A CRITICAL INVESTIGATION INTO THE CURRENT SHORTAGE OF INFORMATION TECHNOLOGY POSTGRADUATES PRODUCED BY UNISA

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Abstract

Postgraduate studies (master's and doctoral studies) are vital for any higher education institution with regard to funding and reputation. It is therefore important to ensure that the headcount and throughput rates of postgraduates are monitored on a continuous basis. However, there are a number of higher education institutions that are currently failing to offer postgraduate studies to meet the targets set by the Department of Education. This is especially the case within open distance learning (ODL) institutions. The primary investigation in this paper is the current shortage being experienced by the industry and government sectors regarding postgraduate students who have specialised in Information Technology (IT). This is of great concern because IT is one of the fields in which South Africa needs to be remain competitive within the economic sector.

Firstly, the headcount and throughput rate at the University of South Africa (Unisa), the largest ODL-based university within South Africa, are investigated. The second part of this paper deals with four dimensions of postgraduate success which, for this paper, are identified as the headcount, the throughput rate, time to completion and the dropout rate of students enrolled for master's or doctoral studies within the School of Computing at Unisa.

Key words: open distance learning (ODL), postgraduates, dropout rate, graduation rate

1. Introduction

Postgraduate success is an integrated and significant segment of any higher education institution (Edwards 2002; Lee 2009; Cassim 2011). Postgraduate success contributes to the education institution's funding formula and improves the reputation of the institution (IEASA 2011). It is therefore vital that higher education institutions ensure that postgraduate students successfully complete their studies within the given time. South Africa must urgently address the low postgraduate graduation rates to create a situation in which the country can be globally competitive (MacGregor 2009).

Increasing postgraduate success is a huge undertaking for any higher education institution and even more so for institutions based upon an ODL platform. Unisa is the largest ODL university in South Africa and aims to have a 25% graduate rate for postgraduate qualifications (master's and doctoral degrees) by 2015 (Unisa 2008). These statistics are higher than the targets set by the National Plan for Higher

Education (NPHE) in 2001 (MOE 2001). According to the NPHE, the target rate is 25% for master's graduates and 20% for doctoral graduates within a distance-based education environment (MOE 2001). The target master's graduation rate was lowered in 2004 to 22.5% and the doctoral graduation rate was not specified and therefore remained unchanged (MOE 2004). The aim of this paper is therefore to critically investigate, evaluate and position the postgraduate graduation rate within Unisa with the emphasis on postgraduate degrees in IT. An attempt is made to address the current postgraduate situation by investigating the following postgraduate dimensions:

- headcount
- throughput rate
- average time to completion
- dropout rate

This investigation focuses not only on the overview of postgraduate studies at Unisa, but also on the technology degrees within Unisa.

2. Postgraduate studies within South Africa

The South African strategy is to increase and accelerate human capital development, including postgraduate education to a large degree (Crest 2009; Van Wyk 2010). This national strategy to increase the number of postgraduate qualifications within South Africa is directly linked to the economic development and global competitiveness of South Africa (ASSAF 2010). This is vital for South Africa to remain competitive and to be able to generate knowledge that is responsive to a wide range of social needs (Crest 2009). Currently South Africa is in dire need of delivering more postgraduates to achieve this ambitious goal. The graduation rate in South Africa is less than 15%, one of the lowest in the world (MOE 2001).

However, increasing postgraduate qualifications within South Africa is easier said than done. According to the Academy of Science of South Africa (ASSAF) consensus report published in 2010, this task is daunting to say the least. This report included the following statistics regarding postgraduate studies within South Africa (ASSAF 2010):

- South Africa produced an average of 1 039 doctoral graduates per year from 2000 to 2007.
- South Africa produced an average of 7 163 master's graduates per year from 2000 to 2007.
- The average time to complete a PhD was 4.8 years.
- 26 PhD graduates are produced per year per million people of the South African population.

The statistics above depict the poor state of postgraduate supervision in South Africa.

One specific area of concern regarding postgraduate qualifications in South Africa is science and technology. A technology qualification is defined in this research as a qualification contributing to the growth of the ICT sector in South Africa and includes

qualification fields such as computing, computer science and information systems. According to the Department of Science and Technology (2008), South Africa's prospects for improved competitiveness and economic growth rely to a great degree on science and technology. However, technology skills and qualifications are currently in short supply across South Africa (Cohen 2012; Harris 2011; IT WEB-JCSE 2009). According to the ASSAF report (2010):

- 54% of all PhD graduates in 2007 were from the humanities and social sciences
- 28% were from the natural sciences
- 10% were from the health sciences
- 7% were from engineering and technology

This is confirmed by a report commissioned by the Council on Higher Education which indicates that between 2000 and 2005, technology was one of the smallest growing fields with only a 2.6% growth in doctoral admissions (Crest 2009).

The statistics clearly indicate that postgraduate qualifications within technology-related fields in South Africa need urgent attention. The aim of the Department of Science and Technology (2008) is a fivefold increase in the annual production of research doctorates within Science, Engineering and Technology (SET) by 2018. According to Harris (2011), universities contribute to the current lack of technology skills in South Africa. It is therefore vital that all education sectors (especially universities) reconsider their contribution to delivering technology specialists in an attempt to alleviate this postgraduate technology shortage within South Africa. This research therefore focuses on the postgraduate situation at Unisa with a further in-depth investigation into technology degrees.

3. ODL at Unisa

Unisa is South Africa's only comprehensive, dedicated distance education university. The conceptualisation of distance education and open learning is central to achieving its goal to become a university for humanity (Unisa 2008). Unisa has moved away from the corresponding teaching method and toward ODL. Distance education remains a significant component of the provision of access to higher education in South Africa (Rosenberg, Ramsarup, Burt, Ellery & Raven 2009).

Unisa (2008) defines ODL as "a multi-dimensional concept aimed at bridging the time, geographical, economic, social, educational and communication distance between student and institution, student and academics, student and courseware and student and peers. Open distance learning focuses on removing barriers to access learning, flexibility of learning provision, student-centredness, supporting students and constructing learning programmes with the expectation that students can succeed." The specificities of distance education in conjunction with past and current life circumstances of students make studies more difficult (Visser & Subotsky 2011).

Due to the nationwide shortage of technology skills, as already mentioned, the current postgraduate situation within the School of Computing (SOC) at an ODL institution (Unisa) was examined. SOC is part of the College of Science, Engineering

and Technology (CSET). This research focused on headcount, graduation rate, average time to completion and dropout rate of postgraduate students within different colleges at Unisa, specifically CSET. Finally, within SOC the technology contribution of postgraduate studies at Unisa was investigated.

4. Statistics for postgraduate studies at Unisa

Unisa has six academic colleges:

- College of Economic and Management Sciences (CEMS)
- College of Human Sciences (CHS)
- College of Law (CLAW)
- College of Education (CEDU)
- College of Agriculture and Environmental Sciences (CAES)
- College of Science, Engineering and Technology (CSET)

In this section the statistics regarding the headcount and throughput rate are for all six colleges at Unisa. The statistics were obtained using the DISA system at Unisa.

4.1 Headcount

The headcount reported on here is for master's and doctoral degrees at Unisa between 2006 and 2010. The headcount is defined as the number of unduplicated students enrolled at Unisa within a specific year, which means that each student is counted only once. Figure 1 depicts the master's degree headcount for all the colleges.

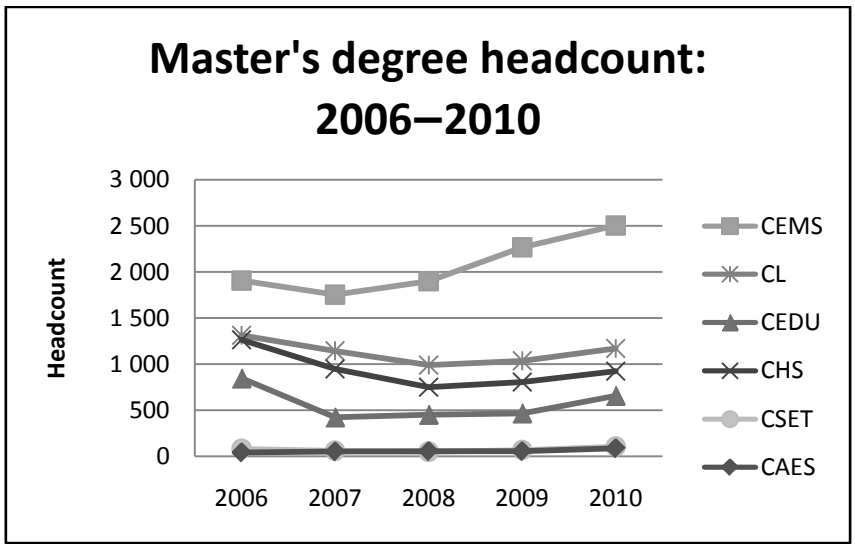

Figure 1: Master's degree headcount (2006–2010)

Figure 1 indicates that the headcount for all the colleges at Unisa for the five years clearly dropped from 2006 to 2008. It then steadily increased from 2009 to 2010. The deduction can be made from the statistics that the headcount for master's degree

students is steadily increasing. If Figure 1 is reworked to depict the total headcount for Unisa, the same curve is seen in Figure 2.

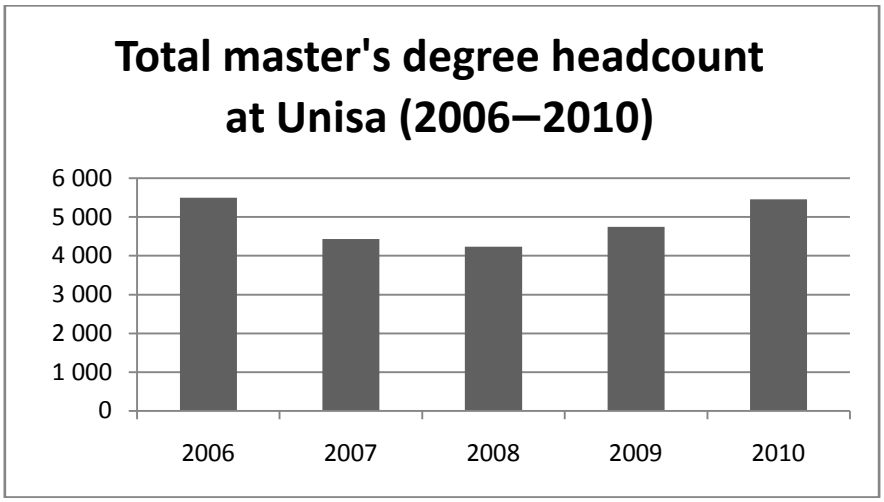

Figure 2: Total master's degree headcount (2006–2010)

The total number of master's students was approximately 5 497 in 2006. This figure dropped to 4 429 in 2008 and then increased again to 5 459 in 2010. This pattern is similar to the doctoral degree headcount. Figure 3 depicts the doctoral degree headcount for all colleges at Unisa.

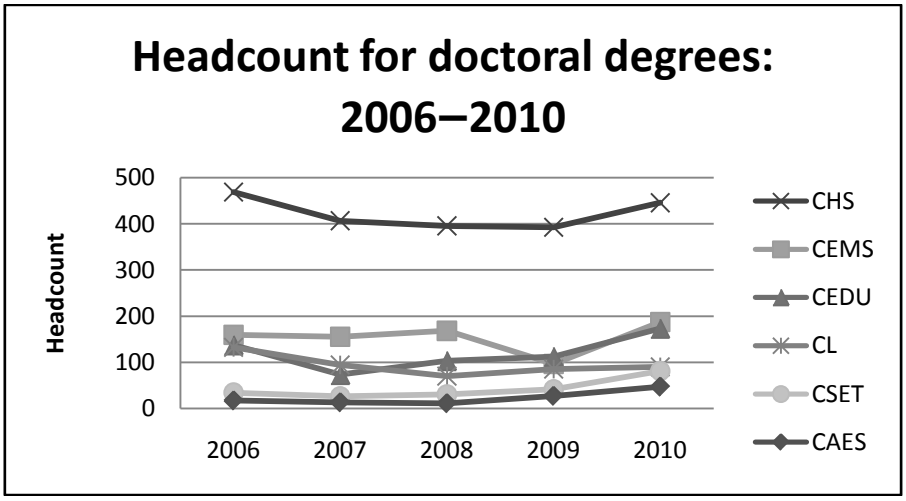

Figure 3: Doctoral degree headcount for Unisa (2006–2010)

The headcount curve in Figure 3 is also depicted in Figure 4, which illustrates the doctoral degrees within Unisa for 2006–2010.

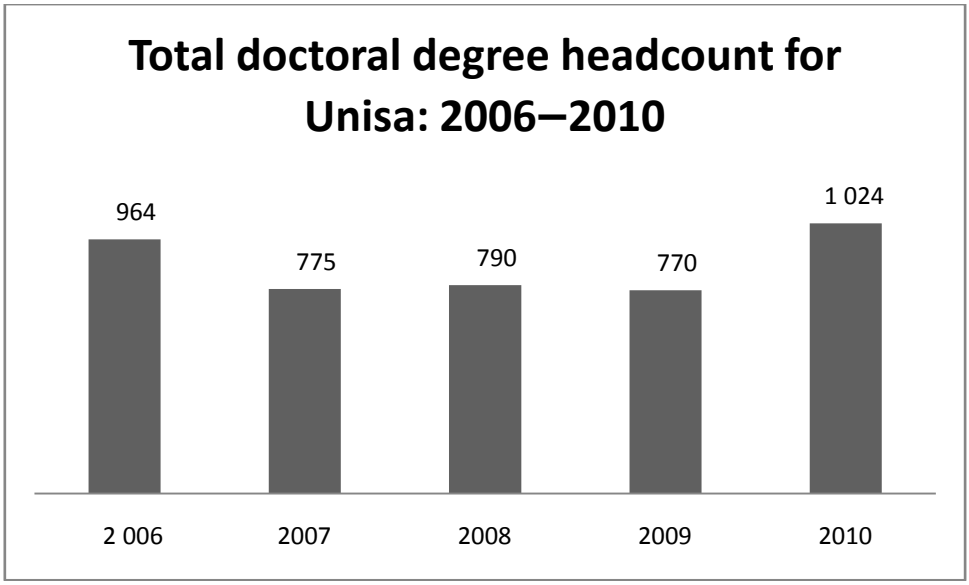

Figure 4: Total headcount for doctoral degrees at Unisa: 2006–2010

Figure 4 shows that the doctoral degree headcount of 964 in 2006 dropped to 770 in 2008 and then increased to 1 024 in 2010.

The deduction can be made from Figure 4 that the headcount for postgraduate students dropped dramatically from 2006 to 2008. However, after 2008 the headcount increased steadily.

4.2 Throughput rate

The second postgraduate aspect investigated was throughput. A number of models are available internationally to obtain more information regarding throughput such as those by Spady (1970), Tinto (1975, 1988, 2002) and Braxton (2000). Within an ODL and South African environment very little research and conceptual exploration have been done regarding the impact of the specific South African context on understanding student throughput and retention in an ODL environment (Prinsloo 2009). Figure 5 depicts the master's degree throughput rate from 2006 to 2010 for all the colleges at Unisa.

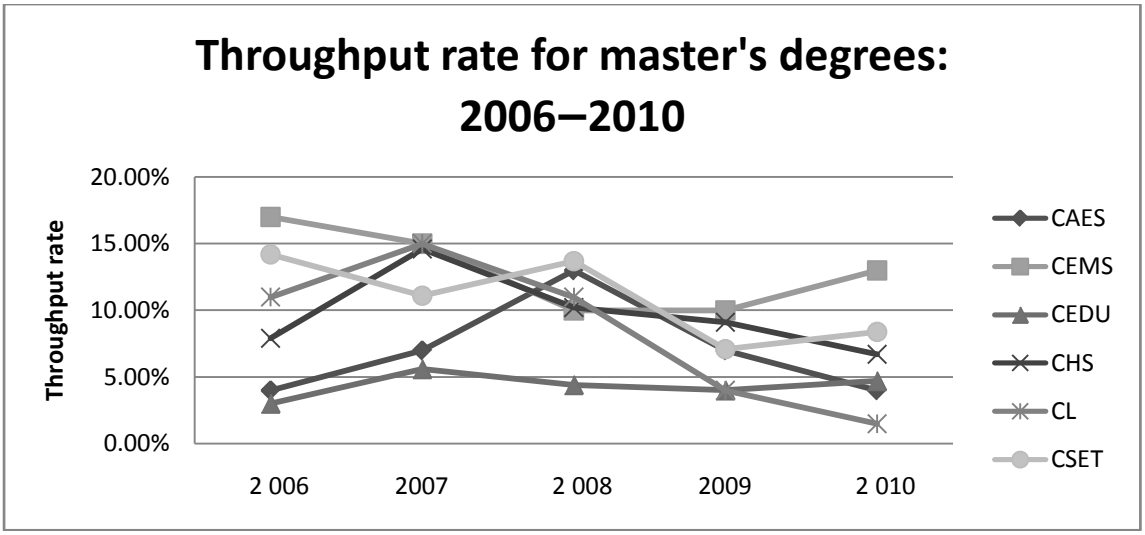

Figure 5: Throughput rate for master's degrees (2006–2010)

Figure 5 shows that the throughput rate of three colleges increased in 2010. However, the remaining three colleges had a decline in throughput rate. One of these colleges examined in more detail in this research was CSET, especially the IT degrees within SOC. Figure 6 depicts the average throughput rate for master's degrees from 2006 to 2010.

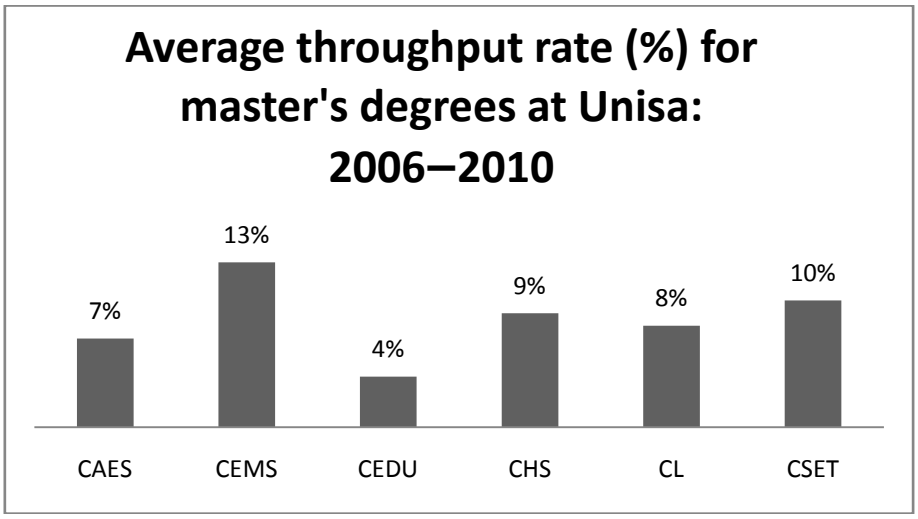

Figure 6: Average throughput rate for master's degrees (2006–2010)

It is clear from Figure 6 that overall the Unisa postgraduate throughput rate for master's degrees is far below the target set by Unisa as well as the Department of Education. This is very similar to the throughput rate for doctoral students at Unisa. Figure 7 depicts the throughput rate for doctoral degrees from 2006 to 2010.

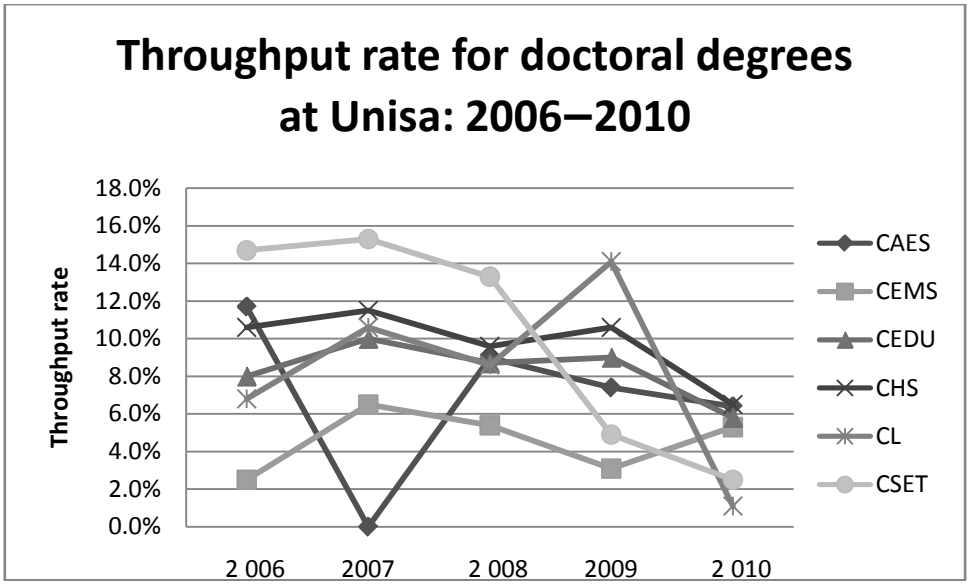

Figure 7: Throughput rate for doctoral degrees (2006–2010)

Figure 7 clearly indicates a decrease in throughput rate at all the colleges at Unisa. Figure 8 expands on this issue by depicting the average throughput rate for the different colleges in the same period.

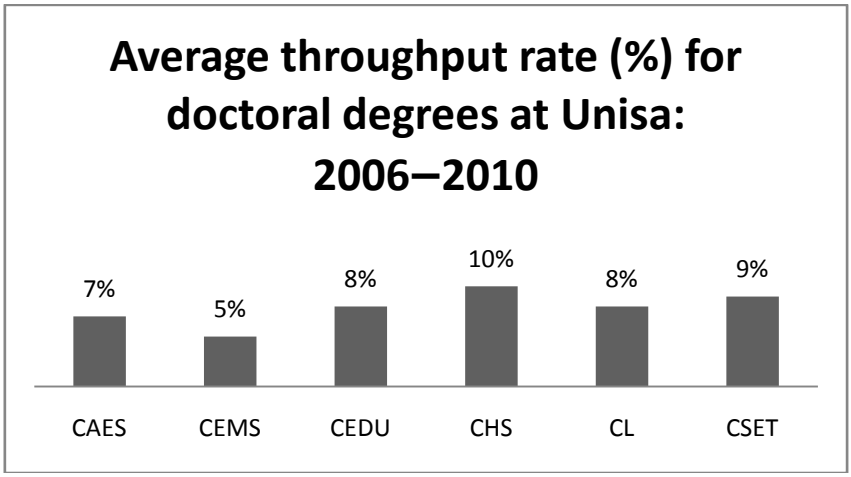

Figure 8: Average throughput rate for doctoral degrees (2006–2010)

Figure 8 therefore also depicts a very low overall throughput rate for Unisa at doctoral level.

The deduction this investigation makes is that the headcount for postgraduate students is increasing but the throughput rate is decreasing.

The rest of this paper deals with the postgraduate success rate, specifically in IT degrees at Unisa, to determine if the overall deduction made in this section also applies to the IT degrees within SOC at Unisa. The main aim of this research was to determine the problem areas causing the current lack of postgraduates available to meet the needs of (demands from) the industry and government sectors.

5. Statistics for Computing degrees at Unisa

The postgraduate statistics within SOC are now the focus. SOC is one of three schools within CSET and is divided into two departments: Information Systems (INF) and Computer Science (COS). Both these departments offer a wide range of technology-based degrees.

The main aim of examining SOC is directly linked to the shortage of technology skills within industry and the growing technology demands by the government, educational and industry sectors. To understand the postgraduate success rate within SOC, the statistics focused on are as follows:

- headcount
- throughput rate
- average time to completion
- dropout rate

5.1 Headcount

The first aspect is the headcount of master's and doctoral degree students within SOC. Figures 9 and 10 show the postgraduate headcount for technology enrolments within SOC. The statistics for CSET are also depicted for comparison reasons.

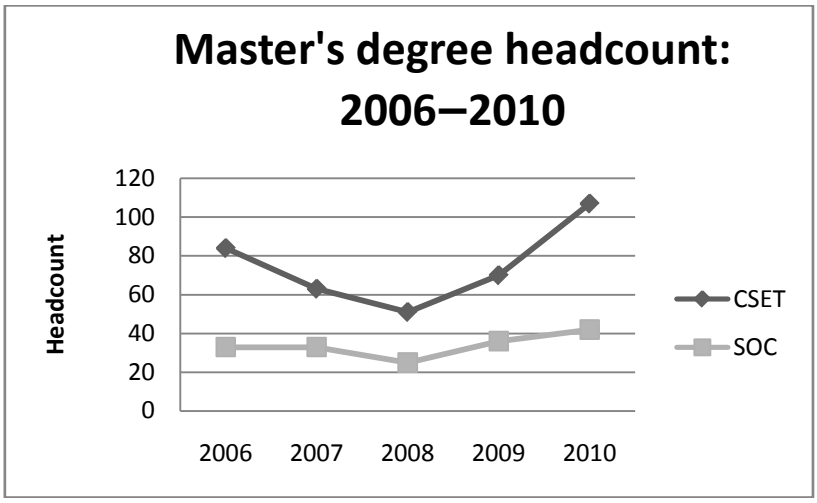

Figure 9: Headcount of master's degrees in CSET and SOC (2006–2010)

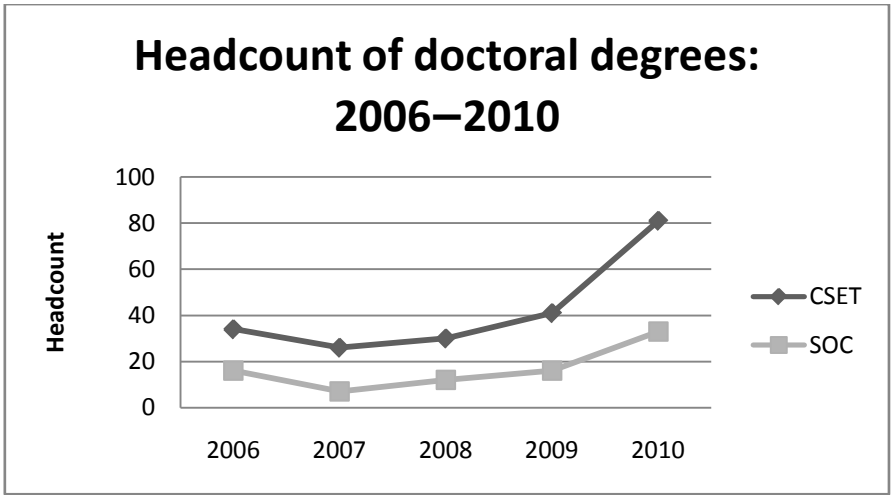

Figure 10: Headcount of doctoral degrees in CSET and SOC (2006–2010)

Figure 9 shows that the headcount for master's degree students within SOC has steadily increased from 2006 with an average of 40 master's students enrolled for 2010. This is with the exception of 2008 which saw a drop in enrolments; this drop is in line with the College's statistics and will therefore not be seen as a school-related issue.

The growth in master's students within SOC is also reflected in the headcount for doctoral students. From 2006 there was a constant increase in the headcount with an average of 38 doctoral students enrolled for 2010.

From Figures 9 and 10 the deduction is made that the headcount for master's and doctoral degree students within SOC is increasing yearly. These enrolments are below the target set by the DOE and even with this steady growth might not make the set targets for 2015. However this research concludes that with a steady growth in master's and doctoral enrolments each year, the headcount may contribute to the overall postgraduate success rate – but this is not the main issue within SOC.

5.2 Time to completion in Computing

The third dimension addressed is the time to completion for technology degrees within SOC. Time to completion of a qualification is defined as the time to complete the degree in elapsed time less the stop out periods (Visser & Subotzky 2011). Figure 13 depicts the average time to completion between 2006 and 2010 for technology degrees within SOC.

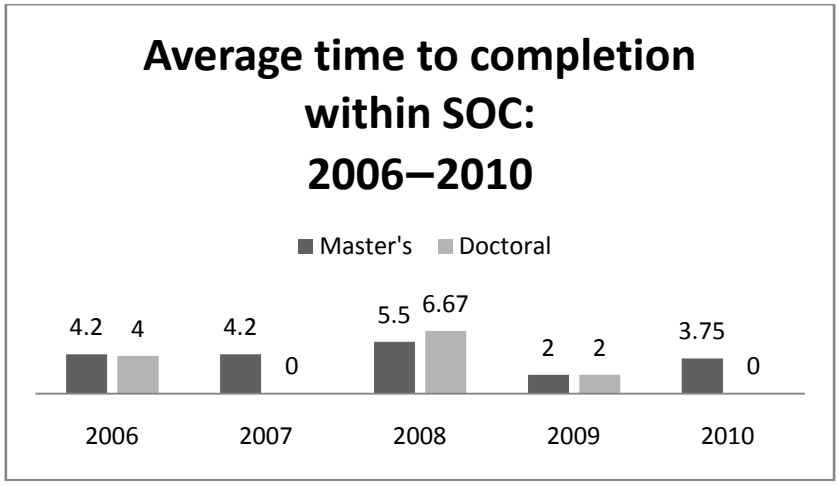

Figure 13: Average time to completion within SOC (2006–2010)

Note that few students graduate, as mentioned in the previous section. The average time to completion for master's students depicted in Figure 13 ranges from 2 to 5.5 years, with an average of approximately four years. This is within range of the target set by Unisa. According to Unisa regulations, master's degrees must be completed within four years. However, students may stay for an extra (fifth) year to complete the degree. Therefore, the average time to completion for master's degrees within SOC is on track.

This trend is similar to that of the doctoral degree students. Note that in 2007 and 2010 no students graduated and therefore no values are available. Within the remaining years the doctoral students' time to completion ranged from 2 to 6.67 years, with an average of 4.2 years. This is within the target set by Unisa, which is 5 years to complete doctoral studies.

The findings for this section indicate that currently the time to completion may be a problem for a few individual students. However, overall the target set by Unisa for postgraduate time to completion is met for both master's and doctoral degrees within SOC.

5.3 Dropout rate of postgraduate students

According to Prof Jansen of the ASSAF, there will not be a rapid growth in PhD qualifications in the near future (ASSAF 2010). This means that if the headcount of PhD (as well as master's) degrees is not likely to increase, higher education institutions need to do something to ensure that the technology demands of industry are met. The high dropout rates in universities are a threat to South Africa's future (Letseka & Maile 2008). The dropout rate for postgraduate students is also alarming and needs urgent attention (IEASA 2009). The dropout rate for technology degrees within SOC is shown in Figure 14.

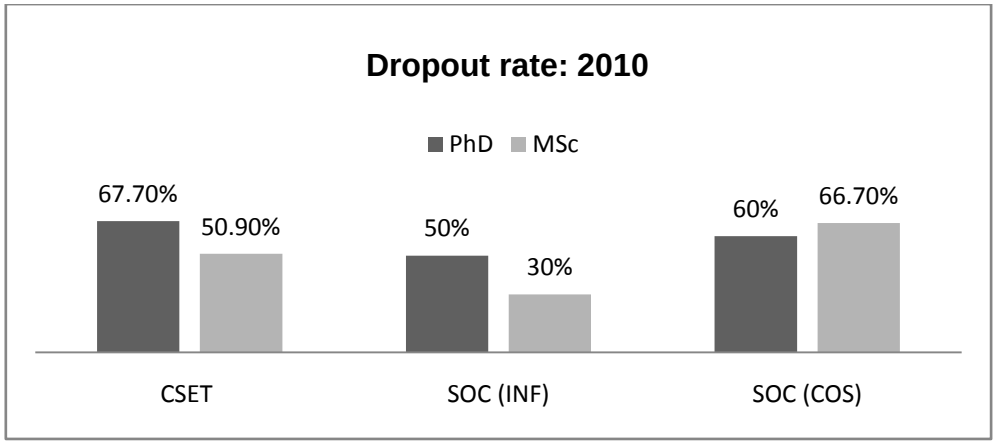

Figure 14: Dropout rate in CSET and SOC

Figure 14 depicts a dire situation regarding the dropout rate within CSET and SOC. According to the statistics, of the master's degree students enrolled for Information Systems (INF), 30% drop out within the first year of study. This is lower than the 66.7% of master's degree students enrolled for Computer Science (CS). The average dropout rate therefore for all master's degree students within SOC is an alarming 48% within the first year of study. This is similar for the doctoral degree students. Of the enrolled doctoral students for INF, 50% drop out in the first year and of the COS students, 66.7% drop out. This is an average of a 55% dropout rate for all SOC doctoral students in 2010.

When examining the doctoral dropout rate within SOC, the deduction can be made that the average dropout rate is 51% in the first year of study. A number of studies have been conducted regarding dropout rates for undergraduate modules (CHE 2010). However, little research output is currently available on dropout rates for postgraduate degrees. This includes the ODL environment, with special focus on IT degrees.

5.4 Throughput rate

The second aspect regarding the postgraduate success rate is throughput rate. The throughput rate is determined by the number of students who successfully graduate. Note that, for example, the dropout rate for master's students in 2010 was 50% and this therefore forms the cohort of students.

Figures 11 and 12 depict the throughput rate between 2006 and 2010 for master's and doctoral students within SOC.

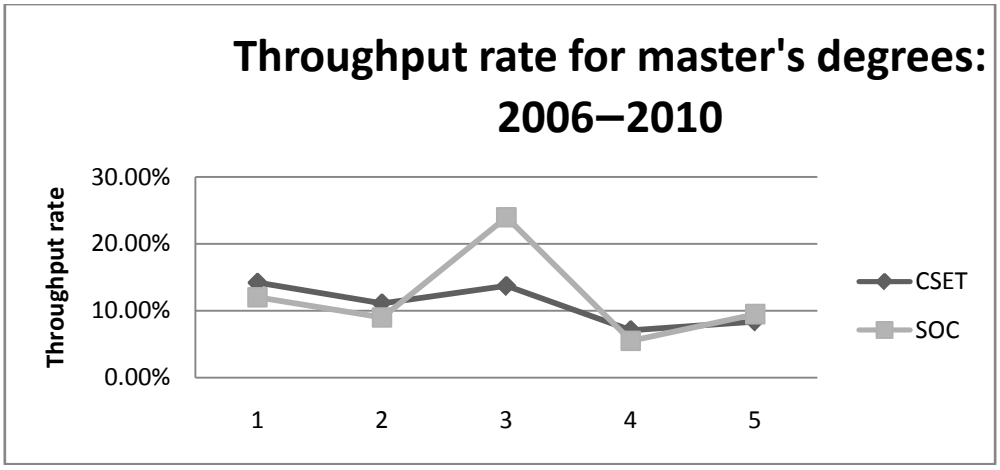

Figure 11: Throughput rate for master's degrees in CSET and SOC (2006–2010)

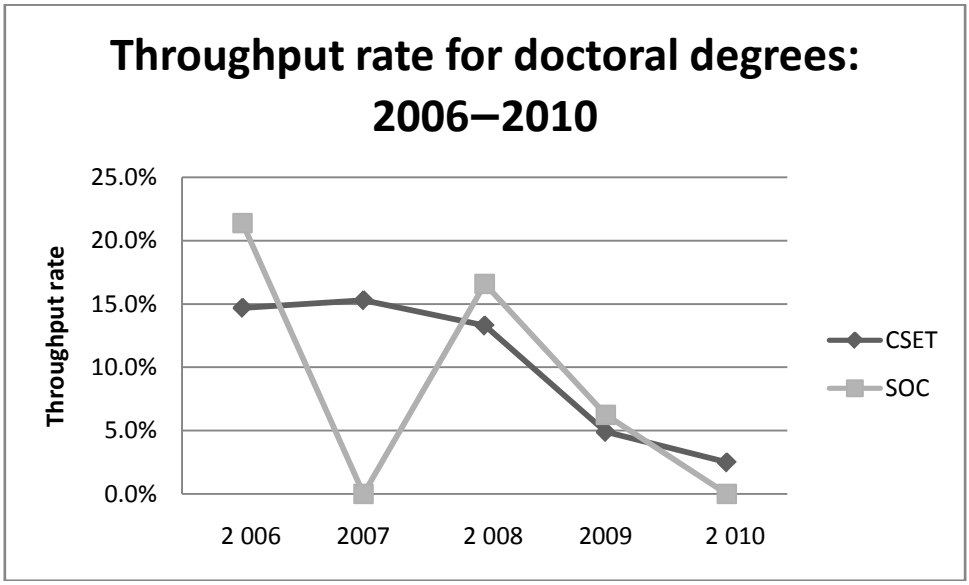

Figure 12: Throughput rate for doctoral degrees in CSET and SOC (2006–2010)

Figure 11 illustrates that the throughput rate for master's students within SOC varies between 5% and 15% (within the exception of 2008). This is an average of about 10% (similar to the throughput rate in 2010). Figure 12 shows the throughput rate of doctoral students within SOC. This clearly shows that the throughput rate decreased significantly from 15% in 2006 to below 5% in 2010. This drop in throughout rate is in line with that of the College.

The deduction is that both for master's and doctoral degrees, the throughput rate dropped from 2006 to 2010. This is clearly a problem and must be addressed urgently. It means that the issue raised at the beginning of the paper regarding the current lack of IT graduates within industry is still not being addressed.

5. Discussion

The research findings indicate that three of the four dimensions discussed above are currently below target and need urgent attention. However an attempt will be made to arrange these dimensions in order to assist in the planning stage to improve postgraduate studies within IT. Table 1 depicts the four dimensions and indicates whether the target set by either Unisa or the DOE has been met, as well as whether this had a positive or negative impact from 2006 to 2010.

Table 1: Discussion of four dimensions

	Meet target	Positive impact	Negative impact
Headcount			
Master's	No	X	
Doctoral	No	X	
Throughput rate			
Master's	No	X	
Doctoral	No		X
Time to completion			
Master's	Yes	N/A	N/A
Doctoral	Yes	N/A	N/A
Dropout rate			
Master's	No		X
Doctoral	No		X

Table 1 can be divided into three categories: on target, below target but with a positive impact (growth), and below target with a negative impact. The two issues that must be highlighted from Table 1 and that are most critical are the following:

- throughput rate for doctoral degree students
- dropout rate for both master's and doctoral degree students

Both these issues are below target with a negative impact, which is of great concern in the challenge to increase the overall postgraduate success rate.

The concern regarding these negative trends is that a number of studies have indicated and proposed possible solutions to the problem of postgraduate success within an ODL environment. The question that can be asked, then, is why there is still an alarming problem with the throughput rate for doctoral students as well as the dropout rate. The conclusion is that more research must be conducted not only on why these postgraduate dimensions still have a negative impact, but also what approaches must be adopted from the proposed solutions for ODL, as they are clearly not solving the current problems.

More research must be undertaken to find out why current research and implementation plans to increase the throughput rate and decrease the dropout rate within IT degrees are not thriving.

6. Conclusion

The postgraduate successes within IT degrees offered by the School of Computing at Unisa were investigated critically in this paper. Unisa faces a number of teaching and learning problems due to its unique nature as an ODL institution. The question that was posed is whether Unisa is contributing positively to producing master's and doctoral degree students in an attempt to satisfy the current lack of IT professionals within South Africa. Four important areas relating to the postgraduate success rate were highlighted: student headcount, throughput rate, time to completion and dropout rate. Statistics from 2006 for the six colleges at Unisa as well as for SOC were analysed to position Unisa's contribution of IT professionals. The conclusion was that currently all four areas mentioned are below the targets set by the DOE and Unisa. The dropout rate of master's and doctoral students is currently the most vulnerable aspect contributing to the low postgraduate success rate.

7. Acknowledgement

Searchlight

8. References

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