Doctoral Education in Context

Perspectives from Africa

Edited by
Jan Botha, Liezel Frick, Nompilo Tshuma

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4 Eccleston Place, Somerset West, 7130
Cape Town, South Africa
info@africanminds.org.za
www.africanminds.org.za

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CHAPTER 23

Career and professional development of the doctoral candidate

Tracy Kellermann

South Africa has a population of 62 million. The country has 26 public universities with a total enrolment of 1.1 million students. Doctoral enrolments in South Africa have increased from 9 994 in 2008 to 23 588 in 2020 (CHE, Vitalstats). During the period 2000-2018, a total of 32 025 doctoral students graduated at South African universities. Annual doctoral graduates increased from 972 in 2000 to 3 339 in 2019 (SciSTIP, Tracer Study).

Stellenbosch University became an independent university in 1918, tracing its origins to the Theological Seminary of the Dutch Reformed Church (est. 1859) and Stellenbosch College (est. 1880). The university has ten faculties located on four campuses (in Stellenbosch, Bellville Cape Town and Saldanha). In 2021 it had 1 400 academic staff members and 32 471 students, including 1 611 doctoral candidates, and 310 doctoral degrees were awarded. The first doctoral degree was awarded by Stellenbosch University in 1923, in physics.

1. Introduction

Since the 1990s, an emphasis has been placed on the influence of knowledge and information technology on economic growth (Bryan & Guccione, 2018; Hancock, 2019). Academic education is associated with wealth generation in the global move towards knowledge-based economies (Goneos-Malka, 2018). Consequently, the importance of higher education in the promotion of socio-economic development in the Africa region has become a political agenda (Friesenhahn, 2014). Human capital is seen as the capacity for innovation

and subsequent productivity (Pederson, 2014) and the assumption exists that having a doctorate allows its bearer to have a choice of employment opportunities, either in academia or industry. A doctorate, internationally recognised, is seen as prerequisite preparation for a career in academia (Bazeley, 1999) and perhaps a PhD qualification, as a measure of quality, can be used as a screening tool by prospective employers (Pederson, 2014). The desire to undertake a PhD is dependent on the job market for such highly qualified individuals. Due to an increasingly competitive and evolving job market, decreases in governmental funding, commercialization and internationalization (Matas, 2012), the applicability of a PhD in its traditional format and its translation into the employability of its holder needs to be reconsidered.

With the increasing demand for PhD studies, attention needs to be given to the market needs for not only highly specialized knowledge, insights and skills, but also 'soft' skills (Young et al., 2020) and eventual employment opportunities of these highly qualified people, as relatively few candidates continue to do research within academia (Mulvaney, 2013; St Clair et al., 2019; Stringer et al., 2018; Sharmini & Spronken-Smith, 2020). The traditional apprenticeship model PhD format is perhaps not 'fit for purpose', as it prepares graduates for faculty research careers despite a large proportion eventually working in non-academic environments. How are current doctoral programmes and institutions guiding and preparing PhD candidates for employment opportunities outside of academia to fulfil their roles in the global knowledge-based economy?

This chapter aims to investigate career guidance and development opportunities for biomedical PhD students at Stellenbosch University, South Africa, as well as to evaluate the employment opportunities for biomedical PhD graduates. Furthermore, I shall draw on global research in this field to consider the challenges and opportunities in aligning doctoral studies with available academic and industry employment opportunities.

2. Literature review

Globally, there has been an increase in the number of PhDs generated annually (Cyranoski et al, 2011). However, the perceived demand for PhDs to boost economies by investment in human capital might not be as great as previously predicted and PhD graduates may struggle to find employment (Pederson, 2014; Cyranoski et al., 2011; Åkerlind, 2005; Barnacle & Dall'Alba, 2011; McAlpine & Emmioğlu, 2015; Palumbo & Cavallone, 2022), an observation that has also been made in the South African context (Blitzer, 2016; Goneos-Malka, 2018).

A *Nature* survey conducted by Woolsten (2017) showed that many PhD student respondents hoped to secure an academic job after graduation, despite a global decrease in available academic positions. Various authors investigated issues to related to the employment prospects of doctoral candidates (Bazely, 1999; Matas, 2012; Acker & Haque, 2017; Leathwood & Read, 2020; Kyvik & Olsen, 2012). After completing a PhD, researchers wanting to embark on an academic career enter into post- doctoral training, viewed as a transitionary phase for growth and development in preparation for a research career (Åkerlind, 2005). However, they are increasingly frustrated by low pay and an inability to secure permanent academic jobs where they are kept in a cycle with no job security, no benefits and no guarantee of future employment (Åkerlind, 2005; Acker & Haque, 2017). This has led to a decrease in the number of post-docs, with potentially negative consequences for the quantity and quality of biomedical research (Garrison et al., 2016). Furthermore, after post-doctoral positions, there are limited employment opportunities for junior researchers (Bazely, 1999) and an increasing global trend of short-term contracts within academia, with women especially overrepresented in these precarious positions (Stringer et al., 2018). This, together with the alienation of academics from their profession by mass education and corporatized management structures, creates high levels of dissatisfaction, stress and insecurity (Åkerlind, 2005; McCarthy et al., 2017; Leathwood & Read, 2020; Vohlídalová, 2021; Stringer et al., 2018).

In South Africa, approximately half to two thirds of PhD graduates across all scholarly fields are employed in the higher education sector (ASSAf, 2010; Goneos-Malka, 2018; Mouton & Van Lill, 2022), with only 17% employed in business enterprise, 11% in government and 0.07% employed permanently by the top 200 companies of the Johannesburg Stock Exchange (Goneos-Malka, 2018). A recent study showed that only 2–3% of doctoral graduates in South Africa were not employed (Mouton & Van Lill, 2022). Therefore, in the South African context, PhD holders appear to be highly employable, but approximately 18% of graduates are not able to find employment in their area of expertise (Mouton & Van Lill, 2022).

STEM (science, technology, engineering and mathematics) education, knowledge and innovation are seen as essential drivers of economic growth (Hancock, 2019). In the early 2000s, policies aimed at increasing the number of PhDs in STEM fields were implemented with a view to create innovation and technological advancement (Pederson, 2014), but in recent times factors such as political agendas, Visa restrictions and the Covid-19 pandemic have all influenced the representation of minority groups globally in STEM fields (McGee et al., 2021; Kahn & MacGarvie, 2020). In a global STEM pipeline that

urgently needs diversification, it is alarming that females are still underrepresented in research and more likely to leave the STEM workforce altogether compared with other groups (Turck-Bicakci et al., 2014), no doubt compounded by gender-associated remuneration gaps in the labour force, although previous inequalities are becoming more balanced (Shauman, 2017). In some parts of the world, the movement of female STEM doctorates into business and industry is now gender neutral, women are more likely to obtain tenured faculty positions and women are as likely as men to stay in the STEM field, although less likely to hold research-associated jobs (Shauman, 2017).

Policies need to be implemented at national, industry and institutional level to foster growth in STEM fields (TurkBicakci et al., 2014). It is possible to minimize attrition rates of underrepresented minorities (URM) in STEM higher education using interventions targeting recruitment (recruitment drives in historically underrepresented communities, removal of socio-economic barriers), admissions (thorough management of admissions review), inclusion and retention (academic and social support groups), and faculty demographics (mentor diversity to mimic demographics of URM students) (Wilson et al., 2018). In South African higher education, policies have been implemented to increase the number of female PhD graduates, particularly African women, in the historically white male dominated STEM fields. These policies have not, however, considered how underlying subtle prejudices and assumptions about identity influence inclusion and sense of belonging, which influences participation, retention and advancement in an academic environment (Idahosa & Mkhize, 2021).

A *Nature* survey of 5 700 PhD candidates conducted by Woolsten (2017) indicated that worry and uncertainty are rife, with 12% of all respondents having sought help for mental health issues related to their PhDs. Most worry about their futures and whether their efforts will pay off in the form of a well-compensated job (Woolsten, 2017; Mata, 2012). Where supply outstrips market demand, the possibility of an over-skilled labour force arises, where a PhD degree is not necessary for the position held. This could have implications for the PhD graduates' motivation and subsequent career trajectories (Pederson, 2014; Bazeley, 1999) and leave individuals feeling as though their studies were a waste of time (Bazeley, 1999). Where an individual's path to a PhD is purely incidental, they may not have such strong feelings, but there have been reports of higher levels of burnout in these individuals than other groups (Bazeley, 1999).

Only 31% of the *Nature* survey respondents stated that their PhD programme was preparing them well for a fulfilling career. 18% responded that they did not

have useful career-related discussions with their supervisor, particularly about careers that are non-academic (Woolsten, 2017), a widely confirmed observation (McAlpine & Emmioğlu, 2015; Turk-Bicakci et al., 2014; Gibbs & Griffin, 2013; St Clair et al., 2017; Matas, 2012; Bazeley, 1999). Furthermore, supervisors are often reported as being disparaging of careers outside of academia (Woolsten, 2017; Åkerlind, 2005). Career guidance in the doctoral environment is typically not structured and largely ad hoc and most graduates feel that career guidance at the post-doctoral stage is too late and should be provided before embarking on a PhD (Åkerlind, 2005).

3. Methodology

Open access publications or those available through Stellenbosch University library subscriptions were obtained by means of Google Scholar searches using the following key words, phrases and combinations thereof: 'PhD employment/employability'; 'PhD skills'; 'biomedical science PhD'; 'biomedical PhD South Africa'; 'social cognitive career theory'; 'doctoral degree biomedical South Africa'. Information from the DIES/CREST Training Course for Supervisors of Doctoral Candidates at African Universities was also utilised. In addition, the Stellenbosch University Career Services and Faculty of Medicine and Health Sciences Doctoral Office were contacted. Both groups were asked the following questions:

- Do you provide any career counselling services for PhD candidates?
- Do you ever receive requests for career guidance from PhD candidates?
- Can you recommend a department/group that could be contacted in this regard?

A South African recruitment agency, SciStaff, which specializes in matching science-based jobs with prospective employees, was contacted and the following questions regarding PhD employment were posed:

- How often do you have requests from prospective employers for jobs requiring a PhD in a biomedical field? Often (5+ requests per month), occasionally (5 requests every 3 months) or seldom (5 requests every 6 months).
- As a percentage of these requests, how many are for jobs in academia and how many are for industry?
- For these jobs, what would the salary range offered be?
- How much value do prospective employers place on prior work experience?

- Are industry jobs for management positions, R&D, delivery of a service, or other?
- Other than the PhD qualifications, what other skills do prospective employees list as being a requirement for these jobs?
- Have you noticed areas in which the PhD graduates are lacking in their job applications which results in them not being considered for the positions?
- Do you think that short courses or workshops on project management, writing skills, teaching courses etc. would make any difference to a candidate's CV?
- Any other comments/observations?

4. Results

Career guidance is provided to undergraduate students by Stellenbosch University Career Service, and they do not receive requests for, or offer to provide, career counselling to PhD students. The Doctoral Office at the Faculty of Medicine and Health Sciences indicated that they do not provide career counselling to doctoral students and were not aware of any group that offers this on a formal basis within the faculty. These institutional findings are concurrent with literature findings of a lack of formal career guidance, particularly for non-academic career trajectories (McAlpine & Emmioğlu, 2015; Turk-Bicakci et al., 2014; Woolsten, 2017; Åkerlind, 2005; St Clair et al., 2017), as well as the author's experience of postgraduate studies at three different South African universities in the field of biomedical sciences.

The SciStaff recruitment agency responded that they seldom (5 requests every 6 months) receive job opportunities for PhD graduates and that any requests were typically for industry positions, predominantly for research and development and for sales and application specialist positions. Apart from technical skills such as laboratory methodology techniques (e.g. ELISA, flow cytometry), method development and validation, prospective employers also required report writing skills and the ability to work in a team. Additional course certificates or workshop attendance in ISO17025/15189, good laboratory practice, good clinical practice and statistics could benefit a candidate in a research position. Employers place an enormous amount of weight on prior work experience. The respondent emphasised that students should realise that most employers do not regard PhD research as work experience. It was suggested that PhD candidates get more exposure to industry, either by doing a project in collaboration with industry partners or by doing temporary vacation work in industry.

5. Discussion

A broad range of literature pertaining to the employment and employability of PhD graduates globally has been incorporated into this chapter and will be discussed further in the context of the findings of the study. These findings are like previous observations that PhDs are not financially rewarded for having their degree. One explanation for this trend is that while PhDs are completing their studies, individuals with master's degrees are gaining work experience, allowing them to become attached to the industry, giving employers a means of gauging their skill level (Pederson, 2016). It is possible that certain industries only require master's graduates, and that there is an oversupply of PhDs who are over-skilled for the work description and have insufficient experience in the soft skills required within a cooperative environment (Goneos-Malka, 2018; Bazeley, 1999). PhDs are therefore not able to fulfil their training to advance knowledge and industry is not able to exploit their human capital. (Bazeley, 1999; Bryan & Guccione, 2018). Those who are employed outside of academia are often moved into management positions, becoming further removed from hands-on research (Bazeley, 1999). Several authors also comment that previous work experience, whether paid or through integrated work experiences, has a positive effect on permanent job attainment (Jackson & Michelson, 2015; Pederson, 2014), which concurs with the present author's own work experience between industry and academia. The success of any employment application was always based on the experience and skills obtained in industry. When recruited for an academic job, industry experience and a sought-after, rare skillset was valuable, but an insufficient number of publications was a disadvantage. As an academic, a publication track record is essential for obtaining early-career seed funding with which to initiate research.

Industries in certain countries may not be sufficiently developed to convert PhD skills into a financial asset, which is possibly the case in South Africa too. Alternatively, there is a lack of understanding in South African (and other countries') industry of the value PhD graduates can contribute, or inadequate marketing (Goneos-Malka, 2018; Bryan & Guccione, 2018). Employers have the impression that PhD graduates are overqualified, too expensive and may not remain in a company for a prolonged period, views that are exacerbated by openly discriminatory stances of human resource departments, effectively the gatekeepers of hiring (Goneos-Malka, 2018).

There is a clear gap between employers' needs and what is currently being generated through conventional doctoral programmes (Young et al., 2020; Acker & Haque, 2017). Market forces define the needs as not only highly specialized

knowledge, insights and skills that go beyond the commercialization and application to industry, but also soft skills (Young et al., 2020). If one measures the success of doctoral education as high employment rates in a satisfying and stimulating workplace and graduates who are equipped for global citizenship, then doctoral programmes in their current apprenticeship format are failing (Spronken-Smith, 2018). PhD programmes that are enriched with practice-directed learning activities help with graduate employment, suggesting that interventions aimed at supplementing the quality of learning experiences are successful (Pulambo & Cavallone, 2022). Development should not stop after graduation, but early-career researchers must continually be supported and developed professionally to secure permanent positions (Robbins & LePeau, 2018).

5.1 Strategies to consider for improving PhD graduate employment outcomes

Traditional PhD programme structures favour academic career paths, despite a paucity of positions and a growing number of graduates employed in industry. Solutions to improving doctoral employability should involve better alignment of the needs of the student, institution and industry (Young et al., 2020; Sharmini & Spronken-Smith, 2020). These strategies need to consider the formative process of developing a doctoral professional identity, the environmental and social characteristics that drive career choices, development of skills required in industry and the introduction of career guidance and professional development into doctoral curricula.

Development of professional identity

Reforms should be implemented during doctoral studies to aid with professional identity development and exposure to a research career intended to boost the resilience of these highly skilled individuals to ensure their valued social, cultural and economic contributions (Hancock & Walsh, 2016; Roberts, 2018), while taking the individual nature of a PhD into consideration and enabling communities of practice (Hancock, 2019). This includes the creation of interdisciplinary research spaces in which STEM doctoral students can interact across fields to share their doctoral experiences, such as the doctoral group monthly engagement in the Faculty of Medicine and Health Sciences at Stellenbosch University, hosted by an experienced health sciences education researcher. These discussions include social, economic and ethical issues with a

view towards identity formation which allows adaptability within the dynamic environment of scientific research (Spronken-Smith, 2018; Hancock & Walsh, 2016), but also promotes development of global citizens and informed leaders with critical awareness of themselves and their actions (Spronken-Smith, 2018). Any measures introduced to improve the employability of PhD graduates should not detract from the academic rigour as a respected outcome of a PhD, or the professional identity associated with completing a doctorate (Roberts, 2018).

Social cognitive career theory

The social cognitive career theory (SCCT) proposes that individual interests influence a training path which requires actions and self-belief to achieve those envisioned goals while also considering how personal characteristics, learning experiences and support/obstacles can influence this process (Gibbs & Griffin, 2013). A modified SCCT model can be applied where an individual adapts their career choices and development according to the resources and challenges experienced (St Clair et al., 2017), such as having to work while completing their PhD (Bekova, 2021; Mouton & Van Lill, 2022). Academic and demographic characteristics affect strategy to secure preferred futures, with the PhD viewed as a time for calculated risk-taking (Hancock, 2019).

The importance of social interactions and networking at the level of engagement in the career development process cannot be understated (St Clair et al., 2017; Vekkaila et al., 2016). Advisors and faculty can form social capital resources or barriers to candidates pursuing and seeking career progression resources (St Clair et al., 2017; St Clair et al., 2019). High levels of supervisor support are associated with a lower likelihood of pursuing career development resources, while low support levels from departments, supervisors and peers leads to a lower likelihood of seeking any type of career development resource. Individuals with low self-efficacy or interest in a broader range of career opportunities are most interested in structured career development opportunities (St Clair et al., 2019; St Clair et al., 2017).

Race, ethnicity and belonging to an underrepresented demographic can have significant influence on agency in pursuit of career paths within doctoral programmes (Jaeger et al., 2017; Gibbs & Griffin, 2013). Being one of few students (or employees) of colour or being an international candidate within a department can create feelings of isolation (Jaeger et al., 2017; St Clair et al., 2017; Idahosa & Mkhize, 2021) and for longevity requires an individual to brush off negative experiences related to their social identity (Gibbs & Griffin,

2013). Faculties promoting diversity and inclusion should provide opportunities to engage and connect students and staff, creating a support structure to develop agency in their doctoral career progression and beyond (Jaeger et al., 2017; Idahosa & Mkhize, 2021).

Career coaching model

Traditionally, doctoral students rely on the mentorship of advisors and faculty members to acquire formal research skills and informal life coaching, provided the mentors have the skills and time to impart this knowledge (Thakore et al., 2014; Wilson et al., 2018). However, perhaps mentoring as a construct is flawed due to mentor workload, time constraints, subjectivity of the mentor and challenges with integration of individuals from different backgrounds (Thakore et al., 2014). Faculty demographics must mirror student demographics to be effective, particularly for formerly underrepresented groups such as women (Wilson et al., 2018). Programmes have been implemented for training of mentors, as can be seen with the DIES/CREST Training Course for Supervisors of Doctoral Candidates at African Universities. A formal group coaching approach can be used to overcome these obstacles while considering the development of professional identity. This concept incorporates the communities of practice principle which states that individuals with a common interest and goal work together to achieve their goal (Thakore et al., 2014). This could be particularly beneficial with minority students who have a relative lack of social and cultural capital. Individual development plans and self-assessment exercises should be undertaken for the process of career development (Thakore et al., 2014; Sharmini & Spronken-Smith, 2020; Williams et al., 2016).

Critical skills development

Despite country-specific variations in approaches to PhD programmes (Williams et al., 2019), doctoral studies largely equip students to design, conduct and communicate research. Some programmes involve the formalized acquisition of broader applied skills and knowledge base, such as the professional or 'new route/modern' doctorates where the student serves as the project manager with access to a network of expert assistance of colleagues and technicians (Mulvaney, 2013; Mulvaney & Lackovic, 2012; Botha, 2019; Matas, 2012; Spronken-Smith, 2018). PhD graduates often lack the know-how to adapt their academic knowledge and skills to an industry-related environment (Pederson, 2016; Bazeley, 1999; Young et al., 2020). To overcome this obstacle, transferable

skills development and career guidance should be implemented as a structured part of a PhD curriculum, or even at an earlier stage (Åkerlind, 2005; Bazeley, 1999; Gibbs & Griffin, 2013; Spronken-Smith et al., 2018; Young et al., 2020; Spronken-Smith, 2018; Sharmini & Spronken-Smith, 2020; Mulvaney, 2013).

PhD graduates are often found lacking in the generic and technical skills required for their positions (ASSAf, 2010). The soft skills most sought-after by potential industry employers of PhD graduates include technical skills, communication, capacity to learn new skills, adaptability, critical and systematic thinking, statistics, teamwork, data analysis, project and finance/business management, leadership, commercial awareness and application of skills, work experience, personal motivation, resilience, commitment, perseverance and ability to network (Bazeley, 1999; Matas, 2012; Jackson & Michelson, 2015; Pederson, 2014; Kyvik & Olsen, 2012; ASSAf, 2010; Spronken-Smith, 2018). Traits reportedly required for academic careers include theoretical knowledge within the scholarly field, computer proficiency, decision-making and problem-solving skills, publication rate and presentations at conferences (Bazeley, 1999; Åkerlind, 2005). Furthermore, the concept of 'who you know' is becoming increasingly more important than 'what you know', emphasising the importance of networking opportunities for postgraduate students (Jackson & Michelson, 2015). Initiatives must be implemented to create a holistic set of skills within doctoral programmes (Spronken-Smith, 2018), while taking care against reducing doctoral studies to a set of activities to acquire generic skills at the expense of respected academic rigour and professional identity (Roberts, 2018).

Inclusion of career guidance and development in the PhD curriculum

Often PhD candidates have few opportunities to learn about career possibilities and the skills associated with jobs, particularly outside of their knowledge field (Bazeley, 1999; Gibbs & Griffin, 2013; Spronken-Smith, 2018; McAlpine & Emmioğlu, 2015; St Clair et al., 2017). Supervisors or faculty form the primary source of career guidance for doctoral students, mostly on an informal basis and often with a bias towards academic career paths (Gibbs & Griffin, 2013; Sauermann & Roach, 2012) and reticence to guide outside of their chosen career paths (Hancock, 2019) due to lack of exposure, particularly to industry (Gibbs & Griffin, 2013). Doctoral students are often not realistic about their preferences for faculty careers considering the low availability of academic positions and relative oversupply of PhD graduates (Sauermann & Roach, 2012; McAlpine & Emmioğlu, 2015). There is a need to more clearly define career paths (Pederson, 2014; McAlpine & Emmioğlu, 2015; Spronken-Smith et al., 2018).

Given the lack of influence of the supervisor on graduate employment, career development and exposure should be implemented and promoted within institutions for academic and non-academic careers paths (McAlpine & Emmioğlu, 2015; Williams et al., 2019). Institutions could organise career workshops in which PhD graduates describe their career paths, including the influences of personal circumstances (McAlpine & Emmioğlu, 2015). Effective integration of career planning into a PhD curriculum should be implemented to understand short- and long-term career trajectories (Jackson & Michelson, 2015; Pederson 2014; Sauermann & Roach, 2012; Spronken-Smith, 2018; Sinche et al., 2017; Williams et al., 2019), while taking personal values into consideration (Gibbs & Griffin, 2013). Such a career-conscious model should help trainees recognise their existing skills, and address shortfalls according to employee ratings of importance (Sinche et al., 2017). Doctoral students could also benefit from an institutional career development service (Jackson & Michelson, 2015), but students should also be encouraged to make use of such services and start thinking about potential career pathways earlier in their studies too (McAlpine & Emmioğlu, 2015).

Universities should enable work experience during the PhD process, either by integrating work experiences into the course design, or by encouraging or facilitating part-time employment in academia or a related industry (Hancock & Walsh, 2016; Young et al., 2020; Mulvaney, 2013; Roberts, 2018). A team approach to supervision could provide exposure to a broad range of academic and non- academic networks with an increased possibility of access to integrated career experience (Scaffidi & Berman, 2012; Pyhältö et al, 2015). These opportunities can serve to break down the perceived strict boundaries between industry and academia and to broaden horizons (Hancock, 2019). Programmes can even include personal professional development plans with formative portfolios (Sharmini & Spronken-Smith, 2020) and perhaps PhD training should be tailor-made to fulfil the needs of PhD holders and various employment sectors (Kyvik & Olsen, 2012; Pederson, 2014; ASSAf, 2010; Spronken-Smith, 2018; Palumbo & Cavallone, 2022; Sharmini & Spronken-Smith, 2020; Roberts, 2018).

6. Conclusion

Globally, it has been acknowledged that pedagogical changes need to be implemented to improve the employability of doctoral students. Solutions to improving doctoral employability should involve better alignment and defining of the needs of the student, institution and industry (Young et al., 2020).

Spronken-Smith (2018) proposes that a reformation is required in global doctoral education where rates of employment, satisfaction with the types of employment and graduates who are global citizens equipped with the hard and soft skills to thrive, should be the indicators of success. Aligning doctoral education with desired career paths can introduce an apprenticeship model tailored to create graduate attributes in individuals. This can be achieved by additional training in generic and transferable skills to all doctoral candidates, possibly even at an earlier stage of postgraduate studies. This training can be provided as formal group or individual sessions, as well as an online tool geared towards a non- academic training matrix. Furthermore, the role of the individual supervisor in providing or facilitating such training should be explored with the aim of creating awareness of the importance of improving the preparedness of doctoral students for academic and non-academic career paths.

Career planning and professional development are essential to achieving these goals in quality- controlled PhD programmes (Spronken-Smith, 2018; Palumbo & Cavallone, 2022; Sharmini & Spronken-Smith, 2020; Sinche et al., 2017; Mulvaney, 2013). Institutions, supervisors and mentors should be clear to students about the value, purpose and essence of a doctorate and its contribution to the knowledge economy (Hancock, 2019; Mulvaney, 2013). Awareness of the value of employing doctoral graduates must be raised among industry employers to promote an understanding of the varied and unique benefits that doctoral graduates can provide to an employer, and this mutual appreciation by both the employer and the graduate could bridge the gap between supply and demand of doctoral graduates (Bryan & Guccione, 2018). Similar to reforms that have been implemented in other parts of the world, South African higher education institutions need to provide career development opportunities and engage with industry partners to create collaborations that could provide applied integrated work experience. Such partnerships can harness the creativity and innovation that PhD graduates contribute to solving industry-focused problems, while respecting the academic rigour and unique professional identity formed during a PhD (Roberts, 2018).

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