,82	2,93
Engineering Sc	5,90	5,92	5,33
Med. & Health Sc	20,36	24,26	23,65
Natural Sc	34,47	35,56	34,30

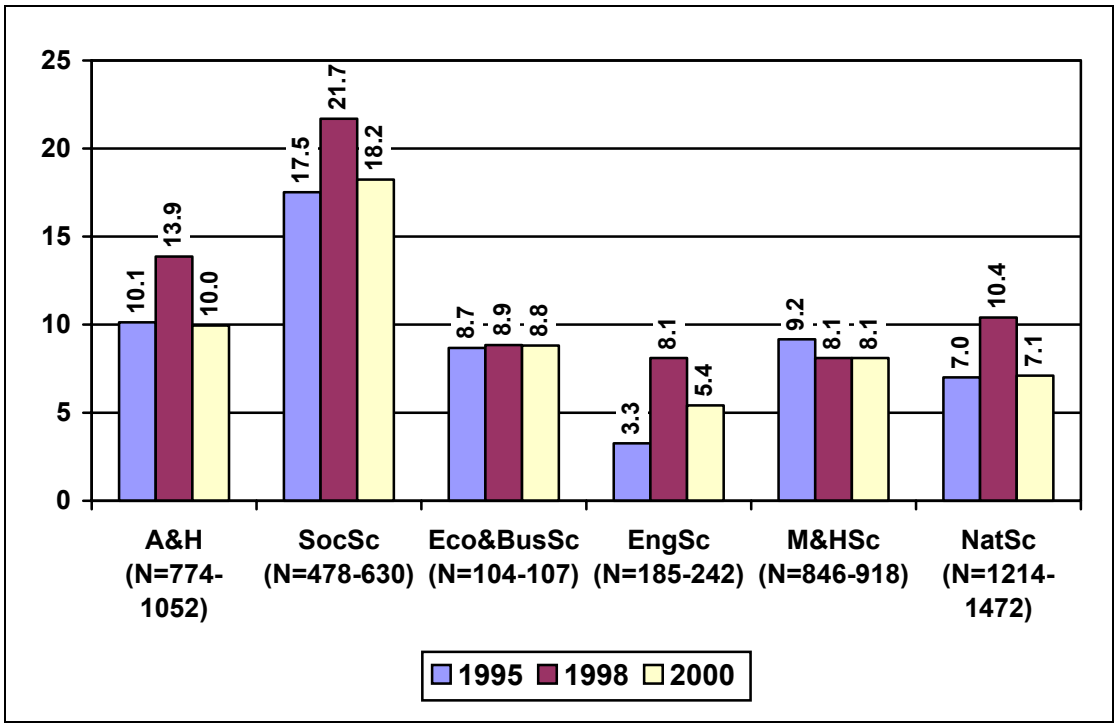
- Compared to HAIs, HDIs published significantly more in the Social Sciences (26% versus 12% in 2000 – Figure 60 and Figure 61), and fewer in the Natural Sciences (25% versus 34% in 2000).
- Moreover, Figure 61 reveals that no significant changes were evident in the distribution of publications in the HDIs by science field between 1995 and 2000. Publications were roughly evenly divided between Arts and Humanities, Social Sciences, Medical and Health Sciences, and Natural Sciences (around 20%-25%), with fewer in the Economics and Engineering Sciences (around 2%-3%).

Figure 61: Distribution of publications in historically disadvantaged institutions, by field of study, 1995, 1998 & 2000



	1995 (N=418)	1998 (N=471)	2000 (N=341)
Arts &Humanities	25,45	22,79	23,32
Social Sc	26,37	25,05	25,60
Econ.& Bus. Sc	2,15	2,02	2,74
Engineering Sc	1,89	3,86	2,94
Med. & Health Sc	19,49	15,80	20,11
Natural Sc	24,66	30,48	25,29

Figure 62: HDIs' contribution to HE publications by field of study, 1995, 1998 & 2000



- Figure 62 shows that the contribution of HDIs to the total HE scientific output lay largely in the Social Sciences (18% in 1995 and 2000, and 22% in 1998).

5.4.7 The impact of mergers

A final consideration is the impact of the mergers of public HE institutions on both scientific output and scientific productivity in the system. Four of the top universities as far as research output is concerned (Cape Town, Stellenbosch, Pretoria and Witwatersrand) will be unaffected by the mergers – other than the incorporation of the Mamelodi Vista campus into the University of Pretoria and the incorporation of the Stellenbosch Dental School into UWC. It can therefore be assumed that the current patterns of output and productivity of these institutions will continue. The same applies to Rhodes University, despite the incorporation of its East London campus into Fort Hare.

However, two of the most productive universities, Natal and Rand Afrikaans, will undoubtedly be affected by the mergers with UDW and Technikon Witwatersrand respectively. Table 51 below shows the combined SAPSE output and scientific productivity figures of the two new merged institutions.

Table 51: Academic staff and SAPSE output of new institutions formed by the merger of UDW & University of Natal, and RAU & Technikon Witwatersrand

	Academic staff			SAPSE output			Output/staff ratio		
	1995	1998	2001	1995	1998	2001	1995	1998	2001
University of Durban-Westville	421	412	367	127	124	107	0.30	0.30	0.29
University of Natal	816	832	925	555	511	500	0.68	0.61	0.54
New institution (Univ. of KwaZulu-Natal)	1237	1244	1292	682	635	607	0.55	0.51	0.47
Rand Afrikaans University	294	314	348	316	307	311	1.08	0.98	0.89
Technikon Witwatersrand	342	369	396	1	15	7	0.00	0.04	0.02
New institution (Univ. of Johannesburg)	636	683	744	317	322	318	0.50	0.47	0.43

- Table 51 clearly demonstrates the "averaging" effect of two of the intended mergers, part of the rational of which is to overcome traditional barriers between HAIs and HDIs, and between universities and technikons. As is evident, in both cases, scientific productivity in the two original institutions varies widely, especially in the RAU/Wits Technikon case (just under .9 and .02 publications per academic in 2001). In both cases, the outcome of the merger in productivity terms will be about just less than one publication for every two staff members.
- In terms of the merger rationale, this can be seen as a positive move, with the HDI in each case gaining greater productivity and opportunities to enhance research. However, if one takes the HAI in each case as the unit of analysis, the final outcome could be seen as a net loss.
- It is important to note that institutions (or clusters of institutions) as systems, cannot simply combine as neatly as these figures suggest. Institutional differences and imbalances, such as variations in research capacity, are deeply embedded in institutional cultures. As all the literature on mergers suggests, such aspects of institutional culture persist within mergers for a long time, creating tension within the merged institution. This is particularly applicable to the RAU/Technikon Wits merger. In this case we have the most productive university in the country, with a vibrant research culture, about to merge with a technikon with basically no research capacity and an even larger academic staff component.
- For these reasons, following the course of this and other mergers from the perspective of the impact on research culture and scientific output and productivity constitutes another important future policy research topic.

5.5 South Africa's HE research capacity: profile of academic staff

Another key indicator of the research capacity of the HE system is the academic staff complement. A brief profile of this is now presented.

Table 52: Academic staff by new institutional groups and race, 1995-1998-2001

		African		Coloured		Indian		White		Other		Total	
Year	New Inst. Group	No	%	No	%	No	%	No	%	No	%	No	%
1995	Universities	919	11%	279	3%	404	5%	6 474	80%	7	0%	8 083	100%
	Technikons	120	6%	111	6%	177	9%	1 501	78%	4	0%	1 913	100%
	Comprehensives	607	18%	32	1%	61	2%	2 654	79%	0	0%	3 354	100%
	Vista	143	24%	11	2%	13	2%	429	72%	0	0%	596	100%
1995 Total		1 789	13%	433	3%	655	5%	11 058	79%	11	0%	13 946	100%
1998	Universities	1 039	13%	252	3%	448	6%	6 250	78%	11	0%	8 000	100%
	Technikons	295	13%	153	7%	263	11%	1 613	69%	1	0%	2 325	100%
	Comprehensives	802	23%	62	2%	93	3%	2 574	73%	0	0%	3 531	100%
	Vista	166	27%	11	2%	14	2%	434	69%	0	0%	625	100%
1998 Total		2 302	16%	478	3%	818	6%	10 871	75%	12	0%	14 481	100%
2001	Universities	1 268	16%	315	4%	568	7%	5 872	73%	18	0%	8 041	100%
	Technikons	414	17%	178	7%	288	12%	1 511	63%	7	0%	2 398	100%
	Comprehensives	1 037	29%	81	2%	129	4%	2 327	65%	1	0%	3 575	100%
	Vista	236	38%	16	3%	22	4%	348	56%		0%	622	100%
2001 Total		2 955	20%	590	4%	1 007	7%	10 058	69%	26	0%	14 636	100%

Source: SAPSE, 1995, 1998; HEMIS, 2001. Notes: 1) No 1995 and 1998 data available for University of the North West. 2) As data for the various campuses of Vista University were not available, this institution is shown separately.

- Table 52 shows that the academic staff complement of South Africa's HE institutions numbered 14 636 in 2001, up from 13 946 in 1995.
- While whites dominated (69% in 2001), the profile was gradually more equitable with a growth in the number and proportion of African academics from 1 789 (13%) in 1995 to 2 955 (20%) in 2001. Correspondingly, the number and proportion of white academics declined from 11 058 (79%) in 1995 to 10 058 (69%) in 2001. The number of Indian and Coloured academics also rose between 1995 and 2001, but less dramatically, from 433 (3%) to 590 (4%) and 655 (5%) to 1 007 (7%) respectively.
- Among the new institutional types which will be created by the restructuring process, it can be seen that greater numbers and proportions of white academics were concentrated in the universities (73% in 2001) than in other types (63% in technikons, 65% in comprehensives and 56% at Vista). African staff were concentrated in the comprehensives (29% of total academics in these institutions) and Vista (38%).

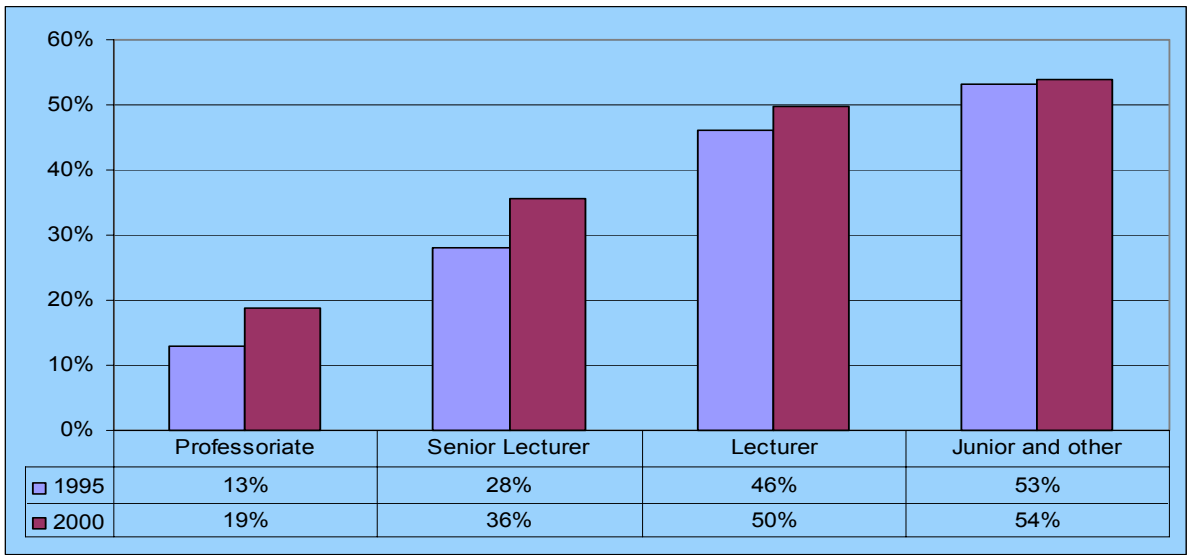
Table 53: Academic staff by gender, 1995-1998-2001

Year	New Institutional Type	% Women
1995	Universities	29%
	Technikons	34%
	Comprehensives	39%
	Vista	47%
1995 Total		33%
1998	Universities	33%
	Technikons	37%
	Comprehensives	41%
	Vista	48%
1998 Total		36%
2001	Universities	36%
	Technikons	39%
	Comprehensives	43%
	Vista	48%
2001 Total		39%

Source: SAPSE, 1995, 1998; HEMIS, 2001.
Notes: 1) No 1995 and 1998 data available for University of the North West. 2) As data for the various campuses of Vista University were not available, this institution is shown separately.

- Regarding gender, women remain under-represented, forming only 39% of all academics in 2001. However, this was up from 33% in 1995 and 36% in 1998, indicating a constant improvement in overall gender equity over time.
- The proportion of women was higher at Vista (48% in 2001) and the comprehensives (43%) than at technikons (39%) and universities (36%). This no doubt is largely shaped by the range of teaching programmes at the various institutions and the overall emphasis on teaching or research, as women academics tend to be clustered in certain fields associated with the gendered division of labour in society and in the academy, and in teaching activities.

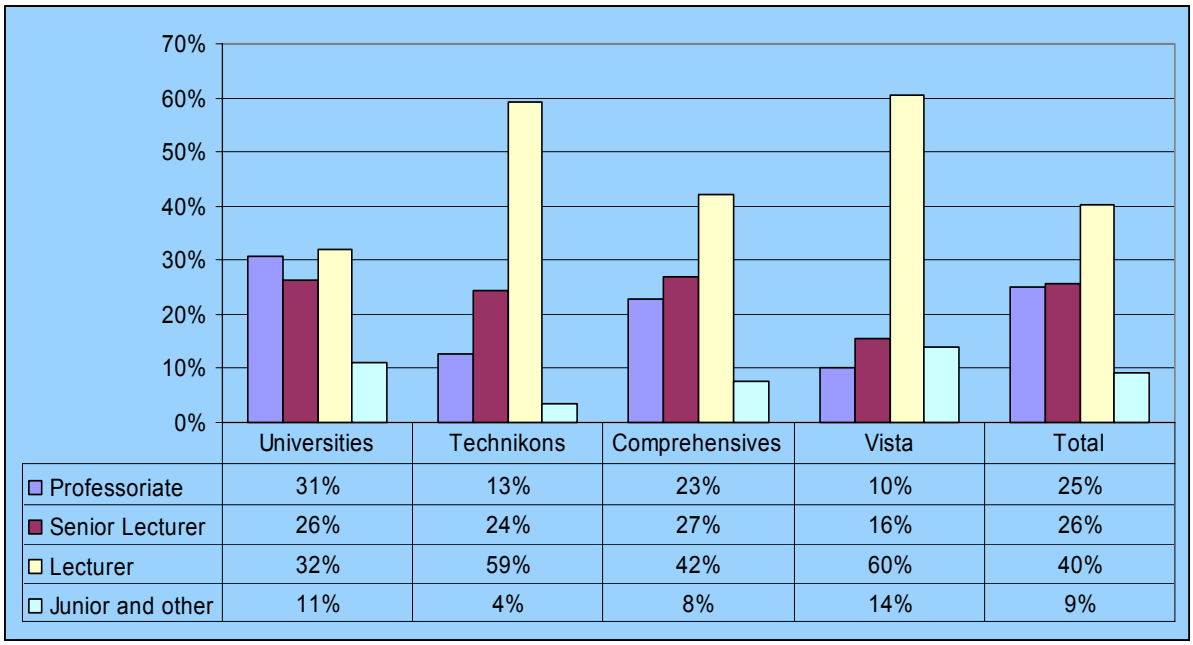
Figure 63: Changes in the proportion of women academics by rank, 1995 & 2000



Source: HEMIS, 2001. Note: 1) No data were available for the University of the North and UCT. Data from 1999 were used for these institutions instead.

- It is important, however, to disaggregate these overall figures by rank to reveal further gender disparities in HE institutions.
- While women remain highly under-represented in senior ranks, their position did improve between 1995 and 2001. Figure 63 shows that women's proportion of the professoriate increased from 13% to 19% over the period, which is favourable by international comparison. Likewise, their proportion of senior lecturers increased from 28% to 36% and among lecturers and junior lecturers from 46% to 50% and from 53% to 54% respectively.

Figure 64: Proportion of academic staff by rank across the new institutional landscape



	Universities	Technikons	Comprehensives	Vista	Total
Professoriate	31%	13%	23%	10%	25%
Senior Lecturer	26%	24%	27%	16%	26%
Lecturer	32%	59%	42%	60%	40%
Junior and other	11%	4%	8%	14%	9%

Source: HEMIS, 2001. Note: No data were available for the University of the North and UCT. Data from 1999 were used for these institutions instead.

- Considering the distribution of academic staff across the new institutional types, it can be seen from Figure 64 that among universities, significantly higher proportions of academics were professors. In the universities, 31% of academics were professors, while in comprehensives the figure was only 23% were in technikons 13%.
- Correspondingly, 59% of technikon academics were at the lecturer rank, versus 42% in comprehensives and 32% in universities.

Table 54: Distribution of academic staff by rank across the new institutional types, 2001

	Professoriate	Senior Lecturer	Lecturer	Junior and other	Total
Universities	67%	56%	44%	66%	55%
Technikons	8%	16%	24%	6%	16%
Comprehensives	22%	26%	26%	21%	24%
Vista	2%	3%	6%	6%	4%
Total	100%	100%	100%	100%	100%

Source: HEMIS, 2001. Note: No data were available for the University of the North and UCT. Data from 1999 were used for these institutions instead.

- Table 54 shows the concentration of senior ranks in the universities. In 2001, 67% of professors were in universities, as were 56% of senior lecturers, 44% of lecturers and

66% of junior lecturers. By contrast, only 22% of professors were in the comprehensives and just 8% in technikons.
- Clearly, a common goal across the institutional types will be to increase the qualification levels and rank of academic staff.

5.6 Postgraduate involvement in research projects

The profile of the postgraduate subsector presented in this report has focused on the extent of postgraduate enrolments and graduations, and where data are available on the success of postgraduates in the system. Another key consideration, of course, is the quality and relevance of postgraduate education. However, no systematic data on this aspect are available. Nonetheless, one important aspect of the quality and relevance of postgraduate education is the extent to which postgraduate students are involved in research projects.

The link between research and postgraduate education is a multi-layered and mutually beneficial one (see EPU, 1997 for an extended discussion of this). The presence of experience and vibrant researchers attracts postgraduate students. Conversely, the presence of postgraduate students facilitates the conduct of larger and more complex research projects through the availability of research assistance. Most importantly for the purposes of this report, postgraduate involvement has the potential to enrich postgraduate education and directly strengthen research capacity through hands-on training in actual project work. The opportunity to work with experienced researchers in tackling real problems and challenges is an important form of gaining experience and thus building solid research skills and knowledge.

The analysis presented here on the involvement of postgraduate students in research projects is based data derived from a National Survey on Research Utilisation, commissioned by NACI, and conducted by the Centre for Interdisciplinary Studies (CENIS) in 2002. The purpose of the survey was to identify factors that relate to the successful utilisation and implementation of research conducted at South African universities, technikons and science councils. Project leaders, who completed the survey, were asked whether any postgraduate students worked on the project. The reason for including this question is that postgraduate students often play an integral role in the utilisation of research. Apart from being intended beneficiaries (through skills development), they also act as transfer agents in the sense that the (tacit) skills and knowledge acquired on the project are transferred to and drawn upon in their work environment.

Information was obtained about 1 264 projects in the HE sector (1 081 at universities and 183 at technikons). Of these, 1 222 project leaders answered the question about the involvement of postgraduate students, with 49% indicating that postgraduates were involved. Figure 65 to Figure 72 summarise the main project characteristics that correlate with postgraduate involvement in research projects in the HE sector[19]. These are:

- The science fields of the project (Figure 65)
- Years of experience of the project leader (Figure 66)
- The initiator or 'driver' that led to the research being conducted (Figure 67)

[19] Not all the projects have the same years in common (e.g. some started in 1995 but ended in 1999 whereas others started in 2001 and are still ongoing). The year that the majority of projects have in common is 2000. Therefore the coverage of projects in terms of the share of public R&D expenditure is estimated for 2000 only. In terms of funding for that year, the university and technikon projects cover about 18% of public R&D expenditure in the HE sector.

- The size and source of project funding (Figure 68 and Figure 69)
- Incidence and sector of collaboration (Figure 70 and Figure 71)
- The intended project beneficiary (Figure 72)

Figure 65: Involvement of postgraduate students in HE research projects by science field

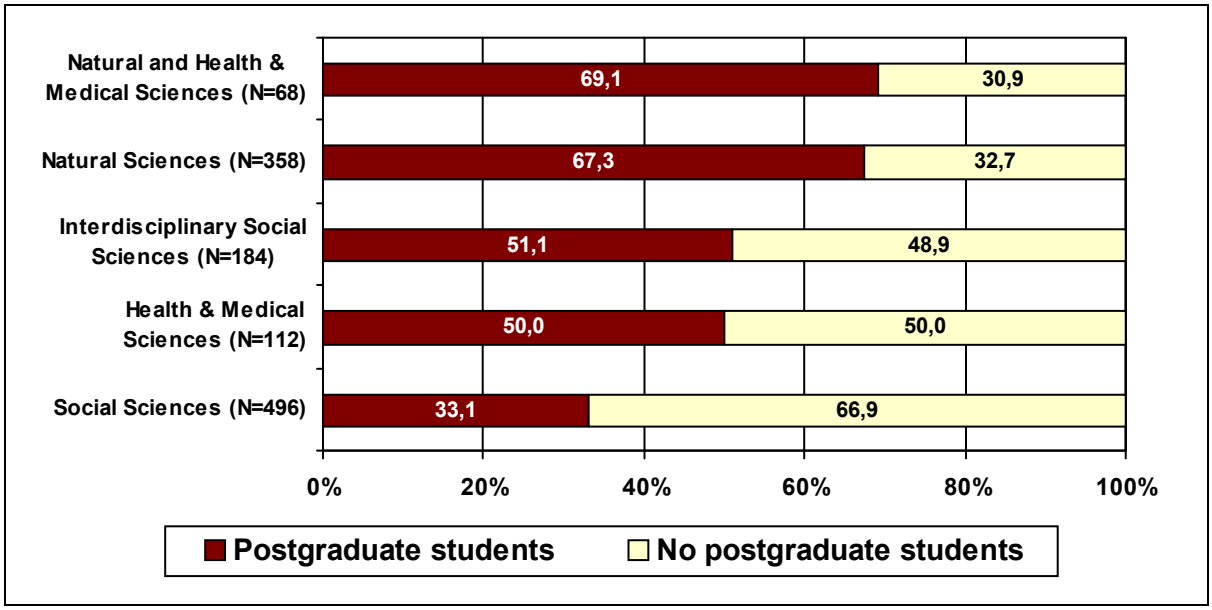


Figure 66: Involvement of postgraduate students in HE research projects by years of experience of project leader

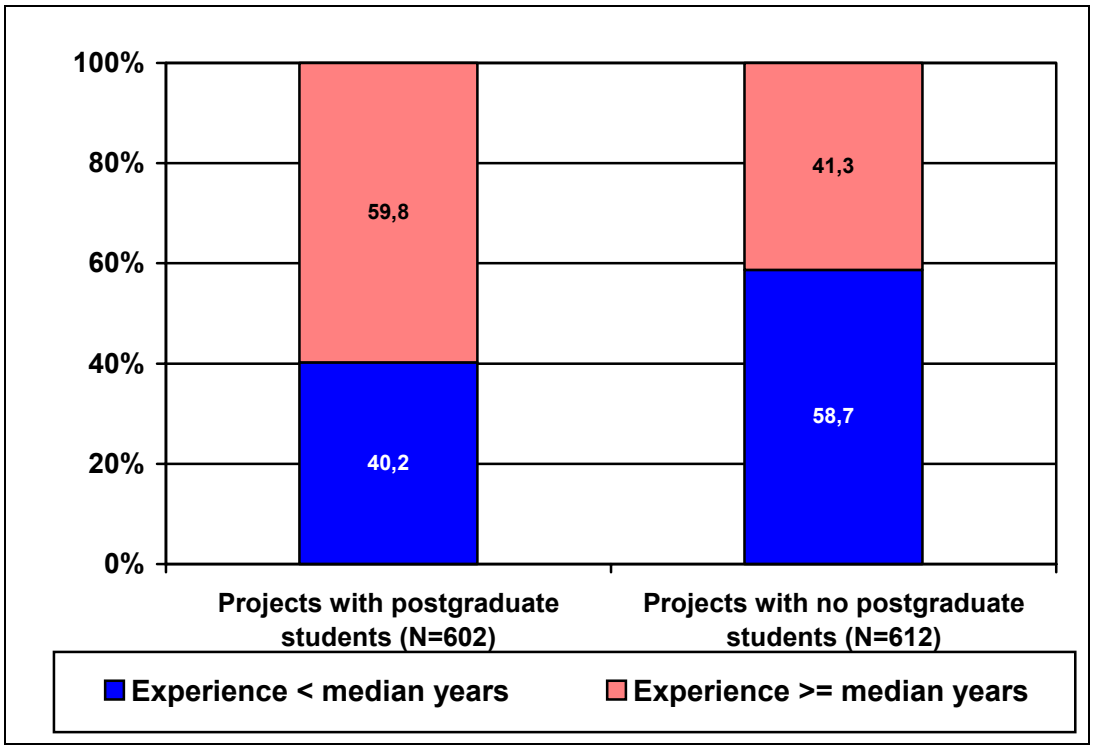


Figure 67: Involvement of postgraduate students in HE research projects by initiator of the research

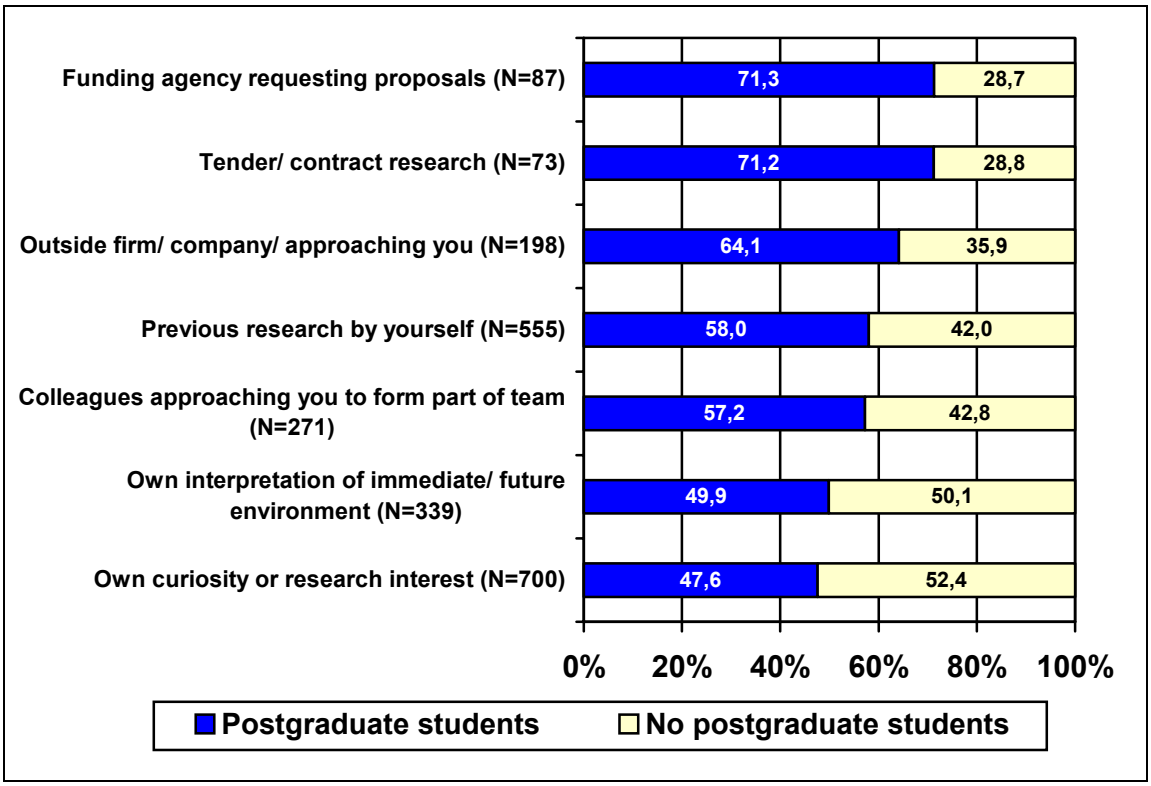


Figure 68: Involvement of postgraduate students in HE research projects by size of project funding

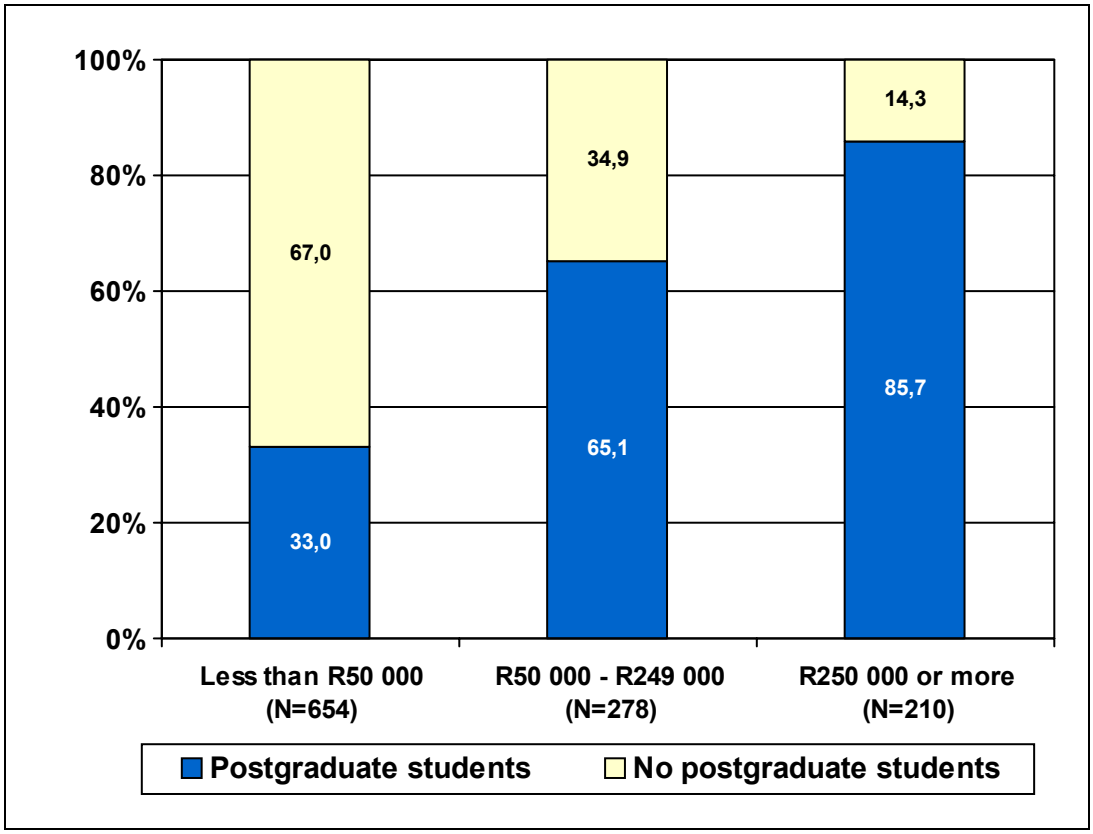


Figure 69: Involvement of postgraduate students in HE research projects by source of project funding

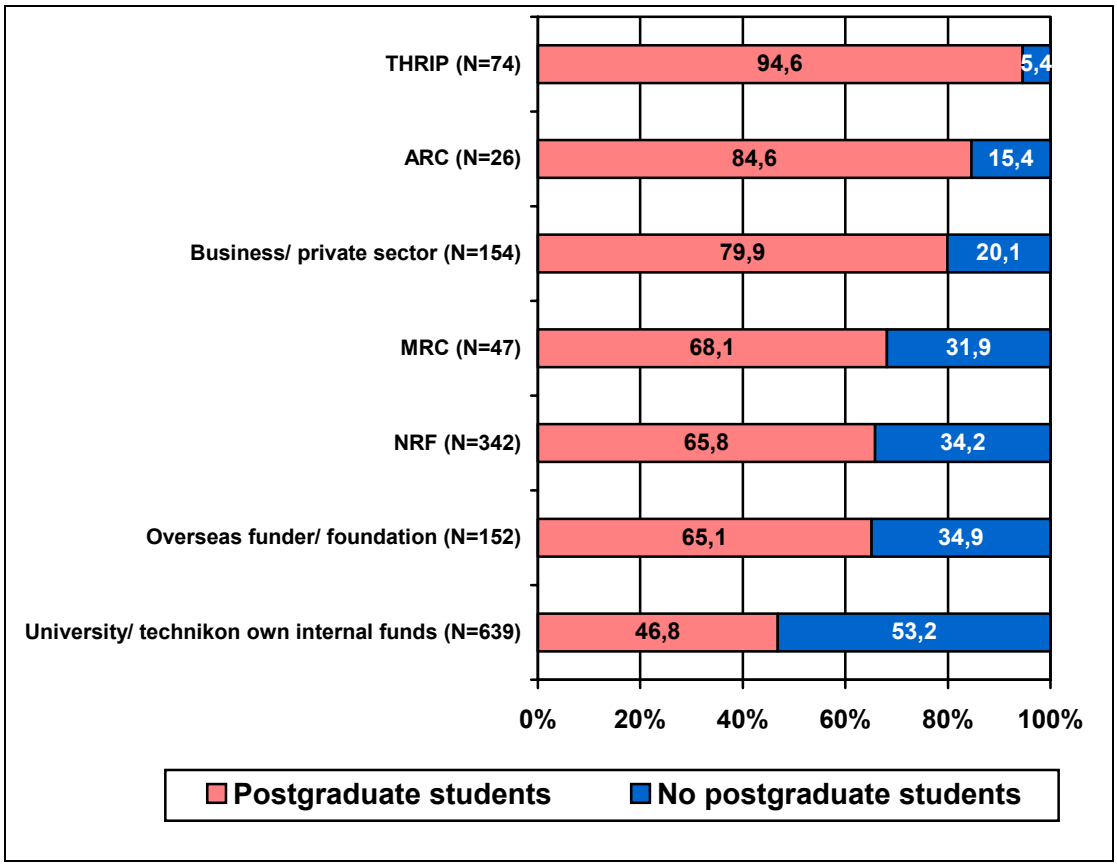


Figure 70: Involvement of postgraduate students in HE research projects by instances of project collaboration

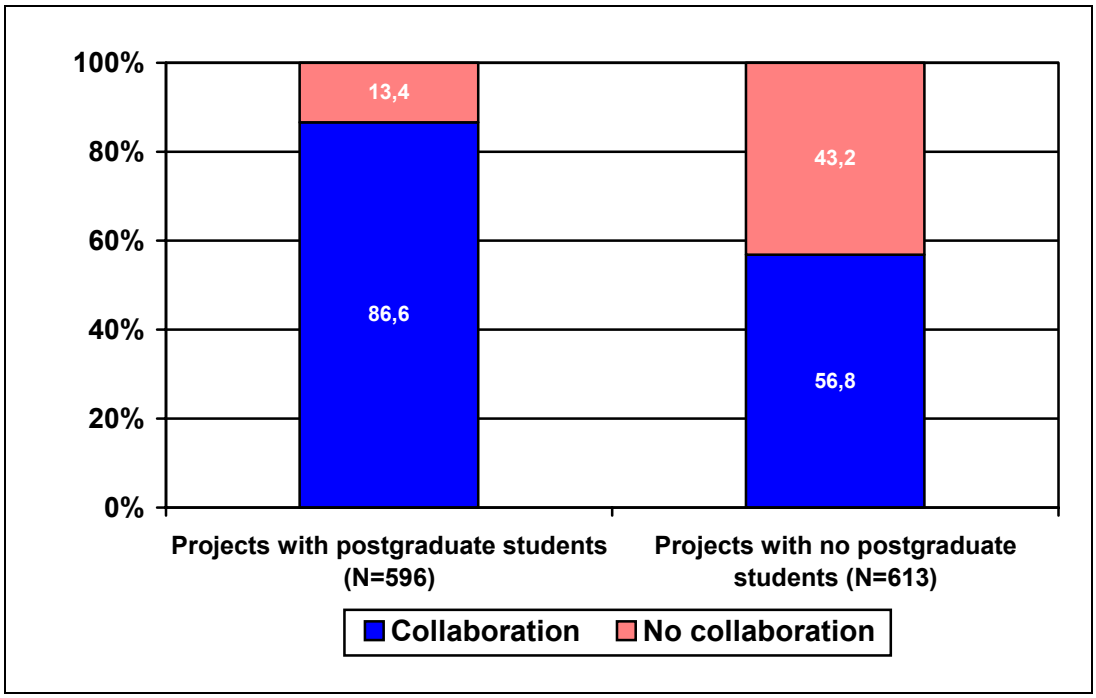


Figure 71: Involvement of postgraduate students in HE research projects by sector of collaboration

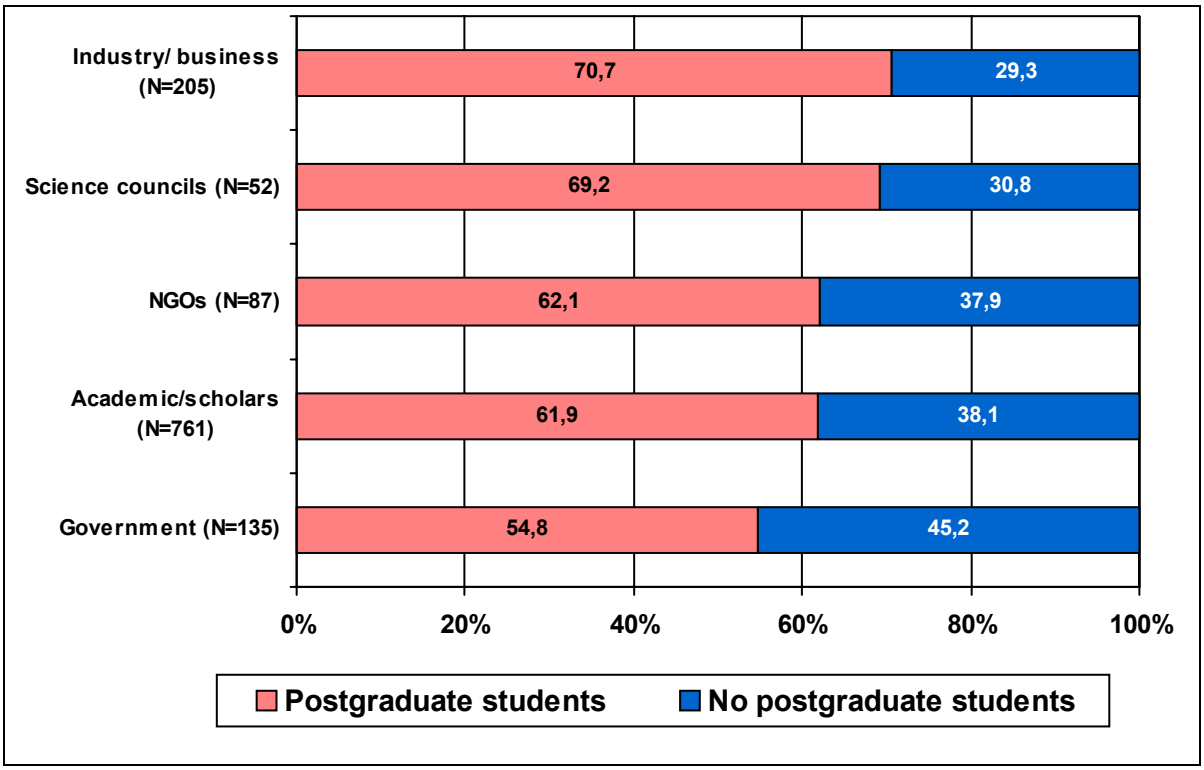
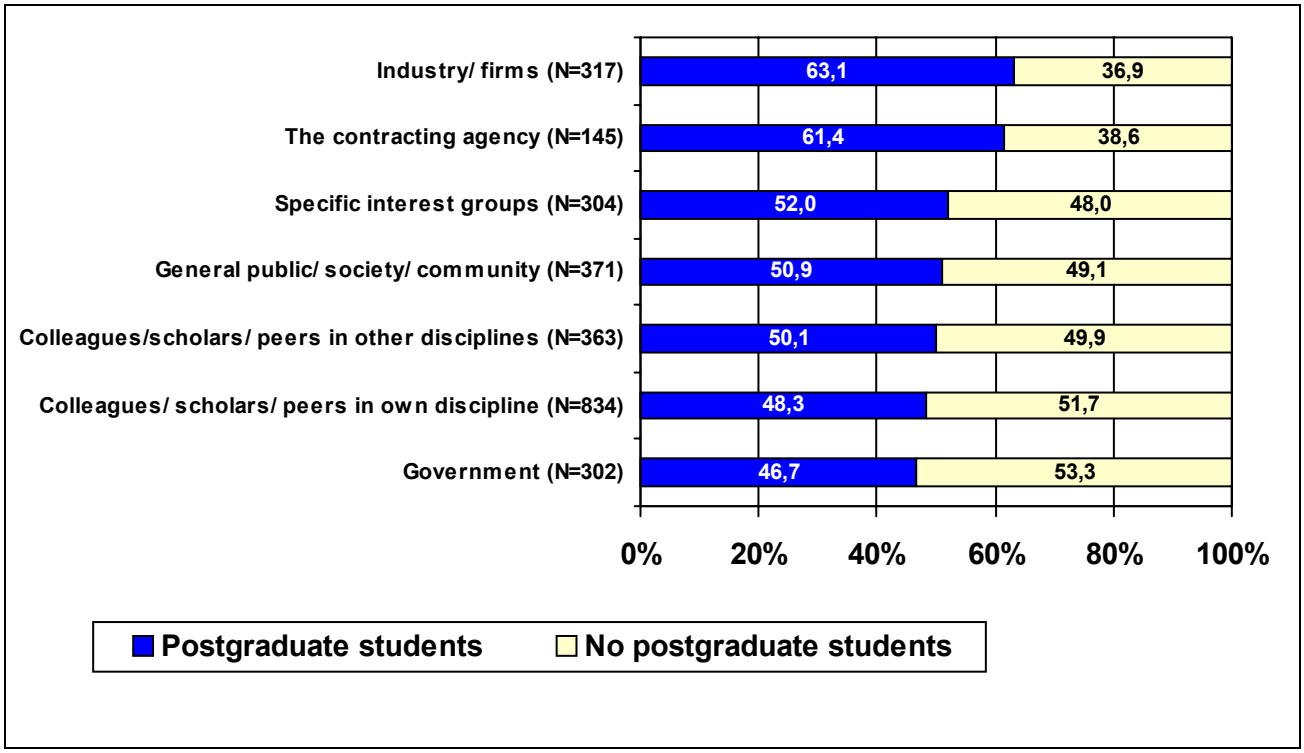


Figure 72: Involvement of postgraduate students in HE research projects by intended beneficiary



- Summarising these findings, Figure 65 to Figure 72 show clearly that postgraduate involvement in research projects is highest when:
  - The project falls within the natural sciences, or involves activities that span both the natural and the medical and health sciences
  - The research experience of the project leader is greater than the average of experience of others in his/her sector
  - The research is initiated or driven by a funding agency, a tender or contract
  - The project has substantial funding, coming from THRIP, industry and those science councils with a agency function
  - There is collaboration with industry/business or the science councils
  - The project beneficiary is an entity with clear organisational boundaries, such as a specific firm, agency or interest group or firm, i.e. the research is commissioned and there is a clear research contract.
- These findings suggest that Postgraduate involvement in HE research projects is reasonably high (overall nearly 50% of respondents in the study).
- This percentage should be read against the fact that a large proportion of postgraduate students at South African universities and technikons study part-time or are non-residential students. This would make it difficult or impossible for such students to participate meaningfully in institutional research projects.
- It is also clear from the findings above that conditions can be created to encourage more postgraduate involvement. Contract research projects with substantial funding which are done collaboratively provide more opportunities for postgraduate students to participate. However, students should ideally have the opportunity to be involved in more basic and fundamental type research. In both cases, it is clear that funding agencies could stipulate conditions and create opportunities that could lead to even greater involvement of postgraduate students in university and technikon research. This would undoubtedly strengthen research capacity building in HE.

5.7 Policy framework and key issues

The final section of this report draws attention to key policy documents and issues regarding postgraduate education and training and the research system.

In the last seven years several policies and initiatives have emerged that address issues in postgraduate education and the academic research community in general. All these policies and initiatives have been driven by national systemic[20] goals of equity (regarding participation and success), excellence (quality), quantity (the required range of outputs), responsiveness (relevance) and efficiency[21].

The main issues regarding postgraduate education and research include participation and throughput rates within postgraduate education, participation rates of women and black researchers, research capacity development, quality and quantity of research outputs, research funding, research productivity, research management and research focuses. In addition, related issues of coursework vs thesis programmes and the optimal balance between disciplinarity and inter-disciplinarity have become figural issues in response to changing modes of knowledge production and their contribution towards development

[20] "System" can be taken to refer both to the HE system and the National System of Innovation.
[21] See CHERDA (2003) – the Cape Higher Education Research and Development Alliance, comprising the CSHE at UWC, CREST (ex-CENIS) at the University of Stellenbosch and the Centre for Higher Education Transformation.

priorities. Most of the research funding mechanisms and strategies are geared towards addressing these issues.

In this section, different policy documents discussed in relation to these issues. Thereafter, some pertinent issues are raised relating to postgraduate education and research that are not addressed in the policy documents.

5.7.1 Research capacity development

The need for research capacity development and support programmes and initiatives in HE are clearly linked on the one hand to the human resource and labour market concerns in policy documents, and on the other, to an acknowledgment that historically, HE institutions have developed different capacities and expertise to conduct and sustain research. There is therefore a need, through support and development programmes, to build and sustain research capacity in an equitable way across the system and in this way to meet the dual demands of equity and development.

To these ends, a key strategic objective identified in the NPHE (DoE, 2001b: 23) is "To build high-level research capacity to address the research and knowledge needs of South Africa". The NPHE therefore lists as a priority: "To sustain research capacity and strengths, and to create centres of excellence and niche areas in institutions where there is demonstrable research capacity or potential". It further proposes that government funds to HEIs should be earmarked "to build research capacity, which will be awarded on the basis of a research development plan that is approved as part of an institution's three-year 'rolling' plan".

The R&D Strategy (DST, 2002) addresses the issue of research capacity indirectly through the government's Human Resource Development Strategy. In particular, it proposes that Centres and Networks of Excellence[22] provide ideal locations for research capacity development opportunities and that a well-balanced human resource development approach for SET must have a strong gender perspective. Previously marginalized groups (including women) must therefore be attracted via targeted programmes.

The NRF has subsequently further articulated the proposals for the establishment of Centres of Excellence. Although there are a number of proposed centres of excellence that will be directly managed by the Department of Science and Technology, the NRF has been tasked with the establishment and management of such Centres within HE. The passage below, taken from the NRF document on Centres of Excellence, which was released in May 2003, describes the overarching aim of this initiative and how it relates to other national policy frameworks and goals.

> The NRF is mandated to support and promote the creation of knowledge and innovation as well as the development of research in all fields of science and technology (including indigenous knowledge). It is expected to do this through funding, human resource development and the provision of the necessary research facilities. The Research and Innovation Support Agency of the NRF has a variety of initiatives that translate the complexity of this mandate into a range of well-defined programmes with hard budgets and measurable outputs and outcomes. One of these is the Focus Area Programme (FAP). The location of Centres of Excellence at the pinnacle the FAP framework is designed to raise the research and capacity development ceiling of already existent top level scientists and further enhance their contribution to regeneration of the broader science community. This approach is synergistic with the NRF's overall strategic plan. It is also in keeping with the National Research and

[22] The notion of a "network of excellence" is clearly taken over from the European Union 6th Framework philosophy which promotes the idea of multi- and trans-national networks of excellence.

> Development Strategy as well as the National Science and Innovation System. Centres of Excellence are specifically designed to accelerate the delivery of appropriate human resources and knowledge capacity in science and technology, development and innovation, especially in areas of strategic national importance. (NRF, 2003: XX)

The key activities and functions of Centres of Excellence are to:

- Undertake research focused on the creation and development of new knowledge and technology.
- Undertake education and training
- Be actively involved in information brokerage, networking and service rendering.

The further elaboration on what is meant by "education and training" is worth quoting in full:

> Human resource development is to be done through masters and doctoral programmes, post-doctoral support, internship programmes, support for students to study abroad, joint ventures in student training, etc. In creating, broadening and deepening research capacity, a CoE needs to pay particular attention to racial and gender disparities.

The Higher Education Quality Committee (HEQC) of the Council for Higher Education has statutory responsibility for quality assurance in HE and to conduct institutional audits of HEIs. In 2002, the HEQC published its *Institutional Audit Framework* (CHE 2002) in which it proposed a first cycle of institutional audits[23] to start in 2004. It then published a discussion document on *Proposed Criteria for the HEQC's first cycle of audits: 2004-2009* (CHE 2003b). In this document The HEQC has identified "Quality management of Research" as one of the target areas in its first cycle of institutional audits. Included in this target area are criteria for the quality management of postgraduate education. Two of the criteria for quality management of research relate to research capacity support and development. The document provides some examples of what would be expected of an institution to meet the criteria of effectively developing and supporting research capacity[24]:

Criteria 9.2
Sub-Area: Support and development
Criterion: The institution has clear and effective policies and strategies geared towards the support and development of its institutional goals for research as well as for new researchers, with due attention to race and gender considerations
In order to meet the criterion, the following are examples of what would be expected:
(i) Support, development and incentives are available to new researchers at all the levels of research activities
(ii) Support, development and incentives are available for collaborative and problem-solving research, in particular those at the local/regional and national levels

[23] The audit seeks to establish the nature and extent of the quality management system in place at the institution and to evaluate the effectiveness of the quality management system on the evidence largely provided by the institution itself.
[24] Note, since this is still a discussion document, the numerical references given here and layout may be different in the final document.

Criteria 9.6
Sub-Area: Support and development
Criterion: The institution has clear and effective policies and strategies to develop, support and improve postgraduate education
In order to meet the criterion, the following are examples of what would be expected:
(i) Training and development opportunities are available to new supervisors
(ii) Research design and methods courses are available to postgraduate students
(iii) Access to special support services are available to postgraduate students
(iv) Regular access to supervisors and other researchers in the field are facilitated
(v) Special funds to support postgraduate research are available
(vi) Additional support and development programmes are available to previously disadvantaged groups of students

To conclude: Four major recent policy initiatives (the DoE's *National Plan for Higher Education*, the DST's *Research & Development Strategy*, the NRF's *Centres of Excellence* discussion document, and the CHE's HEQC *Institutional Audit Framework*, which includes criteria for research support and development) all identify research capacity building in one form or other as a key priority and address the issue accordingly. It will be important to monitor the process of implementation of these initiatives and to evaluate their effectiveness in meeting the policy goals towards which they are directed. The monitoring, evaluation and in-depth research into these issues therefore constitutes another important element of further inquiry in this area.

5.7.2 Quality and quantity of research outputs

The focus in recent policy documents on the quality and quantity of research outputs stems primarily from two concerns, namely:

(i) a decline in total published outputs in recent years based on an analysis of research output trends over the past decade[25]; and
(ii) weaknesses and limitations of current policies and procedures to define and measure research outputs.

As just indicated, the NPHE (DoE, 2001b: 77) identifies the need "To increase research outputs" as one of its five priorities and proposes the following mechanisms and strategies to enhance research output and quality:

- Introducing a separate research component within the new funding formula, which will be based on research outputs, including at a minimum, masters and doctoral graduates and research publications;
- Revising the current policies and procedures on the measurement of research outputs at universities and technikons; and
- Facilitating the establishment of processes and mechanisms to ensure greater co-ordination in the determination of national research priorities and funding between state departments, the science councils, in particular the NRF, and other key role players, including the establishment of a national and integrated database for research

[25] The NPHE refers to a decline in total published outputs within higher education. As the statistics elsewhere in this report shows, this is an unfortunate error. The trends in SAPSE research outputs, which is supported by SA Knowledgebase, reveals much more of a steady state condition: the volume research outputs have stayed pretty much the same over the past 6 years.

The next section below examines in more detail the HEQC's Audit Criteria (CHE 2003b) that include monitoring and evaluating the quality and quantity of research outputs within the context of a research quality management system.

In addition to the proposed New Funding Framework, the Department of Education released a draft policy in which it addressed the state of accredited journals at the beginning of 2003. This policy proposes the following criteria for the inclusion of journals for purposes of research funding:

- International journals (SCI, SSCI & AHCI of the ISI), including SA journals on ISI
- South African journals not on international list

It is further stated that the DoE will "motivate for inclusion of SA journals onto international list". South African journals that would like to apply for inclusion need to meet the following criteria:

- The purpose of the journal must be to disseminate research results and the content must support high level learning, teaching and research.
- The journal must have an ISSN (International Standard Serial Number)
- The journal must be published regularly (frequency of publication)
- The journal must have an editorial board
- Membership of the editorial board must be beyond a single institution
- Articles accepted for publication in the journal must be peer-reviewed
- The journal must be distributed beyond a single institution
- The seat of the Journal must be in South Africa
- The articles should preferably have English abstracts.

As part of the current initiative a total of 292 South African journals were "evaluated". The result was as follows:

- 55 journals meet all criteria
- 42 journals meet some of the criteria
- 69 journals did not meet all criteria.

However, it should be noted that the procedure whereby South African journals were reviewed is problematic[26]. It is not acceptable to judge the "quality" of a journal on the basis of information provided in the journals themselves. There are at least three reasons why such a procedure is flawed:

- The information contained in the journal (on peer review procedures, composition of the board, etc.) might be inaccurate or dated or both
- The information provided could be interpreted in many ways. So, for example, does "peer review" mean that an article has been reviewed using blind refereeing methods? It is also not clear how many reviewers are involved, what procedures are in place for the selection of reviewers and whether the same reviewer is asked to review articles for a particular journal. These factors can seriously undermine the quality of the peer review process.
- Even where some of this information is present, it was never intended to be used by an outsider to judge the quality or acceptability of the journal for inclusion in the DoE's list.

[26] The concerns discussed in this section were voiced in a submission made to the Department of Education by Prof. Johann Mouton of CREST (ex-CENIS) in March 2003.

This means that the current procedure is fundamentally unfair to the editors and journals concerned.

Given these concerns, a number of proposals have been made that would lead to strengthening the quality of South African journals and, therefore indirectly, the quality of scientific production in the country[27].

Proposal 1: That the department conduct as a matter of urgency a comprehensive review of the current South African journals in order to establish a "baseline" list that is based on appropriate and methodologically sound information and which have general acceptance in the scientific community.

Proposal 2: That the review referred to in Proposal 1, be repeated every 3 to 5 years to establish whether South African Journals continue to meet the criteria for inclusion in the DoE list.

Proposal 3: That the DoE give consideration to a scheme which would encourage South African journals to apply for inclusion to the ISI database. This could be in the form of one-off monetary incentives or through a scheme whereby journal articles that are published in ISI-index journals, get a stronger weighting (e.g. 1.2 or 1.25) for subsidy purposes. Similar schemes in countries such as Mexico and Brazil have in fact led to more journals from those countries being included in the ISI.

Proposal 4: As a parallel scheme to the one proposed in Proposal 3, the DoE might consider ranking South African journals using various criteria (including impact) and thereby encouraging them to apply for ISI inclusion. In itself, it would assist potential authors if a list of SA Journals, which clearly indicates which local journals are more regularly cited than others, in their decision to submit.

As stated previously, it is not only the quantity of research output that is important, but also of course the quality. These issues around the strengthening of the quality of South African journals are therefore vital ones in considering the contribution of HE research to knowledge and development.

5.7.3 Research management

The HEQC's audit criteria (CHE 2003b), make explicit the expectations for HE institutions to demonstrate the nature, extent and effectiveness of their research quality management systems. These criteria include policies, structures and strategies for quality management of research and postgraduate education. The criteria should be read in the context of institutional audits that aim to enable HEIs to identify their own strengths and weaknesses and to seek support to build capacity where necessary. The criteria and expectations in CHE (2003b) for the target area "Quality management of Research" are the following[28]:

[27] These proposals were contained in CREST's submission to the DoE.

[28] Note, since this is still a discussion document the numerical references given here and layout may be different in the final document.

Table 55: Criteria for the quality management of (non-degree) research

Criteria 9 **Sub-Area**: Policies and regulations **Criterion**: The institution has policies, regulations and criteria that allow for planning, implementation and monitoring of research participation, research output, research funding and research and development In order to meet the criterion, the following are examples of what would be expected: (i) Research plans and policies that clearly state the institutional goals and missions for research (ii) Policies that make clear the criteria for the evaluation and approval of research proposals (iii) Policies that encourage the development of new researchers, with due regard to race and gender considerations (iv) Policies that encourage collaborative and problem-solving research at the local/regional/national level (v) Policies and criteria regarding access to and allocation of funding for research (vi) Policies and regulations with regard to research outputs
Criteria 9.1 **Sub-Area**: Structures **Criterion**: The institution has structures (e.g. research committees) that quality assure and monitor research In order to meet the criterion, the following are examples of what would be expected: (i) Structures which apply clear criteria against which to evaluate, monitor and approve research proposals (ii) Structures which apply clear criteria against which to evaluate, monitor and approve the establishment of research programmes/groups/teams/units (iii) Structures to manage and monitor the commercialisation of research
Criteria 9.2 **Sub-Area**: Support and development **Criterion**: The institution has clear and effective policies and strategies geared towards the support and development of its institutional goals for research as well as for new researchers, with due attention to race and gender considerations In order to meet the criterion, the following are examples of what would be expected: (i) Support, development and incentives are available to new researchers at all the levels of research activities (vii) Support, development and incentives are available for collaborative and problem-solving research, in particular those at the local/regional and national levels
Criteria 9.3 **Sub-Area**: Information system **Criterion**: The institution has an effective research information system that monitors research participation, research output and research funding throughout the institution In order to meet the criterion, the following are examples of what would be expected: (i) Essential information regarding research is captured by a central research information system (ii) Captured data is linked in a way that allows meaningful reporting on research at the institution

Table 56: Criteria for the quality management of postgraduate education

Criteria 9.4 **Sub-Area**: Policies and regulations **Criterion**: The institution has policies, regulations and criteria that allows for planning, implementation and monitoring of postgraduate education In order to meet the criterion, the following are examples of what would be expected: (i) Policies that clearly state the nature of postgraduate education at the institution (ii) Policies that make clear the criteria for the evaluation and approval of doctoral proposals (iii) Policies and criteria regarding access to and allocation of funding for postgraduate research (iv) Policies and regulations that specify the role and responsibilities of supervisors for postgraduate research (v) Policies that make clear the criteria for assessment or examination of completed doctoral research (vi) Policies and regulations regarding postgraduate publications
Criteria 9.5 **Sub-Area**: Structures **Criterion**: The institution has structures that quality assure and monitor postgraduate education In order to meet the criterion, the following are examples of what would be expected: (i) Structures which apply clear criteria against which to evaluate, monitor and approve postgraduate research (ii) Structures that evaluate and approve funding for postgraduate research (iii) Structures that enable postgraduate students to lodge complaints or appeals as well as enable opportunities to defend their research
Criteria 9.6 **Sub-Area**: Support and development **Criterion**: The institution has clear and effective policies and strategies to develop, support and improve postgraduate education In order to meet the criterion, the following are examples of what would be expected: (i) Training and development opportunities are available to new supervisors (ii) Research design and methods courses are available to postgraduate students (iii) Access to special support services are available to postgraduate students (iv) Regular access to supervisors and other researchers in the field are facilitated (v) Special funds to support postgraduate research are available (vi) Additional support and development programmes are available to previously disadvantaged groups of students
Criteria 9.7 **Sub-Area**: Information system **Criterion**: The institution has an effective research information system that monitors postgraduate education In order to meet the criterion, the following are examples of what would be expected: (i) Essential information regarding postgraduate research is captured by a central research information system (ii) Captured data is linked in a way that allows meaningful reporting on postgraduate research at the institution

The HEQC's audit criteria thus provide the framework for the quality assurance in the area of research management. As mentioned above, the key issue is how effectively these criteria and the audit process itself will be in bringing about the required improvements. To this end, the ongoing monitoring, evaluation and research into this area will be important.

5.7.4 Research focus

There are at least three recurring themes relating to research focus which are addressed in policy documents on HE and research and development. They are: research collaboration, responsiveness of research and nature of research. All of these have implications for research activities at HE institutions, including postgraduate education and are now briefly discussed.

Research collaboration

Research collaboration in the NPHE (DoE, 2001b) is seen as a mechanism to build research capacity in HBUs and HBTs thereby ensuring that race and gender inequities in postgraduate training are addressed. The NPHE proposes the introduction of "earmarked funds for research collaboration", in particular for "inter-institutional collaboration both regionally and nationally, with specific emphasis on collaboration that enhances research capacity in historically black institutions and technikons" (DoE, 2001b: 77).

In the R&D Strategy (DST, 2002), research collaboration is seen as a mechanism for building research capacity as well as a means of strengthening the likelihood of South African researchers remaining in South Africa. The Strategy proposes that research collaboration should take the form of continental and international S&T networks and connections. It views these networks and connections as opportunities to link South African scientists into global research developments as well as international human and financial resources. The R&D Strategy suggests that not only will these collaborations enhance opportunities for technological innovations, they also present the opportunity to take advantage of peer review systems to assess postgraduate programmes and exchange programmes of scientists and post-doctoral fellows.

Responsiveness of research

Responsiveness of research refers specifically to the responsiveness of research to meeting the national social and economic development goals of the State. These national goals are best articulated in the *White Paper on S&T* (DACST, 1997). The White Paper proposes that a NSI will be an enabling framework that will make it possible for all South Africans to enjoy the economic, socio-political and intellectual benefits of science and technology.

In response to this, one of the priorities stated in the NPHE is "To promote articulation between the different elements of the research system with a view to developing a national strategy linked to the national system of innovation" (DoE, 2001b: 77). It proposes that one of the strategies to achieve this is to facilitate "the establishment of processes and mechanisms to ensure greater co-ordination in the determination of national research priorities and funding between state departments, the science councils, in particular the NRF, and other key role players" (ibid.).

One of the strategic objectives towards meeting the national goals of economic development identified in the R&D Strategy (DST, 2002) is "Achieving mastery of technological change in our economy and society (innovation)". It proposes that this can be achieved through the establishment of new technology missions and mobilising all institutions (including universities) "to deliver innovation through the technology missions". The Strategy goes further by proposing focuses for these missions, thereby suggesting possible research agendas to be undertaken in HE institutions. The proposed focuses include:

- Science and technology for poverty reduction
- Research and development in ICT
- Research and development in biotechnology
- Technology for advanced manufacturing, such as in the automotive, chemical and pharmaceutical industries
- Technology and knowledge for and from resource based industries, such as agriculture, fishing and forestry, mining and minerals and energy production.

The R&D Strategy also describes a number of funding mechanisms and technology diffusion and transfer programmes available that encourage R&D collaboration between HEIs and industry. These include the Innovation Fund (IF), the Support Programme for Industrial Innovation (SPII), the Technology Stations Programme (Tsumisano) and GODISA (The DST/DTI Incubator Programme).

Nature of research

The issues around the nature of research as addressed in the policy documents on HE and research and development revolve around the different objectives and outcomes of basic research versus applied or problem-solving research. The issues arise particularly out of concerns raised above with respect to responsiveness of research.

All recent major policy documents (NPHE, R&D Strategy, White Papers on HE and S&T), endorse and support the place and endeavour of basic or fundamental scientific research within a national system of innovation. The *White Paper on HE* (DoE, 1996), states that basic research is "crucial in nurturing a national intellectual culture, generating high level and discipline specific human resources, and providing opportunities for keeping in touch with international scientific developments – all of which facilitates innovation" (DoE, 2001b: 72). *The White Paper on S&T* (1997) describes fundamental research activity as the "preserver of standards without which, in the long term, the applied sciences will also die".

The NPHE supports the above objectives, but highlights recent data on research outputs that suggest that over the past decade the focus of research has shifted "towards strategic and applied research, with the emphasis on socio-economic and industry-related issues, and a concomitant decline in basic research" (DoE, 2001b: 71). It suggests that this shift "has clearly been influenced by the increased availability of resources for contract research both from Government and the private sector". The NPHE therefore challenges HE institutions to "increase strategic or problem-solving research, while maintaining and, if possible, strengthening the system's core knowledge base in basic science" (DoE, 2001b: 72).

Although the *R&D Strategy* echoes the NPHE in proposing that research should be both outcomes-driven (as in applied and problem-solving research) and globally competitive in terms of high quality leading-edge basic research, it suggests that the former should take priority in stating that: "Despite the fact that the motivations of individual scientists are generally fired by intellectual curiosity rather than by the weighing of potential outcomes, it is necessary for decisions to be made unsentimentally. Not to prioritise in a way that attempts to optimise impact is irresponsible and potentially wasteful" (DST, 2002: 54).

In conclusion: Several recent policy documents address the issues of research collaboration (as a means of building capacity), and the responsiveness and nature of research (which are central to enhancing the relevance of research to development priorities). These formulations, though framed as broadly normative policy objectives, constitute important statements of intent against which subsequent implementation can be assessed.

6. Conclusion

This report, commissioned by the National Advisory Council on Innovation (NACI), provides a profile of the postgraduate subsector of HE and the HE research community in South Africa with a view to informing policy-makers and stakeholders of key trends and issues. Postgraduate education and HE research form a pivotal part of the national science and innovation system and therefore have a key role to play in contributing towards national development. It is therefore important to track and analyse trends in these domains.

Constructing the profile has been constrained by the unavailability of complete and reliable data regarding some aspects of the inquiry. It is hoped that this report will form the basis of future and more comprehensive profiles. Despite these data limitations, the profile presents a comprehensive and informative account of the postgraduate subsector and the HE research community.

The overall picture emerging from this profile is that the postgraduate sector and academic research community shows considerable strengths and potential on the one hand, but also formidable weaknesses, unevenness and problem areas on the other. Clearly, to fulfil its role in producing the next generation of researchers for the HE system and the labour market, the postgraduate subsector will have to expand in the required fields and especially at the upper levels, producing graduates more efficiently and equitably, and better prepared for the requirements of the changing labour market. Likewise, research output and productivity will have to improve considerably. Various strategies and policies have been developed by the government and other key agencies to address these and other problems. The ongoing monitoring, evaluation and research of these to ascertain their effectiveness and impact will be important to improve HE's vital contribution to national development and to greater equity in the science and innovation system.

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