

## Chapter 3

# The demand for improved efficiency

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The policy discourse after the first democratic election in 1994 was dominated to such an extent by concerns about equity, and racial equity in particular, that the important issue of efficiency was ignored. Badat (2004) identified equity versus development as the main tension in the post-apartheid era, but it could be argued that the real strain that emerged was between equity and efficiency. It is often forgotten that the apartheid regime, in addition to racial differentiation, was also deeply inefficient and corrupt. Separate development policies required enormous amounts of

duplicated funding – for example, the fact that a university was developed and funded in every homeland – whether it was viable or not (Cloete and Moja 2005).

### The tension between equity and efficiency in policy guidelines

The newly elected democratic government was immediately faced with the twin problems of bringing about greater equity and also greater efficiency, even though the public and policy debates focused on equity. The first major national framework policy, the Reconstruction and Development Programme (RDP) (ANC 1994), emphasised equity and democratisation. However, the jolt of the 1996 fiscal crisis re-emphasised the need for an overall improvement in efficiency and higher education was not exempt from this. These shifts in emphasis in the policy documents can be read as an indication of the move towards efficiency after the formulation of the Growth, Employment, and Redistribution (GEAR) macroeconomic policy in 1996 (Department of Finance 1996). GEAR was a package of mainly macroeconomic measures that included faster fiscal deficit reduction, budget reform, consistent monetary policy, stable and coordinated policies, and a strong emphasis on efficiency and restraint on government spending (Department of Finance 1996). The main aims were to stimulate growth through foreign investment, improved competitiveness and efficiency.

The National Commission on Higher Education's *A Framework for Transformation* (NCHE 1996) and the 1997 *White Paper* (DoE 1997) together laid the first stone of equity as the foremost transformation principle. In contrast, the Council on Higher Education report *Towards a New Higher Education Landscape: Meeting the equity, quality and social development imperatives of South Africa in the 21st century* (CHE 2000) listed effectiveness and efficiency challenges before mentioning equity, and the *National Plan for Higher Education* (NPHE) (DoE 2001) began its discussion on the challenges facing higher education with the need for human resource development (Cloete and Moja 2005).

The most clearly articulated efficiency policy initiative was the implementation of a new funding and planning framework. To do this the Department of Education (2005c) engaged in a system-wide student enrolment planning exercise (2005 to 2007) aimed at facilitating the implementation of the new funding formula. This strongly guided approach by the Department of Education was partially to address the wastage diagnosed from student dropout and failure rates. An analysis of the cohort completion rates for the 2006 first-time entering students showed a completion rate of 48% for all three- and four-year qualifications after a period of five years for contact universities (CHE 2013: 45). The former Ministry of Education had had a more efficient target of 67% (Bunting and

Cloete 2004) in mind, but there were great institutional variations, ranging from an annual pass rate of less than 30% in some institutions to over 80% in others (Department of Education 2005c). But these figures pertained to undergraduate throughput rates. No argument was put forward about the efficiency of postgraduate throughput.

The DoE's objective therefore was to improve the graduate output by ensuring that the growth in graduates was higher than that of enrolments. This should result in systematic improvement in throughput rates and the graduation numbers should then advance at a higher rate than enrolments for a period, and improve the historically low levels of graduate output. The *White Paper for Post-school Education and Training* (DHET 2013c: 34) expressed the urgent need to explore ways of ensuring a greater enrolment and through-flow of postgraduate students from whose ranks academics and researchers could be drawn. The *National Development Plan 2030* subsequently argued that throughput rates of programmes should be increased to more than 75% (NPC 2012).

The National Planning Commission (NPC) also voiced concern about inefficiencies in the higher-education system and said that the low numbers of postgraduates had to be addressed if universities were to deliver the skills needed for development. Furthermore, the report argues that the quality of research outputs should also be improved and the number of masters and doctoral graduates increased dramatically to accelerate knowledge production and the innovation needed for the development of the country (NPC 2012).

In this chapter, four indicators of efficiency are explored. The chapter concludes with a comparison of South Africa's completion rates with those of Norway, the United States, Canada and the United Kingdom.

### On defining efficiency

Although there are different ways of defining 'efficiency' within higher-education studies, we have settled on the following definitions in this chapter:

- The system is efficient when optimal numbers of students progress from lower degree levels to doctoral studies (progression rates).
- The system is efficient when optimal numbers of students are retained in the system (retention rates).
- The system is efficient when optimal numbers of students enrolled for a degree complete within acceptable time-frames (completion rates).
- The system is efficient when academic staff holding doctorates produce (on average) increasing numbers of doctoral graduates (productivity rates).

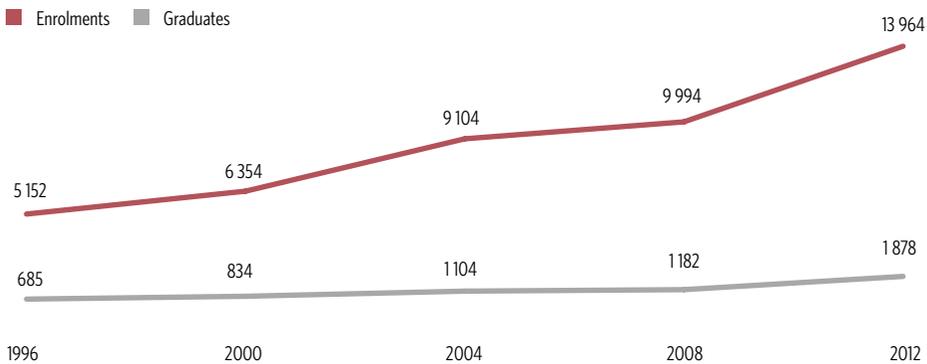
We will show in the statistical analysis below that efficiency (in terms of all of these definitions) varies by institution. Similarly, we will also show that efficiency varies across scientific fields. This may be the result of various other factors, including differences in proportions of full-time versus part-time students across different fields, but also because there are differences in the models of doctoral studies across different fields. There is increasing evidence that students in some fields – especially the natural and health sciences fields – are following the route of doing a PhD by publication. This, in itself, is often highly correlated with higher retention and completion rates. But, again, we will also show that efficiency (at least as far as progression and completion rates are concerned) is influenced by the deep structure of the socio-economic realities of doctoral education in South Africa. This translates into differential progression and completion rates for different subgroups of students (as disaggregated by race, gender and age).

### The relationship between enrolment and graduation in efficiency

While enrolment and graduation numbers rose marginally between 1996 and 2006, there was a sharp increase in both enrolments and graduates during the period 2008 to 2012 (see Figure 3.1). Over this period, doctoral enrolments increased from 5 152 in 1996 to 13 964 in 2012 (a 171% increase), with an average annual growth rate of 6.4%.

The number of doctoral graduates increased from 685 in 1996 to 1 878 in 2012, a growth of 174%, and the average annual increase over the period was 6.5%. Graduates have thus grown more or less at the same annual rate

Figure 3.1: Comparison of doctoral enrolments and graduates (1996–2012)



Source: DoE (1999), DHET (2013a)

as enrolments. At the same time we should note that relatively large proportions of enrolled doctoral students (around 45%) dropped out before graduating. This will be illustrated through the cohort analyses later in this chapter. If the growth rate in graduates is higher than that of enrolments it signals an improvement in efficiency.

The data for graduate output and efficiency for the three institution types show that:

- The universities displayed a slight improvement in efficiency with an average annual increase in graduates of 6.5%, compared to 6.4% in enrolments;
- The comprehensive universities increased their doctoral enrolments as well as graduates by 5.1% on average per annum over the period 1996 to 2012. These universities have thus not improved their efficiency over this period; and
- Doctoral enrolments in universities of technology grew on average by 20.0% per annum, whilst their graduates increased by 20.7%, which signals a small increase in efficiency (see Table 2.2 and Table 2.3 in Chapter 2).

### **Cohort tracking as a measure of doctoral graduate output efficiency**

The cohort-analysis methodology was applied to individual student records extracted from the Higher Education Management Information System (HEMIS) database, which is maintained by the Department of Higher Education and Training. Enrolments and graduates have been linked through cohort tracking since 2003 (DHET 2013a). This allows for accurate measures and comparisons of the proportion of doctoral students who drop out before completing their studies, and the share of students who eventually graduate.

#### **Methodology**

The cohort data were analysed as follows for each of the 23 public universities (across the categories of universities, comprehensive universities and universities of technology):

- Students who enrolled for doctoral studies for the first time in 2003 to 2007 were identified in the student record systems of each of the 23 public universities. These students were then tracked through each university's student record system for each year from 2003 to 2012. If a student registered for doctoral study, for example, in 2003 and was not registered in any subsequent year up to 2012, then he or she was

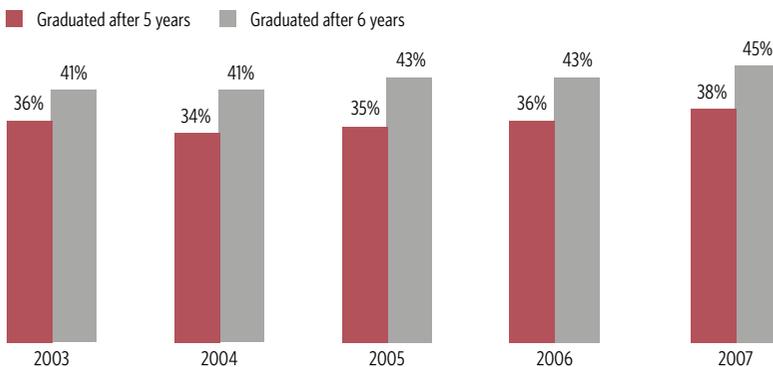
counted as a dropout. However, if a student who registered for the first time in the same year was not registered for a number of subsequent years, but then re-emerged in the student record system some years after initial registration, and then remained registered until 2012, he or she was reinstated in the cohort count and eventually recorded either as a graduate or with ‘studies incomplete’.

- The same procedures were followed for students who enrolled for doctoral studies for the first time in 2004 to 2007. They were also tracked through the student record systems of each of the 23 public universities, and were counted as dropouts (a) if they discontinued their registration, and (b) if they were not reinstated at any time before 2012. The dates on which they finally graduated were also recorded.

### Graduation rates five and six years after registration

Figure 3.2 shows that throughput rates improved marginally for the new cohorts over the period 2003 to 2007. A comparative analysis of the 2003, 2004 and 2005 cohorts illustrated similar trends with an average graduation rate of 35% after five years and 42% after seven years. The 2006 cohort had a 43% completion rate after six years, whilst the 2007 cohort showed a 45% completion rate after the same period. The percentage of new enrolments who graduated after five years grew from 36% for the 2003 cohort to 38% in 2007. The percentage of new enrolments who graduated after six years increased slightly from 41% for the 2003 cohort to 45% in 2007. Although the percentage of the doctoral cohort who graduate is still low, these increases show there were improvements in doctoral graduation rates.

Figure 3.2: Percentages of new doctoral intakes who graduated after five and six years respectively (2003-2007)

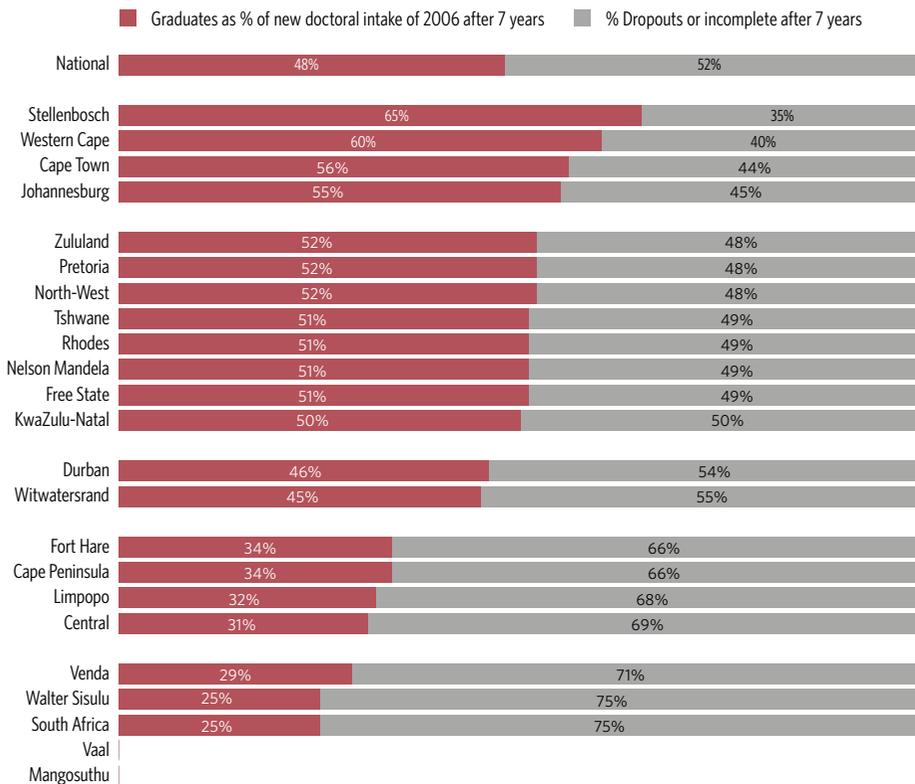


Source: DHET and CHE Cohort Analysis 2014

Figure 3.3 provides a summary by institution of the progress made after seven years by the new doctoral intake of 2006. This cohort was selected for analysis because it includes enrolment and graduation data for a full seven-year period (2006–2012) and it was the cohort with the most stable data following the 2005 mergers. The main trends observed from the analysis of progress are: (1) two universities, Stellenbosch and Western Cape, had throughput rates above 60%; and (2) 12 of the 23 institutions had a throughput rate of 50% or higher for the 2006 new doctoral intake.

While 12 institutions graduated 50% or more of the new 2006 doctoral intake, six institutions graduated between 30 and 50% of the intake, and three graduated less than 30 per cent of their intake. Stellenbosch University had the highest throughput rate (65%) of all universities in the country. The Mangosuthu and Vaal Universities of Technology had no new doctoral students for the 2006 period.

Figure 3.3: Progress of 2006 intake of new doctoral students after seven years by bands of performance



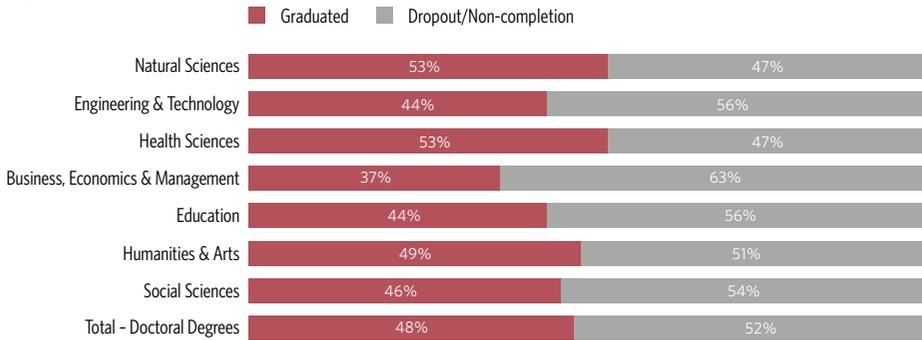
Source: DHET and CHE Cohort Analysis 2014

### Throughput by field of study

Analysis for the 2006 new doctoral intake per field of study (Figure 3.4) reveals that doctoral students in natural sciences and health sciences had the highest throughput rate (53%), followed by doctoral students in humanities and arts (49%). Doctoral students in social sciences and in education had a throughput rate of 46% and 44% respectively. Doctoral students in business, economics and management had the lowest rate of 37%, as well as a high incomplete and dropout rate of 63% after seven years.

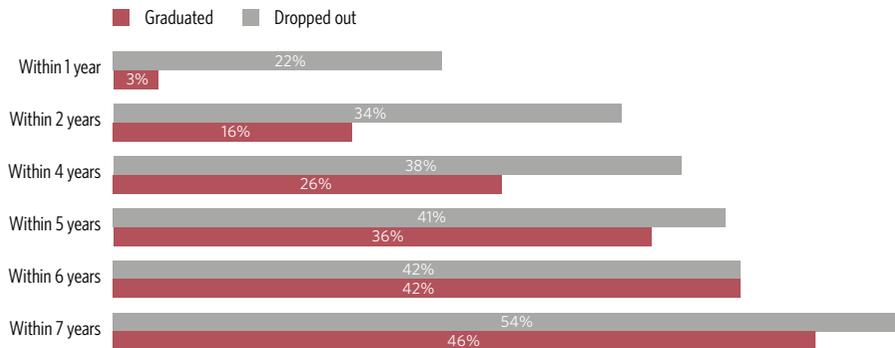
Figure 3.5 illustrates that if doctoral students of the 2006 cohort were to drop out, most did so in their first year of study (22%), and that 46% of all the doctoral students enrolled in 2006 graduated within seven years.

Figure 3.4: Progress of 2006 intake of new doctoral students after seven years by fields of study



Source: DHET and CHE Cohort Analysis 2014

Figure 3.5: Dropout and completion rates of the 2006 new entering doctoral cohort



Source: DHET and CHE Cohort Analysis 2014

Throughput by institution type

In terms of differentiation, there are not only major distinctions within institution types, but also between universities, comprehensive universities and universities of technology.

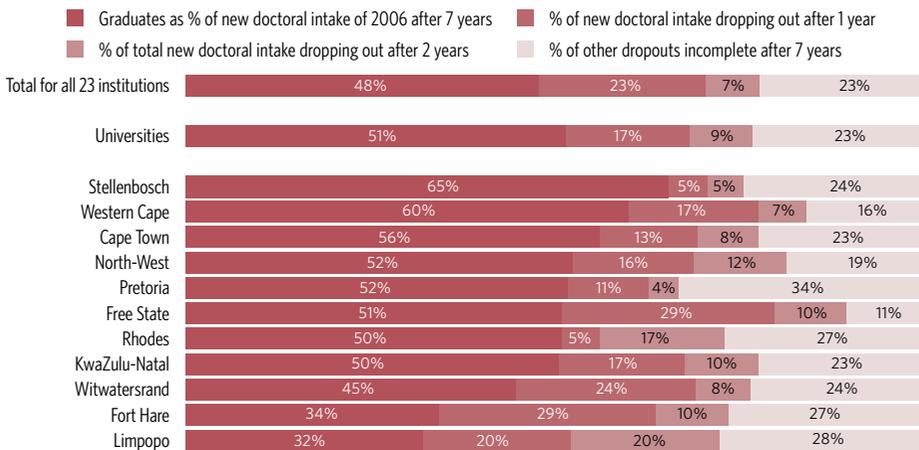
Figures 3.6, 3.7 and 3.8 reveal that, of the three groups, the universities group was most successful in terms of completion rates (51%), with two universities (Stellenbosch and Western Cape) graduating 65% and 60% of their 2006 new doctoral entrants by 2012. Six universities (Cape Town, North-West, Pretoria, Free State, Rhodes and KwaZulu-Natal) graduated between 50% and 56% of their 2006 enrolments within seven years.

Comprehensive universities as a group were less successful than universities, and recorded a completion rate of 38% for their 2006 enrolments for the period 2006 to 2012. Three of the comprehensive universities – Johannesburg (55%), Zululand (52%) and Nelson Mandela Metropolitan (51%) – graduated more than the average percentage for their group.

Universities of technology also graduated 38% of their 2006 new doctoral intakes. The Tshwane and Cape Peninsula Universities of Technology graduated higher-than-average percentages of their 2006 doctoral intake during the seven years of analysis (51% and 46% respectively).

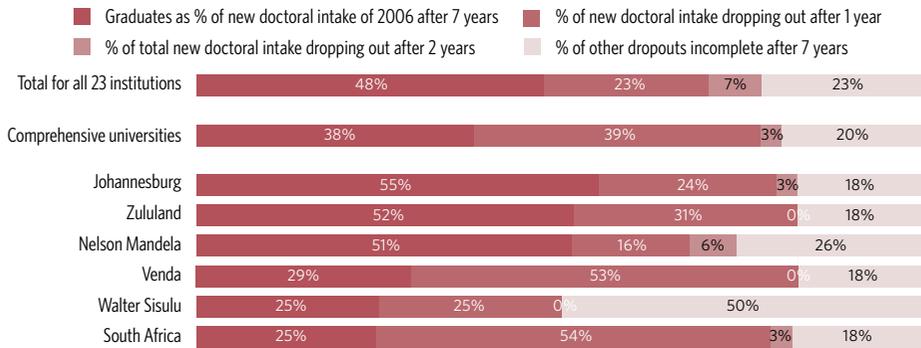
Dropout rates were the highest after the first year of study, with the national average at 23%. The highest dropout rate after a year was in the comprehensive universities group (39%), followed by the universities of technology (28%) and the universities group (17%).

Figure 3.6: Progress of 2006 intake of new doctoral students at universities after seven years



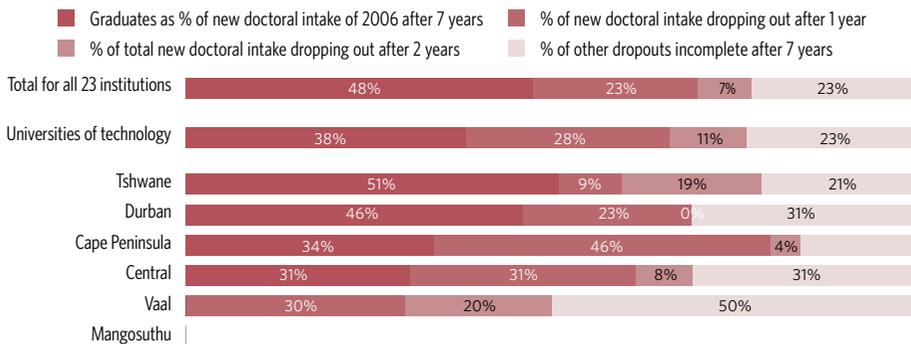
Source: DHET and CHE Cohort Analysis 2014

**Figure 3.7: Progress of 2006 intake of new doctoral students at comprehensive universities after seven years**



Source: DHET and CHE Cohort Analysis 2014

**Figure 3.8: Progress of 2006 intake of new doctoral students at universities of technology after seven years**



Source: DHET and CHE Cohort Analysis 2014

Note: The Vaal University of Technology had ten students, all of whom dropped out or did not complete their degrees. Mangosuthu University of Technology had no new doctoral student registrations in 2006.

### International PhD completion rates: How does South Africa fare?

This section compares South African doctoral-completion rates with selected countries. Comparisons could only be made with information from similar studies in other countries and comparative completion-rate data were limited to Norway, the United States, Canada and the United Kingdom. The comparisons are restricted because data for different cohorts of different years and for different periods are juxtaposed. Data for the United States and South Africa were available by nationality, and for the

United Kingdom data were obtainable separately for full-time and part-time study.

The infographic on page 70 presents international comparative information on completion rates. According to *Studies in Higher Education* (2013: 7–8) the completion rates for recent cohorts (2002/3) of fellowship-holders (about two-thirds of all doctoral students) in Norwegian doctoral training, 59% had graduated after five years and 76% after eight years. The completion rates between the various fields of study differed. Of the 2002/3 cohorts, 84% of the doctoral candidates in the natural sciences had graduated with a PhD within eight years, compared to 82% in medical sciences, 78% in agricultural sciences, 76% in the humanities, 71% in technology and 67% in the social sciences.

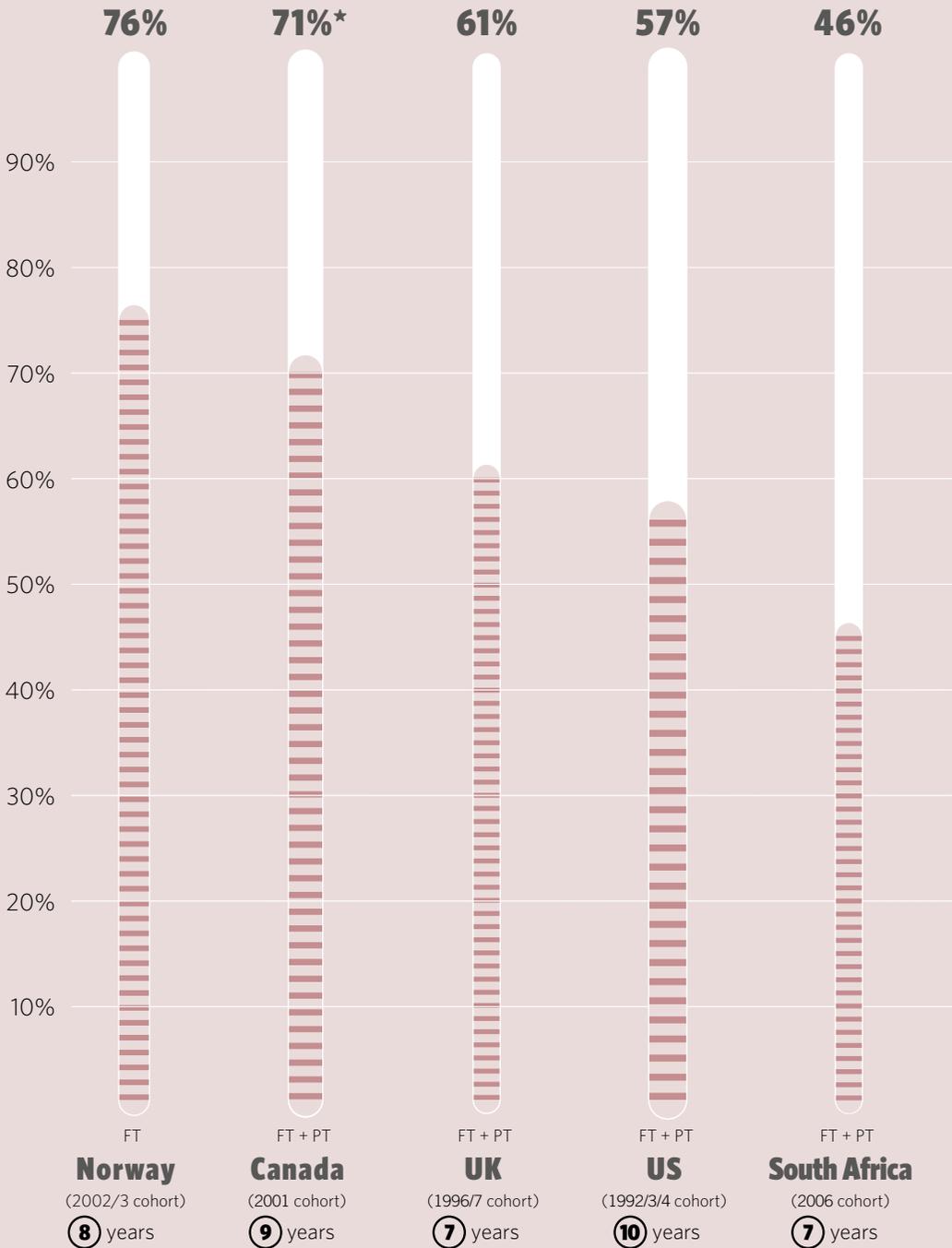
Data for PhD completion rates in the United States were taken from studies by the PhD Completion Project, which captured data submitted by 24 universities (mostly US ) for 19 000 students who entered doctoral programmes in 1992–93 to 1994–95 (Council of Graduate Schools 2008). The study found that the overall cumulative ten-year completion rate for the students was 57%. The completion rate for men (58%) was 3% higher than that for women (55%). The study also found that the overall cumulative ten-year completion rate for international students was 67%, compared with 54% for domestic students. In terms of race, whites scored highest in completion rates at 55%, compared with 51% for Hispanic Americans, 50% for Asian Americans, and 47% for African Americans. The completion rates by field of study also varied considerably, with a ten-year cumulative completion rate of 64% in engineering, followed by life sciences (62%). Physical science and mathematics and social sciences doctoral students had a ten-year cumulative completion rate of 55%, while humanities students trailed with 47%.

The latest data on completion rates and periods compiled by Canada's 15 research-intensive universities (also known as the U15) revealed that 70.6% of the students who entered PhD studies in 2001 successfully completed within nine years across disciplines. Among the 2001 cohort, the highest cumulative completion rate was in the health sciences (78.3%), while completion rates in physical sciences averaged 75.4%, with 65.1% for those in the social sciences. The lowest completion rate was in the humanities (55.8%).

The Higher Education Funding Council for England (HEFCE) examined the completion rates of a cohort of research students who started their PhD degrees in higher education institutions in the academic year 1996–97 for a period of seven years up to 2002–03. Data were drawn from the Higher Education Statistics Agency. The study found that after seven years, 71% of full-time PhD students had completed their studies compared to 34% of part-time students. The cumulative completion rate was 61% for all PhD

# DOCTORAL COMPLETION RATES

## INTERNATIONAL COMPARISON



30%  
20% = % complete within period of analysis  
10%

① = 1-year period of analysis  
⑤ = 5-year period of analysis

FT = Full-time PT = part-time PhD graduates

\* The 2001 cohort was comprised of students from a select number of Canadian research-intensive universities  
Sources: Council of Graduate Schools (2008), DHET and CHE Cohort Analysis (2014), Higher Education Funding Council for England (2005), Studies in Higher Education (2013), Tamburri (2013)

students. They also found that students from the natural sciences, medicine and veterinary sciences had the highest completion rates. Social studies and business studies students showed considerably lower completion rates (HEFCE 2005). The best completion rates for full-time students were in the biological and physical sciences, both with 81% completion rates. Social sciences doctoral students had a 61% completion rate and business studies 54%, with the lowest for architecture (54%). Part-time students had the best completion rate for medicine and veterinary sciences (53%) and the worst for architecture (22%). In the social sciences part-time students had a 29% completion rate, compared to 28% for business students. The HEFCE (2005: 34) related the relatively low completion rates in the social sciences to the fact that:

*fields of research in 'Social sciences and humanities' are not always as well established as in the natural sciences, and methodologies may still be disputed. Sometimes it may be difficult to identify topics, which can yield substantial results through a PhD research programme.*

The HEFCE (2005: 20) also found that international students (non-EU and EU) had a higher completion rate than UK students. The study found that gender affected the completion rates minimally, with men finishing slightly faster than women. In the case of full-time students, 72% of men completed compared to 70% of the women, and for part-time students, 34% of men completed compared to 35% of women (2005: 22). The study also concluded that the younger the student age group, the better the completion rates, with older students dropping out more frequently in both full-time and part-time programmes.

A confounding factor for completion rates is whether students study full-time or part-time, and this is evident from the United Kingdom data which revealed that more than double the percentage of full-time doctoral students graduated (71%) compared to part-time students (34%). Unfortunately, it was not possible to do a comparison between full-time and part-time study for South Africa because this data field had not been populated by institutions for the majority of students. However, some conclusions could be drawn from the 2006 new-entrant completion rate of the University of South Africa (UNISA), a distance-education institution. The completion rate for UNISA was 25% after seven years, while the average for the contact universities for the same period was 51%, despite a substantial portion of enrolments (mostly staff members) also studying part-time. Furthermore, the country with the highest completion rate is Norway, where doctoral studies are full-time posts (for four years) with students being paid the equivalent of a junior lecturer.

International comparisons show that South Africa is underperforming in terms of number of PhDs produced, but when it comes to efficiency the picture is not as clear.

In South Africa, 48% of the 2006 cohort graduated after seven years, while the country that came closest, the United States, had a 57% completion rate, but after ten years. Studies in the United Kingdom presented a 71% completion rate for full-time doctoral students after seven years, but only 34% for part-time studies after seven years. Two countries that proved more efficient than South Africa were Canada with a 71% completion rate after nine years, and Norway with 76% of students graduating after eight years, but these are full-time students. So what is perhaps more clear is that South Africa has too many part-time students, and in terms of part-time students, South Africa does not seem to be more inefficient than the UK. What is also clear is that South Africa has to start gathering data on PhD study that distinguishes between the type of registration – full-time or part-time.

Another very clear finding is that there is considerable differentiation in the production of PhDs, between both different types of institutions and between different fields of study. The cohort tracking showed that at the institutional level, clear bands were revealed for the period 2006 to 2012: two universities graduated 60% or more of their students, 12 of the universities had a throughput rate of 50% or higher, six had a completion rate of between 30% and 50%, and three graduated less than 30% of their intake.

In terms of the three institution types, the universities group performed better in terms of completion rates (51% in seven years for the 2006 new entrants). Comprehensive universities and the universities of technology were less successful, with a completion rate of 38% for their 2006 new-entrant doctoral students for the period 2006 to 2012.

A cohort analysis by field of study showed that after seven years doctoral students in the natural sciences and health sciences had the highest completion rate (53%), with the lowest graduation levels in business, economics and management (37%), and education and the social sciences (44%).

### **The postgraduate pipeline: Progression and completion rates**

In this section we discuss the postgraduate pipeline in more detail, with an emphasis on the progression to doctoral studies. The data for this section were collected as part of a study commissioned by the Department of Science and Technology in 2014, which was completed in May 2015 (Study 3 in Appendix 1). The study consisted of two main components: a secondary analysis of the micro-student records in the HEMIS database from 2001 to 2013, and a national survey of postgraduate students currently enrolled at

South African universities. Some of the findings from this survey are used in the following section of the chapter, where we report on the results of the HEMIS analyses.

The first set of results was for the retention and completion rates of postgraduate students in South Africa, and specifically about the ‘leaking’ pipeline. It is imperative that we ‘follow’ the retention of postgraduate students as they progress throughout the entire pipeline from honours to doctoral studies, and analyse the completion rates at each level. The illustrations below show quite clearly why the results point to a ‘leaky pipeline’.

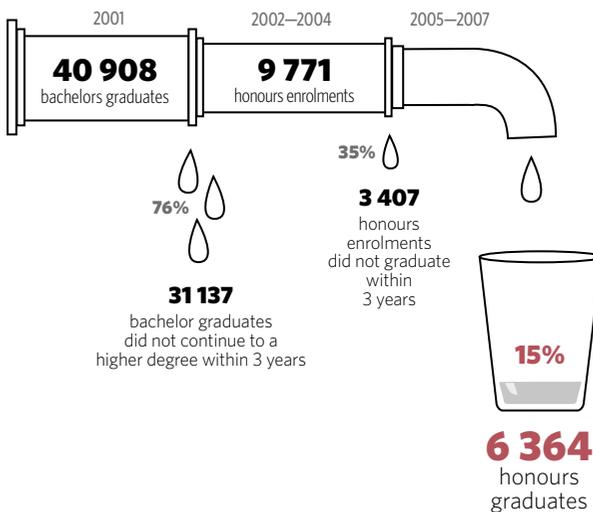
### Progression and completion from bachelors to honours

Just less than a quarter (24%) of bachelors students enrolled for an honours degree within three years, and 29% of these did so within five years after graduation.

But the really interesting trends emerge when we disaggregate by key demographic variables. The analysis shows that the progression rates of bachelors to honours for the following sub-groups significantly exceeded the national average (which is 28%):

- Students in the natural sciences (41.6%);
- Students in business, economic and management sciences (36.8%);
- White students (34%); and
- Students younger than 25 (33.9%).

### Progress of 2001 bachelor graduates to honours graduates (6 years)



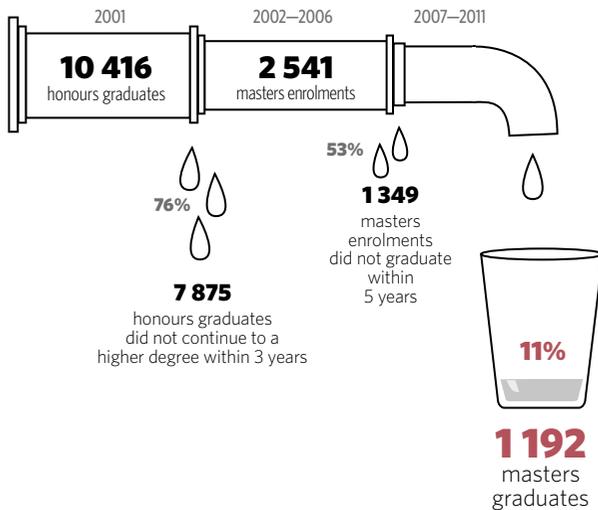
### Progression and completion from honours to masters

In terms of progression from honours to masters, on average, 24% had enrolled for a masters programme within three years after graduation. The corresponding average for honours graduates who did so within five years after graduation is 27%.

The disaggregation by demographic variables shows that the progression rates of honours to masters students for the following sub-groups significantly exceeded the national average (which is 26%):

- Students in the natural sciences (49.1%);
- Students in engineering and technology (43.4%);
- Students in health sciences (39.2%);
- Students in the humanities and social sciences (34.9%);
- Students from elsewhere in Africa (34.1%);
- Male students (30.5%); and
- Students younger than 30 (29.7%).

### Progress of 2001 honours graduates to masters graduates (10 years)



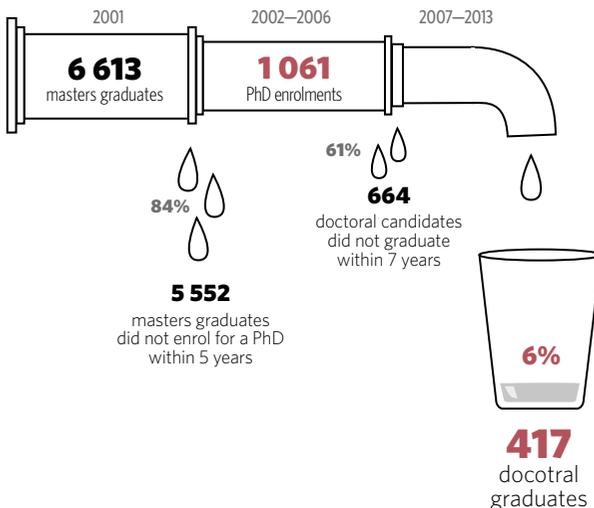
### Progression and completion from masters to doctorate

Of those enrolled for a PhD, on average 16% had graduated with a masters degree in the previous three years, and 15% within the previous five years.

The analysis by demographic variables shows that the progression rates of masters to doctoral students for the following sub-groups significantly exceeded the national average (which is 16%):

- Students in education (27.4%);
- Students in the natural sciences (26.2%) (mainly those younger than 35 and older than 40);
- Students older than 40 (21.3%);
- Indian students (20.3%); and
- Coloured students (19.7%).

#### Progress of 2001 masters graduates to doctoral graduates (12 years)



These progression trends reveal a very worrying picture of regular interruptions of studies. As the figures show, the typical study trajectory from a completed bachelors to a completed doctoral degree can be anywhere between 12 (minimum period) and 25 years (average maximum). *But the problem is not merely a leaking pipeline at every level of the system. The pipeline is also progressively shrinking at what may be regarded as an alarming rate.*

In an attempt to gain a more qualitative understanding of the factors that affect progression and completion rates, we conducted a national survey of postgraduate students enrolled at South African universities during 2014. The total number of completed questionnaires was 5 700. In the following paragraphs we present the salient findings of this survey.

Low progression and retention rates are mainly due to the part-time nature of studies (which is related to the lack of funding for full-time studies)

All the evidence generated by the survey points to the fact that the most dominant factor that explains low progression and retention rates is that between 60% and 70% of South African students study part-time (study while they work). This conclusion is supported by a number of specific findings from the survey:

- The most commonly cited reason for students interrupting their studies was that of employment conditions or work obligations. This reflects the fact that the majority of students work while studying.
- The progression rates for younger students (both at the honours and masters levels) are higher than for older age cohorts, who are more likely to be working while studying.
- Additionally, among the top three reasons given for considering dropping out, across all three levels of study, are challenges to find sufficient time for studies, for example, the challenge of balancing work with studies. This is particularly pertinent to masters and doctoral students, as well as students older than 30.
- Doctoral students who study full-time complete their studies on average in half of the time (just over three years) that it takes part-time students to complete their studies (just over five years).

Students in the natural sciences (where larger proportions study full-time) have significantly higher progression and completion rates

The effect of part-time studies is also evident when we compare progression and completion rates across different scientific fields. Again, the evidence for this conclusion is provided from a number of specific survey findings:

- The progression and completion rates for bachelors to honours students are better for students enrolled in the natural sciences and business, economic and management sciences than in other fields of study. This is also true for honours and masters students, as students enrolled in the natural sciences' progression and completion rates are almost 15% higher than for the humanities and social sciences.
- The natural sciences consistently record better progression and completion rates across all three levels of study. Students enrolled in the social sciences and humanities emphasised the challenge of coping with study demands and finding sufficient time for studies, whereas this was not the case with students enrolled in the natural sciences.

- A greater percentage of the latter (together with students in engineering and the health sciences) also indicated that they intended to enrol immediately for another university degree after completing their current degree whereas this intention was not as prominent among students in the social sciences and humanities.
- A look at the average age of South African honours students in 2013 reveals that students in the natural sciences, engineering and business, economics and management sciences were on average younger than students enrolled in other sciences. The average age of honours students in education was significantly higher.
- These age differences, as well as differences in progression and completion rates, also correlate clearly with the fact that larger proportions of students in the social sciences and humanities are enrolled part-time, and therefore take longer to complete, are older, and often struggle with the demands of their studies.

### Efficiency defined as supervisor productivity

We conclude this chapter with a brief discussion on another indicator of efficiency: the number of doctoral graduates produced by staff members with PhDs. In Table 3.1 we present the data – by university – for the years 2011 to 2013.

Over this period, the national ratio of doctoral graduates to staff holding doctorates at all South African universities has increased from 0.25 (2011) to 0.28 (2013). This means that – on average – every staff member at a South African university with a PhD ‘delivers’ a PhD in about three and a half years. But again we see that there are huge institutional differences. At the best performing (‘most efficient’) universities in 2013 (Stellenbosch, Western Cape, Pretoria, Rhodes and Wits) each staff member with a doctorate is producing a PhD in fewer than three years.

### In conclusion

Our discussion in this chapter focused on different ways of measuring efficiency in doctoral production. We used four measures:

- The ratio of graduations to enrolments;
- Cohort analyses of graduating students;
- Progression and completion rates of doctoral students; and
- The ratio of PhD students to academic staff with doctorates.

As to the first measure (*ratio of graduations to enrolments*), South African universities displayed a slight improvement in efficiency, with an average

Table 3.1: Number of PhDs and staff with doctorates by university (2011–2013)

University	2011			2012			2013		
	Staff PhD	PhD Grad	Grad:Staff	Staff PhD	PhD Grad	Grad:Staff	Staff PhD	PhD Grad	Grad:Staff
SU	521	150	0.29	516	240	0.47	614	225	<b>0.37</b>
UP	616	206	0.33	623	200	0.32	658	242	<b>0.37</b>
UWC	283	80	0.28	290	75	0.26	301	111	<b>0.37</b>
RU	174	57	0.33	171	67	0.39	198	70	<b>0.35</b>
WITS	560	169	0.30	595	150	0.25	639	221	<b>0.35</b>
UNISA	455	93	0.20	611	152	0.25	625	201	<b>0.32</b>
UKZN	606	154	0.25	663	177	0.27	688	207	<b>0.30</b>
NMMU	212	59	0.28	226	86	0.38	245	74	<b>0.30</b>
UCT	667	163	0.24	699	198	0.28	725	205	<b>0.28</b>
NWU	582	115	0.20	624	154	0.25	634	168	<b>0.26</b>
CPUT	91	13	0.14	106	24	0.23	113	28	<b>0.25</b>
UFH	102	44	0.43	119	43	0.36	124	30	<b>0.24</b>
UFS	349	107	0.31	374	94	0.25	393	91	<b>0.23</b>
TUT	136	28	0.21	144	44	0.31	150	32	<b>0.21</b>
DUT	73	14	0.19	88	6	0.07	97	18	<b>0.19</b>
CUT	60	5	0.08	60	5	0.08	71	12	<b>0.17</b>
UJ	287	68	0.24	294	109	0.37	451	78	<b>0.17</b>
UZ	82	19	0.23	79	28	0.35	92	14	<b>0.15</b>
UL	147	17	0.12	132	17	0.13	139	14	<b>0.10</b>
VUT	44	2	0.05	41	2	0.05	42	4	<b>0.10</b>
WSU	73	4	0.05	69	3	0.04	76	3	<b>0.04</b>
UV	103	9	0.09	103	4	0.04	116	3	<b>0.03</b>
MUT	16	0	0.00	16	0	0.00	18	0	<b>0.00</b>
<b>National</b>	<b>6 239</b>	<b>1 576</b>	<b>0.25</b>	<b>6 643</b>	<b>1 878</b>	<b>0.28</b>	<b>7 209</b>	<b>2 051</b>	<b>0.28</b>

Source: DHET 2013a

annual increase in graduates of 6.5% compared to 6.4% in enrolments between 1996 and 2012.

The results of the *cohort analyses* for the 2003, 2004 and 2005 cohorts showed that the average graduation rate of 35% after five years increased to 42% after seven years. The 2006 cohort had a 43% completion rate after six years, whilst the 2007 cohort showed a 45% completion rate after the same period of time. The percentage of new entrants that graduated after five

years grew from 36% for the 2003 cohort to 38% in 2007. The percentage of new entrants that graduated after six years increased slightly more from 41% for the 2003 cohort to 45% in 2007. Although the percentage of doctoral cohorts who graduate is still low, these increases show improvements in doctoral graduation rates.

The main finding from our analysis of the *progression and completion rates* relates to the effect of part-time studying on progression and completion rates. The fact that more than 60% of South African students – across all scientific disciplines – study while they work has far-reaching effects on all aspects of doctoral production. This is very clear when we compare students in the natural sciences (where larger proportions study full-time) with students in other fields. For the former, progression and completion rates are significantly higher: students in these fields (or students who are able to study full-time) progress faster from honours to masters to doctoral studies *and* complete their studies at each level in shorter times. We also found clear evidence of the effect of socio-economic realities on these rates. Black students (and especially African students) have far fewer resources to support their postgraduate studies. This also translates into longer progression and completion times for this subgroup.

Our final measure (*ratio of PhDs produced by academic staff with doctorates*) shows that there has been an increase in the overall efficiency in the system in the recent past. We have again found evidence of huge institutional differences, with the best-performing institutions demonstrating significantly higher ratios of PhDs produced by academic staff with doctorates. These ratios have also increased steadily over the recent past.

Our analyses of the efficiency of doctoral education have produced a mixed picture. The analysis of the doctoral pipeline reveals low progression rates: only 24% of bachelor students enrolled for an honours degree after five years and 35% did not graduate within three years. From honours to masters only 24% registered within three years and 53% did not graduate within five years. Only 16% of masters students enrolled for doctoral study within five years of graduating, and 61% did not complete their doctoral studies within seven years. The end result is that the pipeline is not only leaky but also very long. From a systems perspective, this is indicative of a very inefficient system.

However, despite the lack of sufficient funding for doctoral studies, regular interruptions of studies for work- and employment-related reasons, and hence an older-than-average doctoral cohort (compared to the age of students completing in Europe and North America), completion rates compare favourably with international benchmarks. Despite high teaching loads and the increasing ‘burden of supervision’, academic staff at the top South African universities have increased their PhD per capita output in recent years. This suggests that South African universities and supervisors

are quite efficient in the production of graduates that are in the system. Thus, university support to and supervision of doctoral students is not the major problem in the system. These structures and mechanisms are by themselves quite effective and efficient – particularly for the throughput and completion rates of the top research universities. The efficiency challenge seems quite obvious: we need to ensure that larger proportions of postgraduate students are able to study full-time (with sufficient funding) and there should not be interruptions to their studies.