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Data-Driven Insights: A Decade of Sol Plaatje University's Research Journey and Development

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ABSTRACT
This paper analyses Sol Plaatje University's (SPU) progress on increased research activities. The paper employs bibliometric analysis review method to demonstrate the university's transition from being a predominantly teaching-focused to a more research-oriented institution. A novel, data-driven methodology is also adopted in this paper, to identify and examine SPU's research niche through publications. This paper's data were collected from the Scopus and Web of Science databases. The paper's findings reveal that there was an overall significant increase in research outputs, observable on yearly basis for a decade (2014 to 2023). The yearly increase in research output is recorded from diverse research fields, including machine learning, cryptography, environmental research, and public health. Findings further reveal that SPU has built its international research collaborations within the African and European continents. This paper's findings contribute to literature on higher education development by offering insights into how newly established universities can transition from a teaching-centric focus to becoming research-active. This paper revealed the importance of strategic planning, interdisciplinary research, and international collaboration in the development of a vibrant research environment.

KEYWORDS
Data-Driven; Sol Plaatje University; research niche.

INTRODUCTION

Sol Plaatje University (SPU) was established under Section 20 of the Higher Education Act (Act 101 of 1997), and was officially gazetted by the government on August 22, 2013. SPU commenced its teaching and learning activities in 2014. Its first enrolment amounted to 124 students, primarily within the School of Education. Amongst its other strategic goals for 2014, SPU sought, "*To recruit and registers the first cohort of 125 students in three academic programmes offered at the university at the first-year level of study"* (Annual Report 2014, p.3). In its inaugural year, SPU offered three programmes: Bachelor of Education (B.Ed.) which enrolled 45 students, Diploma in Information and Communication Technology (ICT) (39 students), and a Diploma in Retail Business Management (40 students).

The overall module pass rate for SPU's inaugural programmes was an impressive 90%. In 2021 SPU enrolled 2474 students, and the pass rate was 88%. This was a slight decrease compared to 2014's pass rate. In 2016, SPU witnessed the graduation of its inaugural cohort of students out of which, 54.4% finished their qualification in minimum time (known as N), while 67.66% (N + 1) and 68.33% (N + 2) in 2021. Initially, SPU emphasised teaching and enhancing the teaching capabilities of its academic staff. This focus likely contributed to the notable student performance, as observed over the past decade. However, the university's intended role extends beyond teaching, and includes serving as a hub for knowledge development. This expanded vision became more pronounced in the second generation of the university's strategic plan, which explicitly stated SPU's ambition to evolve into a research-active institution.

In relation to teaching, SPU has identified its flagship programmes, which include Data Science, Heritage Studies, and Education. However, the university has arrived at a juncture where it needs to clearly articulate these flagship programmes as its research niche areas. While the progression to research from these teaching niches may appear natural and relatively easy; they require careful consideration. Scholars suggest that the success of institutions' development of their research niches lies heavily on the involvement of multiple stakeholders such as: the academic staff, government, and coorporates (Santos & Horta, 2018; Villaveces et al., 2010, Mosia, 2016). Noel et al. (2019) notes academic staff's participation in itself is crucial. Furthermore, the academic staff's research experience is important in the development of the institutions' research niche because it largely influences their research interest. Additionally, Mzembe et al. (2023) and Mitchell et al. (2020) note research funding, which may be closely related to the government as a stakeholder (Santos & Horta, 2018; Villaveces et al., 2010), as also greatly important.

However, Mzembe et al. (2023) and Mitchell et al. (2020) make a different point that the niche must be linked to collaborative projects that involve the academic staff, which could be more attractive for research funders such as the government. Furthermore, scholars show that another strategy for institutions to attract research funding is for them to create a culture that beneficiates knowledge sharing (Marzocchi et al., 2023; Mitchell et al., 2020; Mzembe et al., 2023). Marzocchi et al. (2023) study extend the discourse by introducing research management

and argues that, in addition to academics, research management professions should provide support in widening knowledge exchange. Auf (2022) and Eissler et al. (2014) present a more egalitarian perspective by arguing for the creation of a global research environment, which will foreground issues of sustainable development, while ensuring researcher independence. Meyer et al. (2022) point out that there has been criticism of the excessive influence of donors who support research. They are sometimes perceived as impeding researchers' ability to operate independently – free from the funders' agendas.

In the scholarly discourse on transitioning from heavily teaching to intensive research university, to this end Tanira and KhalfAlla (2023) provide a thorough examination of migrating to research institutions. Tanira and KhalfAlla's (2023) study is essential in understanding complex problems and solutions needed to transform universities into research institutions. Their findings acknowledge universities' research performance discrepancy. Political and economic issues that hinder academic freedom and financing may lead to deficiencies in policy application, resulting in a lower ranking in research activeness (Tanira & KhalfAlla, 2023). Thus, institutional autonomy and financial stability are key to research quality (Makhlouf & Al-Bahabh, 2023).

Additionally, good administration is crucial in becoming a research university. Tanira and KhalfAlla (2023) stress that, research universities need research development control systems and administrative processes. Similar studies have also noted the harmful effects of political restraints on university autonomy and intellectual freedom (Badir, 2020). Nevertheless, the effectiveness of these research conducive political and economic conditions is also greatly reliant on institutions retaining talented researchers (Badir, 2020). Badir's (2020) study further emphasises cultivating researchers' intellectual capital to improve scientific research results. However, research stress the difficulties in keeping and nurturing highly skilled researchers, which aligns with global concerns about brain drain and the need for better talent management in academia (Mohammed et al., 2020).

In the context of transitioning to a research university, one could frame this change within the notions of change management, although cautiously – to avoid managerialism. While acknowledging the change management, which may be necessary, Tanira and KhalfAlla (2023) argue that if the transition is to be successful, there is a need to elevate the discourse to an innovative strategic perspective, that is, converting efforts into opportunities and results. In advancing the innovative strategic perspective, some scholars note that one of the challenges that are experienced by universities transitioning to being more research focused is the way in which their funding is restructured (Akkar & Al-Amri, 2022). They argue that for the universities to succeed they need to restructure their finance methods to sustain their research paradigm (Akkar & Al-Amri, 2022).

Linked to the notion of the quality of scientific research, Drużdżel and Kalagnanam (2018) identified administrative and motivational issues as two potential sources of low-quality scientific research. They argue that there is need for improved administrative systems that

promote scientific research development. In the same line of thought, other researchers further highlight the policy environment as a potentially challenging area that universities face when transitioning to being research institutions (Ahmed & Mahmoud, 2017; Al-Saqry and Al-Mutairi, 2021; Tanira & KhalfAlla, 2023). These researchers advocate for flexible institutional frameworks that enables collaborations and policies that foster innovation and patenting.

Moreover, Tilak (2021) emphasises research universities' role in innovation and society's progress. Tilak (2021) argues that universities drive the global research agenda and equally foster multidisciplinary research. However, Tilak (2021) cautions that transitioning or already research universities are struggling to balance research and teaching. Literature discussed in this introduction is important for SPU, which has done fairly well in teaching and is starting to chart a more strategic research agenda, growth, and leadership.

In light of the foregoing discussion, there appears to be a gap in literature on how universities can successfully chart their research agenda, particularly when moving from a base of teaching intensity. Existing literature primarily focuses on funding structures and policies with some reference to collaboration. However, very little is said about how an existing university transitioning into research can go beyond developing niche research areas. More importantly, it is crucial to understand how SPU's identified niche areas can secure active researchers, to drive the institution's research agenda on these areas. Thus, this paper is interested in aligning the interests of researchers with those of the institution – an area which is not covered by the existing literature.

METHODOLOGY

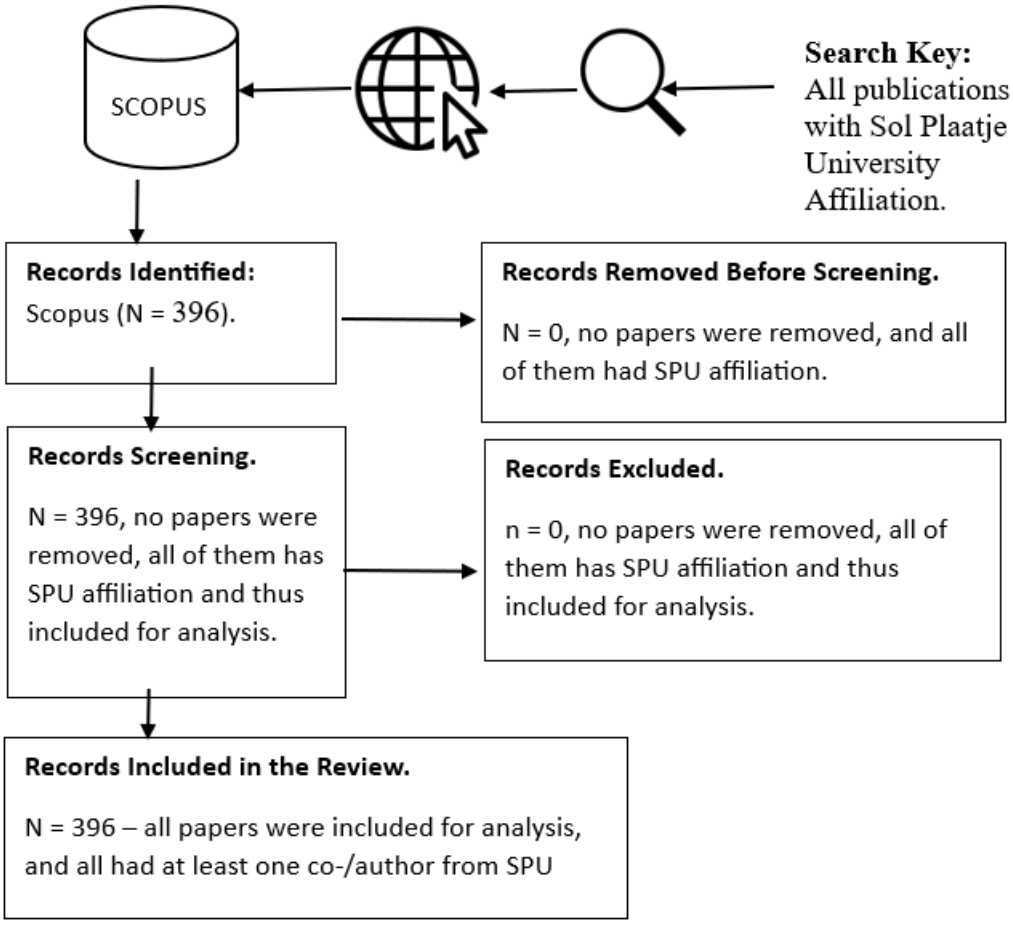
This paper used a bibliometric and systematic approach to comprehend how university publications can be utilised to develop that university's research niche. The paper analysed publications' history and generated thematic areas. This was achieved by specifically focusing on 2014 to 2023 publications that were authored or co-authored by individuals that were affiliated with Sol Plaatje University The paper used statistical methods to detect topic clusters in Scopus text data. The study categorised journal articles by citation frequency (Luo et al., 2018). The paper used bibliometric analysis, which Qiu et al. (2020) recommend for assessing research topics and trends. The method enabled analysis of previously published research.

The current study is supported by Nobanee and Ellili (2023), who demonstrate that the use of bibliometric and systematic approaches reveals current research areas and future research directions. As Choudhri et al. (2015) note, the bibliometric approach examines scholarly work, which aids academic advancement and recognition. Akturk (2022) advocates integrating bibliometric mapping with conventional analysis to better assess and discover idea linkages. The bibliometrics literature covers several themes and historical perspectives. Vinkler (2010) emphasises the growth of bibliometrics from the Science Citation Index to Cybermetrics. Additionally, Ellegaard and Wallin (2015) suggest that bibliometric analysis is required to assess research and scholar achievements.

Using bibliometric methods, Ellili (2022) and Nobanee and Ellili (2023) conducted a considerable sustainability study. Srivastava and Srivastava (2022) analysed the Indian publication of Palliative Care journal using Bibliometrix and VOSviewer. Liu et al. (2013) propose full-text citation analysis to improve academic networks. Akturk (2022) extensively reviewed the Journal of Computer-Assisted Learning bibliometric research. Additionally, Schneider et al. (2017) propose using standard bibliometrics to translational research. Ellili (2022) also applied bibliometrics to C-suite governance challenges. Collectively, these papers show that bibliometrics is flexible and can be used in various research fields. They stress its application to identifying research impacts, spotting trends, and visualising academic networks to examine as well as evaluate scholarly work.

Figure 1.

Study Review Process



RESULTS

Bibliometric data- main information

The bibliometric study of Sol Plaatje University's research outputs over the last decade shows the institution’s dynamic and changing academic environment. In total, 766 authors contributed to helping the university grow its research community since 2014 to 2023. The 38 single-author publications and several collaborative efforts demonstrate this. The findings demonstrate that

solo and group research are balanced. The authors' usage of 1406 keywords underline this research's variety. This paper's findings demonstrate that SPU has diverse academic interests and skills.

A review of publishing sources (e.g. journals) found 250 publications and conferences emerging from and/or related to SPU. SPU can fulfil numerous publication requirements and has a broad intellectual reach. Moreover, each found document had an average citation rate of 4.424. When combined with the fact that the papers were just one decade old, it means that SPU's research is growing and has the potential to become increasingly prominent in academia. The institution's academic activities have increased with a 61.08% annual growth in research output in this period. The 396 documents that were created by SPU affiliated authors during the 2014 to 2023 period show SPU's flexible research culture. Each publication that was found in the current paper had an average of 3.6 co-authors, demonstrating that the university's culture of research teams accelerated the rise in its research outputs. The 35.68% of SPU research's foreign co-authorship rate enhanced its research and shows its worldwide academic involvement.

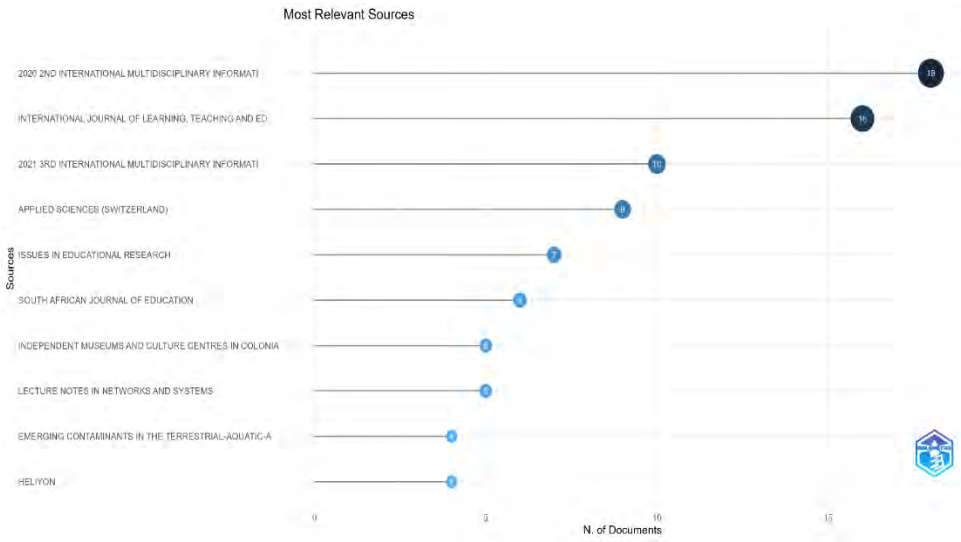
Leading academic sources and organisations in collaboration with SPU

Source analysis

The source analysis provides insight into the most prominent publication outlets for documents affiliated with SPU over the last decade. The proceedings from the "2nd International Multidisciplinary Information Technology and Engineering Conference (IMITEC 2020)", that was held in 2020, emerged as the most significant source. This conference was hosted by Sol Plaatje University and its proceedings were published through IEEE – marking a noteworthy contribution to the academic landscape.

Figure 2.

Top 10 relevant sources according to the number of documents published.



In the domain of journal articles, "Applied Sciences (Switzerland)" emerged as the journal with the most significant sources connected to SPU. Applied Sciences was closely trailed by

"Issues in Educational Research" and the "South African Journal of Education," which both played a vital role in the compilation of academic publications affiliated with SPU.

Organisational analysis

To shape SPU research agenda, we can analyse the distribution of collaborative institutions and organisations associated with the institution. This analysis provides an understanding of the departments that are internally more research-active and identify SPU's external collaborative partners.

Figure 3.

Top 20 Collaborators Institutions

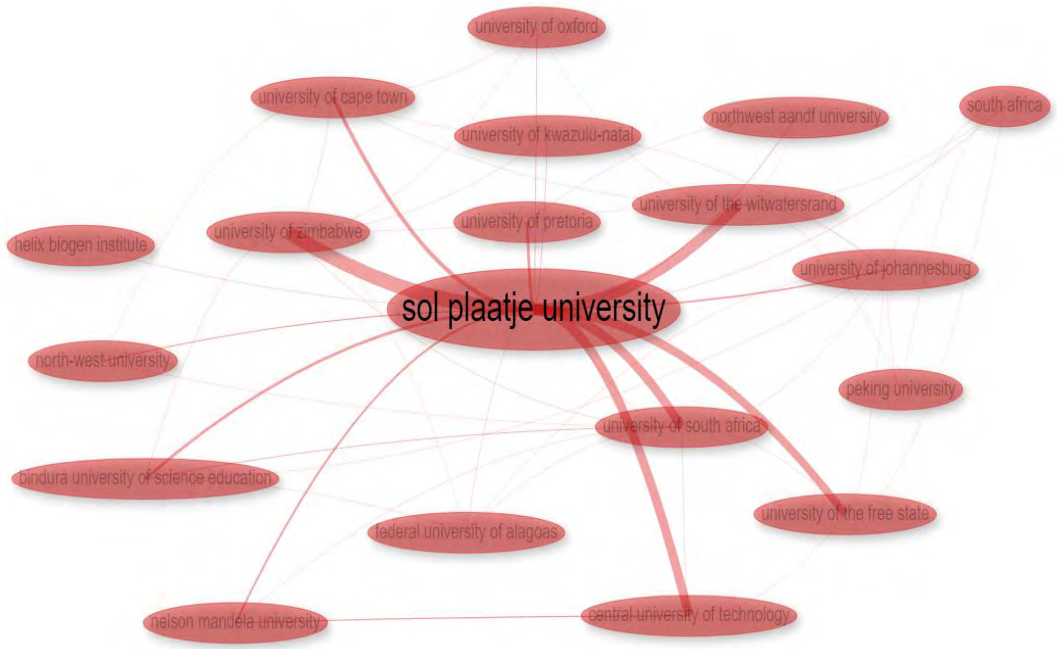


Figure 3 illustrates the top 20 institutions and organisations that collaborate with SPU, encompassing a mix of both local and international universities. The data in figure 3 indicates that SPU maintains strong collaborative ties with regional institutions, including the Central University of Technology, the University of the Free State, and North-West University. Notably, the figure also highlights that the most substantial collaborative relationships are with regional universities. Beyond local ties, the collaboration strength with other universities is notable, as indicated by the thick connecting lines (or edges) between the nodes representing SPU and other institutions such as the University of Witwatersrand, University of Cape Town, University of South Africa, and University of Pretoria. Noteworthy, in its first decade, SPU engaged in collaborations with ten South African universities. This represented 38% of the universities in South Africa, indicating a substantial level of connectivity and partnership within the national academic landscape.

Countries analysis

Regarding international presence, SPU has established a network of collaborators across the globe within its first decade. Among the top 25 countries SPU collaborated with, seven are in

Africa, and Zimbabwe stood out as the country with most collaborations. Beyond the African continent, the United Kingdom emerged as a significant partner, rivalling the extent of collaboration with all African countries and ranking as the second most collaborative country after Zimbabwe among the top 25.

Figure 4.

The Top 25 Countries in Collaboration with SPU

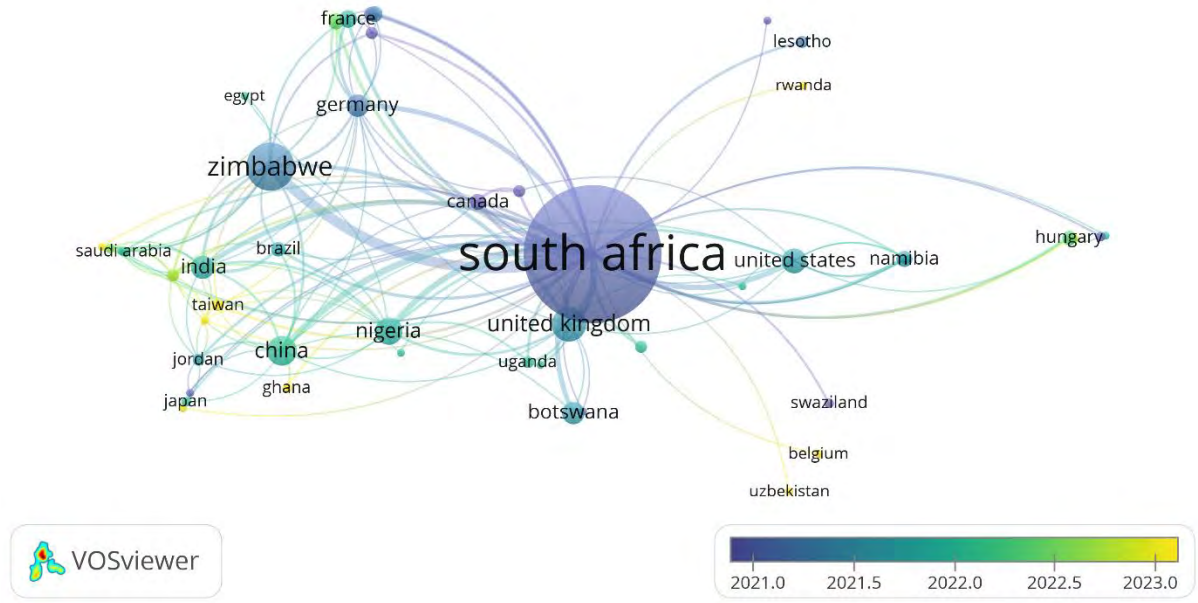


Figure 5.

Countries' Collaboration World Map

Although SPU initially prioritised teaching in its formative years, its second strategic plan has shifted to include aspirations of becoming research-active. It is significant to observe that, even before this strategic pivot, the university had already engaged in both continental and international collaborations.

Figure 5 as displayed above, illustrates that although SPU engaged in collaborations with co-authors from various countries, these countries with were themselves significant collaborators in their own right.

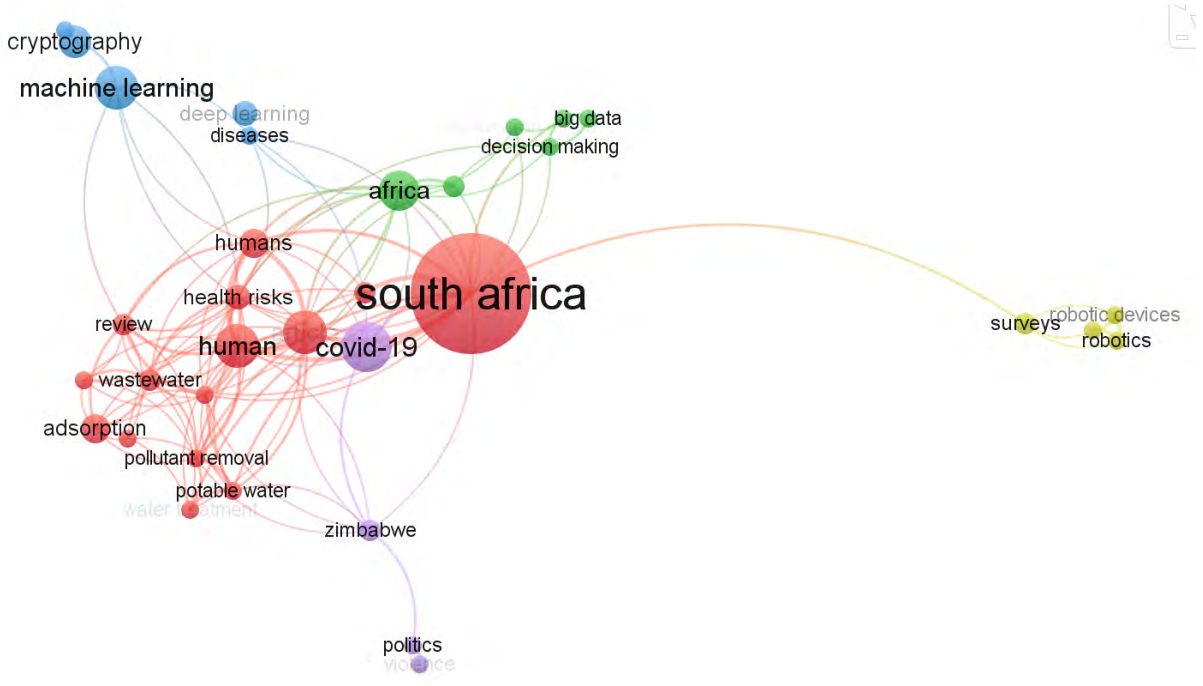
Keyword analysis and thematic development

Upon establishing a minimum occurrence criterion of five instances, a subset of 36 keywords emerged from a total pool of 3010 keywords. Each keyword surpassed the set frequency threshold. Subsequent computation of the co-occurrence link strengths for these keywords facilitated the distillation of a core interrelated network. The resulting visualisation underscored the centrality of “South Africa” within the corpus of SPU affiliated publications. This was a predictable outcome considering the institutional and geographical context of the research. Remarkably, “Zimbabwe” emerged as a singular national focus outside of South Africa in relation to keywords analysis, likely attributable to the substantial collaborative ties with the country, as evidenced by the thematic linkage of “Zimbabwe” to “politics” and “violence.”

The network mapping further disclosed SPU's scholarly response to the COVID-19 pandemic, with investigations spanning across South Africa and Zimbabwe. The graphical representation (Figure 2) delineates four salient research niches that originated from SPU. Foremost among the four salient research niches was a thematic concentration on aqueous pollution control and treatment methodologies, intersecting decisively with human health imperatives.

Figure 6.

Keywords Co-Occurrence



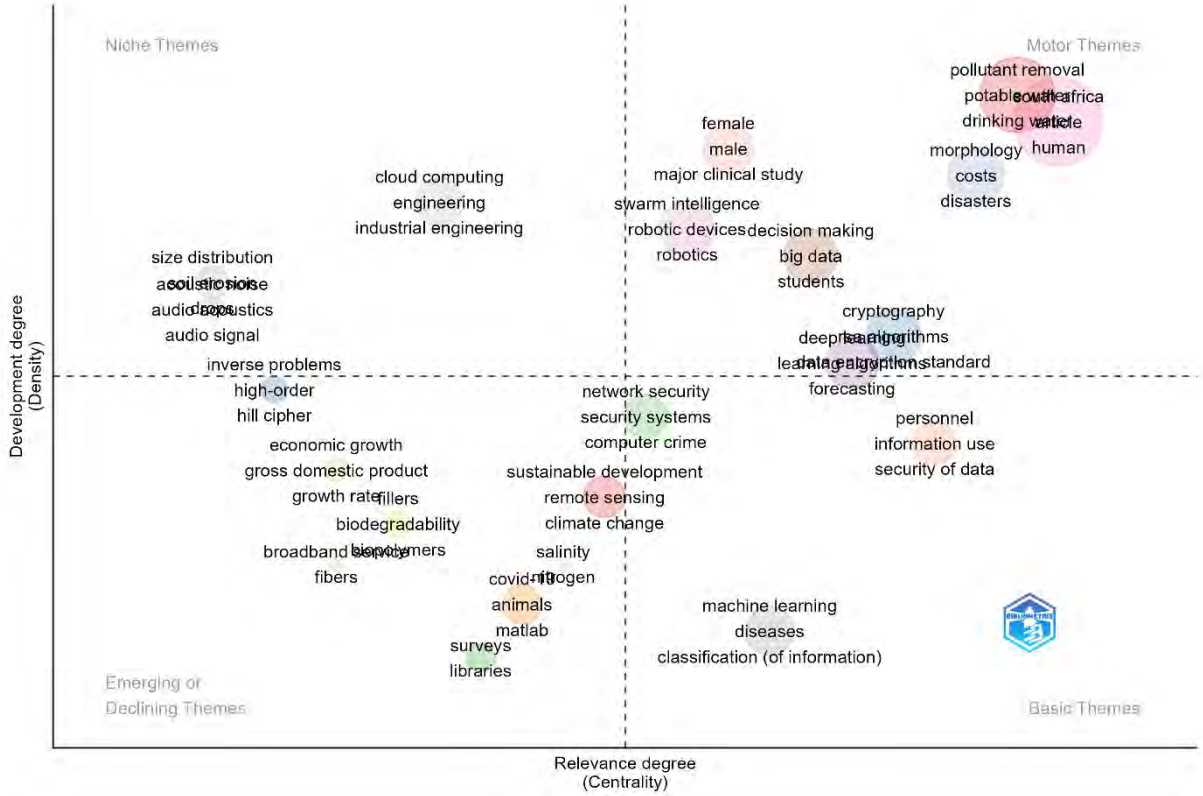
This strand of inquiry – addressing wastewater management, health risk appraisal, and pollutant abatement – resonates with the acute hydrological challenges inherent to the

Northern Cape's arid landscape. In this vein, SPU's research endeavours appear to be strategically attuned to leveraging its unique locational context for scholarly inquiry.

The second research emphasis at SPU converges on the intersection of machine learning and cryptography. This suggests a deliberate focus on applied research which aims to improve human conditions. The applied research encompasses application of deep learning technologies. The connections between the nodes in this cluster, particularly those linked to the 'human' node, indicate a direct relevance to human-centric applications. The notable presence of reviewed studies within this cluster may signify a scholarly environment where researchers are critically assessing literature to identify gaps and define specific areas for future research and interest for SPU. The emerging research niche in areas such as machine learning and cryptography at SPU indicates that the institution is actively engaging with cutting-edge technological research, purposefully aligning these advanced computational sciences with the goal of societal improvement.

Figure 7.

Thematic map



The final two thematic strands identified in the SPU research portfolio encompass big data/data-informed decision-making and robotics. Although these themes are currently presented as distinct clusters within the research network, their inherent interrelatedness suggest a potential convergence which is not immediately apparent in SPU's extant publications. Notably, the "decision-making" node is connected to both "health risks" nodes, indicating that SPU researchers are venturing into the realm of data-driven inquiry, particularly within the contexts of health and risk management. The outcomes of the network analysis are

corroborated by the thematic map which is depicted in Figure 5. The first quadrant encompasses the most mature themes, including pollution control and treatment methodologies within water research. Similarly, the research concerning Zimbabwe, robotics, and big data is also well-established, with the latter extending into studies involving students.

The thematic map reveals a pronounced regional concentration on environmental issues, as evidenced by the positioning of 'South Africa' and 'Zimbabwe' within the motor themes quadrant, closely associated with 'pollutant removal'. This suggests a robust scholarly attention to ecological concerns within these geographical contexts. Concurrently, the dispersion of technology-oriented terms such as 'machine learning', 'data', and 'robotics' across various quadrants of the map indicates a diverse application of these technologies, ranging from fundamental to specialised fields, with 'machine learning' emerging as a focal point within the broader research milieu. Additionally, the link between 'decision-making' and the nodes representing 'health' and 'risk', especially in the realm of big data, highlights an academically emergent direction toward leveraging data-driven approaches in the arenas of public health and risk management, pointing to a strategic integration of data analytics into these critical sectors.

DISCUSSIONS

This study used bibliometric analysis to identify potential themes from publications affiliated with SPU in its first decade. The study focused on how SPU could discover its potential research niche from already published studies. This study's findings reaffirm the views of scholars and offer new insights into the challenges faced by a university in striving to become research active. The study's findings show that SPU is gradually shifting from being teaching-centric to becoming research-active – a view shared by Santos and Horta (2018).Paphitis et al. (2016) expanded on this, noting that universities need to effectively manage the changing academic landscape as they become more active in research universities.

According to Trowler (1998) universities' first priority should be teaching, then research thereafter. Thus, a new university should emphasise teaching. However, SPU faces challenges in maintaining teaching quality while embracing research. SPU may strengthen its research through Master's and Doctoral degree programmes. Villaveces et al. (2010) noted that emerging higher education institutions promote research but lack postgraduate degrees, making it challenging to create strong research cultures. Despite early setbacks, SPU's research output has grown significantly, challenging the idea that new universities will not succeed without postgraduate degrees – SPU only had its first two graduates in 2023 from the School of Humanities.

SPU's academic output is largely concentrated on fields such as machine learning, cryptography, and environmental research, which is in accordance with Noel et al.'s (2019) findings, who highlight global academic trends. This is a reflection of the strategic emphasis placed on issues that are at the same time internationally significant and locally impactful. Furthermore, SPU has published big data analytics-based public health studies, which showcase

interdisciplinary research that is emerging from the institution in its first 10 years. Jacobs and Frickel (2009) provide additional evidence that multidisciplinary and interdisciplinary research makes us better positioned to solve difficult social problems.

Equally important is international visibility for a research institution. This finding expands from Auf (2022) and, Ibsen and Eriksen's (2022) bibliometric analyses. SPU's increased research output and international collaboration can help explain how newly established institutions can make global science and innovation contributions. The foregoing is supported by Xu et al. (2022), who argue that targeted collaborations and research may help accelerate newly established universities to gain worldwide prominence and grow quickly. Despite this excellent finding, O'Neill and Sinden's (2021) findings show a considerable cognitive-practice gap in institutions' sustainability approaches. Internationalisation, such as drawing global talent and growing student bases from developing countries, offers sustainability issues for universities (O'Neill & Sinden, 2021).

International student mobility and academic conferences raise carbon footprints, which institutions like St Andrew's acknowledge yet fail to address owing to their internationalisation goals. This suggests a complicated conflict between academic brilliance, global presence, and environmental sustainability. SPU's case conclusions must be contextualised within this argument. Xu et al. (2022) state that expansion and worldwide cooperation are admirable and correspond with academic trends. However, O'Neill and Sinden (2021) note that they face sustainability issues. Emerging institutions such as SPU must combine expansion with environmental sustainability, making this duality a key topic for policy development. Internationalisation's environmental implications must be mitigated by incorporating sustainable practices into growth models and international cooperation.

CONCLUSION

The study of SPU's research development over its initial decade contributes significantly to literature on higher education development, particularly for new universities. This case study underscores the importance of strategic planning, interdisciplinary focus, and international collaboration in establishing a vibrant research environment within emerging higher education institutions. The paper challenges conventional models, and provide a blueprint for success in contemporary academia. In the context of SPU's bibliometric analysis, the paper recommends prioritising advanced degree programmes, especially Masters and Doctoral degree programmes, to recruit and develop scholars. SPU must strengthen research areas including machine learning, cryptography, and environmental studies to lead these important fields. Interdisciplinary research, especially in big data analytics and public health, is crucial, given the results of the bibliometric review, which shows that SPU researchers are already publishing in these areas. SPU should also expand international relationships by focusing on African and European institutions, to diversify and improve research. Modern academic institutions must overcome the cognitive-practice gap in sustainability by integrating sustainable practices within

SPU's research paradigm. To remain relevant, SPU must adapt to global academic trends and problems using a methodical and data-driven strategy.

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