



TOWARDS A HOLISTIC DOCTORAL SUPERVISION IN AFRICA: AN INPUT-OUTPUT APPROACH

Joseph Evans Agolla*	Botswana Open University, Gaborone, Botswana	nyagonya2009@gmail.com
Mmabaledi K. Seeletso	Botswana Open University, Gaborone, Botswana	mmaba.see@gmail.com

* Corresponding author

ABSTRACT

Aim/Purpose	This study examines the challenges in doctoral education supervision support within African universities, focusing on the need for effective strategies to meet the increasing demand for quality doctoral education.
Background	The rapid socio-economic development in Africa has put pressure on higher education systems to meet the growing demand for quality doctoral education. Some African universities are attempting to produce doctoral degrees with minimal resources while maintaining doctorateness but are facing criticism from policymakers and stakeholders. The term “doctorateness” refers to the attributes of a doctoral student, including their research strategy, knowledge gaps, and unique contributions to the field. It is frequently seen as a turning point in the PhD process.
Methodology	The research uses a critical literature review methodology to propose an input-output support model, arguing that universities should consider doctoral supervision as an input-output model to improve the quality and versatility of doctoral graduates.
Contribution	The review presents a model and debate on doctoral education supervision support in a developing context, highlighting both theory and practice.
Findings	The study suggests that universities should adopt an “input-output model” for doctoral supervision to improve the quality and suitability of doctoral holders for various employment opportunities.
Recommendations for Practitioners	Based on a critical literature review, the study proposes that practitioners rethink doctorateness as an input-output approach to enhance their supervision skills.

Accepting Editor Charles Randy Nichols | Received: April 21, 2024 | Revised: February 6, 2025 |
Accepted: March 5, 2025.

Cite as: Agolla, J. E., & Seeletso, M. K. (2025). Towards a holistic doctoral supervision in Africa: An input-output approach. *International Journal of Doctoral Studies*, 20, Article 6. <https://doi.org/10.28945/5468>

(CC BY-NC 4.0) This article is licensed to you under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/). When you copy and redistribute this study in full or in part, you need to provide proper attribution to it to ensure that others can later locate this work (and to ensure that others do not accuse you of plagiarism). You may (and we encourage you to) adapt, remix, transform, and build upon the material for any non-commercial purposes. This license does not permit you to use this material for commercial purposes.

Recommendations for Researchers	The study contributes to the existing knowledge on doctoral education supervision and encourages further empirical study to validate the proposed model.
Impact on Society	Doctoral education is crucial for solving societal problems, producing quality scientific research, preparing academics for future work environments, and serving as a bridge between academia, research, and society.
Future Research	The study provides valuable insights and debates but requires further empirical research to validate its applicability.
Keywords	Africa, universities, doctoral, education, supervision, support model, challenges, prospects, quality, input-output

INTRODUCTION

Africa's doctoral education programs encounter numerous obstacles, including the inability of African universities to generate enough professionals to support research output, inventions, and advancements in science and the economy (Council on Higher Education [CHE], 2023; Herut & Gorf, 2024; Kigotho, 2024; Omoya et al., 2024). Empirical evidence (CHE, 2023; Herut & Gorf, 2024; Kigotho, 2024; Omoya et al., 2024) suggests that most African universities have significant attrition rates, prolonged completion durations, and study delays among their PhD candidates. Researchers (Kigotho, 2024; Omoya et al., 2024) discovered that the programs' low medium- and long-term viability and financial limitations negatively influenced PhD training. PhD candidates in Africa must support their education or seek financial aid and scholarships. Inadequate facilities and a lack of resources, including labs, libraries, and educational materials, present challenges for PhD applicants (Herut & Gorf, 2024; Kigotho, 2024; Omoya et al., 2024). They also face a shortage of workspace and little oversight. With several African nations lacking even a national objective or money for PhD research and teaching, African PhD training is at a crossroads (Kigotho, 2024; Omoya et al., 2024). Therefore, the goal of producing 100,000 PhD graduates in the next ten years is probably going to be difficult and exhausting for a continent whose PhD programs are marked by poor graduation rates, staffing issues, a lack of finance, and a dependence on partner organizations (CHE, 2023; Kigotho, 2024; Omoya et al., 2024). Africa, and by and large, across the world, there is a move away from the one-to-one model of postgraduate supervision to that of either cohort, team, or project-based approaches to providing support to both master's and doctoral students (CHE, 2023; EUA Council for Doctoral Education, 2016; Nxumalo et al., 2024). The proponents of these models argue that students need to undertake their doctoral studies within a research-rich culture with multiple opportunities that enable research to be modeled to practice their own knowledge-creation attempts and to get feedback from their peers and expert researchers (CHE 2023; Nxumalo et al., 2024).

Africa has recently made substantial socioeconomic and educational growth (African Research Universities Alliance, 2022; African Union, 2013; David & Grobler, 2020; Kokutse, 2022). This has increased the demand for high-quality PhD education to address Africa's socioeconomic development needs (Asiimwe, 2019; Cross & Backhouse, 2014; Jowi, 2021; Mekonnen & Cuthbert, 2016; Seeber & Horta, 2021). African research institutions contribute significantly to social and economic change, but their role is underutilized, with only 0.3% of worldwide R&D and 0.5% of patent applications coming from Africa. The growing demand for doctoral education has put enormous pressure on higher education institutions to provide doctoral education degrees with inadequate resources while retaining the core components of a PhD program (Fulgence, 2019; Manderson et al., 2017; Tamrat & Fetene, 2021; Zeleza, 2021). According to the African Research Universities Alliance (2024), most African countries have strategic objectives that prioritize knowledge-based economies in line with the 2063 African Union Agenda (African Union, 2013) to drive economic growth. This necessitates pursuing a high-quality PhD program at a higher education institution. In the modern economy, as

nations move toward knowledge-based economies, there is a need for a skilled and educated labor force that can solve social problems in novel ways (Mukhwana, 2020; Nerad & Evans, 2014). For example, PhD graduates have shown significant success in solving socio-economic problems by identifying root causes, collecting data, setting goals, consulting specialists, applying critical thinking, breaking down problems into manageable parts, and using brainstorming to promote ideation without judgment. This approach requires discipline, logic, open-mindedness, and evidence-based thinking. In fact, most of the innovations have come from research and development in collaboration between doctoral students and industry. Furthermore, research indicates that universities are preparing doctorate students with both specialized and transferable skills to generate sustainable and productive research for the global knowledge-based societies of the 21st century (Cross & Backhouse, 2014; Jowi, 2021; Matas, 2012; Mouton, 2011; Pelser, 2024). For instance, quality doctoral education should demonstrate key outcomes, such as research and information management, self-management and work habits, written and oral communication, time management, decision-making, problem-solving, troubleshooting, project management, leadership skills, and data analysis (Fredua-Kwarteng, 2023). It should be noted that transferable skills can be soft skills, like collaboration and problem-solving, or hard skills, like data analytics or coding. Soft transferable skills include communication, presentation, facilitation, organizational, feedback, evaluation, critical thinking, leadership, mentoring, and management and supervision skills.

Moreover, it is now widely recognized that world-class PhD preparation must go beyond academic, disciplinary, analytical, and technical knowledge and skills and that transferable skills are an essential component of PhD education, providing the foundation for the leadership required in the global knowledge economy (Auðardóttir & Tiegen, 2021; Fredua-Kwarteng, 2023; Mukhwana, 2020; Nerad & Evans, 2014; Zeleza, 2021). With all of this in mind, there is an urgent need to build a functional doctoral support model for African students seeking PhD studies to meet the continent's ever-increasing demand for higher education (Pelser, 2024; Zeleza, 2021). Thus, the current study is structured as follows: a brief background of African higher education institutions with a focus on doctoral education, motivation, and research questions; a critical review of relevant literature on challenges in doctoral education; various approaches and methods of doctoral supervision in the African context; discussion; an input-output model; and conclusion.

BACKGROUND: AFRICAN STUDY CONTEXT

African universities suffer a high unemployment rate among PhD holders because the focus of the doctoral curriculum has been on finding jobs as academics rather than the broader sector of the economy (Pelser, 2024; Petruka, 2019). To increase the employment of PhD graduates, there is a call for a shift from the current traditional supervisory model of one-on-one doctoral supervision to project, cohort, and panel approaches. However, where the one-on-one and co-supervision models remain, they are increasingly augmented with curricula initiatives at a departmental, faculty, or institutional level (CHE, 2023; Pelser, 2024; Petruka, 2019). The 2063 African Union Agenda (African Union, 2013) sets out several pillars for the continental socio-economic development of Africa to meet its demands, concluding that Africa requires tens of thousands more PhDs to expand higher education, advance research, replace the aging professoriates, and create high-level skills for the continent's economies (Herut & Gorf, 2024; Kokutse, 2022). A PhD program is significantly more demanding than other academic degrees due to the importance and the contributions to both bodies of knowledge and solutions to societal problems (Fetene & Tamrat, 2021; Herut & Gorf, 2024; Inter-University Council for East Africa, 2018; Johansen et al., 2019; Kumar & Kaur, 2019). For instance, societal problems such as unemployment, poverty, social inequality, climate change, poor public policy, and disease outbreaks (COVID-19) are some of the societal problems that PhD graduates are expected to address innovatively.

Moreover, studies (Baydarova et al., 2021; Halse & Levy, 2014) opine that having an academic doctorate and research skills alone is not sufficient to be an effective doctoral education advisor or an effective doctoral supervisor who can apply his/her knowledge to any aspect of life in the 21st century

(Fredua-Kwarteng, 2023). Effective supervision can be defined as a positive working relationship between the supervisor and the student (Al Makhmreh & Stockley, 2019). A PhD supervisor must have a doctorate degree to guide students through the rigorous process of research, critical analysis, and dissertation creation, ensuring they have experienced the same complexities themselves before (Al Makhmreh & Stockley, 2019; Ungadi, 2021). Though this is not only necessary but a must for any supervisor, evidence suggests that in some instances, PhD supervisors have failed to provide effective and quality supervision, resulting in non-completion or withdrawal (Dominguez-Whitehead & Maringe, 2020; Herut & Gorfu, 2024). However, African universities are unable to meet the increasing demand for doctoral education due to financial resource constraints, leading to problems, for example, a shortage of supervisors to oversee the increasing number of applicants for doctoral education and a narrow focus on doctoral outcomes that often fail to meet the demands of academia and industry (Bacwayo et al., 2017; Petruka, 2019). Moreover, traditionally, PhD education has long focused on the production of these with little outcome on transferrable skills. Simply put, emphasizing more research skills as opposed to other skill sets for employment beyond academia fails to meet the demands of academia and industry (Petruka, 2019).

PhD programs in African universities are of a high caliber, but there are concerns about the quality of supervision and management (Kokutse, 2022; Pelser, 2024). For example, 118 PhD candidates, 56 of whom graduated from a public university in Kenya in 2019, led to concerns about students who did not have a legitimate bachelor's degree being admitted to master's programs, eventually later enrolling in PhD programs. In addition, the report found that supervisors supervised more than 15 PhD students, which was more than the required three PhD students and five master's degree students per supervisor (Bacwayo et al., 2017; CHE, 2019; Manderson et al., 2017). Similarly, in Uganda for example, the National Council on Higher Education (NCHE, 2013) recalled the PhD degrees of 66 graduates which were awarded by one of the universities between 2011 and 2012 (22 and 42 graduates in 2011 and 2012 respectively) over suspicion of compromised quality (Asimwe, 2019). These problems are not unique to African universities; they are compounded in the developed world. A supervisor in the United States, Australia, and the United Kingdom might oversee more than ten PhD candidates at once. The National Tertiary Education Union (NTEU) applauded the recent proposal by South Africa's Minister of Higher Education, Hon. Blade Nzimande, to increase the retirement age for university professors from 60 to 80 years.

At certain universities in South Africa, professors retire at 60 years old, but some are still as sharp as ever at 80 years old. (News24, 2012).

This is due to the importance of the knowledge and abilities obtained after completing a doctoral program (Inter-University Council for East Africa, 2018; Johansen et al., 2019).

The South African education system's National Development Plan 2012 (National Planning Commission, 2012) aims to increase doctoral degree production from 1,876 in 2012 to 5,000 by 2030, emphasizing the need for high-quality PhD education in Africa (N. Cloete et al., 2015; Pelser, 2024). This trend is evident in other African countries, too, and postgraduate students must be overseen by trained faculty members who meet the requisite qualifications and expertise criteria (African Research Universities Alliance, 2024; Fredua-Kwarteng, 2023; MacGregor, 2013b, as cited in N. Cloete et al., 2015). Similar issues have been noted in Ghana and Nigeria, where there is a shortage of supervisors for doctoral education (British Council, 2018; Matheka et al., 2020). The primary impetus for the growth of PhD programs is the national push to raise the PhD level of qualifications for higher education academics (British Council, 2018). By 2030, the South African government hopes to have 75% of its permanent workforce possess a PhD (CHE, 2020, 2022, 2023). Academic staff members must possess a PhD according to laws or regulations in three of the nations (British Council, 2018). Most universities, especially in Southern Africa, retire their faculty members when they turn 65, but many senior academics are at the pinnacle of their fruitful careers by the time they turn 65. The case for keeping them in place at this point is stronger than the case for retiring them. Senior academic

supervisors in East and West African institutions retire at 75 years old, with competent ones likely to become full professors in their late 50s or early 60s (Fetene & Tamrat, 2021).

Following an initial review of the literature, several gaps were identified, leading to the current study. First, the growing number of African universities offering PhD programs aligns with the continent's efforts to shift to a knowledge-based economy (African Union, 2013; Pelser, 2024). Second, there is a dearth of empirical evidence regarding the viability of low doctorate throughput (Kokutse, 2022; Zeleza, 2021). Third, there is a lack of knowledge regarding management support and doctoral supervision models suitable for African institutions (Vidak et al., 2017). Fourth, there is a high unemployment rate of doctorate holders due to a lack of employment options, which is made worse by inadequate funding in other sectors (Auðardóttir & Tiegen, 2021; Mukhwana, 2020). Fifth, there is a lack of supervisors to manage the growing number of PhD candidates applying for admission, along with senior academics' mandatory retirement at age 65 (British Council, 2018; Fetene & Tamrat, 2021; Ligami, 2019; Matheka et al., 2020; Pelser, 2024). Sixth, the Doctoral Graduate Tracer Study (Department of Science and Innovation, 2022) reports that only 22% of doctoral candidates receive funding from South African agencies, 8% rely on international agencies, 6% from non-university organizations, 33% self-finance and 30% receive university support. Seventh, there are inadequate resources (equipment, supervisory capacity, insufficient HEIs to maintain and expand infrastructure or attract staff, inadequate facilities, and research infrastructure) available to train PhD candidates who can make major contributions to socio-economic development in all economic sectors (CHE, 2023; Mukhwana, 2020; Zeleza, 2021). Finally, irregular supervision support and approaches to PhD education impede efficient and timely mentorship to ensure timely completion (Fredua-Kwarteng, 2023; Mukhwana, 2020; Pelser, 2024). These are the voids that the present study hopes to fulfill. Therefore, to accomplish the aims of this study, a systematic literature review was conducted to develop a supervision support model dubbed "an input-output model" for doctoral supervision that addresses these gaps and contributes to the present debate. Thus, we pose the question:

RQ: How best can African universities provide supervision support for doctoral students and prepare them for work outside academia?

LITERATURE REVIEW

The concept of "doctorateness" is crucial for monitoring doctoral education and managing its complexities (Gatfield & Alpert, 2002; Trafford & Leshem, 2009; Xu & Grant, 2017; Yazdani & Shokooh, 2018). The term "doctorateness" refers to the attributes of a doctoral student, including their research strategy, knowledge gaps, and unique contributions to the field. It is frequently seen as a turning point in the PhD process (Polkinghorne et al., 2023; Yazdani & Shokooh, 2018). Therefore, the term "doctorateness" is a combination of "doing" and "achieving" a doctorate, which combines the concerns of research methodology and research process (Botha, 2017; Polkinghorne et al., 2023). Therefore, the holders of a doctorate are entitled to a title and a claim to research expertise, rigor, and incisiveness, which involves a hard academic study program and a rigorous evaluation process (Leshem & Bitzer, 2024). While scholars (Botha, 2017; Denicolo & Park, 2013; Trafford & Leshem, 2009; Yazdani & Shokooh, 2018) have tried to come up with several definitions of the term "doctorateness," the literature on doctorate education lacks a conceptual definition of this term, making it difficult to assess doctoral degrees and supervision models (Walker & Thomson, 2010, p. 28). The concept is loosely defined as a common quality shared by individuals with PhD credentials (Poole, 2015; Xu & Grant, 2017; Yazdani & Shokooh, 2018). However, the process of creating this quality remains a mystery (Yazdani & Shokooh, 2018, p. 32). Understanding the concept of doctorateness is essential for developing theories on doctoral supervision support models (Botha, 2017; Denicolo & Park, 2013; Trafford & Leshem, 2009; Yazdani & Shokooh, 2018). The effectiveness of any PhD program relies heavily on the quality of supervision provided. To achieve desired outcomes (Cornér et al., 2018; Green & Bowden, 2012; McConnell & Geesa, 2021), it is essential to incorporate quality assurance measures into doctoral education supervision program and evolve supervision procedures

and support as the number and quality of doctorates increase (Kumar & Kaur, 2019; Matheka et al., 2020; Seeber & Horta, 2021). However, the process for creating this “common quality” is still a mystery. Yazdani and Shokooh (2018, p. 42) proposed the definition as follows:

A personal quality that, following a developmental and transformative apprenticeship process, results in the formation of an independent scholar with a certain identity and level of competence and the creation of an original contribution, which extends knowledge through scholarship and receipt of the highest academic degree and culminates scholarship of the discipline.

Another striking alternative definition of the term ‘doctorateness,’ according to Denicolo and Park (2013), also supports the view that doctorateness is a quality possessed by the researcher, not the project. They argue that the purpose of a thesis or dissertation within a doctoral degree is:

To demonstrate in a public form that a candidate has achieved ‘doctorateness,’ that is, in summary, the ability to conduct autonomously and within restricted boundaries of resources, including time, research that is ground-breaking in the sense that it results in a novel/unique, non-trivial contribution to knowledge, and that is publishable in some form.

The quality of supervision procedures and the support provided must evolve alongside the increasing quantity and quality of required doctorates (Kumar & Kaur, 2019; Matheka et al., 2020; Seeber & Horta, 2021). The term’s ‘supervision support’ refers to institutional incentives, reduced teaching loads, and administrative work provided to PhD students’ supervisors as motivating factors to ensure quality inputs during the doctoral training journey, especially when the supervisor is motivated. Second, the term denotes PhD supervisory support that is given to the students during the doctoral training journey, which could be better achieved when the assigned supervisor is motivated to ensure there is quality inputs into the PhD education process. These two forms of support are critical in ensuring quality and timely throughput.

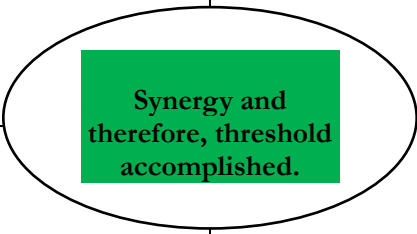
DOCTORATENESS AS A THRESHOLD

“Threshold concepts” represent a gateway (a portal) to learning and understanding through which candidates must pass but where they may encounter real difficulties in learning and understanding (Botha, 2017). Scholars (Botha, 2017; Yazdani & Shokooh, 2018) argue that doctorate criteria should include high-quality research, but doctoral education primarily focuses on academic skills, neglecting other industries. This leads to a surplus of PhD holders struggling to adapt to the 21st-century job market, limiting their employment prospects to academic institutions. To achieve this, doctoral candidates are expected to progress beyond merely reporting facts because the doctorate represents a level of knowledge, skills, and attitudes that involves intellectualizing, conceptualizing, and contributing to existing knowledge (see, Kimani, 2014). Candidates and supervisors thus must understand the scholarly nature of the doctoral degree by appreciating the connection between doing research, writing a doctoral thesis, and, at some institutions, defending a thesis in a doctoral viva.

Doctorateness is viewed as a pathway to acquiring specialized knowledge and abilities in various disciplines, not just academics (Fetene & Tamrat, 2021; Polkinghorne et al., 2023). Doctoral education focuses on technical aspects like research, scholarship, and original knowledge, as well as instilling soft skills for excelling in both academics and industry (V. B. Baptista et al., 2020; Buehling & Geisler, 2022). It requires practical experience in the industry, for example, having a supervisor outside the academic environment or having doctoral candidates’ complete internships in the sector. Evidence suggests that there are two types of skills: soft and digital skills (Mantai & Marrone, 2022). These skills are deemed critical in PhD outcomes given the expectation from PhD candidates to network, collaborate, co-publish, pitch, and communicate their research to diverse audiences and have advanced technical and digital competencies (Mantai & Marrone, 2022). Moreover, studies (e.g., Mantai & Marrone, 2022) further indicate that the current trending categories are interpersonal skills (including teamwork, negotiation, networking, conflict resolution, etc.), besides critical thinking, problem-solving, abstraction and creativity, analytical and synthesis, superior communication, empathy,

and listening abilities. These skills can be complemented with the knowledge from industry collaborations during the doctoral journey. For example, in Table 1, an attempt is made to illustrate the concept of doctorateness as a threshold in practice, which depicts doctorateness as synergy when all the components are presented and fitted together.

Table 1. Components of doctorateness

Contribution to knowledge	State gap in knowledge	Explicit research question	Conceptual framework
Conceptual conclusions			Explicit research design
Research questions answered			Appropriate methodology
Cogent argument throughout	Full engagement with theory	Clear/precise presentation	Correct data collection/mining

Source: Trafford and Leshem (2009, p. 309)

QUALITY OF SUPERVISION AND DOCTORATENESS AS THRESHOLD

PhD candidates' success depends on the level of supervision support they receive (Kumar & Kaur, 2019). However, it is important to note that other factors influence doctoral students' performance. PhD student performance is influenced by various factors, including the quality of the supervisor-student relationship, availability, expectations, supervisor knowledge, student qualities, communication, support, background, and the need for continuous nurturing (Haley et al., 2024). Other factors include institutional culture, student background characteristics, and psychological characteristics like personality and motivation (Mantai & Marrone, 2022; Nxumalo et al., 2024; Seeber & Horta, 2021; van Rooij et al., 2021). For example, African universities vary in practices related to the adoption of systematic and current approaches to postgraduate supervision. There is evidence to suggest that the practice of postgraduate supervision in Africa is largely rooted in the traditional, individualistic model (Kumar & Kaur, 2019; Nxumalo et al., 2024; van Rooij et al., 2021). Moreover, the successful adoption of alternative and new approaches to postgraduate supervision remains hindered by contextual challenges related to the availability of resources, funding, and high staff-student turnover or ratios (Feast, 2022; Nxumalo et al., 2024). According to studies (Cross & Backhouse, 2014; Igumbor et al., 2022; Mantai & Marrone, 2022; Nxumalo et al., 2024; Tikkanen et al., 2024), supervisor competence in a certain research topic is critical for successful supervision and completion of PhD students, besides the institutional support system should also need to be considered. Furthermore, other issues highlight the impact task load may have on supervisors. Working under a supervisor with a larger number of PhD students negatively affects students' satisfaction regarding their professional relationships, even when considering the frequency of meetings, which suggests that having a larger number of PhD students is likely to affect the length (and/or quality) of these meetings (Seeber & Horta, 2021). A high student/supervisor ratio remains a major concern, perhaps leading to insufficient supervision (Ligami, 2019; Matas, 2012; Matheka et al., 2020; Seeber & Horta, 2021). Previous studies (Nxumalo et al., 2024; Seeber & Horta, 2021; van Rooij et al., 2021) show the importance of balancing the number of PhD students and academic supervises with enough time for frequent meetings. These meetings could either take place face-to-face or use appropriate technology, where feasible for both parties involved in the PhD supervision (Zvavahera & Masimba, 2019). Given the massification of PhD programs, supervisors and university administrators must be aware of and manage the trade-off between quantity and quality, which is particularly critical when the quality of

the doctorates is arguably on the decline, and the pressures on PhD students are mounting (Seeber & Horta, 2021).

PhD students are typically unprepared for the challenges that come with their studies (Pinto, 2021; Seeber & Horta, 2021). This lack of preparedness leads to other concerns, such as poor academic writing skills, which irritate both supervisors and doctoral students and force them to abandon their relationships (Vidak et al., 2017). For instance, a student's failure in academic writing skills may frustrate the supervisor and water the importance of establishing boundaries, arguing that supervisors should avoid "over-involvement" for two reasons: (1) to allow PhD students to demonstrate their ability to work largely on their own, which guarantees the students' autonomy, originality, creativity, and intellectual potential and paves the way for them to become independent researchers, and (2) to avoid over-influencing the students or doing the thinking or writing for them. Supervisors get frustrated as they must hold on to a student for a longer period due to poor academic writing skills (Seeber & Horta, 2021). This type of delay in PhD completion is sometimes attributed to the supervisor as the cause (Al Makhamreh & Stockley, 2019; Chaló et al., 2023; Pinto, 2023; Seeber & Horta). Igumbor et al. (2022) feel that effective PhD supervision begins with the selection of PhD candidates for doctoral programs on a competitive basis. For example, studies (Mantai & Marrone, 2022; Nxumalo et al., 2024) have shown that the caliber of students entering a university determines the quality of the graduates generated by the institution. The reasons for this are that students pursue doctoral education for various reasons and, therefore, should never be judged as having the desire to become academics or researchers. For instance, some students drift into doing PhD education, perhaps just as another qualification, without thinking about what it involves (Chaló et al., 2023). In fact, studies (Chaló et al., 2023; Seeber & Horta, 2021) have demonstrated that quality supervision cannot be left to the supervisor or students alone but rather to all stakeholders. Moreover, apart from the motivation behind a person pursuing doctoral education, other factors, for example, demographics, are not taken into consideration in admitting students into the program, while studies have correlations between successful completion and failure rates (Al Makhamreh & Stockley, 2019; Chaló et al., 2023; Seeber & Horta, 2021). Supervisors are supposed to supervise and provide appropriate support once students have been allocated to them. They must also help students identify subjects and guide them through the proposal writing process (Griffiths & Warren, 2015; Pinto, 2021). This includes helping students develop study processes and providing continuing supervision to ensure completion, perhaps within a stipulated period (Matas, 2012).

Student's relationship with supervisor

Effective supervision should involve both supervisors and PhD students. Furthermore, both parties need to maintain a positive relationship during the research or supervision journey (Igumbor et al., 2022; Jowi, 2021). This allows the PhD students to receive continuing guidance and academic assistance from the supervisor. To produce competent doctorate candidates within the designated timeframe, the supervisor and the student must cultivate an appropriate collaborative relationship, clarify expectations, comprehend their roles, and execute their responsibilities efficiently (Haimbodi, 2023; Nasir & Masek, 2015). For instance, studies (e.g., Jacobsen et al., 2024) have shown that what worked with one did not work with another because different students require different kinds of interaction and supervision. Furthermore, studies (Nasir & Masek, 2015; Seeber & Horta, 2021) suggest that the difficulties with the student-supervisor connection originate from a mismatch between supervisory styles and structured student learning approaches. A critical appraisal of doctoral supervisory styles – apprenticeship or *master-slave*, contractual, *pastoral*, *directorial*, technical rational, and negotiated order – indicates that there is no absolute one best fit, but rather the application is more dependent on what works for a given circumstance. Academics use *laissez-faire styles*, while contractual styles provide strong structure and support. *Pastoral supervision* allows students to handle research projects, while *directorial supervision* sets expectations. The technical rational model aims to create independent researchers, foster scholarly creativity, or expedite completion. However, each of these approaches also suffers several limitations despite the benefits they offer. Therefore, only supervisors who understand these models and mix them effectively can better help their students grow (Haley et

al., 2024). Studies (Al Makhamreh & Stockley, 2019; Pinto, 2023; Seeber & Horta, 2021) have indicated factors; for example, supervisory traits, student traits, and supervisor-student interactions are some of the aspects that need consideration to ensure that there is always fit between the supervisor and the student.

Arguably, the focus on PhD student recruitment ought to be more stringent and aim to select students who prefer tasks requiring creativity and the ability to deal with abstraction and ambiguity (Golde, 2000; McAlpine & Norton, 2006; Nerad & Chiappa, 2022; Seeber & Horta, 2021). Research (Seeber & Horta, 2021) has shown that satisfaction is associated with a good supervisory relationship that enables successful outcomes of the PhD and, therefore, considering all dimensions that can contribute to this potential success should be envisaged when possible. However, these suggested selection criteria are rarely applied in most cases, if not all PhD student selection processes, making it difficult for the university to find a fit or match.

While Fulgence (2019) argues that doctoral supervision is critical to achieving the aims of doctoral education and the doctorate process, the doctorate education process, as a journey, transforms a student through orientation, knowledge gathering, discovery, and explanation, which can only be achieved when both sides establish cordial relationships based on collegiality and respect. Supervisors must assist their doctoral students in a way that promotes self-discovery and independence (Guarimata-Salinas et al., 2024; Pelser, 2024). Supervision support, which is synonymous with doctorate education, should assign one or more supervisors to each student. However, if the two are not effectively structured, it may cause problems later. The mistake that has previously been made is the expectation that the two supervisors offer complementary knowledge and abilities to the supervision process. However, this frequently leads to misunderstanding and dissatisfaction if not managed properly. Hence, it compromises its purpose, resulting in delays or students dropping out.

Supervision support

Mouton et al. (2015) discovered that most supervisors in African institutions bear a “quality” burden because they also supervise master’s students and engage in other teaching and learning activities. As a result, it became evident that supervisors do not devote appropriate time to their PhD students. Auðardóttir and Tiegen (2021) found that certain models make supervisors non-directive, resulting in less personal contact with students and less motivation. For instance, Auðardóttir and Tiegen (2021) suggest that PhD students benefit from having many supervisors, which sometimes may result in group supervision or students having a main supervisor and a co-supervisor. However, due care is needed before selecting the model with the most benefits and analyzing the advantages and disadvantages of group supervision. Moreover, studies (Auðardóttir & Tiegen, 2021; Griffiths & Warren, 2015; Guarimata-Salinas et al., 2024) define academic supervision as “a complicated, multi-faceted process that functions across many academic levels and learning situations, aimed at assisting learners in engaging in the sustained, independent work process that fundamentally rely upon interpersonal interaction, which can either facilitate and validate learning or inhibit it.” Furthermore, it is essential to recognize that effective supervision is not isolated but is deeply integrated within academic community interactions; for instance, colleagues in academia serve as the primary context for supervisory development and are a significant source of professional support (Tikkanen et al., 2024).

Supervisory process and timeous feedback

It is vital to adequately record and define the importance of successful supervision of PhD candidates in Africa (Igumbor et al., 2022). The researchers (Igumbor et al., 2022; Jacobsen et al., 2024; Ribau, 2020) feel that providing timely feedback to students can excite them. Supervisors can define and enforce deadlines with their protégés (Auðardóttir & Tiegen, 2021; Gasa & Gumbo, 2020). They also advise that while working with PhD students to establish these timelines, the supervisor(s) be sympathetic, adaptable, and non-judgmental. For instance, Auðardóttir and Tiegen (2021) and Gasa and Gumbo (2020) stress the significance of critical thinking and innovation for doctorate candidates. Moreover, the study by Auðardóttir and Tiegen (2021) revealed that students desire high-

quality feedback that is not only timely but also encourages questioning, challenges their thinking, and prompts critical inquiry. The applicants like supervisors who provide thorough, insightful, and challenging feedback, as they believe that constructive criticism, along with encouragement and praise when suitable, significantly contributes to fostering a healthy working relationship between the candidate and the supervisor (Auðardóttir & Tiegen, 2021; Ribau, 2020).

General support

Competent PhD supervision is crucial for students to complete their studies on time and requires a combination of strategies that allow for high-level communication skills and professional interpersonal qualities (Baydarova et al., 2021; Cornér et al., 2018; Pinto, 2021; Wisker et al., 2021). Support from multiple departments within the university can be beneficial for PhD students' studies and improve their ability to manage teaching load and supervisory responsibilities (Doyle et al., 2016; Tamrat & Fetene, 2021). For instance, a study of six African countries discovered that most PhD candidates did not contribute significantly to knowledge generation, highlighting the need for improved support and limited access to opportunities (Jowi, 2021). The absence of engagement in research forums can lead to unhappiness, stress, loneliness, and attrition, indicating a deficiency in general support for doctoral students (Auðardóttir & Tiegen, 2021; Pinto, 2021). Despite the significance of such aid, there exists a deficiency in comprehensive support for doctorate students in Africa, a gap that necessitates rectification.

Technology-enhanced support

In the technology age, universities must invest in infrastructure to provide a conducive learning environment for PhD students (A. L. Cloete, 2017; Igumbor et al., 2022; Matas, 2012). However, many African universities lack adequate institutional support, limiting access to data analysis programs and improving supervisory skills (Jowi, 2021; Matheka et al., 2020; Stein & Sim, 2020). The relationship between supervisor and student is crucial in doctoral supervision, and drop-in consultations can be beneficial at the PhD level (Gasa & Gumbo, 2020; Kereluik et al., 2013; Wisker et al., 2021). Technology can be used to bridge the existing gap due to distance between the supervisor and student (Guerin & Aitchison, 2021; Kigwilu & Nyonje, 2024). For instance, physical separation exists, and face-to-face communication is not frequently feasible, hence assisting in minimizing isolation and loneliness, which may lead to stress and burnout in doctoral candidates (Gredler & Harland, 2022).

Doctorate education students frequently struggle to articulate the contributions of their studies to society due to a lack of community-centered conceptualization of the field. This can be avoided by strengthening cooperation among institutions, industry, and society (British Council, 2018; Doyle et al., 2016; Grimm, 2018; Ligami, 2019; Matheka et al., 2020; Pelser, 2024). Organizations have used systems theory to respond to external environment changes, for example, technologies, climate change, and disasters (Guarimata-Salinas et al., 2024; Katz & Kahn, 1966; Lain & Lin, 2017; Salmi, 2021). However, failure to consider doctoral education support as an open system has resulted in stakeholders being placed last in studies (Germain-Alamartine & Moghadam-Saman, 2020). To benefit society, doctoral education should be viewed as a product or service, considering interdependent interactions between businesses and their surroundings (Guarimata-Salinas et al., 2024; Mukhwana, 2020; Pelser, 2024).

Open systems theory suggests that organizations are open systems that accept inputs from the outside world and transform them into outputs or services through operations, production, personnel activities, technology operations, and more (Figure 1). This interdependent interaction results in a continuous cycle of feedback loops, correcting market shortcomings (Lain & Lin, 2017; Pelser, 2024). The current traditional doctoral supervision is criticized for its production style, which focuses on the academic environment. The primary goal is to meet academic work requirements while ignoring the environment or society.

Open system theory emphasizes the interdependence between internal and external parts of the environment (de Jesús Pérez Durán, 2021; Glaser & Halliday, 1980; Sarthory, 1979). Universities should

continuously collect and evaluate feedback from stakeholders, including doctoral supervisors. This feedback is crucial for improving the quality and quantity of inputs, transformation processes, outputs, and outcomes of doctoral supervision (Chick, 2004). Key components of an open system in doctoral supervision include students, peers, supervisors, funders, scholarships, and institutional support (Gasparski, 2009). Understanding the connectivity between these parts is critical for the effective and successful PhD supervision journey (Bearman et al., 2024). The feedback relationship between supervisor and student is productive when collaborative and productive (Bearman et al., 2024).

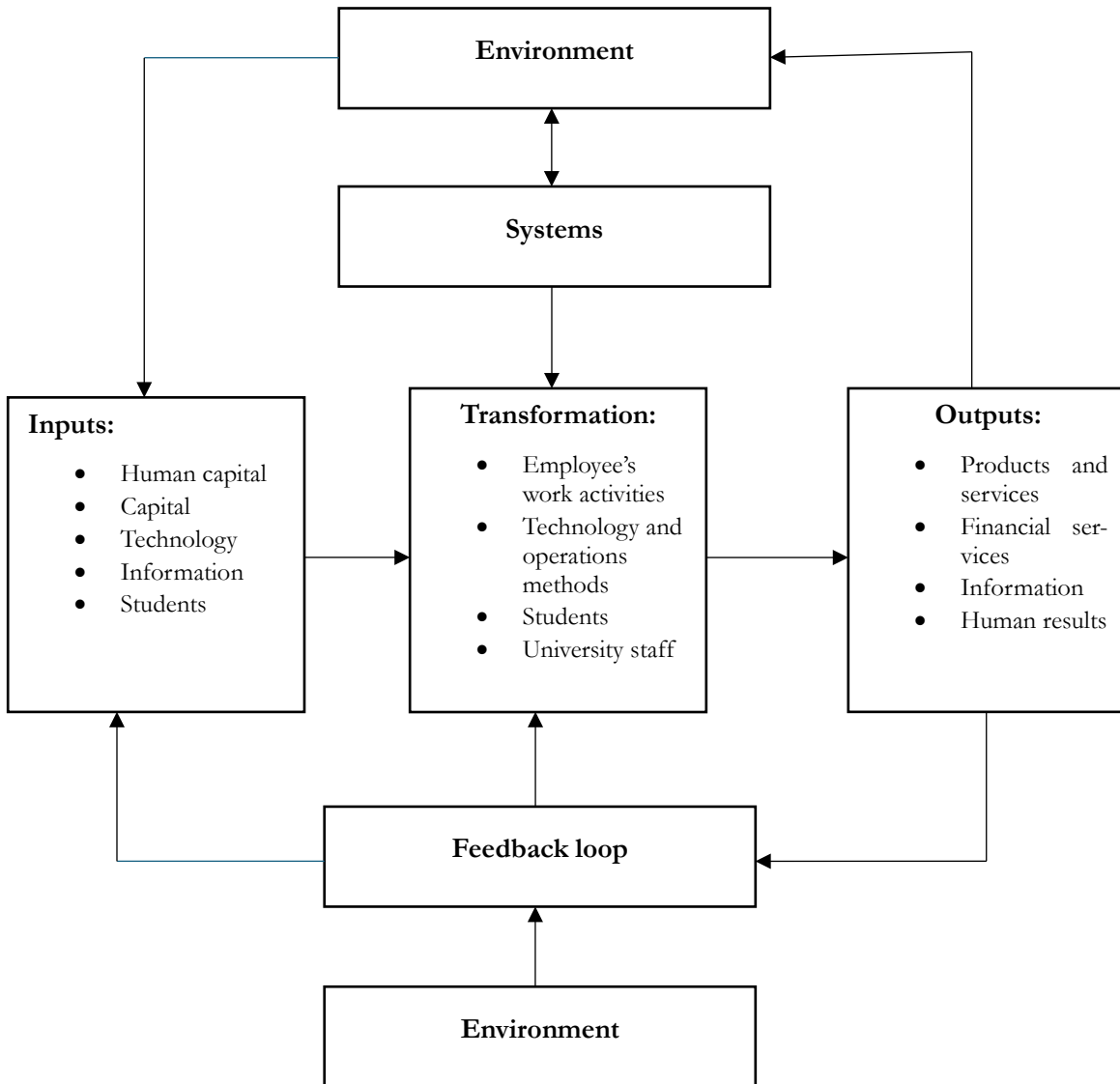


Figure 1 University as an open system

Similarly, in doctoral education, the open system approach could be applied to provide support for PhD candidates to complete successfully (Stevens et al., 2021). Research (Bearman et al., 2024; Editorial, 2023) indicates that, for doctorate education to match society's expectations, training and mentorship must move beyond the nineteenth century. The complexities of a PhD program in education

require an understanding of the process, which is made up of interdependent parts that need to be put in the right order to accomplish the desired outcomes (Chaló et al., 2023; Chikere & Nwoka, 2015). This is an approach that is currently not so much in practice in most universities' doctoral supervision process. To achieve this, doctoral candidates are expected to progress beyond merely reporting facts since the doctorate represents a level of knowledge, skills, and attitudes that involves intellectualizing, conceptualizing, and contributing to existing knowledge. Candidates and supervisors thus must understand the scholarly nature of the doctoral degree by appreciating the connection between doing research, writing a doctoral thesis, and, at some institutions, defending a thesis in a doctoral viva.

Studies (Al Makhamreh & Stockley, 2019; Krumsvik, 2022) have shown that most universities have regulations and policies guiding supervision processes, ranging from national qualifications frameworks or regulatory authorities like the UK Higher Education Quality Assurance Agency, South African Qualification Authority, Botswana Qualification Authority, and Kenya National Qualifications Authority. These bodies regularly review degree programs and recommend improvements, leading to the implementation of quality assurance monitoring mechanisms in their respective countries. For instance, most of the regulatory authority's states that universities are increasingly expected to adopt team supervision, skills training, and timely completion (Krumsvik, 2022). The expectations and policies are two different things; therefore, universities are at liberty to adopt what works for them based on several factors. Today, PhD programs have become a national policy for most governments, where universities are regulated on quality assurance, starting from the accreditation of the PhD program to the completion of the study. For example, the minimum duration of the program qualifications of the PhD supervisors is needed to ensure the sustainability of the study journey (Krumsvik, 2022). Furthermore, PhD supervision not only takes place as an interpersonal relationship between the PhD supervisor and student but also as part of and influenced by wider global and national policy agenda and institutional leadership practices (Bengtson & McAlpine, 2022).

THEORETICAL FRAMEWORK

A critical review of the literature on PhD supervision models highlighted several weaknesses that call for a new approach to doctoral supervision (Sanganyado et al., 2022). *First*, the traditional PhD supervision one-to-one, also known as the Oxbridge model, master-apprentice model, or tutorship model, has been criticized for not offering sufficient doctoral supervision support due to being viewed as insufficient, inappropriate for some forms of knowledge-making and can be a major factor in the so-called 'lonely scholar' experience of postgraduate education (CHE, 2023; Dominguez-Whitehead & Maringe, 2020). Moreover, the supervisor bears a great deal of responsibility under the one-to-one model because it is their responsibility to make sure the student comprehends and promptly complies with the requirements of postgraduate study (CHE, 2023; Dominguez-Whitehead & Maringe, 2020; Nxumalo et al., 2024). It is the supervisor's duty to ensure the quality of the study and to support and guide the student. The research project may be endangered if the supervisor lacks the necessary expertise in the field or methodological approach, is ill-prepared to help the student improve their academic writing or fails to provide feedback on time or at all (Herut & Gorfu, 2024). In most African universities, this is the most common model, though it is always intended to include co-supervision, and in some circumstances, it fails (Herut & Gorfu, 2024). The weaknesses of the one-to-one model range from power dynamics between supervisor and student that can be exacerbated due to cultural differences to that of subject-specific or methodological approaches; hence, calls for consideration for alternative PhD supervision models (Herut & Gorfu, 2024).

Second, collaborative models and structured models. The literature (CHE, 2023; Dominguez-Whitehead & Maringe, 2020; Nxumalo et al., 2024) indicates that a rise in the number of students and expectations for increased efficiency has led to more collaborative and structured models. Collaborative and structured approaches are praised as impressive increases in both retention and throughput (Dominguez-Whitehead & Maringe, 2020). While these models differ greatly in their nature, they all

have the expectation that students will engage in a variety of group activities and reach specific learning objectives (CHE, 2023; Nxumalo et al., 2024). Global postgraduate supervision trends, including those in several African countries, are pushing for a change to more integrative and collaborative approaches (Cornell et al., 2022; Dominguez-Whitehead & Maringe, 2020). These consist of peer mentorship, cohort supervision, and integrated frameworks that incorporate different aspects of contemporary and conventional supervisory approaches (Dominguez-Whitehead & Maringe, 2020; Nxumalo et al., 2024). Evidence suggests that group supervision enhances supervision skills and positively impacts postgraduate students' writing by providing support, resources, quick thinking practice, encouragement, and professional growth opportunities (Clark et al., 2021; Cornell et al., 2022). However, despite offering several benefits, these approaches also suffer from problems, for instance, conflict in contradicting feedback and power play between the principal supervisor and co-supervisor, who are, in most cases, junior academics still under the mentorship, which causes confusion for PhD students. Without a clear explanation of the extent of each work, a lack of awareness of the breadth of responsibilities required can have a detrimental effect on the co-supervisors' relationship with the postgraduate (Grossman & Crowther, 2015; Herut & Gorf, 2024). Moreover, these approaches advocate for timely PhD completion with little emphasis on both outcomes, for example, technical and soft skills, as the focus is on doctoral education.

This study presents the conceptual model depicted in Figure 2, building on the preliminary literature review and the quest for an integrated supervision model to cater to the gaps identified in the current models (Ngulube, 2021; Olsson & Bernhard, 2020; Ungadi, 2021).

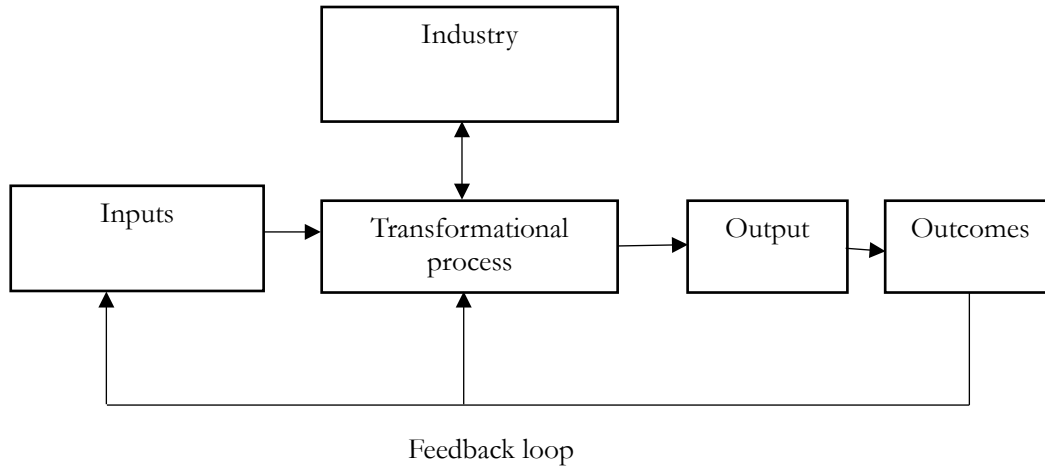


Figure 2. Input-output doctoral supervision support model

There is a widely recognized need to focus on the supervisory model, but the proposed approaches for implementing this type of doctoral supervision vary considerably (Bitzer & Albertyn, 2011). Discrepancies in the use of doctoral supervision support and management assistance exist among institutions, as well as within university faculties and departments (Gatfield, 2006). Therefore, due to the lack of uniformity in doctoral supervisory models, this study proposes a comprehensive descriptive model that aims to characterize the relevant system, its interfaces, and interdependencies that need to be considered regardless of the preference for supervisory support from universities or supervisors. In this proposed model (Figure 2), the resources (inputs) are utilized in the production process (transformation), which undergoes a thorough screening process and meets quality requirements. This is particularly true for raw materials (inputs) used in the manufacturing business to create a specific product (Maier et al., 2023). Such measures ensure that the product meets customer expectations. It also implies that materials that do not meet the defined minimum quality are either rejected or reworked (Olsson & Bernhard, 2020; Salimi et al., 2016). Likewise, junior faculty members can offer specialized instruction to support weaker students and provide them with a solid foundation in

fundamental research principles, bridging any gaps as necessary. Moreover, at the institutional level, universities face a multitude of candidates who aspire to be admitted to PhD education programs, but such high demand comes with its challenges (Cornér et al., 2018). For example, there is an increase in workload on the already stretched academics, facilities, funding, and administrative staff. In such a scenario, many universities accept PhD applicants without ensuring they have the necessary resources to see them through to completion.

INPUTS

The input stage in doctoral education supervision is often overlooked, whereas it is the initial point of contact between potential students and the learning institution (Figure 2). Doctoral students bring various characteristics, for example, age, gender, career goals, race, ethnicity, cultural orientation, educational background, employment experience, and marital status (Al Makhamreh & Stockley, 2019; Chaló et al., 2023; Matheka et al., 2020; Pinto, 2023; Seeber & Horta, 2021). Studies (Chaló et al., 2023; Pinto, 2023) indicate that profiling students during admission could assist the admitting institutions to prepare the necessary resources required for the duration of the doctoral journey. For example, matching doctoral candidates with potential supervisors is crucial to avoid mismatches based on these factors: funding or scholarships, study materials, facilities, and administrative staff (Pinto, 2023; Xu & Grant, 2017). As one of the inputs in doctoral education, students are a critical resource, and their quality cannot be underestimated. For example, studies (Chaló et al., 2023; Pinto, 2023; Seeber & Horta, 2021) show that students being admitted into university doctoral programs should have a minimum level of theoretical knowledge and research skills. Furthermore, students pursue PhD programs for several reasons; some are motivated by the pursuit of higher knowledge, a career in academics, a career in a non-academic environment, independent research, personal prestige, and job requirements (Anderson & Gold, 2019). These traits are worth knowing when the students seek admission because they later affect effective PhD supervision. These are critical traits, yet very little has been done to ensure that they are part of the admission criteria for a doctoral program.

Quality supervision support begins with the qualities of the doctoral students, as well as the recruitment, selection, and admission procedures (Chaló et al., 2023; Cornér et al., 2018; Krumsvik, 2022). Studies (e.g., Kurysheva et al., 2019) indicate that most universities do not have admission criteria which are rigorous. For instance, through transparent admissions, applicants can assess if their non-cognitive qualities, academic background, and past accomplishments are appropriate for a program and what they can learn or do better to increase their chances of being admitted (Krumsvik, 2022; Kurysheva et al., 2019; Kyarö et al., 2019). Ignoring these basic quality standards during a selective admissions process could have many detrimental effects. For instance, employing faulty and untrustworthy selective admission criteria may result in more false-negative cases – rejected applicants who could have completed the program but were not given the opportunity to – and false-positive cases – students who are accepted into a program but are unable to finish it (Krumsvik, 2022; Kurysheva et al., 2019). Insufficiently informed applicants are at a disadvantage because they are unable to get the knowledge and skills necessary for a graduate program, are unable to realistically assess their chances of being accepted into a PhD program and are discouraged from applying if there is a lack of transparency or inaccurate information regarding selective admission criteria, documents, and procedures (Kurysheva et al., 2019).

A model for doctoral education supervision assistance, comprising four components (input, transformation process, industry feedback loop, outputs, and outcomes), may be essential for enhancing doctorate education results (Guo & Rose, 2015; Kálmán et al., 2022; Maier et al., 2023). This paradigm is essential for enhancing doctorate education outcomes. The advantages of this supportive approach are manifold, encompassing the provision of doctorate candidates with knowledge and skills that transcend the conventional limits of their professional milieu and the exploration of career prospects inside higher education institutions (Palmer & Gillaspy, 2021). The recruitment of doctorate students in Germany lacks standardization, as supervisors frequently recruit applicants informally and tailor their education according to personal experiences (Cyranoski et al., 2011). This strategy raises

questions regarding potential conflicts of interest and personal relationships between supervisors and students. To address this issue, German institutions have formalized their procedures, mandating that PhD students undertake planned courses beyond the laboratory (Cornér et al., 2017; Hasgall et al., 2019). The objective is to guarantee that PhD candidates are adequately equipped for diverse job prospects outside academia (Hasgall et al., 2019), as seen in Figure 1. To cultivate a research culture that prioritizes rigor, resilience, creativity, critical thinking, independence, and the capacity to produce new knowledge, the application and admission procedure must comply with stringent criteria (Devos et al., 2016; Krumsvik, 2022).

Doctoral applications and admissions should focus on areas such as interviews, proposal creation, and research concept presentations to faculty members involved in graduate supervision (Hasgall et al., 2019). For example, a study (Krumsvik, 2022) states that PhD applicants must document their formal education and publications in addition to other master's dissertations and a ten-page project description. The scientific committees, who evaluate the quality of the candidates in general and the project description in particular, strongly link these procedures (Kyarö et al., 2019). Furthermore, Krumsvik (2022) states that the process normally involves a letter from the expert committees, who submit a list ranking the candidates who have applied to the faculty. The highest-ranked candidates are then invited to the interviews for the PhD positions, and based on the outcomes, a final ranking list is sent from the committee leader to the faculty board, which makes the final decision on admission. The PhD program leaders then consider the candidate for admission to the program.

Similarly, in Chinese universities, for instance, quality supervision is influenced by factors such as longer PhD training duration, ensuring supervisors are adequately qualified, implementing quality monitoring systems, and establishing clear processes for screening out substandard candidates (Devos et al., 2016). Mismatches in these traits can contribute to challenges in doctoral education supervision (Bitzer, 2014; McConnell & Geesa, 2021). Aligning supervisor characteristics with students is crucial for effective and high-quality supervision (Cornér et al., 2018; Winchester-Seeto et al., 2014). Supervisors often acquire supervisory skills by reflecting on their own experiences as students. However, this approach may lead to issues, such as a passive approach to doctoral study and limitations passed on if previous supervisors were not exemplary (Cornér et al., 2018; Stephens, 2014). The appointment of doctoral supervisors should be based on rigorous and transparent recruitment and selection criteria. Research indicates that the recruitment and appointment processes for supervisors in many institutions lack structure.

TRANSFORMATIONAL PROCESS

Doctoral education is a transformative process involving factors like admission, financial support, and supervisor incentives. Universities should establish systems to ensure high standards and effective supervision. Dedicated supervisors and a well-structured support system attract enthusiastic academics (Golde, 2005; Kálmán et al., 2022; Pinto, 2023; Yazdani & Shokooh, 2018). Studies indicate that mentorship is crucial for new PhD graduates, allowing them to understand cultural contexts and research traditions (Chaló et al., 2023; Pinto, 2023). Training actions should develop intercultural communication skills for supervisors to supervise across languages and cultures (Krumsvik, 2022; Pinto, 2023). The transformation process, or process, comprises peer assistance to the PhD student, models in which learners support each other, and the provision of free articles; physical or online training depends on the nature of the learners (Figure 2). Moreover, the PhD student transformation process involves an effective approach, for instance, initial training, to ensure that students meet the minimum standards for knowledge and skills required for their doctoral studies (Chaló et al., 2023; Pinto, 2023). This stage presents general training, so the students have those competencies (knowledge and skills). This is basically done to homogenize all students, so they have homogenization as a building foundation for the thesis. In a nutshell, homogenizing the students' knowledge so afterward, everyone may develop a thesis with quality (Chaló et al., 2023; Pinto, 2023). This helps develop the student's ability to determine what a PhD is. Moreover, other students' transformation

processes include information on resources, institutional regulations/policies, academic writing, research methods, and general support.

UNIVERSITY-INDUSTRY INTERFACE

Traditional supervision of doctoral education needs to be updated to align with the current global economic landscape (Halse & Mowbray, 2011). The call for modern knowledge frameworks is rooted in the belief that education has not adequately prepared students for the demands of the knowledge-based economy (Buehling & Geissler, 2022). To boost Africa's knowledge-based economy, PhD education should link with organizations beyond academia (Boehe, 2016; Kálmán et al., 2022; Kereluik et al., 2013). Involving stakeholders, including industry and clients, can lead to attractive research opportunities and funding resources (Boehe, 2016; Kálmán et al., 2022). These connections can take various forms, for example, doctoral students interning in industry, NGOs, and the public sector, as well as individuals employed in companies serving as mentors during their PhD studies (see, Bernhard & Olsson, 2022; Bernstein et al., 2014). The aim of this arrangement is to provide PhD candidates with the necessary information and practical skills beyond the traditional academic boundaries that have prevailed in doctoral education for many years (Figure 2). This move will entirely equip doctoral students with multiple opportunities in the labor market. In the twenty-first century, doctoral education should prioritize career options outside academia. For instance, studies (Krumsvik, 2022; Malfroy, 2011; Pinto, 2023; Welch et al., 2018) indicated that university-industry research had good advantages but highlighted areas of discord and changing practices. A key component of creating fruitful cooperative relationships was the development of individual personal abilities (Blake & Mouton, 1964). This study highlights the need for a more robust institutional, pedagogical, and epistemological framework that benefits both universities and industries in research partnerships, which aligns with current national and international priorities for a nexus between university and industry research (Grimm, 2018). The objective is to equip supervisors and doctoral students with soft skills, for example, communication, translating their research into real-world contexts, creativity, interpersonal skills, and strategic thinking (Asiimwe, 2019; Hasgall et al., 2019; Jowi, 2021; Kálmán et al., 2022; Kereluik et al., 2013; Maier et al., 2023).

Evidence indicates that products developed in collaboration with universities are more appealing to customers, even after actual product testing (Kneller et al., 2014; Stamati & Willmott, 2023). Additionally, multiple studies have found that customers are willing to pay up to 65% more for products branded as co-developed with a university (Maier et al., 2023). Universities should capitalize on this emerging trend as they nurture a mutually beneficial relationship between the two ties (Figure 2). This symbiotic connection yields benefits, for instance, bridging gaps between employers' expectations outside of academia and the skills possessed by doctoral-level talents (Bröchner & Sezer, 2020; Germain-Alamartine & Moghadam-Saman, 2020). For instance, in Sweden, PhD candidates in engineering are often employed by their institutions for a five-year period, during which they spend 20% of their time engaged in outreach activities ties. Additionally, creativity frequently thrives in collaborative environments (Figure 2). When doctoral students engage together on creative projects, they gain valuable collaboration and communication skills. These skills are useful not only in the classroom but also in the workplace, where successful collaboration is critical to success (Asiimwe, 2019; Hasgall et al., 2019; Kálmán et al., 2022).

OUTPUTS

Doctoral education supervision at universities produces high-quality doctorates, patents, intellectual property, and numerous job prospects for graduates. As indicated in the proposed model in Figure 2, for universities to acquire doctoral status, well-structured supervision, quality student support, and institutional support are required (Kálmán et al., 2022; Pinto, 2021; Tamrat & Fetene, 2021). Interdisciplinarity, intersectoral collaboration, internationalization as well as efforts to improve the quality of doctoral supervision are key directions and strategies for innovating doctoral education (Kálmán et al., 2022; Pelser, 2024; Pinto, 2021; Tamrat & Fetene, 2021). Furthermore, feedback methods on the

performance of these doctorate graduates using the tracer study technique from both industries and doctorate graduates are required, which institutions may utilize to enhance doctoral education supervision procedures (Zou & Kong, 2019) (Figure 1). These are only achievable in conditions where quality is key to the supervision process. Quality PhD holders are anticipated to find work in a variety of fields, not only academics, as has previously been the case, reducing graduate unemployment (Fetene & Tamrat, 2021; Matas, 2012; Nerad, 2011). University administrators must devise methods for tracking their PhD graduates using well-structured procedures and use this information from companies to enhance doctoral supervision processes (Asiimwe, 2019; Hasgall et al., 2019; Kálmán et al., 2022). Doctoral education can provide PhD holders with more work options thanks to this form of support (Bran et al., 2023). Studies (Bogle et al., 2010; Fetene & Tamrat, 2021; Maier et al., 2023) have identified several PhD holders' potential employers (large and small), particularly those outside academia, governments, and government departments, as drivers of innovation policy and funders of doctoral education, as well as employers, politicians, advisors, and policy discussion support organizations.

In addition, these PhD graduates serve as think tanks for public and commercial funders of doctoral candidates, research training, and management (Asiimwe, 2019; Hasgall et al., 2019; Kálmán et al., 2022). There are also university faculty and students who give or want to deliver doctorate courses to student unions and student bodies (Figure 2). Contemporary social concerns at all levels, from local to global, are complex and frequently require the incorporation of several viewpoints and competencies (Olsson & Bernhard, 2020; Stamati & Willmott, 2023). Therefore, to foster learning, new knowledge, the sharing of research findings, innovation, and social impact, stronger university-society partnerships are required (Compagnucci & Spigarelli, 2024; Olsson & Bernhard, 2020). A facet of this involves cooperation between academia and business via industrial PhD students engaged in the academic-business interface, meaning they work in industry while pursuing their PhD third cycle, engaging in both theoretical and practical work in academia and business (Compagnucci & Spigarelli, 2024; Kneller et al., 2014; Olsson & Bernhard, 2020). The results of PhD education include the contributions doctoral holders make to their area of study, the new knowledge they develop, and their influence on society as they progress in their careers (Figure 2). As a result, career tracking is useful for examining the long-term results of PhD education (Steyn et al., 2022; Zou & Kong, 2019). This data might be included in the system (university) to increase supervisory support for doctoral candidates.

OUTCOMES

The economic impact of a PhD should serve as an effective oversight and support system for high-quality doctoral education (A. Baptista et al., 2015). As they pursue their chosen careers, PhD candidates must be able to reflect on the information and skills required for current research (Ortega & Kent, 2018). A noteworthy trend has been the establishment of PhD programs to foster innovation in all economic sectors (Nerad et al., 2022; Pelser, 2024). Conventional PhD funding is designed to generate graduates whose primary goal is to meet the demands of higher education, particularly academics, with little regard for the other economic sectors to which these graduates are supposed to contribute significantly. The systems technique (Figure 2) aims to enhance doctoral supervision by assessing research findings in terms of their economic significance within an industrial system. These kinds of contributions should be obvious in a wide range of professions for which PhD candidates are qualified. Evidence (Jones, 2018; Pelser, 2024) indicates that doctoral education policies are shifting towards more university-industry interactions, transferable skills, and increased university-industry engagement, which is directly related to the growing importance of private finance and the value of applied research. The outcomes of any PhD education supervision must include transmitting new information to academic groups and communicating it to society (Anderson & Gold, 2019; Mukhwana, 2020; Pelser, 2024; Zou & Kong, 2019). In addition to other requirements, these outcomes should develop and demonstrate academic legitimacy, allowing the graduate to be recognized as a member of a global scholarly community and persevere in achieving long-term objectives.

METHOD

The present study followed a critical literature approach to doctoral supervision models in the context of African universities. Data mining was guided by one research question: *How best can African universities provide supervision support to doctoral students and prepare them for both work within and outside academia?* To answer this question, the study investigated the current trends in doctoral supervision models and approaches used in African universities, considering both primary and secondary databases. First, prominent databases were identified based on the rule of thumb of “credibility.” Data mining from prominent academic web databases, such as Google Scholar, EBSCO, Emeralds, Web of Science, Scopus, ScienceDirect, and Academic Search, was used to conduct a critical literature review. Second, Boolean operators “AND” “OR” and “NOT” were utilized to make searches more precise in searching these databases. The keywords are Africa, doctoral, education, supervision, models, styles, postgraduate, and supervisors. Applying each one of these Boolean operators interchangeably yielded articles 20,000 articles. Third, we applied inclusion criteria using abstracts that were contextually relevant to the present study, originality, and publications post-2017, except for seminal or technical works and reports, which resulted in 1,710 articles. Fourth, we applied research articles, not reviews, for further refinement, yielding 518 articles. Fifth, refinement using published works only appearing not more than once yielded 210 articles. Sixth, refinement applied evaluation methods of abstracting and indexing in credible databases, yielding at least 187 articles. We finally applied four keywords: Africa, models, doctoral, and supervisions. Therefore, any publications that did not match the above second keywords were excluded from the review papers and yielded the current 150 journal articles. These 150 articles were further refined based on other factors, such as empirical, peer review process, number of citations, and geographical coverage. These data were critically reviewed and assisted in the development of the study’s proposed model.

DISCUSSION

The objective of this review was to gain insights into doctoral supervision support methods and develop a support model for African universities. The study’s findings highlight the need for the continent (Africa) to produce PhDs to enable the continent to meet its developmental agenda (Ligami, 2019; Van’t Land, 2011). Furthermore, the literature is fraught with the need to have quality doctoral graduates fill various positions, such as academic teaching, research, independent consultants, government, and private sector of the economy. However, despite these calls from both governments and academics to fast-track the production of PhD degrees, the literature highlights several challenges that hinder universities from meeting these demands (Hyatt & Williams, 2011). For example, budgetary constraints, over-reliance on government subventions, over-reliance on donor funding, poor supervision or inadequate doctoral supervisors, delay in PhD completions, and unstructured and variation in supervision models have been mentioned. Moreover, inadequate facilities, equipment, and research infrastructure, shortage of scholarships, and insufficient HEIs to maintain and expand infrastructure or attract academic staff are some factors compounding the problems in doctoral education in African universities.

The evidence suggests that most African countries are facing similar problems, such as shortages of PhD degree holders who can work as lecturers, researchers, and supervisors at the university level. These problems seem to have forced several universities to work with lean resources to produce PhD degree holders, which may negatively impact the quality of the throughputs. For example, university PhD graduates lack technical and soft skills relevant to the industry and self-employment. Of interest in this study are the findings clearly pointing towards university-industry collaborations to impart both technical and soft skills.

A critical literature review revealed limited studies on support for doctoral education supervision in the African context (Academy of Science of South Africa [ASSA, 2010; Barasa & Omulando, 2018; Jowi, 2021; Kigotho, 2014). The definition of “doctorate” or “doctorateness” is still debated among

scholars (Fulgence, 2019; Kálmán et al., 2022; Ngulube, 2021; Poole, 2015; Yazdani & Shokooh, 2018). While there are numerous publications focusing on supervision models, the approach to PhD supervision support receives less attention from researchers (Kálmán et al., 2022; Ngulube, 2021). Further literature is needed to establish robust modes of doctoral supervision. Most studies show that doctoral education supervision still predominantly follows a conventional approach (Fetene & Tamrat, 2021; Fulgence, 2019). As the world moves towards a knowledge-based economy, it is crucial to keep up with the evolving demands (Ngulube, 2021). Combining the study's findings with the supervision support model, a doctorate education support model (inputs, transformational process, industry, feedback loop, output) was developed (Figure 1). This study argues in favor of the input-output doctoral supervision support paradigm. Industrial doctorates offer greater employment opportunities compared to traditional ones, promoting candidates with diverse skills who understand both academic and business expectations (Kálmán et al., 2022). Therefore, there is a need to revisit the current doctoral supervision model so that the product can serve both academics and industry.

Industry supervisors, alongside primary academic supervisors, are responsible for ensuring the scientific quality and successful completion of doctoral projects (Kálmán et al., 2022; Van't Land, 2011). Careful selection of industry co-supervisors is important, including an external supervisor familiar with the academic environment (Fulgence, 2019; Kálmán et al., 2022; Zhang & Chen, 2023). Greater collaboration between academic and industry supervisors in the doctoral education supervision process is necessary (Maier et al., 2023; Mukhwana, 2020). This collaboration between universities and industries serves several purposes: first, to help align the doctoral studies needs of the industries and government; second, to help align the doctoral research to the needs of society; and third, to assist in the commercialization of research and technology transfer support after the output amongst others (Mukhwana, 2020). Doctoral education supervision should involve a learning alliance between multiple institutional stakeholders (Asiimwe, 2019; Kálmán et al., 2022). This includes supervisors' time, status, power, and authority, as well as personal resources, for instance, experience, knowledge, networks, and commitment (Fulgence, 2019; Kálmán et al., 2022). Supervisors must possess transferable and soft skills to effectively manage the supervision process and improve the employability of their doctoral students (Auðardóttir & Tiegen, 2021; Fulgence, 2019; Kálmán et al., 2022). Addressing the shortage of supervisors in African institutions requires re-evaluating strategies, for example, reviewing retirement age regulations for senior academics (British Council, 2018; Matheka et al., 2020; News24, 2012). Failure to review the current retirement age of the academics in most universities in Africa will further exacerbate the already existing problems experienced in support of the program. However, the evidence suggests that these senior academics play a crucial role in supervision and providing critical support for doctoral students.

Higher education institutions have a vital role in the progression of a knowledge-driven society and economy (Mukhwana, 2020). All nations must equip PhD candidates for diverse societal tasks (Jowi, 2021; Kokutse, 2022; Lešer et al., 2018; Seeber & Horta, 2021). Higher education must amalgamate education, research, and innovation to actively connect with the community and equip scholars for various societal responsibilities (Acharya et al., 2023; Bjurström et al., 2020; Lešer et al., 2018; Mantai, 2019). "Doctoral supervision encompasses assisting doctoral candidates in acquiring knowledge, engaging in stimulating scholarly discourse, fostering critical thinking, and developing practical skills through feedback, demonstration, and dialogue" (Wisker et al., 2021, p. 614). Such qualifications support is not only confined to obtaining an academic credential but also encompasses the development of transferable skills, such as data analysis, public engagement, project management, business, economics, the application of their research findings in real-world contexts, and finance (Auðardóttir & Tiegen, 2021; Editorial, 2023; Thune, 2010). It further underlined that the value of such training would be significantly enhanced if these abilities were examined in conjunction with a thesis rather than seen as optional. This study aims to evaluate the elements of doctorate education supervision and assist in developing versatile PhD holders capable of pursuing various employment opportunities (Auðardóttir & Tiegen, 2021).

CONCLUSIONS AND IMPLICATIONS

This study explores the PhD supervision process, focusing on four key aspects: input, transformative process, university-industry linkages, and output (Olsson & Bernhard, 2020; Zhang & Chen, 2023). It highlights the importance of partnerships between universities and industries in establishing high-quality doctoral education programs, bridging the gap between theory and practice. It emphasizes the need to consider the characteristics and backgrounds of prospective candidates, including socioeconomic backgrounds, ethnic identities, and cultural contexts (Olsson & Bernhard, 2020; Zhang & Chen, 2023). It also highlights the need for mentorships and internships to minimize stress and attrition amongst the students due to frustrations experienced during the PhD supervision journey. Doctoral education is a transformative journey (Figure 2) that requires various factors, for example, admission, financial support, supervisor incentives, research environment, supervisor workload, library support, technological resources, collaborations with industries, student evaluation processes, and management of relationships with external examiners (Kálmán et al., 2022; Yazdani & Shokooh, 2018).

RECOMMENDATIONS

First, the study suggests that thorough initial screening of PhD candidates should be conducted during the hiring process. This may involve taking up an examination and writing a motivation letter stating why they are pursuing a PhD and for what purpose they are doing this program. This is done to gauge the degree of commitment and readiness to take the study journey. Studies have found that PhDs are a higher calling and require a certain level of commitment and dedication; hence, they can only be pursued by candidates who are ready to devote their entire time to navigating the educational terrain. Moreover, evidence suggests that whenever there are delays in student completion, non-completion, or poor PhD outcomes, it is easier to blame the supervisors, while the problem could also be the student. Therefore, to minimize such counter-blames, the study suggests stringent rules in admitting PhD applicants beyond the production of undergraduate or master's degrees with these distinctions.

Second, African universities should establish systems to ensure their PhD graduates meet high standards, and effective supervision requires institutional practices that support both students and supervisors (Pelser, 2024; Yazdani & Shokooh, 2018). Dedicated supervisors and a well-structured support system are essential for attracting enthusiastic academics. Effective supervision requires a deep understanding of both the subject matter and the process. Mentorship is crucial for new academics with PhD degrees.

Third, PhD supervisors and students should receive ongoing training and professional development to ensure good supervision relationships. However, the training of PhD supervisors can take place once a year for both novices and professors to expose them to the changing nature of PhD pedagogies and industry needs. The PhD students should receive guidance on seeking suitable support and using resources to achieve their objectives. Effective institutional support mechanisms are required, including academic advisors, dissertation chairs, and non-faculty mentors, which will go a long way in providing holistic supervision support. Studies (Bitzer, 2014; Devos et al., 2016; Fetene & Tamrat, 2021; Pelser, 2024) indicated that most universities neglect to provide such initiatives, for instance, training to supervisors. However, it is important to note that researchers frequently lack adequate training and development when they first begin working in academia.

Fourth universities should implement clear and transparent recruitment processes to screen out non-competitive applicants. Students should undergo rigorous selection processes, for example, preparing and defending a proposal and submitting a letter of motivation for admission into a doctoral program. Other prerequisites should also be considered, such as available resources, previous academic performance, and work experience.

Fifth, incentives for supervisors are crucial. A transparent and equitable reward structure for supervisors should be implemented to motivate them to commit to supervision activities and capacitate new scholars (Corn  r et al., 2018; Devos et al., 2016; Halse & Mowbray, 2011).

Sixth a doctoral supervision support model should involve collaboration between universities and industries, enabling PhD applicants to address research objectives and explore various employment options (Maier et al., 2023; Zhang & Chen, 2023). University-industry relationships offer advantages, such as collaborative product or process development, access to academic networks, competency development and supply, and economic potential. This shift in knowledge production and increased collaboration among government, universities, and industry has sparked debates about doctoral education organization and competencies. Therefore, this is an area in which policymakers should consider expanding the PhD supervision beyond the production of academics and the industry. Addressing these gaps is crucial for doctorate criteria. It requires an effective supervision support model that prepares the PhD student for multiple employment opportunities to participate in meaningful economic, political, and social engagement.

Policymakers

Governments should reassess the retirement age for senior professors to mitigate the current shortage in public universities in Africa and devise effective strategies to retain experienced senior academics capable of supporting doctoral supervision (Germain-Alamartine & Moghadam-Saman, 2020). Academics may be exempted from additional duties, such as instructing large undergraduate courses, or they should be prohibited from performance contracts to ensure superior supervision of doctoral education (Bitzer, 2014; Jowi, 2021; Mushemeza, 2016). Furthermore, policymakers should devise financial mechanisms that might assist institutions in producing PhDs, as research indicates that most doctoral students now finance their studies independently, often leading to non-completion of their programs.

Future research

The present study contributes to future research in two ways. First, this study proposes an input-output doctoral supervision model developed from a critical literature review. This framework offers future scholars not only the opportunity to further explore the variables but also lays the foundation for future studies to investigate and validate, hence the contribution to the field. Second, the study identified some gaps. Whereas some themes repeatedly appear in several studies, only a handful of the themes, for example, the study provides a thought-provoking debate among the scholarly community on the model for doctoral supervision in the African context.

LIMITATIONS

This study contributes to the ongoing scholarly discourse on doctoral supervision within the African setting; nonetheless, it has certain weaknesses that we wish to highlight for the readers' consideration. This is a crucial literature review; it is possible that recent advancements in knowledge development have diminished its originality. Secondly, owing to its contextual character, only literature published in English was reviewed, so limiting its breadth and applicability. Third, PhD supervision is a process; hence, even within the same institution, variances in supervision methods exist, rendering a thorough pursuit unfeasible. Ultimately, future research could benefit from investigating the rationale behind the application of various supervision methods throughout institutions despite doctorate outcomes suggesting a uniform approach. Furthermore, longitudinal research may offer advantages over cross-sectional investigations. Notwithstanding these limitations, the present study offers valuable contributions to the discourse in this crucial domain.

DISCLOSURE STATEMENT

The authors declare no potential conflict of interest.
QuillBot online for grammar check was utilized in this study.
No physical human participants were used in the present study.
All data used are within this study.
No funding was received for the current study.
The authors contributed equally to this study.

REFERENCES

- Academy of Science of South Africa. (2010). The PhD study: An evidence-based study on how to meet the demands for high-level skills in an emerging economy. <https://www.assaf.org.za/wp-content/uploads/2015/05/40696-Bolddesign-PHD-small.pdf>
- Acharya, V., Rajendran, A., & Shenoy, S. (2023). A framework for doctoral education in developing students' mental well-being by integrating the demand and resources of the program: An integrative review. *F1000Research*, 12, 431. <https://doi.org/10.12688/f1000research.131766.2>
- African Research Universities Alliance (ARUA). (2022). Strategic Plan 2022 – 2027. <https://arua.org/#:~:text=ARUA%20Strategic%20Plan%202022%2D2027,developmental%20challenges%20confronting%20the%20continent>
- African Research Universities Alliance (ARUA). (2024, July 25). ARUA ushers in new collaborative PhD programmes. <https://arua.org/arua-ushers-in-new-collaborative-phd-programmes/>
- African Union. (2013). *Agenda 2063: The Africa we want*. <https://au.int/en/agenda2063/overview>
- Al Makhamreh, M., & Stockley, D. (2019). Mentorship and well-being: Examining doctoral students' lived experiences in doctoral supervision context. *International Journal of Marketing and Coaching in Education*, 91(1), 1-20.
- Anderson, V., & Gold, J. (2019). The value of the research doctorate: A conceptual examination. *The International Journal of Management Education*, 17(3), 100305. <https://doi.org/10.1016/j.ijme.2019.100305>
- Asiimwe, J. A. (2019). Understanding doctoral supervision: Concepts and experiences of selected supervisors and PhD graduates in Uganda. *MIER Journal of Educational Studies, Trends and Practices*, 9(2), 134-146.
- Auðardóttir, A. M., & Tiegen, F. (2021). The complexities of the doctoral candidate-supervisor relationship: Voices of candidates at the University of Iceland. *Icelandic Journal of Education*, 30(2), 45-65. <https://doi.org/10.24270/tuom.2021.7>
- Bacwayo, K. E., Nampala, P., & Oteyo, I. (2017). Challenges and opportunities associated with supervising graduate students enrolled in African universities. *International Journal of Education and Practice*, 5(3), 29-39. <https://doi.org/10.18488/journal.61/2017.5.3/61.3.29.39>
- Baptista, A., Frick, L., Holley, K., Remmik, M., Tesch, J., & Åkerlind, G. (2015). The doctorate as an original contribution to knowledge: Considering relationships between originality, creativity, and innovation. *Front-line Learning Research*, 3(3), 55-67. <https://doi.org/10.14786/flr.v3i3.147>
- Baptista, V. B., Maryl, M., Wciślik, P., Fletcher, I., Buchner, A., & Pohl, C. (2020). Final report on understandings of interdisciplinary and transdisciplinary research and factors of success or failure. Report: Shaping Interdisciplinary practices in Europe. <https://doi.org/10.5281/zenodo.3760417>
- Barasa, P. L., & Omulando, C. (2018). *Research and PhD capabilities in Sub-Saharan Africa: Kenya report*. British Council and DAAD. https://www2.daad.de/medien/der-daad/analysen-studien/research_and_phd_capabilities_in_sub-saharan_africa_-_kenya_report.pdf
- Baydarova, I., Collins, H. E., & Saadi, I. A. (2021). Alignment of doctoral student and supervisor expectations in Malaysia. *International Journal of Doctoral Studies*, 16, 1-29. <https://doi.org/10.28945/4682>

- Bearman, M., Tai, J., Henderson, M., Esterhazy, R., Mahoney, P., & Molloy, E. (2024). Enhancing feedback practices within PhD supervision: A qualitative framework synthesis of the literature. *Assessment & Evaluation in Higher Education*, 49(5), 634-650. <https://doi.org/10.1080/02602938.2024.2307332>
- Bengtson, S. S. E., & McAlpine, L. (2022). A novel perspective on doctoral supervision: Interaction of time, academic work, institutional policies, and lifecourse. *Learning and Teaching*, 15(1), 21-45. <https://doi.org/10.3167/latiss.2022.150103>
- Bernhard, I., & Olsson, A. K. (2022). Industrial PhD education – Exploring doctoral students acting in the intersection of academia and work-life. In M. Jones (Ed.), *Proceedings of InSITE 2022: Informing Science and Information Technology Education Conference*, Article 9. Informing Science Institute. <https://doi.org/10.28945/4961>
- Bernstein, B. L., Evans, B., Fyffe, J., Halai, N., Hall, F. R., Jensen, H. S., Marsh, H., & Ortega, S. (2014). The continuing evolution of the research doctorate. In M. Nerad, & B. Evans (Eds.), *Globalization and its impacts on the quality of PhD education* (pp. 5-30). SensePublishers. https://doi.org/10.1007/978-94-6209-569-4_2
- Bitzer, E. M. (2014). Language of the doctorate: ‘Doctorateness’ as a threshold concept in doctoral literacy. *Per Linguam*, 30(3), 39-52. <https://doi.org/10.5785/30-3-585>
- Bitzer, E. M., & Albertyn, R. M. (2011). Alternative approaches to postgraduate supervision: A planning tool to facilitate supervisory processes. *South African Journal of Higher Education*, 25(5), 25-38.
- Bjurström, E., Lund, M., & Nielsen, C. (2020). Are you ready to collaborate? Improving the quality of university-industry collaborations. *Journal of Behavioural Economics and Social Systems*, 2(1), 81-112.
- Blake, R., & Mouton, J. (1964). *The managerial grid*. Gulf Publishing Company
- Boehe, D. M. (2016). Supervisory styles: A contingency framework. *Studies in Higher Education*, 41(3), 399-414. <https://doi.org/10.1080/03075079.2014.927853>
- Bogle, D., Dron, M., Eggermont, J., & van Henten, J. W. (2010). Doctoral degrees beyond 2010: Training talented society. *Procedia - Social and Behavioral Sciences*, 13, 35-49. <https://doi.org/10.1016/j.sbspro.2011.03.003>
- Botha, J. (2017). Academic work at Stellenbosch University 1918-2018, in Stellenbosch University 100: 1918-2018. 199 - 213. http://www.sun.ac.za/english/research-innovation/Research-Development/Postgraduate%20Skills%20Development/SU_SER_Sections_1-8_linked_final_ed.pdf
- Bran, A., Lopes, N., & Lafon, M. (2023). PhD graduates’ appraisals of work demands: Challenging, hindering, and not very threatening. *Studies in Higher Education*, 49(3), 559-575. <https://doi.org/10.1080/03075079.2023.2244963>
- British Council. (2018). *Building PhD capacity in Sub-Saharan Africa*. https://www.britishcouncil.org/sites/default/files/h233_07_synthesis_report_final_web.pdf
- Bröchner, J., & Sezer, A. A. (2020). Effects of construction industry support for PhD projects: The case of a Swedish scheme. *Industry and Higher Education*, 34(6), 391-400. <https://doi.org/10.1177/0950422220904932>
- Buehling, K., & Geissler, M. (2022). PhDs with industry partners – Assessing collaboration and topic distribution using a text mining methodology. In J. M. Azagra-Caro, P. D’Este, & D. Barberá-Tomás (Eds.), *University-industry knowledge interactions: People, tensions, and impact* (pp. 9-24). Springer. https://doi.org/10.1007/978-3-030-84669-5_2
- Chaló, P., Huet, I., Nikolettou, D., & Pereira, A. (2023). Supporting Ph.D. students’ skills development: A three-stage doctoral program. *Frontiers in Education*, 8, 1145342. <https://doi.org/10.3389/feduc.2023.1145342>
- Chick, V. (2004). On open systems. *Brazilian Journal of Political Economy*, 24(1). <https://doi.org/10.1590/0101-31572004-1638>
- Chikere, C. C., & Nwoka, J. (2015). The systems theory of management in modern day organisations: A study of Aldgate Congress Resort Limited Port Harcourt. *International Journal of Scientific and Research Publications*, 5(9), 1-7.

- Clark, C. M., Olson, K., Hacifazhoğlu, O., & Carlson, D. L. (2021). Community of practice among faculty team-teaching education doctorate (Ed.D.) students: A reflective study. *International Journal of Doctoral Studies*, 16, 379-393. <https://doi.org/10.28945/4775>
- Cloete, A. L. (2017). Technology and education: Challenges and opportunities. *HTS Teologiese Studies/Theological Studies*, 73(3), a4589. <https://doi.org/10.4102/hts.v73i4.4589>
- Cloete, N., Mouton, J., & Sheppard, C. (2015). *Doctoral education in South Africa: Policy, discourse and data*. African Minds.
- Compagnucci, L., & Spigarelli, F. (2024). Industrial doctorates: A systematic literature review and future research agenda. *Studies in Higher Education*, 1-28. <https://doi.org/10.1080/03075079.2024.2362407>
- Cornell, J., Kessi, S., & Ratele, K. (2022). Examining the dynamics of belonging and alienation in higher education through photovoice. *Health Promotion Practice*, 23(2), 325-330. <https://doi.org/10.1177/15248399211054779>
- Cornér, S., Löfström, E., & Pyhältö, K. (2017). The relationships between doctoral students' perceptions of supervision and burnout. *International Journal of Doctoral Studies*, 12, 91-106. <https://doi.org/10.28945/3754>
- Cornér, S., Pyhältö, K., Peltonen, J., & Bengtson, S. S. E. (2018). Similar or different? Researcher community and supervisory support experiences among Danish and Finnish social sciences and humanities PhD students. *Studies in Graduate and Postdoctoral Education*, 9(2), 274-295. <https://doi.org/10.1108/SGPE-D-18-00003>
- Council on Higher Education. (2019). *Vital Stats: Public Higher Education 2017*. Pretoria, South Africa: CHE.
- Council on Higher Education. (2020). *South African Post-Secondary Education data and Higher Education Management Information System Data*. Pretoria: CHE.
- Council on Higher Education. (2022). *Doctoral degrees national report*. Pretoria, South Africa: CHE
- Council on Higher Education. (2023). *Council on Higher Education (CHE) Annual Report for the 2022/23 Financial Year*. [https://nationalgovernment.co.za/entity_annual/3277/2023-council-on-higher-education-\(che\)-annual-report.pdf](https://nationalgovernment.co.za/entity_annual/3277/2023-council-on-higher-education-(che)-annual-report.pdf)
- Cross, M., & Backhouse, J. (2014). Evaluating doctoral programs in Africa: Context and practices. *Higher Education Policy*, 27, 155-174. <https://doi.org/10.1057/hep.2014.1>
- Cyranoski, D., Gilbert, N., Ledford, H., Nayar, A., & Yahia, M. (2011). The PhD factory: The world is producing more PhDs than ever before. Is it time to stop? *Nature*, 472, 276-279. <https://doi.org/10.1038/472276a>
- David, O. D., & Grobler, W. (2020). Information and communication technology penetration level as an impetus for economic growth and development in Africa. *Economic Research - Ekonomska Istrazivanja*, 33(1), 1394-1418. <https://doi.org/10.1080/1331677X.2020.1745661>
- de Jesús Pérez Durán, G. (2021). Systemic Model of Organizations. *Open Journal of Business and Management*, 9, 1230-1245. <https://doi.org/10.4236/ojbm.2021.93066>
- Denicolo, P. M., & Park, C. (2013). Doctorateness – An elusive concept? In M. Kompf, & P. M. Denicolo (Eds.), *Critical issues in higher education* (pp. 191-197). SensePublishers. https://doi.org/10.1007/978-94-6209-046-0_15
- Department of Science and Innovation. (2022). *A national tracer study of doctoral graduates in South Africa*. https://www.wrc.org.za/wp-content/uploads/mdocs/FINAL%20REPORT_3006_National%20PhD%20Tracer%20Study.pdf
- Devos, C., Boudrenghien, G., Van der Linden, N., Frenay, M., Azzi, A., Galand, B., & Klein, O. (2016). Misfits between doctoral students and their supervisors: (How) Are they regulated? *International Journal of Doctoral Studies*, 11, 467-486. <https://doi.org/10.28945/3621>
- Dominguez-Whitehead, Y., & Maringe, F. (2020). A cross-national analysis of PhD models. *International Journal of Comparative Education and Development*, 22(3), 233-245. <https://doi.org/10.1108/IJCED-01-2020-0003>

- Doyle, N., Jacobs, K., & Ryan, C. (2016). Faculty mentors' perspectives on e-mentoring post-professional occupational therapy doctoral students. *Occupational Therapy International*, 23, 305 – 317. <https://doi.org/10.1002/oti.1431>
- Editorial. (2023). PhD training is no longer fit for purpose: It needs reform now. *Nature*, 613(19), 414. <https://doi.org/10.1038/d41586-023-00084-3>
- EUA Council for Doctoral Education. (2016). *Doctoral education: Taking Salzburg forward implementation and new challenges*. https://www.eua-cde.org/downloads/publications/2016_euacde_doctoral-salzburg-implementation-new-challenges.pdf
- Feast, L. (2022). Down the brain drain: Searching for doctorateness in all the wrong places. *She Ji: The Journal of Design, Economics, and Innovation*, 8(1), 147-170. <https://doi.org/10.1016/j.sheji.2021.11.001>
- Fetene, G. T., & Tamrat, W. (2021). The PhD journey at Addis Ababa university: Study delays, causes, and coping mechanisms. *International Journal of Doctoral Studies*, 16, 319-337. <https://doi.org/10.28945/4744>
- Fredua-Kwarteng, E. (2023, April 13). Africa needs more PhDs, but they must be of high quality. *University World News*. <https://www.universityworldnews.com/post.php?story=20230412130513149>
- Fulgence, K. (2019). A theoretical perspective on how doctoral supervisors develop supervision skills. *International Journal of Doctoral Studies*, 14, 721-739. <https://doi.org/10.28945/4446>
- Gasa, V., & Gumbo, M. (2020). Supervisory support for Ethiopian doctoral students enrolled in an open and distance learning institution. *International Journal of Doctoral Studies*, 16, 47-69. <https://doi.org/10.28945/4676>
- Gasparski, W. W. (2009). The stakeholder organisation theory and its systemic foundation. *International Journal of General Systems*, 38(6), 659-665. <https://doi.org/10.1080/03081070902865665>
- Gatfield, T. (2006). An investigation into PhD supervisory management styles model: Development of a dynamic conceptual model and its managerial implications. *Journal of Higher Education Policy and Management*, 27(3), 311-325. <https://doi.org/10.1080/13600800500283585>
- Gatfield, T., & Alpert, F. (2002). *The supervisory management styles model*. HERDSA. <https://www.herdsa.org.au/system/files/Gatfield.pdf>
- Germain-Alamartine, E., & Moghadam-Saman, S. (2020). Aligning doctoral education with local industrial employers' needs: A comparative case study. *Planning*, 28(2), 234-254. <https://doi.org/10.1080/09654313.2019.1637401>
- Glaser, S., & Halliday, M. I. (1980). Organizations as systems. *Human Relations*, 33(12), 917-928. <https://doi.org/10.1177/001872678003301203>
- Golde, C. M. (2000). Should I stay or should I go? Student descriptions of the doctoral attrition process. *Review of Higher Education*, 23, 199-227. <https://doi.org/10.1353/rhe.2000.0004>
- Golde, C. M. (2005). The role of the department and discipline in doctoral student attrition: Lessons from four departments. *The Journal of Higher Education*, 76(6), 669-700. <https://doi.org/10.1080/00221546.2005.11772304>
- Gredler, J. J., & Harland, D. J. (2022). Online faculty's use of technology when advising doctoral capstone writers. *Australasian Journal of Educational Technology*, 38(3), 43-57. <https://doi.org/10.14742/ajet.6994>
- Green, P., & Bowden, J. (2012). Completion mindsets and contexts in doctoral supervision. *Quality Assurance in Education*, 20(1), 66-80. <https://doi.org/10.1108/09684881211198257>
- Griffiths, D., & Warren, D. (2015). Effective supervision. In H. Polorny, & D. Warren (Eds.), *Enhancing teaching practice in higher education* (2nd ed., pp. 217-240). Sage.
- Grimm, K. (2018). Assessing the industrial PhD: Stakeholder insights. *Journal of Technology and Science Education*, 8(4), 214-230. <https://doi.org/10.3926/jotse.320>
- Grossman, E. S., & Crowther, N. J. (2015). Co-supervision in postgraduate training: Ensuring the right hand knows what the left hand is doing. *South African Journal of Science*, 111(11/12), 8. <https://doi.org/10.17159/sajs.2015/20140305>

- Guarimata-Salinas, G., Carvajal, J. J., & Jiménez López, M. D. (2024). Redefining the role of doctoral supervisors: A multicultural examination of labels and functions in contemporary doctoral education. *Higher Education*, 88, 1305–1330. <https://doi.org/10.1007/s10734-023-01171-0>
- Guerin, C., & Aitchison, C. (2021). Doctoral writing and remote supervision: What the literature tells us. *Innovations in Education and Teaching International*, 58(6), 624–634. <https://doi.org/10.1080/14703297.2021.1991429>
- Guo, X., & Rose, S. (2015). Ensemble work as a 21st century model for the doctorate in education nondirectional dissertation in practice (DiP) at Lynn University. *International Journal of Educational Policy Research and Review*, 2(2), 25–31.
- Haimbodi, F. N. (2023). Supervisory relationships with doctoral candidates. In K. Luneta, J. Golding, H. M. Kapenda, & P. P. Nalube (Eds.), *Doctoral supervision in Southern Africa* (pp. 59–70). Springer. <https://doi.org/10.1007/978-3-031-46899-5>
- Haley, A., Holmqvist, M., & Johansson, K. (2024). Supervisors' competences from doctoral students' perspectives – A systematic review. *Educational Review*. <https://doi.org/10.1080/00131911.2024.2306938>
- Halse, C., & Levy, G. (2014). *The future of the doctorate in the 21st century*. https://englishbulletin.adapt.it/docs/Christine_Halse_GaryLevy_25_2014.pdf
- Halse, C., & Mowbray, S. (2011). Editorial. Special edition in 2011 of Studies in Higher Education: *Theorising the Doctorate*, 36(5), 513–525. <https://doi.org/10.1080/03075079.2011.594590>
- Hasgall, H., Saenen, B., & Borrell-Damian, L. (2019). *Doctoral education in Europe today: Approaches and institutional structures*. European University Association. <http://www.eua.eu>
- Herut, A. H., & Gorf, Y. A. (2024). Academic procrastination among PhD students in Ethiopia: An examination of prevalence, associated factors and coping mechanisms. *Social Sciences & Humanities Open*, 9, 100854. <https://doi.org/10.1016/j.ssaho.2024.100854>
- Hyatt, L., & Williams, P. E. (2011). 21st century competencies for doctoral leadership faculty. *Innovative Higher Education*, 36, 53–66. <https://doi.org/10.1007/s10755-010-9157-5>
- Igumbor, J. O., Bosire, E. N., Karimi, F., Katahoire, A., Allison, J., Muula, A. S., Peixoto, A., Otworld, K., Gitau, E., Bondjers, G., Fonn, S., & Ajuwon, A. (2022). Effective supervision of doctoral students in public and population health in Africa: CARTA supervisors' experiences, challenges, and perceived opportunities. *Global Public Health*, 17(4), 496–511. <https://doi.org/10.1080/17441692.2020.1864752>
- Inter-University Council for East Africa. (2018, May). *Standards and guidelines for postgraduate studies in East Africa*. <https://iucea.org/?mdocs-file=5905>
- Jacobsen, M., Neutzling, N., Lorenzetti, L., Oddone Paolucci, E., Nowell, L., Clancy, T., Freeman, G., & Lorenzetti, D. L. (2024). Examining graduate student perspectives on supervision and peer mentoring across four professional faculties. *Studies in Graduate and Postdoctoral Education*, (ahead-of-print). <https://doi.org/10.1108/SGPE-03-2024-0035>
- Johansen, B. T., Øverby, N. C., Garred, R., & Enoksen, E. (2019). Team supervision of doctoral students: A qualitative inquiry. *International Journal of Doctoral Studies*, 14, 69–84. <https://doi.org/10.28945/4177>
- Jones, G. A. (2018). Doctoral education in Canada. In J. Shin, B. Kehm, & G. Jones (Eds.), *Doctoral education for the knowledge society* (pp. 147–164). Springer. https://doi.org/10.1007/978-3-319-89713-4_9
- Jowi, J. O. (2021). Doctoral training in African universities: Recent trends, developments, and issues. *Journal of the British Academy*, 9(s1), 159–181. <https://doi.org/10.5871/jba/009s1.159>
- Kálmán, O., Horváth, L., Kardos, D., Kozma, B., Feyisa, M. B., & Rónay, Z. (2022). Review of benefits and challenges of co-supervision in doctoral education. *European Journal of Education*, 57(3), 452–468. <https://doi.org/10.1111/ejed.12518>
- Katz, D., & Kahn, R. L. (1966). *The social psychology of organisations*. John Wiley.
- Kereluik, K., Mishra, P., Fahnoe, C., & Terry, L. (2013). What knowledge is most worth: Teacher knowledge for 21st century learning. *Journal of Digital Learning in Teacher Education*, 29(4), 127–140. <https://doi.org/10.1080/21532974.2013.10784716>

- Kigotho, W. (2014). New partnerships to support 10,000 new PhDs in Africa (University World News, 11 July 2014): <http://www.scidev.net/global/education/feature/phd-crisis-uganda-private-universities.html#sthash.4ncHZpWl.dpuf>
- Kigotho, W. (2024, October 17). PhD training: What calibre of graduates does Africa want? *University World News*. <https://www.universityworldnews.com/post.php?story=2024091712122758>
- Kigwilu, P. C., & Nyonje, R. (2024). Utilization of digital technologies in doctoral thesis supervision at the University of Nairobi: Implications for quality assurance. *East African Journal of Education Studies*, 7(1), 552-561. <https://doi.org/10.37284/eajes.7.1.1844>
- Kimani, E. N. (2014). Challenges in quality control for postgraduate supervision. *International Journal of Humanities Social Sciences and Education*, 1(9), 63-70.
- Kneller, R., Mongeon, M., Cope, J., Garner, C., & Ternouth, P. (2014). Industry-university collaborations in Canada, Japan, the UK, and USA – With emphasis on publication freedom and managing the intellectual property lock-up problem. *PloS ONE*, 9(3), e90302. <https://doi.org/10.1371/journal.pone.0090302>
- Kokutse, F. (2022, June 17). ARUA sets target for increased research outputs, more PhDs. *University World News*. <https://www.universityworldnews.com/post.php?story=20220608191209159>
- Krumsvik, R. J. (2022). Intentions and realities in doctoral education in Norway. New policies for doctoral education in Norway and the implications for an Inter-Institutional Research School (WNGER II) – Some preliminary findings. *Frontiers in Education*, 7, 860087. <https://doi.org/10.3389/feduc.2022.860087>
- Kumar, V., & Kaur, A. (2019). Supervisory practices for intrinsic motivation of doctoral students: A self-determination theory perspective. *International Journal of Doctoral Studies*, 14, 581-595. <https://doi.org/10.28945/4415>
- Kuryshva, A., van Rijen, H. V. M., & Dilaver, G. (2019). How do admission committees select? Do applicants know how they select? Selection criteria and transparency at a Dutch University. *Tertiary Education and Management*, 25, 367-388. <https://doi.org/10.1007/s11233-019-09050-z>
- Kyarö, R., Walsh, N., Martin, T., & D'Agostino, C. (2019). *What determines supervision style? Introducing the key players*. Lund University. https://portal.research.lu.se/portal/files/65822554/Kyro_etal2019_report_Whatdeterminessupervisionstyle_Introducingthekeyplayers.pdf
- Lain, C., & Lin, S. H. (2017). Systems theory: Historical development. In C. Scott, & L. Lewis (Eds.), *The international encyclopedia of organizational communication* (pp. 1-17). Wiley-Blackwell. <https://doi.org/10.1002/9781118955567.wbieoc203>
- Lešer, V. J., Širca, N. T., Dermol, V., & Trunk, A. (2018). Career opportunities for PhD graduates in the knowledge-based economy: Case of Slovenia. *Procedia - Social and Behavioral Sciences*, 238, 104-113. <https://doi.org/10.1016/j.sbspro.2018.03.013>
- Leshem, S., & Bitzer, E. M. (2024). Perspectives of Early career supervisors on navigating the socio-emotional needs of their doctoral candidates. *Journal for New Generation Science*, 22(1): 35-51. <https://hdl.handle.net/10520/ejc-newgen-v22-n1-a3>
- Ligami, C. (2019, August 2). Over 100 PhDs face review in single university. University World News. Report on Jomo Kenyatta University of Agriculture and Technology, 2019 doctoral awards. Ministry of Education. Kenya. <https://www.universityworldnews.com/post.php?story=2019080207255286>
- Maier, L., Schreier, M., Baccarella, C. V., & Voigt, K.-I. (2023). University knowledge inside: How and when university-industry collaborations make new products more attractive to consumers. *Journal of Marketing*, 88(2), 1-20. <https://doi.org/10.1177/00222429231185313>
- Malfroy, J. (2011). The impact of university-industry research on doctoral programs and practices. *Studies in Higher Education*, 36(5), 571–584. <https://doi.org/10.1080/03075079.2011.594594>
- Manderson, L., Bondjers, G., Izugbara, C., Cole, D. C., Egesah, O., Ezech, A., & Fonn, S. (2017). Enhancing doctoral supervision practices in Africa: Reflection on the CARTA approach. *Journal of Higher Education in Africa/Revue de l'enseignement Supérieur En Afrique*, 15(2), 23-40. <https://www.jstor.org/stable/26640369>

- Mantai, L. (2019). A source of sanity: The role of social support for doctoral candidates belonging and becoming. *International Journal of Doctoral Studies*, 14, 367-382. <https://doi.org/10.28945/4275>
- Mantai, L., & Marrone, M. (2022). Identifying skills, qualifications, and attributes expected to do a PhD. *Studies in Higher Education*, 47(11), 2273-2286. <https://doi.org/10.1080/03075079.2022.2061444>
- Matas, C. P. (2012). Doctoral education and skills development: An international perspective. *Revista de Docencia Universitaria*, 10(2), 163-191. <https://doi.org/10.4995/redu.2012.6102>
- Matheka, H. M., Jansen, E. P. W. A., & Hofman, W. H. A. (2020). PhD students' background and program characteristics related to success in Kenya universities. *International Journal of Doctoral Studies*, 15, 57-71. <https://doi.org/10.28945/4467>
- McAlpine, L., & Norton, J. (2006). Reframing our approach to doctoral programs: An integrative framework for action and research. *Higher Education Research & Development*, 25(1), 3-17. <https://doi.org/10.1080/07294360500453012>
- McConnell, K. R., & Geesa, R. L. (2021). Filling the gaps: How the non-faculty mentor role contributes to the doctoral program support structure. *International Journal of Mentoring & Coaching in Education*, 10(2), 188-202. <https://doi.org/10.1108/IJMCE-01-2021-0004>
- Mekonnen, T. M., & Cuthbert, D. (2016). In pursuit of the African PhD: A critical survey of emergent policy issues in select sub-Saharan African nations, Ethiopia, Ghana, and South Africa. *Policy Futures in Education*, 14(6), 635-654. <https://ssrn.com/abstract=2770901>
- Mouton, J. (2011). Doctoral production in South Africa: Statistics, challenges, and responses. *Perspectives in Education*, 29(1), 13-29. <https://www.ajol.info/index.php/pie/article/view/76971>
- Mouton, J., Boshoff, N., & James, M. (2015). A survey of doctoral supervisors in South Africa: leading article. *South African Journal of Higher Education*, 29(2), 1-22. <https://doi.org/10.20853/29-2-467>
- Mukhwana, E. (2020, September 4). *Promoting doctoral training for prosperity in Africa*. Regional Scholarship and Innovation Fund. <https://www.rsif-paset.org/promoting-doctoral-training-for-prosperity-in-africa/>
- Mushemeza, E. D. (2016). Opportunities and challenges of academic staff in higher education in Africa. *International Journal of Higher Education*, 5(3), 236-246. <https://doi.org/10.5430/ijhe.v5n3p236>
- Nasir, S., & Masek, A. (2015). A model of supervision in communicating expectation using supervisory styles and students learning styles. *Procedia - Social and Behavioural Sciences*, 204, 265-271. <https://doi.org/10.1016/j.sbspro.2015.08.150>
- National Council on Higher Education. (2013). Reports of a taskforce in 2013 to examine the 66 PhDs KIU awarded in 2011 and 2012.
- National Planning Commission. (2012). *National development plan 2030: Our future - Make it work*. The Presidency, South Africa. https://www.nationalplanningcommission.org.za/assets/Documents/NDP_Chapters/NDP_2030-Prelims.pdf
- Nerad, M. (2011). What we know about the dramatic increase in PhD degrees and the reform of doctoral education worldwide: Implications for South Africa. *Perspectives in Education*, 29(3)
- Nerad, M., & Chiappa, R. (2022). Why Doctoral Education is a Place to be Committed to Social Justice: From Argument to Practice. In *Global Higher Education During and Beyond COVID-19: Perspectives and Challenges* (pp. 105-118). Singapore: Springer Nature Singapore
- Nerad, M., & Evans, B. (2014). *Globalization and Its Impacts on the Quality of PhD Education: Forces and Forms in Doctoral Education Worldwide*. Springer. <https://doi.org/10.1007/978-94-6209-569-4>
- Nerad, M., Rutledge, J., Strugnell, R., Chen, H., Grund, M., & Mrčela, A. K. (2022). On quality assurance in doctoral education. In M. Nerad, D. Bogle, U. Kohl, C. O'Carroll, C. Peters, & B. Scholz (Eds.), *Towards a global core value system in doctoral education* (pp. 57-81). <https://doi.org/10.2307/j.ctv2f4v5mf.11>
- News24. (2012, March 3). Academics' retirement age may be upped to 80. <https://www.news24.com/news24/academics-retirement-age-may-be-upped-to-80-20150429>

- Ngulube, P. (2021). Postgraduate supervision practices in education research and the creation of opportunities for knowledge sharing. *Problems of Education in the 21st Century*, 79(2), 255-272. <https://doi.org/10.33225/pec/21.79.255>
- Nxumalo, C., Roberts, T., Mohamed, A.-H., Marais, J., & Mayedwa, J. (2024). Mapping evidence of postgraduate research supervision experiences at higher education institutions in Africa: A scoping review protocol. *F1000Research*, 13, 1509. <https://doi.org/10.12688/f1000research.158939.1>
- Olsson, A. K., & Bernhard, I. (2020). University-industry collaboration in higher education – Industry views on investing in industrial PhD students. *Proceedings of the 12th International Conference on Education and New Learning Technologies*, 6726-6733. <https://doi.org/10.21125/edulearn.2020.1751>
- Omoya, O., Jacob, U. S., Odeyemi, O. A., & Odeyemi, O. A. (2024). Exploring perspectives: A scoping review of the challenges facing doctoral training in Africa. *Higher Education*. <https://doi.org/10.1007/s10734-024-01264-4>
- Ortega, S. T., & Kent, J. D. (2018). What is a PhD? Reverse-engineering our degree programs in the age of evidence-based change. *Change: The Magazine of Higher Learning*, 50(1), 30-36. <https://doi.org/10.1080/00091383.2018.1413904>
- Palmer, C., & Gillaspay, E. (2021). Digital shifting in doctoral supervision: Different routes to the same destination. *Innovations in Education and Teaching International*, 58(6), 672-681. <https://doi.org/10.1080/14703297.2021.1991428>
- Pelser, A.-M. (2024). Synergistic advancements: Fostering collaborative excellence in doctoral education. *Frontiers in Education*, 8, 1289424. <https://doi.org/10.3389/educ.2023.1289424>
- Petrucka, P. (2019). Doctoral supervision in developing countries: desperately seeking the scholarship of teaching and learning. *SOTL in the South*, 3(1), 92-99. <https://doi.org/10.36615/sotls.v3i1.65>
- Pinto, S. (2021). “Everything is so different ...”: African students’ voices on the challenges of doing a PhD at a Portuguese university. *Journal of International Students*, 11(4), 895-913. <https://doi.org/10.32674/jis.v11i4.2702>
- Pinto, S. (2023). International doctoral students’ perspectives on the qualities of supervisors: Expectations for intercultural supervision in Portuguese higher education. *Research in Comparative and International Education*, 19(1), 46-62. <https://doi.org/10.1177/17454999231221631>
- Polkinghorne, M., Taylor, J., Knight, F., & Stewart, N. (2023). Doctoral supervision: A best practice review. *Encyclopedia*, 3(1), 46-59. <https://doi.org/10.3390/encyclopedia3010004>
- Poole, B. (2015). The rather elusive concept of ‘doctorateness’: A reaction to Wellington. *Studies in Higher Education*, 40, 1507-1522. <https://doi.org/10.1080/03075079.2013.873026>
- Ribau, I. (2020). Doctoral supervisors and PhD students’ perceptions about the supervision process in a young European university. *Universal Journal of Educational Research*, 8(1), 36-46. <https://doi.org/10.13189/ujer.2020.080105>
- Salimi, N., Bekkers, R., & Frenken, K. (2016). Success factors in university-industry PhD projects. *Science and Public Policy*, 43(6), 812-830. <https://doi.org/10.1093/scipol/scv076>
- Salmi, J. (2021). Impact of COVID-19 on higher education from an equity perspective. *International Higher Education*. <https://ihe.bc.edu/pub/12xmv3vf>
- Sanganyado, E., Nunu, W. N., & Sanganyado, S. (2022). Towards a framework for embedding doctorateness in research proposals. *Innovations in Education and Teaching International*, 60(6), 930-940. <https://doi.org/10.1080/14703297.2022.2124186>
- Sarthory, J. A. (1979). A case for an open system approach to organisational behaviour. *Journal of Educational Administration*, 17(1), 17-29. <https://doi.org/10.1108/eb009802>
- Seeber, M., & Horta, H. (2021). No road is long with good company. What factors affect PhD student’s satisfaction with their supervisor? *Higher Education Evaluation and Development*, 15(1), 2-18. <https://doi.org/10.1108/HEED-10-2020-0044>

- Stamati, K., & Willmott, L. (2023). Preparing UK PhD students towards employability: A social science internship program to enhance workplace skills. *Journal of Further and Higher Education*, 47(2), 151-166, <https://doi.org/10.1080/0309877X.2022.2102411>
- Stein, S. J., & Sim, K. N. (2020). Enhancing the roles of information and communication technologies in doctoral research processes. *International Journal of Educational Technology in Higher Education*, 17, Article 34. <https://doi.org/10.1186/s41239-020-00212-3>
- Stephens, S. (2014). The supervised as the supervisor. *Education + Training*, 56(6), 537-550. <https://doi.org/10.1108/ET-10-2012-0095>
- Stevens, D. D., Chetty, R., Bertrand Jones, T., Yallow, A., & Butler-Henderson, K. (2021). Doctoral supervision and COVID-19: Autoethnographies from four faculty across three continents. *Journal of University Teaching & Learning Practice*, 18(5). <https://doi.org/10.53761/1.18.5.6>
- Steyn, R., Frick, I., Jahn, R., Kohl, U., Mahoney, W. M., Jr., Nerad, M., & Yoshida, A. (2022). Supervision in context around the world. In M. Nerad., D. Bogle, U. Kohl, C. O'Carroll, C. Peters, & B. Scholz (Eds.), *Towards a global core value system in doctoral education* (pp. 82-109). UCL Press. <https://doi.org/10.14324/111.9781800080188>
- Tamrat, W., & Fetene, G. T. (2021). The Achilles heel of doctoral education in African higher education institutions: An Ethiopian university in perspective. *Higher Education Research & Development*, 41(4), 1294-1308. <https://doi.org/10.1080/07294360.2021.1901664>
- Thune, T. (2010). The training of “triple helix workers”? Doctoral students in university–industry–government collaborations. *Minerva*, 48, 463-483. <https://doi.org/10.1007/s11024-010-9158-7>
- Tikkanen, L., Anttila, H., & Pyhältö, K. (2024). How does supervision influence a doctoral supervisor's occupational wellbeing? *European Journal of Higher Education*. <https://doi.org/10.1080/21568235.2024.2314470>
- Trafford, V., & Leshem, S. (2009). Doctorateness as a threshold concept. *Innovations in Education and Teaching International*, 46(3), 305-316. <https://doi.org/10.1080/14703290903069027>
- Ungadi, B. A. (2021). Challenges in doctoral supervision in South African universities. *Open Science Journal*, 6(2). <https://doi.org/10.23954/osj.v6i2.2886>
- van Rooij, E., Fokkens-Bruinsma, M., & Jansen, E. (2021). Factors that influence PhD candidates' success: The importance of PhD project characteristics. *Studies in Continuing Education*, 43(1), 48-67. <https://doi.org/10.1080/0158037X.2019.1652158>
- Van't Land, H. (2011). *Changing nature of doctoral studies in sub-Saharan Africa: Challenges and policy development opportunities at six universities in sub-Saharan Africa*. International Association of Universities.
- Vidak, M., Tokalić, R., Marušić, M., Puljak, L., & Sapunar, D. (2017). Improving completion rates of students in biomedical PhD programs: An interventional study. *BMC Medical Education*, 17, Article 144. <https://doi.org/10.1186/s12909-017-0985-1>
- Walker, M., & Thomson, P. (2010). *The Routledge doctoral supervisor's companion: Supporting effective research in education and the social sciences*. Routledge
- Welch, R. W., Rabb, R. J., & Bower, K. C. (2018, June). *Industry partnerships assist programs for accreditation*. Paper presented at the ASEE Annual Conference & Exposition, Salt Lake City, Utah, USA.
- Winchester-Seeto, T., Homewood, J., Thogersen, J., Jacenyik-Trawoger, C., Manathunga, C., Reid, A., & Holbrook, A. (2014). Doctoral supervision in a cross-cultural context: Issues affecting supervisors and candidates. *Higher Education Research and Development*, 33(3), 610-626. <https://doi.org/10.1080/07294360.2013.841648>
- Wisker, G., McGinn, M. K., Bengtsen, S. S. E., Lokhtina, I., He, F., Corner, S., Leshem, S., Inouye, K., & Löfström, E. (2021). Remote doctoral supervision experiences: Challenges and affordances. *Innovations in Education and Teaching International*, 58(6), 612-623. <https://doi.org/10.1080/14703297.2021.1991427>
- Xu, L., & Grant, B. (2017). International doctoral students' becoming: A dialogic perspective. *Innovations in Education and Teaching International*, 54(6), 570-597. <https://doi.org/10.1080/14703297.2017.1318711>

- Yazdani, S., & Shokooh, F. (2018). Defining doctorateness – A concept analysis. *International Journal of Doctoral Studies*, 13, 31-48. <https://doi.org/10.28945/3939>
- Zezeza, P. (2021). *Quality higher education 'indispensable' for Africa's future*. University World News. <https://www.universityworldnews.com/post.php?story=202107051145016>
- Zhang, Y., & Chen, X. (2023). Empirical analysis of university-industry collaboration in postgraduate education: A case study of Chinese universities of applied sciences. *Sustainability*, 15(7), 6252. <https://doi.org/10.3390/su15076252>
- Zou, M., & Kong, D. (2019). Navigating co-supervision. In M. Dollinger (Ed.), *Getting the most out of your doctorate (surviving and thriving in academia)* (pp. 47-62). Emerald Publishing. <https://doi.org/10.1108/978-1-78769-905-220191010>
- Zvavahera, P., & Masimba, F. (2019). The use of information and communication technology in supervising open and distance learning PhD students. *Ukrainian Journal of Educational Studies and Information Technology*, 7(3), 32-41. <https://doi.org/10.32919/uesit.2019.03.04>

AUTHORS



Joseph Evans Agolla (Nyagonya) received his BCom from the University of Allahabad, MA from Utkal University, Bhubaneswar, Odisha, India, and PhD in Business Management from the University of North-West (UNIBO), Mahikeng, South Africa. His research and teaching interests include business research methodology, organization systems and theory, public sector innovation, Smart Manufacturing, Human-Machine Interaction, banking innovation, Industry 4.0 revolution, technological innovation, and entrepreneurship. Dr. Agolla currently serves as a Senior Lecturer in the Department of Management, School of Business and

Management Studies, Botswana Open University, Botswana. He has published over 30 scholarly papers in peer-reviewed journals and international conferences.



Mmabaledi Kefilwe Seeletso is a lecturer and the head of the Department of Educational Management and Leadership at Botswana Open University (BOU). She has worked in an open and distance learning environment for over twenty years. Dr Seeletso read for her Degree in Humanities and Post Graduate Diploma in Education at the University of Botswana in 1996 and 1997, respectively. She then read for her MA in Educational Management, which she obtained in 2004 from the University of Bath in the United Kingdom. Seeletso acquired her PhD from the University of Pretoria in 2016. She was a recipient of the Fulbright Scholarship, during which she served at the University of Denver as a visiting scholar from August 2017 to January 2018. She is also the University of Bath Ambassador in Botswana and a member of the UKRI International Peer Review College. Dr Seeletso was a Postdoctoral Fellow at the University of South Africa, Pretoria, based at the UNESCO Chair on ODL from April 2019 to March 2020.

Management Studies, Botswana Open University, Botswana. He has published over 30 scholarly papers in peer-reviewed journals and international conferences.