A study of the doctoral pipeline: Time-to-degree in selected disciplines at South African universities

Milandré van Lill
18 June 2018

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Background and rationale

Background

National Development Plan's (2011) vision to graduate 6000 PhD graduates per year in 2030.

- In 2015 there were just over 2500 doctoral graduates in South Africa.

The doctoral pipeline in South Africa is a long and leaky one *(Mouton et al., 2015)*

- An estimated 61% of doctoral students complete after seven years *(Cloete, Mouton and Sheppard, 2015)*

- In the USA only one out of two doctoral students would complete their doctorates *(Crede and Borrego, 2013, Sowell, 2008, Ampaw and Jaeger, 2012)*

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Rationale

Doctoral non-completion and students who remain in the system for long periods of time is a burden on institutional resources

- Institutions and students lose investment of time and money and the burden of supervision increases.

If we want to expand doctoral education in South Africa, we have to think about increasing the efficiency of the higher education system

- I introduce doctoral time-to-degree as a descriptive efficiency indicator

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Problem statement and research questions

Research problem

- There is a big body of scholarship on student retention and completion
- However fewer studies have looked at doctoral time-to-completion on a disciplinary level.
- Those who have done so, found disciplinary differences in doctoral completion and time-to-degree

"The doctoral education experience is not monolithic. Doctoral education is experienced differently within and among different disciplines. Disciplines have their own particular qualities, cultures, codes of conduct, values, and distinctive intellectual that ultimately influence the experiences of the faculty, staff, and, most especially, the students within their walls. Therefore, while studies of the undergraduate experience as related to success often occur at the institutional level, the discipline and the department become the central focus of the doctoral experience, rather than the larger institution." (Gardner, 2009)

Research Questions

Does doctoral completion rates and time-to-degree differ across five disciplines?

1. Education, electrical engineering, the clinical health sciences, physics and sociology.

What factors have a relationship on doctoral time-to-degree and do these differ among disciplines?

1. Student characteristics
2. Epistemological
3. Situational
4. Institutional
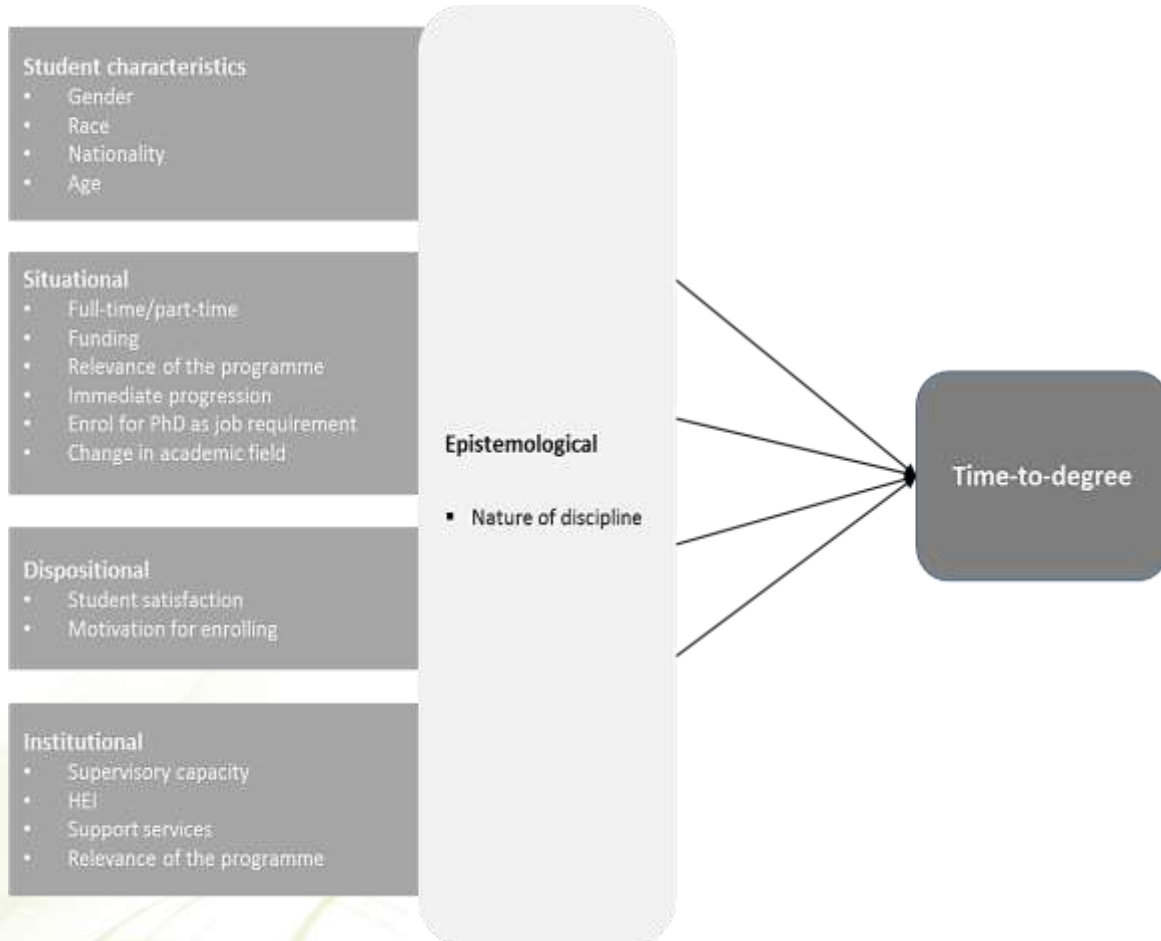5. Dispositional

Theoretical framework

Theoretical Model

I use Cross' (1981) *chain of response model* modified by Morgan and Tam (1999) to classify factors as barriers to participation in tertiary education

I group my analysis of factors' relationship on time-to-degree in five groupings:

1. Student characteristics
2. Situational
3. Dispositional
4. Institutional

Given that my research question looks at doctoral time-to-degree over five disciplines, I include the nature of a discipline in my analysis of all other factors.

Student characteristics
- Gender
- Race
- Nationality
- Age

Situational
- Full-time/part-time
- Funding
- Relevance of the programme
- Immediate progression
- Enrol for PhD as job requirement
- Change in academic field

Dispositional
- Student satisfaction
- Motivation for enrolling

Institutional
- Supervisory capacity
- HEI
- Support services
- Relevance of the programme

Epistemological
- Nature of discipline

Time-to-degree

Disciplinary classification

Defining an academic discipline:

1. Disciplines as historical social orderings *(Foucault, Kuhn, Toulmin, Phenix)*
2. Disciplines as organisational forms (social construct) *(Whitley, Hagstrom, Thompson-Klein)*
3. Disciplines as cognitive structures (body of knowledge)*(Hagstrom, Pantin, Kuhn)*
4. Disciplines as discursive communities (cultural practices)*(Becher, Bourdieu, Geertz)*

How are academic disciplines reproduced?

- Causality conundrum: Do the characteristics of disciplines preclude its definition, or are the distinctive qualities of disciplines results of the institutionalisation and socialisation and performing of a discipline.

Disciplinary classifications

Early classifications:

- Aristotle and Plato *(epistême and technê)*
- Comte *(hierarchy of disciplines)*

Modern classifications

- Hard/Soft – methods used (Storer, 1967)
- Basic/Applied – goals of research (Bush, 1945; OECD)
- Biglan-Kolb – learning styles and cognitive processes (Biglan 1973; Kolb, 1981)

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Abstract-reflective (hard pure)	Abstract-active (hard applied)
Natural sciences *Mathematics*	*Science-based professions (engineering)*
Concrete-reflective (soft pure)	Concrete-active (soft-applied)
Humanities *Social Sciences*	*Social professions (education, social work, law)*

Biglan-Kolb classification

This is the most widely used classification of academic disciplines in the empirical studies of disciplinary differences student performance.

Disciplinary differences

Disciplines differ in their

1. Knowledge structures/ intellectual organisation *(Kolb, 1981)*

2. Phenomena studied (restricted or unrestricted) *(Pantin, 1968)*

3. Paradigm/consensus development (Kuhn, 1970; Lovitts 2001)

4. Methods of inquiry

5. Goals of research

Research design and data collection methods

Research design

Mixed methods

1. HEMIS micro student and staff data (2000 to 2014)
2. Survey analysis of 1313 doctoral students across 16 universities in South Africa

Statistical analyses

1. Means testing of average time-to-degree (Anova and independent sample t-test) of HEMIS data and *projected* time-to-degree of survey data
2. Qualitative survey data analysis
3. Linear regression model of all doctoral graduates in 2014

Key concepts

- Time-to-degree
- Throughput rates
- Completion rates
- Supervisory capacity
- Progression

Profile of doctoral students in five disciplines

Education

- doctoral students are more likely to be older; higher proportion female and black (AIC) students; enrolled part-time; professionals who pursue a doctorate to enhance their skills and better career opportunities

Electrical engineering

- students on average younger; majority male students; high proportion foreign students; funded by industry or employer; on study leave granted by employer; doctorate in the applied sciences often seen as superfluous

Clinical health sciences

- Lower proportions black and foreign students

Profile of students continued

Physics

- Doctoral students more likely to be younger; majority male students; high proportion black and foreign enrolments; more likely to progress directly towards the doctorate; perception of limited career opportunities in the physical sciences; more likely to enroll for a post-doctoral fellowship

Sociology

- Highest proportion of black and black African students; highest proportion of foreign enrolments; UNISA graduated most doctoral students implies that doctoral students in sociology are more likely to be enrolled part-time; fastest growth rates for enrolments and graduates of disciplines analysed (2000 to 2014)

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Results

Throughput and completion rates

- Physics had highest average throughput rates (16,6%) while sociology recorded the lowest (9,7%) (2000 to 2014).

- Among all doctoral students in South Africa (across all disciplines) an average of 42,2% completed their degrees in seven years (2000 to 2014).

- Students the clinical health sciences recorded the highest average seven-year completion rates (46,2%), while those in sociology recorded the lowest (31,7%).

- Fields classified as soft sciences recorded lower completion rates compared to harder fields

AVERAGE ADJUSTED SEVEN-YEAR DOCTORAL COMPLETION RATES OF FIVE DISCIPLINES (HARD/SOFT DICHOTOMY)
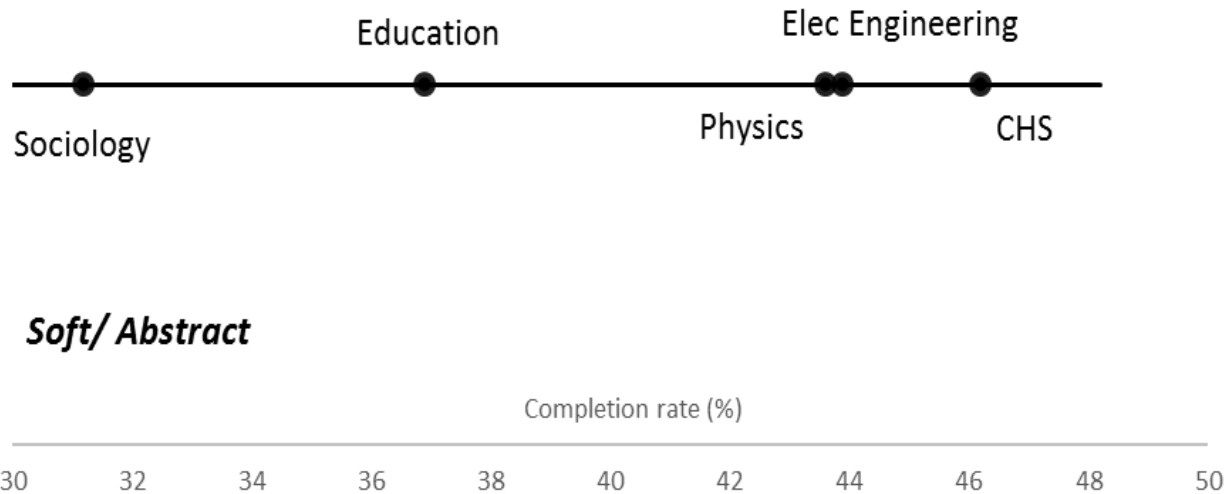
Time-to-degree

- The mean time-to-degree of doctoral students in South Africa in 2014 was 4.68 years.

- Graduates in education recorded the shortest time-to-degree of 4.15 years while students in sociology the longest of 4.74 years.

- Generally, the average time-to-degree increased between 2000 and 2014 for all disciplines.

- The average time-to-degree of graduates in education was statistically significantly shorter compared to that of the clinical health sciences, physics and sociology.
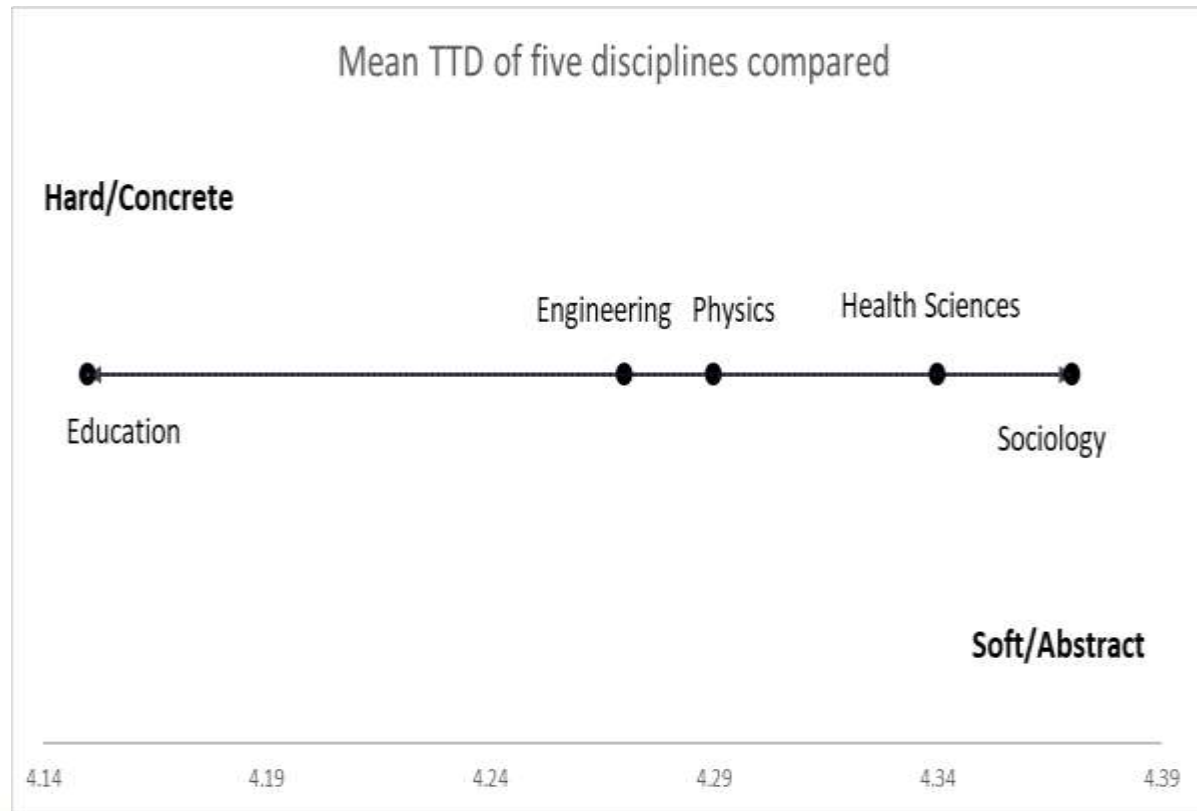
Epistemological factors

Is time-to-degree shorter among fields in the hard sciences compared to the soft sciences?

- Both support in favour of and against – Sociology (soft sciences) longer time-to-degree compared to physics, electrical engineering and the clinical health sciences
- However, education (soft science) shortest time-to-degree.
- Age and mode of study of students in education?

Is time-to-degree in the applied sciences shorter than the pure sciences?

- Education and electrical engineering shorter mean-time-to-degree than physics and sociology.

Student characteristics

Gender

- Within disciplines: No statistically significant differences, except sociology where male graduates recorded significantly shorter mean time-to-degree than female graduates

- Across five disciplines: female graduates in education shorter time-to-degree than female students in sociology and clinical health sciences

Race

- No statistically significant results, although white students (except in clinical health sciences) recorded the lowest average time-to-degree

Student characteristics

Nationality

- No statistically significant results within disciplines. Results varied between disciplines, although in none of the disciplines, did South African graduates record the shortest time-to-degree

- South African graduates statistically longer time-to-degree in the clinical health sciences than education and electrical engineering.
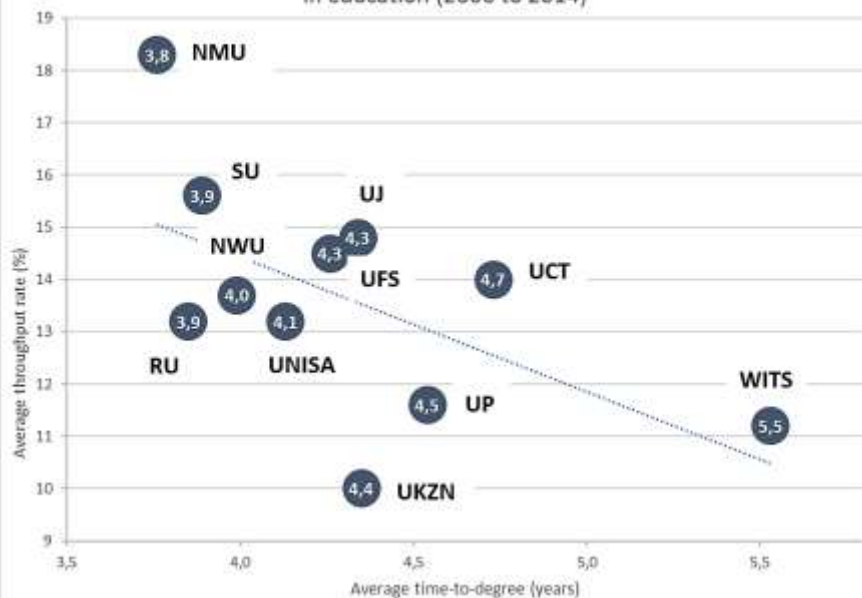
Age

- In electrical engineering, graduates aged fifty years and older recorded longer time-to-degree than graduates in younger age categories.
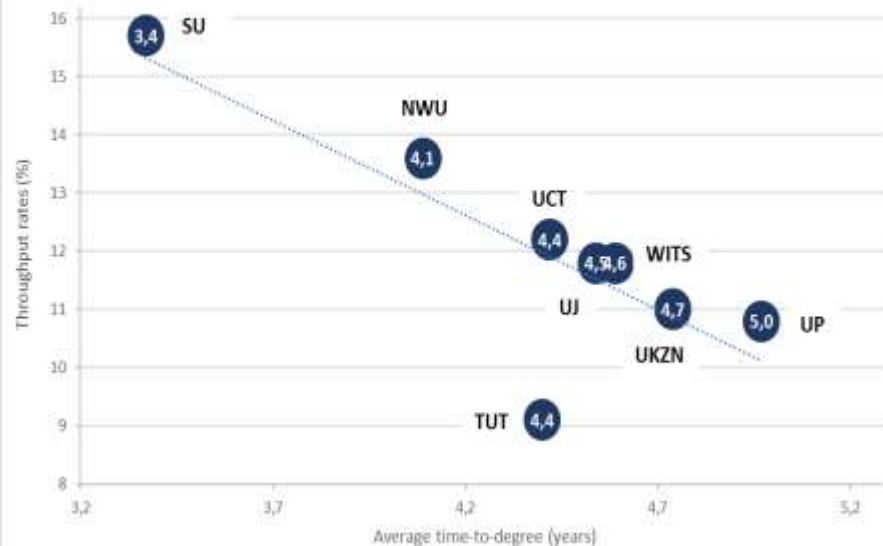
Institutional factors

Is there a relationship between higher institutional average throughput rates and lower mean time-to-degree?

- We see a relationship for education, clinical health sciences and electrical engineering. For physics association is less clear.

- Sociology there is an association between lower throughput rates and shorter time-to-degree
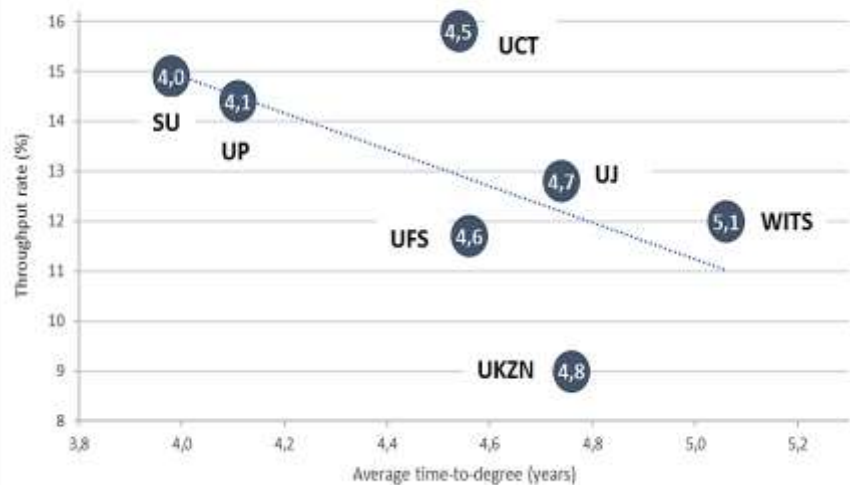
Supervisory capacity

- In 2014, 42,9% of permanent instructional and research staff held a doctorate. For the same year 82,9% of permanent instructional and research staff had PhDs compared to only 34,% in electrical engineering.

- The highest average supervisory capacity was recorded for physics (2,0 students per potential supervisor) compared to electrical engineering (12,7)(2000 to 2014)

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Is there a relationship between high supervisory capacity and shorter time-to-degree?

- Only in electrical engineering. None of the other fields. In fact, institutions with higher student-to-supervisor ratios recorded shorter average time-to-degree.

HEI* plotted by mean time-to-degree and average supervisory capacity in electrical engineering (2000 to 2014)
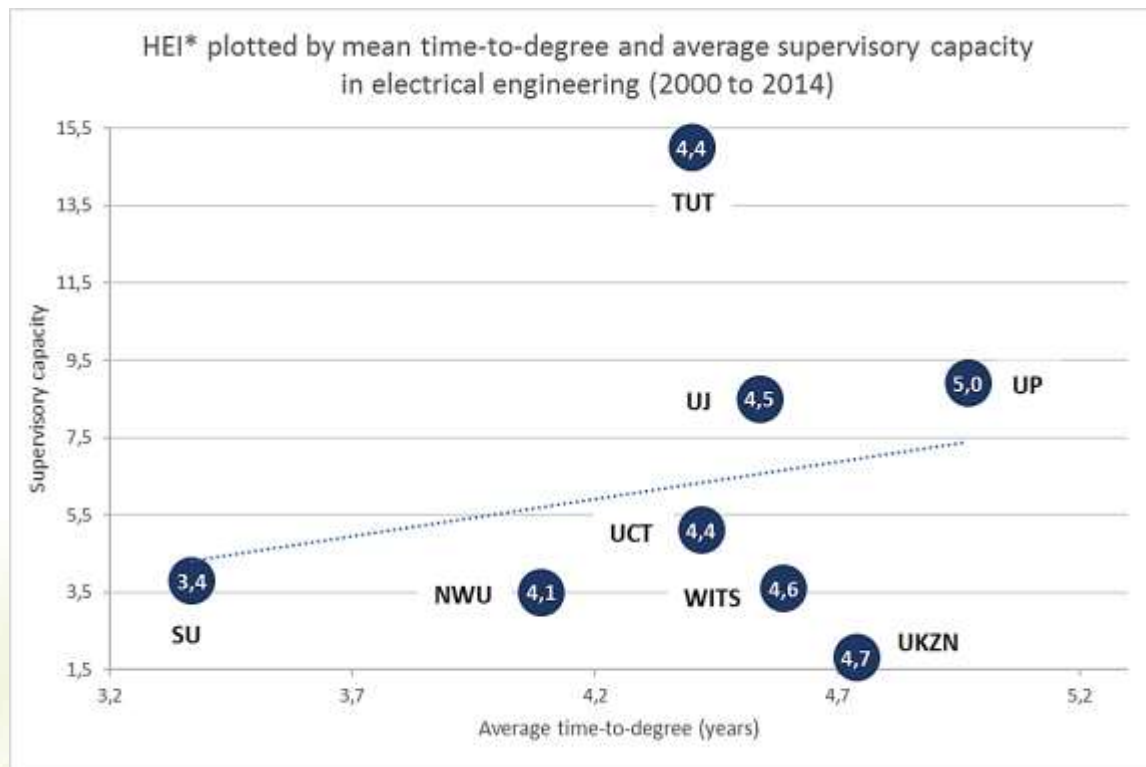
Situational factors

- Across all disciplines surveyed, students who progressed immediately from a previous degree qualification predicted shorter significantly shorter time-to-degree than students who took a break before their doctoral studies.

- Students who did not change fields between previous qualifications and their doctoral studies reported shorter projected time-to-degrees, except in the physical sciences.

- Respondents who indicated that they had considered dropping out of their doctorates recorded longer projected time-to-degree

- The top reasons cited for considering dropping out was financial challenges (particularly in the physical sciences) and challenges to balance work and studies (education)

- Respondents in the physical sciences cited uncertainty about career aspirations

Situational factors continued

- Respondents who were employed full-time during their candidacies reported significantly longer projected time-to-degree than respondents who were not (significant across al disciplines, and within engineering, health sciences and sociology).

- Respondents in the social sciences, who indicated that they enrolled for a doctorate as a job requirement recorded shorter time-to-degree than those who did not.

Dispositional factors

Respondents who indicated that they felt satisfied with their doctoral supervision recorded shorter projected time-to-degree than those who were not.

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Linear regression model of all doctoral graduates in 2014

Preliminary Results

Gender

* There are no significant differences in mean time-t-degree between male and female graduates

Nationality

* Graduates from the rest of Africa have significantly shorter than time-to-degree than South African graduates

Race

* In looking at race there are marginal (not significant) differences with black Africans recording slightly shorter time-to-degree. However, when you control for nationality, we see longer time-to-degree among black Africans. This means that shorter time-to-degree among black Africans are driven by graduates from the rest of Africa.

Age

* Students younger than 40 years take significantly shorter to complete their degrees than students older than 40 years

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Preliminary results continued

Mode of study

- Part-time graduates have significantly longer average time-to-degree than their full-time counterparts

HEI

- Traditional universities and universities of technology record slightly shorter time-to-degree but the differences are not statistically significant

Disciplinary fields

- Fields with the shortest average time-to-degree (in order of shortest to longest) are: public health, mathematics and statistics, education, business and management sciences, life sciences, visual arts, languages and health.

Final thoughts

Concluding remarks

In my analysis, I have identified and attempted to measure the relationship of single factors on timely completion. However, the factors that influence doctoral time-to-degree is multifarious and intersectional.

I am also limited by the available data, particularly the HEMIS data, in the factors that I can test.

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Thank you