



Review Article

Utilizing scientometric analysis to evaluate indicators of quality research at the institutional level: A case study of UEA, a young Central African university

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ABSTRACT

The recognition and reputation of scientists and academic institutions are well-established in the field of scientometrics. However, these aspects face criticism in regions with limited information access and considered underdeveloped. In this study, we aimed to discuss the research performance of young universities (YU) in these challenging contexts. Despite financial, socio-economic, and political struggle, research in these YU has not stagnated and has even produced renowned scientists with global reputation. Our focus is on a case study of a Congolese YU, the Université Evangélique en Afrique (UEA), operating in a conflict-affected zone. The results showed that factors such as capacity building, infrastructure development, funding opportunities, collaborative partnerships, monitoring and evaluation are the main factors boosting the institution viability. Other important factors included scientific publication dynamics, community engagement, and policies for long-term sustainability, and should be reinforced in young central Africa universities to secure prominent positions in the global arena. The case study of UEA demonstrated that there is still room for revitalizing education and research in YU in the Global South. By accumulating citations and calculating the H-index using tools such as “Publish or Perish” and Scopus, this study suggests that platforms such as Google Scholar or ResearchGate alone are inadequate for evaluating research in academic institutions and researchers. Efforts are needed in these YU to promote quality research and minimize waste of data by publishing in predatory journals. This study also suggests that though scientometric indicators are effective in securing a prominent position in the global arena for YU, they are not solely adequate. Grey reports should also be integrated to assess YU’s community engagement and real impact of conducted research at the local and national levels. Despite challenges, these academic institutions provide valuable services to the community, and its researchers actively collaborate on research projects at regional, continental, and global scales. This study contribute to the limited existing literature on quality of education and research in developing central Africa regions by providing a comprehensive understanding through a detailed case study.

1. Introduction

Education is a fundamental catalyst for success and societal development, playing a vital role in regions regardless of their level of development. While some countries have recognized its significance and actively strive to enhance the quality of education, others grapple with socio-economic and political constraints that impede progress, leading to stagnation or regression within their educational institutions

(Mitchell, 2023; Mitchell et al., 2020; Selmi, 2023).

Sub-Saharan African (SSA) institutions face numerous challenges that hinder their progress. It is evident that these institutions require revitalization and research development in order to establish themselves in the competitive landscape of academia (Sawyer, 2004). Achieving excellence and securing a prominent position in the global arena are pressing concerns, and scientometrics has emerged as a valuable tool to address these issues. By utilizing scientometric methods, institutions can

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effectively assess their research performance, measure the impact of their work, and compare themselves to international benchmarks (Sawyer, 2004; Mitchell et al., 2020). This enables them to identify areas for improvement, strategically allocate resources, and enhance their visibility and reputation on a global scale. Embracing scientometrics empowers Sub-Saharan African institutions to navigate the complex world of research evaluation and make significant strides towards academic advancement. However, relying solely on these elements is insufficient and often subject to criticism. While scientometrics offers quantitative insights into research output and impact, it neglects qualitative dimensions like societal relevance, community engagement, and interdisciplinary collaboration. Complementing scientometrics with a holistic evaluation framework is crucial for a nuanced assessment of academic institutions, especially young universities (YUs). SSA institutions face challenges in receiving due recognition, highlighting the need for a comprehensive approach to evaluating their contributions. Originally established during or after the colonial era, these institutions appear to be losing their appeal and support among decision-makers, the youth, and parents as time goes on (Kotoua et al., 2015; Oketch, 2016; Härmä, 2019).

Policies have aimed to improve educational institutions, but this has led to a proliferation of both public and private entities often failing standards (Sawyer, 2004; Mitchell, 2017, pp. 17–34). Despite this, little focus has been on YUs, which play a vital role in development. Many of these institutions and individuals strive to enhance education standards, steadily making progress. Scrutiny of university performance and global competition intensifies, prompting YUs in SSA and globally to seek ways to enhance their international reputation.

Scientometric tools play a pivotal role in assessing the recognition and impact of institutions and individuals in the global research landscape (Teixeira & Mota, 2012; Lin et al., 2019; Orduna-Malea, Aytac, & Tran, 2019; Chen & Zhang, 2023). By providing quantitative measures of contributions to scientific knowledge and progress, these tools, as highlighted by Tijssen (2007) and Onyanha and Maluleka (2011), offer valuable insights into research visibility, impact, and quality. Key indicators such as publication count, impact factor, citations, and international collaborations are used to benchmark institutions against their peers, identifying strengths and weaknesses in research efforts and guiding development strategies for YUs in SSA. However, while scientometric analysis is invaluable, it has its limitations. Studies, including those by Onyanha and Maluleka (2011), have shown the negative aspects of solely relying on scientometric indicators. To address these limitations, it is essential to complement scientometric data with other evaluation methods that consider broader aspects of research impact, such as societal relevance, policy impact, community engagement, and innovation. Additionally, there is a need to improve data availability, promote inclusive research practices, and recognize diverse forms of knowledge production in Africa, as emphasized by recent scholarships. Furthermore, the documentation on honors and research in high-ranked universities worldwide far exceeds that focused on institutions in underdeveloped regions. This discrepancy is particularly evident in SSA, where YUs face a distinct set of challenges stemming from the socio-economic and political context of the region. These challenges include limited funding, inadequate infrastructure, difficulty in attracting qualified faculty members, and navigating political instability, all of which hinder research and academic development.

In our study, we aim to address these challenges by evaluating efforts to revitalize and promote research in YUs across SSA. Through a comprehensive examination of existing literature and discussions with experts in higher education, we seek to augment our insights with scientometric analyses of scholarly output from a specific institution in Eastern Democratic Republic of Congo (DRC). This case study provides a deeper understanding of the subject matter and sheds light on the unique challenges faced by YUs in conflict-affected regions. A YU, as defined by Kinyata and Siraje (2018), typically refers to a newly established educational institution or one that has gained recognition

and accreditation in recent years. These institutions face unique challenges, such as reputation building, infrastructure development, faculty recruitment, and securing funding. Despite these obstacles, YUs offer fresh perspectives, innovative approaches, and a strong commitment to growth and development. Over time, as they gain experience and maturity, YUs have the potential to establish themselves as reputable centers of education and research. However, documentation exploring their research position, challenges, and strategies are still lacking, particularly in conflict and post-conflict regions of SSA. Addressing these gaps is crucial for fostering research excellence and driving sustainable development in the region.

2. Research context

2.1. Constraints for young institutions

Young universities in SSA face a multitude of constraints and challenges, ranging from financial limitations to inadequate resources and infrastructure for research and education. These challenges include: (i) financial constraints as securing adequate funding for infrastructure development, research projects, and faculty recruitment; (ii) limited physical infrastructure as many are lacking sufficient facilities (laboratories, libraries, and research facilities) which hampers research and academic activities; (iii) the competition from more established institutions, both locally and internationally, makes it difficult for young universities to recruit and retain highly qualified faculty members; (iv) young universities often struggle with the issue of brain drain, as talented academics and researchers may leave the country in search of better opportunities abroad, leading to a loss of expertise and a weakened academic workforce (El-Khawas, 2004; Geber, 2013).

Securing adequate funding for research projects is essential for the development and reputation of young universities. However, accessing research grants and funding opportunities, both domestically and internationally, can pose significant challenges in these regions. Additionally, insufficient infrastructure, such as unreliable internet connectivity and limited access to updated research resources, can impede research and academic activities at YUs. Establishing collaborations and partnerships with other institutions, both regionally and internationally, is crucial for knowledge exchange and research advancement. However, building these networks can be challenging, not only for young universities but also for more established ones. YU must also navigate the process of quality assurance and accreditation to establish credibility and gain recognition both regionally and internationally. Meeting the required standards and benchmarks can be a complex and time-consuming process. Despite these challenges, African YU also present unique opportunities for growth and innovation (Geber, 2013; Kinyata & Siraje, 2018; Odhiambo, 2013). With strategic planning, investment in infrastructure and research capacity, and collaboration with other institutions, can contribute significantly to the development of higher education and research on the continent.

2.2. State of the higher education in sub-Saharan African region

Education in SSA countries faces significant challenges despite progress in access. Studies indicate an estimated university education level of 30%, with women experiencing particularly low rates (Lebeau, 2015). Ineffective pedagogical approaches and inadequate resources hinder learning, leading to flawed understanding among students (Luneta, 2022). A critical issue is the shortage of qualified teachers. In 2019, only 78% of primary and 80% of secondary teachers were considered qualified, with even lower rates for higher education (Ogunniyi & Rollnick, 2015). The education landscape in SSA is complex, with disparities in infrastructure, teaching quality, and learning outcomes (Alidou et al., 2006; Fafunwa & Aisiku, 2022). Despite improvements in enrollment rates, challenges persist in terms of education quality, equity, and relevance (Fox & Gandhi, 2021). Many schools lack

proper infrastructure and qualified teachers, resulting in varying education quality across regions. Learning outcomes are a concern, with a significant number of students failing to acquire basic skills. Achieving equity and inclusivity remains a challenge, with disparities based on gender, socio-economic status, and geographic location. Moreover, there is a notable mismatch between skills taught and the demands of the job market (Monekosso, 2014). These challenges necessitate comprehensive efforts to improve the education system.

Addressing these issues requires substantial investments in teacher training, infrastructure development, and the promotion of inclusive policies (Arora & Chakravarty, 2021; Aborode et al., 2020). Sustainable financing mechanisms are also crucial to ensure adequate and equitable access to education. Despite the vision for educational development, many SSA countries allocate less than 20% of their national budget to education (Arora & Chakravarty, 2021; Aborode et al., 2020).

Another challenge is the historical legacy of colonial-era institutions with aging academic staff struggling to innovate and revitalize research. The socio-economic context further complicates progress, underscoring the need for political and economic stability. Revitalizing education and research in SSA requires concerted efforts to address these systemic challenges. This includes investing in human capital development, fostering innovation, and creating an enabling environment for academic excellence. Despite the challenges, there are opportunities for growth and innovation in SSA's education sector. By prioritizing education and addressing these issues, the region can unlock its human capital potential and drive sustainable development. Collaboration between governments, educational institutions, and international partners is essential to overcome these challenges and build a brighter future for the next generation of Africans (Tijssen, 2007; Mitchell, 2017, pp. 17–34).

2.3. The state of education in eastern D.R. Congo

The Democratic Republic of Congo (DRC) and the South-Kivu province, in particular, are not immune to these higher education challenges. While several institutions exist in the province, questions persist regarding their effectiveness, the actual level of education provided, and the productivity of researchers. It is evident that institutions in the South-Kivu province characterized by armed conflict, political instability demonstrated lower efficiency, effectiveness, and productivity, a situation exacerbated by the prevailing socio-economic conditions and the security situation (Bennouna et al., 2016; de Herdt & Poncelet, 2010; Jones & Naylor, 2014). Consequently, the only institutions that can be considered relatively reliable tend to concentrate in urban centers such as Bukavu and Uvira. A prominent example occurred in 2021 when several hundred institutions were closed by ministerial decree. A noteworthy observation within this context, which can be described as “negotiation” and “institutional fabrication,” is that certain local communities and religious groups have attempted to improve the existing situation. Private institutions like the Université Evangélique en Afrique (UEA), Université Catholique de Bukavu (UCB), and public institutions such as the Official University of Bukavu (UOB) and the Higher Pedagogical Institute (HPI) have taken the initiative to bring about change and establish reliable institutions that foster the education of the future Congolese elite, serving as the cornerstone for future transformations. In this study, we specifically focused on one of these institutions, the UEA. Founded in 1991, it contributes to the education of Congolese youth and supports community development through various initiatives, including development projects, consultancy services, and the provision of facilities such as laboratories and recreational areas.

2.4. Presentation of the case study

2.4.1. Presentation of the Université Evangélique en Afrique (UEA)

Université Evangélique en Afrique (UEA) is a young institution that has prioritized research as a core focus. It encompasses various

departments and research programs in key areas such as Social sciences, Natural sciences, Health sciences, and Theological studies. However, UEA, as most Congolese institutions, faces specific challenges in research development, including limited infrastructure, resources, and the need to establish international collaborations. Given the country's unstable security situation, which impeded regional and international exchanges, institutions in the region face significant challenges in their development. Opportunities for international cooperation were scarce, making it even more difficult to make progress and establish meaningful partnerships.

2.4.2. Location and history

UEA is a private interdenominational Christian evangelical university located in the city of Bukavu in the South-Kivu Province, Eastern DRC and founded in 1990 by the Community of Pentecostal Churches in Central Africa (CEPAC) of the Eglise du Christ au Congo (ECC). The university received its Ministerial recognition in 1991, followed by the recognition of degrees for the first cycle in 1992, and for the second cycle in 1995. Its final accreditation by presidential decree took place in 2006. UEA consists of five faculties, including the Faculty of Agriculture and Environmental Sciences, Faculty of Medicine, Faculty of Social Sciences, Economics and Management, and the Faculty of Protestant Theology. The slogan of the university is “*Faith, Science, Work*”. In addition, it is noteworthy that a few years after its founding (in 1994–1996), the institution became embroiled in the regional conflicts that engulfed neighboring countries and subsequently spread to the DRC. Thus, from its inception until its recognition, the institution has endured the tumultuous impact of wars and ongoing conflicts in the eastern region of the country. Hence, it is crucial to analyze and comprehend how an institution operating in such a demanding sector manages to carve out a reputation in the region and witnesses its scientists gaining increasing renown and reputation.

Scientific research plays a pivotal role in advancing academic institutions, contributing to knowledge dissemination, innovation, and the creation of new perspectives. This paper focuses on the case study of UEA, aiming to employ scientometric analysis to assess effort to revitalize and promote research, providing objective insights into its performance and identifying areas for further development. We hypothesize that scientometric analysis can help overcome challenges by providing objective data on UEA's performance within the research landscape in the SSA region. Analyzing scientific production in a region characterized by instability and limited resources is crucial for determining research directions and evaluating the effectiveness of researchers and institutions. Scientific production serves as a vital indicator of human and institutional development, showcasing how research contributes to the cultural, economic, and political landscape of the region. This paper aimed to examine efforts to revitalize and establish research in UEA, using scientometrics indicators for UEA and its researchers' rankings in SSA. To clarify our theory, we conducted a case study assessing the research performance of UEA scientists, operating in a socioeconomically challenging and conflict-prone area.

3. Methodology

To conduct this study, we utilized two main approaches. Firstly, we engaged in discussions with experts from local higher education institutions, and drew on their insights and the first author's extensive experience as the university vice chancellor since 2008. Here, we preferred to use the term “experts” because it refers to our colleagues who are university vice chancellors, faculty deans, deputy deans from the local area, neighboring countries, or researchers, and professors operating throughout the region. Secondly, the following boolean combination was used for searches to refine keywords, years, and study areas: (TITLE-ABS-KEY “UEA/Bukavu” OR “UEA” OR “Université Evangélique en Afrique” OR “Evangelical University in Africa” OR “EUA” AND “democratic republic of Congo” AND “RDC” AND “DR

Congo”) AND PUBYEAR >1990 AND PUBYEAR <2023 AND (LIMIT-TO (AFFILCOUNTRY, “Democratic republic Congo”). Among these documents, we removed duplicates, those not aligning with the specific study area, or not addressing the sought-after theme following the PRISMA approach (Okuni, 2007; Fleming et al., 2014). We also used local and international reports produced by members of the institution or those where the university was involved. To reduce bias, we primarily focused on documents retrieved from the Scopus database. Indeed, no significant difference was observed in the number of documents by type of database, whether it was Google Scholar, Web of Science, or Scopus. Since most of the documents in the study area were not indexed in selected major databases, additional searches were conducted in Google Scholar to include relevant non-indexed publications and grey literature. The PRISMA approach was used. In fact, upon removal of duplicate documents (542), those marked as ineligible through automation (48), and those deleted for other reasons (89), websites (2), and reports from organizations were removed from the final data.

Additionally, we consulted available literature on the topic, analyzing all publications focusing on “Central Africa” and “Sub-Saharan Africa” from 1990 to 2023. For the case study component, we established a comprehensive database comprising all publications from UEA. Initially, we obtained data from Scopus and supplemented it with additional sources such as reports, theses, publications in regional and local journals. Thirdly, once we obtained the final database, we conducted various analyses including identifying publication trends over time, key authors, co-occurrence of authors and keywords, collaborating institutions, and partner countries. To present the results, we utilized VOSViewer software, while Microsoft Excel was employed to construct informative graphs and visualizations. Additionally, we used the “Public or Perish” application for citation analysis and related metrics such as the number of publications, H-index, and i10-index. These results helped identify UEA’s research domains, and subsequently, scientometric indicators such as publication count, average impact factor, and citation score were used to assess research performance.

4. Results and discussion

Our preliminary findings reveal that Central Africa young

universities, and specifically those in the African Great Lakes’ region, have made significant strides in research development. The analysis demonstrates an increasing number of publications, from professors, students and research centers indicative of an expanding research output. Additionally, the average impact factor and citation rates suggest a growing impact and influence of Central Africa research contributions. However, further analyses and interpretation are required to fully understand their position relative to regional and international peers. This evolutionary trend can be attributed to various factors, notably the productivity of researchers in the region, collaborations with institutions both within and outside the continent, and, largely, the substantial increase in the number of journals and publications over the past few decades. It was difficult to establish a direct correlation between this output and the type of institutions (young or old), but it is certain that young institutions have made a substantial contribution to this scientific production.

Fig. 2a shows that in the last decade, there was a significant increase in the number of published documents (see Fig. 1). The majority of these research studies are primarily focused on resolving real-life challenges encountered by the population. These documents extensively cover various areas, including social issues (32%), medicine (13%), agriculture and biological sciences (28%), environmental sciences (16%), and many other domains such as economics, econometrics, and finance (11%), among others. Indeed, a significant portion of these universities prominently offers faculties in these fields. It is noteworthy that the majority of these publications still originate from prestigious universities such as Makerere University (Uganda), University of Nairobi (Kenya), and Sokoine University (Tanzania).

Central African universities have encountered a multitude of obstacles that have necessitated substantial changes in their purpose, administration, knowledge generation and dissemination, as well as their engagement with national, regional, and global economies and societies. These transformations reflect a broader paradigm shift experienced by societies and universities worldwide (Brewer & Brewer, 2010; Mushemeza, 2016; Santos & Bocheco, 2010, May; Varghese, 2004). Santos and Bocheco (2010, May) emphasize that the modern university faces a crucial dilemma: it tends to provide weak answers to significant questions; while highlighting that weak answers are

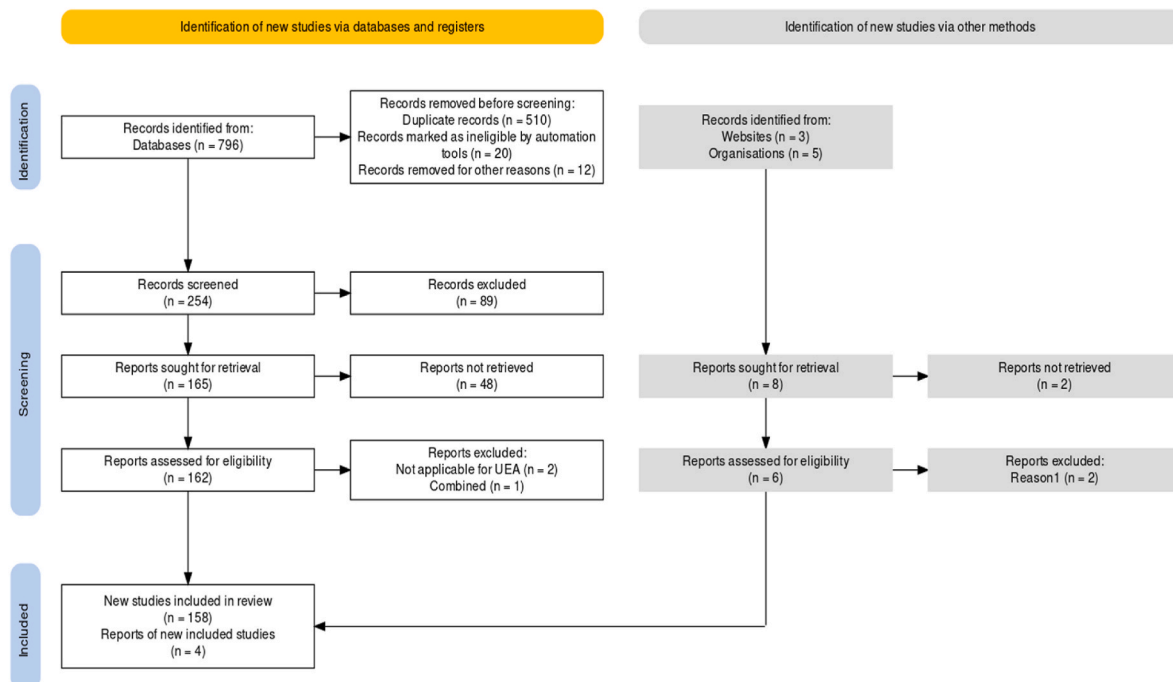


Fig. 1. PRISMA flow diagram used to refine the final data used.

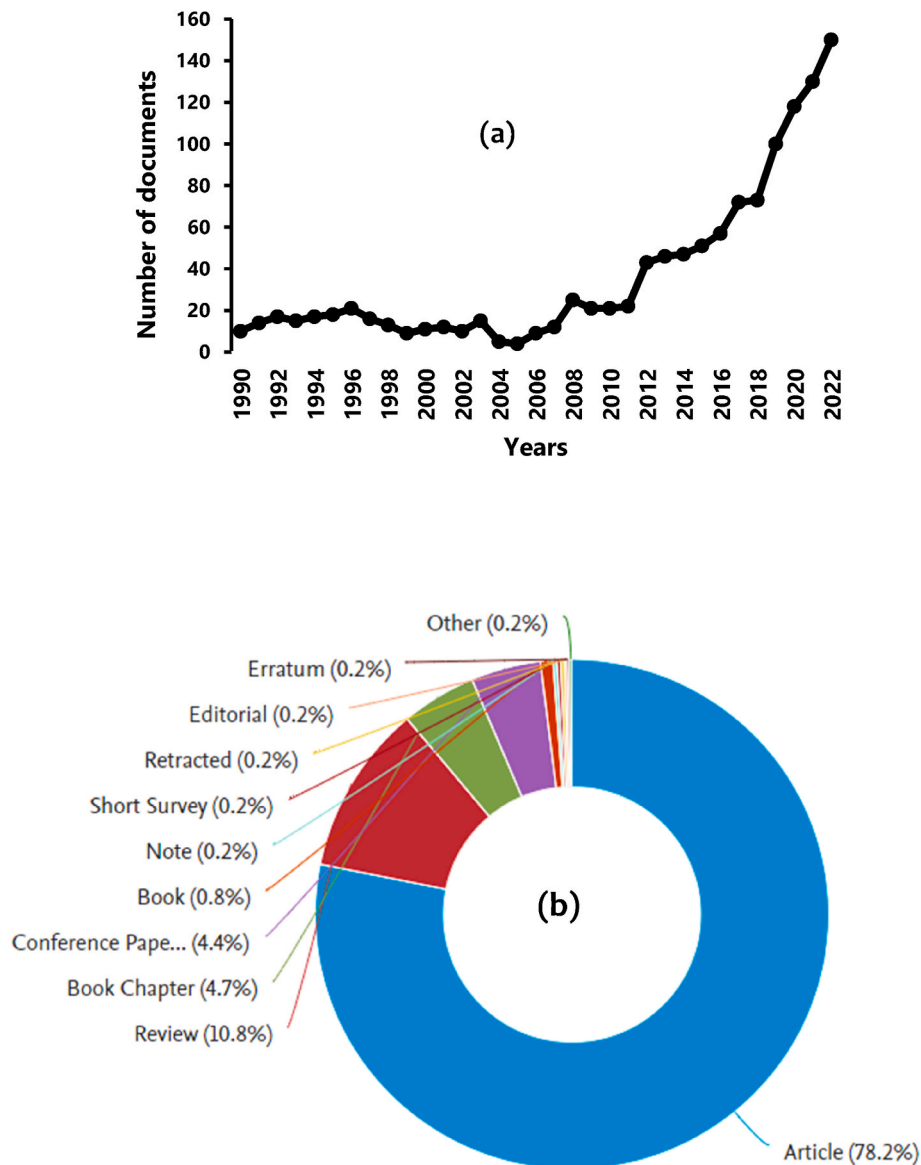


Fig. 2. Trend (a) and type of documents (b) produced by universities from Central Africa from 1990 to 2022 (Here we consider only publications made by researchers from these countries).

characterized by a narrow focus on the problem, detached from broader social and political contexts. On the other hand, strong answers recognize the importance and magnitude of the task at hand and acknowledge the responsibility to analyze, understand, and promote an agenda that aims to transform the current state of affairs. In general, these universities, in their pursuit of excellence in knowledge generation, dissemination, lifelong learning, and community service, are currently confronted with numerous challenges and threats.

To differentiate a Central Africa young university, focusing on key strengths is vital. Through discussions and document analysis, four distinct benefits have been identified. Firstly, specialization in key disciplines showcases academic excellence. Secondly, providing valuable training and certifications equips students with competitive skills. Thirdly, fostering a rich university experience enhances students' connection to the institution's culture and values. Young universities should communicate their unique strengths effectively, aligning messaging with core values and reputation. Leveraging these elements expands reach, attracts talent, and enhances brand performance. In the digital era, universities can promote messages through online and offline channels. Strategies include strategic social media engagement,

responsive website maintenance, advertising methods, mobile development, and search engine optimization (SEO) prioritization. Strategic social media engagement involves compelling content sharing and alumni connections on platforms like Facebook, Instagram, and Twitter. A responsive website optimized for search engines ensures visibility for prospective stakeholders. While offline advertising is declining, universities can still use banners, posters, and outreach programs. Mobile-friendly websites cater to the growing mobile user base, and SEO boosts visibility in search engine rankings. By implementing these strategies, universities effectively promote strengths, enhancing reputation and attracting talents.

4.1. Using scientometrics as indicators for young universities and researcher rankings

While still in development, we propose conducting a case study to illustrate how scientometric analysis can benefit young institutions. We hypothesize that scientometrics offer both positive and negative aspects for such institutions. On the positive side, they provide objective measures of research output, international recognition, benchmarking, and

improvement opportunities. By quantifying publications, citations, and collaborations, scientometric indicators allow for standardized comparisons and enhance visibility, attracting collaborations, funding, and talent. They also serve as benchmarks for performance assessment, fostering competition and driving research quality. However, scientometrics have limitations, including a narrow focus, data constraints, and bias towards quantity over quality. They may overlook research impact beyond publications and citations, particularly in the African context, and face challenges with data availability and accuracy. This can disadvantage certain research fields and incentivize quantity-focused practices, potentially overlooking local contexts and relevance. To address these issues, we propose an integrated approach that combines scientometric analysis with qualitative methods to consider broader impacts and context-specific aspects of research, promoting inclusivity and diverse knowledge recognition in young institutions.

4.2. The case study of the Université Evangélique en Afrique (UEA Bukavu)

4.2.1. Student and teacher evolution trends

The available statistics indicate that there were 134 enrolled students in 1998. In 1999, the number of enrolled students decreased to 107, and it further decreased to 72, 78, and 144 in the years 2000, 2001, and 2003, respectively. Currently, the enrollment is close to 1000 as of 2018, and it was 980 in the year the study was conducted (2022). We provided this trend of first-year enrollments as it is easy to quantify and obtain the data readily. In terms of the teaching staff, the statistics from the reports indicate that there were 8 professors, 5 associate professors (all visiting lecturers), and 17 assistant professors (all visiting staff) at the university founding. However, the current situation is quite different, as the majority of professors (90%) are permanent and have been trained by the university itself. Therefore, in the span of nearly twenty years, the university has transitioned from having no permanent professors to having over a hundred.

4.2.2. Evolution of scientific production

Fig. 2a depicts the evolution of publications at UEA from its inception to the present day. It also provides insights into the types of publications (Fig. 2b) and the primary thematic areas (Fig. 2c) explored in these publications. Based on such figure, the first internationally recognized publications emerged around 2000 (Walangululu & Mushagalusa, 2000), followed by another set in 2008 (Mushagalusa et al., 2008). These two publications sparked a research momentum among the new generation of scholars at the institution. Between 2010 and 2011, three additional publications supplemented the initial ones. However, no international releases were reported in 2012 and 2013. From 2014 onwards, a renewed surge in publications became evident, with three publications in 2014, five in 2015, six in 2016, and eight in 2017. The number of publications experienced a significant surge in 2018, with over 12 articles being published. However, due to the COVID-19 crisis, only 24 publications were produced from late 2019 to the end of 2020, with six and 18 publications in each respective year. Post-crisis, the number of publications has continuously and exponentially increased. At the date of the data downloading (November 24, 2022), 36 publications have been recorded for the year. Overall, nearly 118 publications in internationally recognized peer-reviewed journals have been attributed to the institution, with the majority (80%) being produced within the last five years. These publications predominantly consist of scientific articles (92%), with ~6% being review articles and 2% being notes. The covered themes encompass a wide range of current and diverse topics. Approximately one-fourth of the publications primarily focus on agriculture and biological sciences (24%), followed by medicine (18%), environmental issues (12%), and earth sciences (4%). Social questions account for 10% of the publications, while veterinary science, animal immunology and microbiology, biochemistry and genetics, economics and finance represent 7%, 6%, 3%, and 3%, respectively.

Merely 5% of these publications address multidisciplinary topics. The remaining 8% are dedicated to related or specific research areas such as psychology, business and management, pharmacology, computer science, neuroscience, and others. Regarding researchers, over 55 individuals have contributed to at least one article published in a peer-reviewed journal. In terms of publication count per researcher, the top fifteen are affiliated with the Faculty of Agriculture and Environmental Sciences (Mondo, Mugumaarhahama, Ayagirwe, Mushagalusa, Karume, etc.), with Mukwege, Maroyi, and Kashosi being exceptions (Supplementary Fig. 2).

Even among the following ten researchers on the list, the dominance of scholars from the Faculty of Agriculture and Environmental Sciences remains prominent (Bacigale, Mushagalusa, Amzati, etc.), followed by researchers from the Faculty of Medicine and the Faculty of Social Sciences. Only two authors from the Faculty of Economics and Management were mentioned, each with two publications (Bora and Nyamugira). It is important to note that while the number of articles published by researchers indicated their level of productivity, it does not provide insights into the quality of these articles. It appears that several researchers from these faculties are either absent or significantly underrepresented, as they publish in journals not recognized by peers or in local journals not acknowledged by Scopus.

4.2.3. Top publications

Citations serve as a significant means of professional recognition. They allow for the conceptual association of scientific ideas, connecting current research with previous studies, establishing intellectual transactions or moral obligations towards the work of others, and identifying specialized elements within a specific field. Through the existing spatial relationships among high-quality scientific results, one can map relevant scientific domains.

Based on Table 1, the most cited article from UEA is Mukwege (1112) followed by Mushagalusa et al. (2008), published in *Environmental and Experimental Botany* with an impact factor (IF) of 6. It is followed by the article by Nachege et al. (2021), where Mukwege contributed, published in *The Lancet Global Health* with an IF of 38.9. Other highly cited articles include Kulimushi et al. (2017) in *Frontier in Microbiology*, Mitima et al. (2014) in the *Journal of Infection in Developing Countries*, Bisimwa et al. (2020) in *Veterinary Microbiology*, and Birindwa et al. in *BMC Pediatrics* (Birindwa et al., 2018). The research performance indicators include the h-index, developed by Hirsch (2005:1). It represents the number of a researcher's publications that have been cited at least h times each, while the remaining publications have not been cited more than h times each. The h-index combines both quantity (number of publications) and quality (impact or citations received by those articles). Notably, prestigious journals in specific scientific fields tend to have higher usage, citations, and impact factors. Works published in non-mainstream journals are seldom cited and often overlooked by the scientific community.

It is noteworthy that only two faculties at UEA are actively engaged in internationally accessible research: the Faculty of Agriculture and Environmental Sciences and the Faculty of Medicine. The Faculty of Social Sciences, Economics, and Protestant Theology do not contribute much to the sources mentioned in this study.

4.3. Top partner institutions and funding

In Fig. 3 are illustrated the institutions and organizations involved in research collaboration with UEA. This figure reveals a diverse range of research partners, with over 32 identified collaborators. The majority of UEA's publications are funded or conducted in cooperation with the International Institute of Tropical Agriculture (IITA) through the support from the Bill and Melinda Gates Foundation, the Panzi Reference General Hospital (HGRP), the University of Liège, the ICART, and UCB's sister institution. Other partners include the University of Nairobi, JKUAT, BeCA-ILRI, Pan African University, Makerere University, KU

Table 1

The most cited articles, the corresponding authors, and information about the journals in which the articles were published as produced by researchers from UEA Bukavu as per November 2022

ID	Main author	Author from UEA	Journal	IF	Cite Score	Citations
1	Mushagalusa et al. (2008)	Mushagalusa	<i>Environmental and Experimental Botany</i>	6	9.1	66
1	Nachegea et al., 2021	Mukwege	<i>The Lancet Global Health</i>	38.9	41.8	47
2	Kulimushi et al., 2017	Kulimushi	<i>Frontiers in Microbiology</i>	6.1	8.2	35
3	Mitima et al., 2014	Mitima	<i>Journal of Infection in Developing Countries</i>	2.5	2.4	22
4	Bisimwa N.T et al., 2020	Bisimwa and Banswe	<i>Veterinary Microbiology</i>	3.2	5.6	21
5	Birindwa et al., 2018	Birindwa, Kashosi	<i>BMC Pediatrics</i>	2.4	3.3	16
6	Mondo et al., 2020	Mondo	<i>Agriculture</i>	3.49	3.1	13
7	Kulimushi et al., 2018	Kulimushi, Mushagalusa, Chuma	<i>Environmental Science and Pollution</i>	5.1	6.6	13
8	Kashosi et al., 2017	Kashosi	<i>Pan African Medical Journal</i>	0.5	0.82	11
9	Mugumaarhahama et al., 2021	All	<i>Scientific African</i>	NA	2.4	10
10	Amzati et al., 2019	Amzati	<i>Parasite and Vectors</i>	-	-	10
11	Amzati et al., 2018	Amzati	<i>Parasite and Vectors</i>	-	-	10
12	Birindwa et al., 2017	Birindwa, Ntagereka	<i>Journal of Advanced Veterinary and Animal Research</i>	-	-	10
13	Mondo et al., 2021	Mondo	<i>Plants</i>	-	-	8
14	Mutwedu et al., 2021	Mutwedu	<i>Veterinary Medicine and Science</i>	-	-	8
15	Bisimwa et al., 2021	Bisimwa	<i>Heliyon</i>	-	-	8

Table 2

Citations and other performance indices of main researchers from UEA Bukavu as per November 2022

Authors	H-index	G-index	Indice i10	Citations (total)
D. Mukwege	13	32	11	1112
G.N. Mushagalusa	10	9	10	403
K. Karume	11	16	5	360
J.M. Mondo	9	3	8	235
R. Ayagirwe	9	5	6	187
P. Bisimwa	8	11	8	174
Y. Mugumaarhahama	9	3	8	164
E. Bagula	8	7	7	151
B. Chuma	7	3	5	136
B. Birindwa	6	6	5	132
V. Mutwedu	7	4	4	128
S. Amzati	7	2	5	106
P. Kulimushi	5	4	5	91
S. Bacigale	6	1	4	83
M. Kashosi	4	0	0	78
B. Ndeko	5	1	3	76
P. Baenyi	6	1	1	75
R. Civava	4	8	3	66
C. Cirezi	4	1	3	61
S.S. Ndjadi	6	2	5	45
M.C. Cokola	5	1	1	42
R. Maroyi	3	1	1	28
B. Ndusha	4	0	0	28
C.A. Mushagalusa	3	0	0	22

Leuven, University of Ibadan, and more. Additionally, there are partners involved in agriculture-related aspects such as CIAT (HarvestPlus), RUFORUM, OVG, etc. These partners represent both Northern and Southern countries. Fig. 5 illustrates the countries collaborating with UEA, including local organizations and institutions in the DRC (ICART, IITA, UCB, UNIKIN, Diobass, OVG, etc.), Kenya (JKUAT, UoN, BeCA-ILRI), Nigeria (IITA, University of Ibadan, etc.), the USA, South Africa, Uganda, France, Sweden, Burundi, Germany, Benin, and Cameroon. It is worth mentioning that most of these African institutions collaborate with UEA through cooperation and capacity-building programs facilitated by RUFORUM, including doctoral student exchanges.

Table 2 presents the ranking of researchers at UEA based on performance indicators and the number of citations for each author. The cumulative sum, including other authors not listed in this table, shows that UEA has accumulated ~4233 citations, averaging 132 citations per year. The highest number of citations was observed in 2020. The top five researchers at UEA are Mukwege (with over 1112 citations and an H-index of 13), Mushagalusa (403 citations, H-index: 10), Karume (360

citations, H-index: 11), Mondo (235 citations, H-index: 9), and Ayagirwe (187 citations, H-index: 9). Other notable researchers include Bisimwa, Mugumaarhahama, Bagula, Chuma, and Bwihangane. It is important to note that the number of publications is not correlated with the number of citations. This is evident in the cases of Mugumaarhahama and Birindwa, who had the highest number of publications but their citation counts and indices are comparable to those of Amzati and Kulimushi, who have almost half the number of their publications.

A critical analysis of publications from UEA reveals six specific research themes that researchers are currently working on and which deserve more attention in the future (Fig. 4). The first theme revolves around the state and improvement of patient conditions in pediatric care, particularly focusing on aspects such as blood culture, antibiotic effects, eruptions, and effective treatments. The second theme, within the field of medicine, centers around sexual violence and its various dimensions in the region, including perception, attitudes, disabilities, and the interplay with socioeconomic factors.

In order to support the thematic development within these young institutions, we have conducted an analysis of word clouds representing the keywords found in all of these publications. In fact, the third theme emphasizes the diversity of yams, utilizing genetic tools and markers to explore specific diversity and abundance. This theme is also interconnected with existing genetic research areas. The fourth theme delves into the valorization of crop residues, primarily in cassava and maize cultivation, while simultaneously reducing the impact of field bio-aggressors like caterpillars, fungal and viral diseases, and combating aflatoxins. Additionally, understanding the effects of pesticides and determining product toxicity on these crops remains a critical research aspect. While some studies have already investigated the impact on rabbits, the link between the productions of these major crops, the resultant damage, the implemented control measures, and their consequences on other animals exploited in the region have yet to be thoroughly examined. Similarly, although the presence of aflatoxins has been identified in maize cultivation, the dynamics behind this contamination, its primary causes, and its existence in other prominent crops of the region still require further elucidation. Moreover, the impact of contamination on nutritional value, processing, and flour utilization remains unclear.

Another important theme focuses on tropical diseases. While existing literature covers major diseases like malaria and chikungunya, documentation that is more comprehensive is needed regarding their effects on different age groups, effective antibiotics for treatment, and the connection between these diseases and emerging pandemics currently being observed. Lastly, another crucial theme relates to observed environmental changes and their effects on regional ecosystems. This

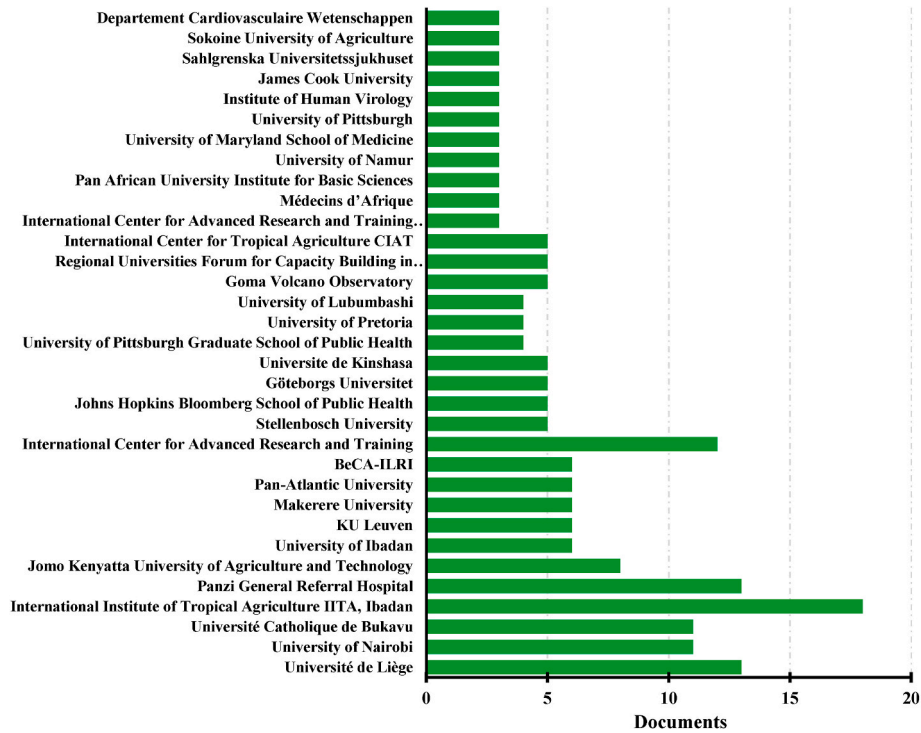


Fig. 3. Institutions and organization collaborating with UEA Bukavu in research.

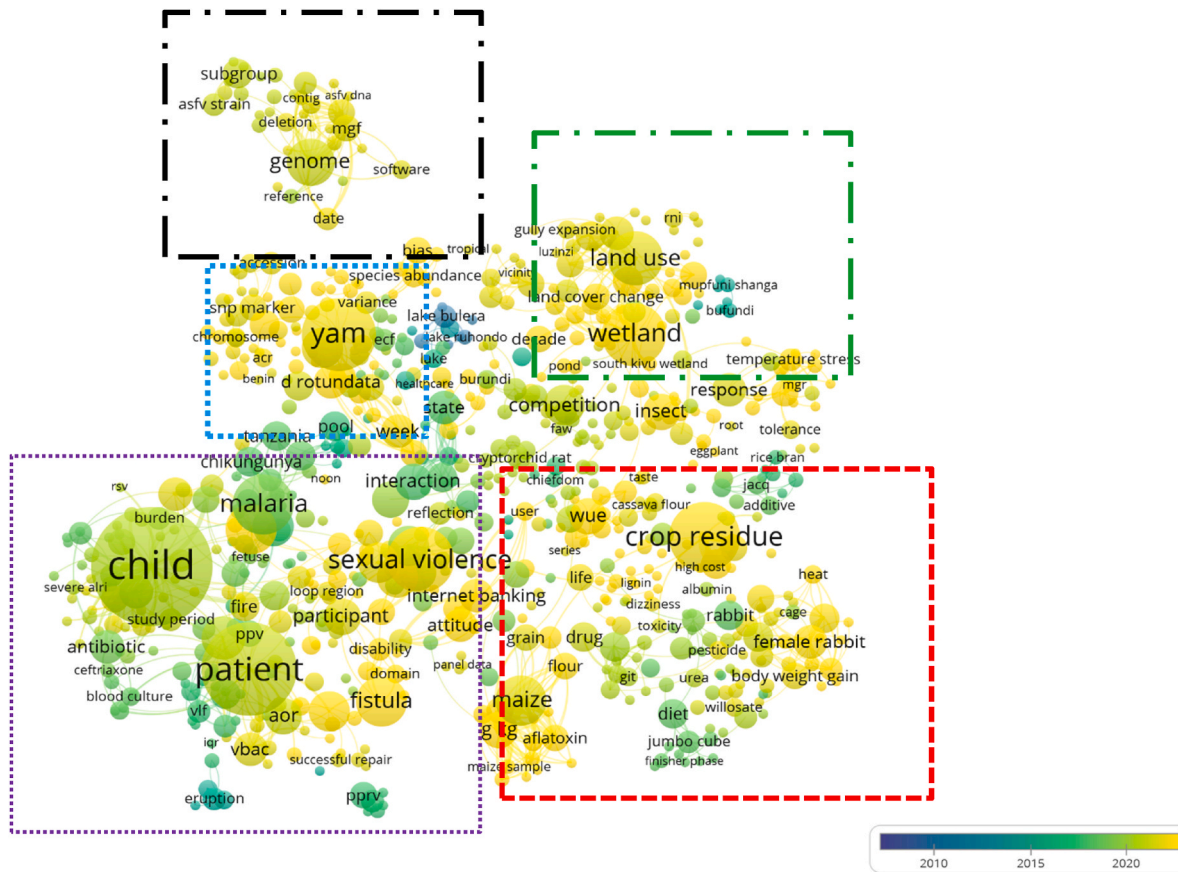


Fig. 4. Co-occurrence and key themes developed by researchers at UEA from 1990 to 2022 (the shape represent the main research thematic groups).

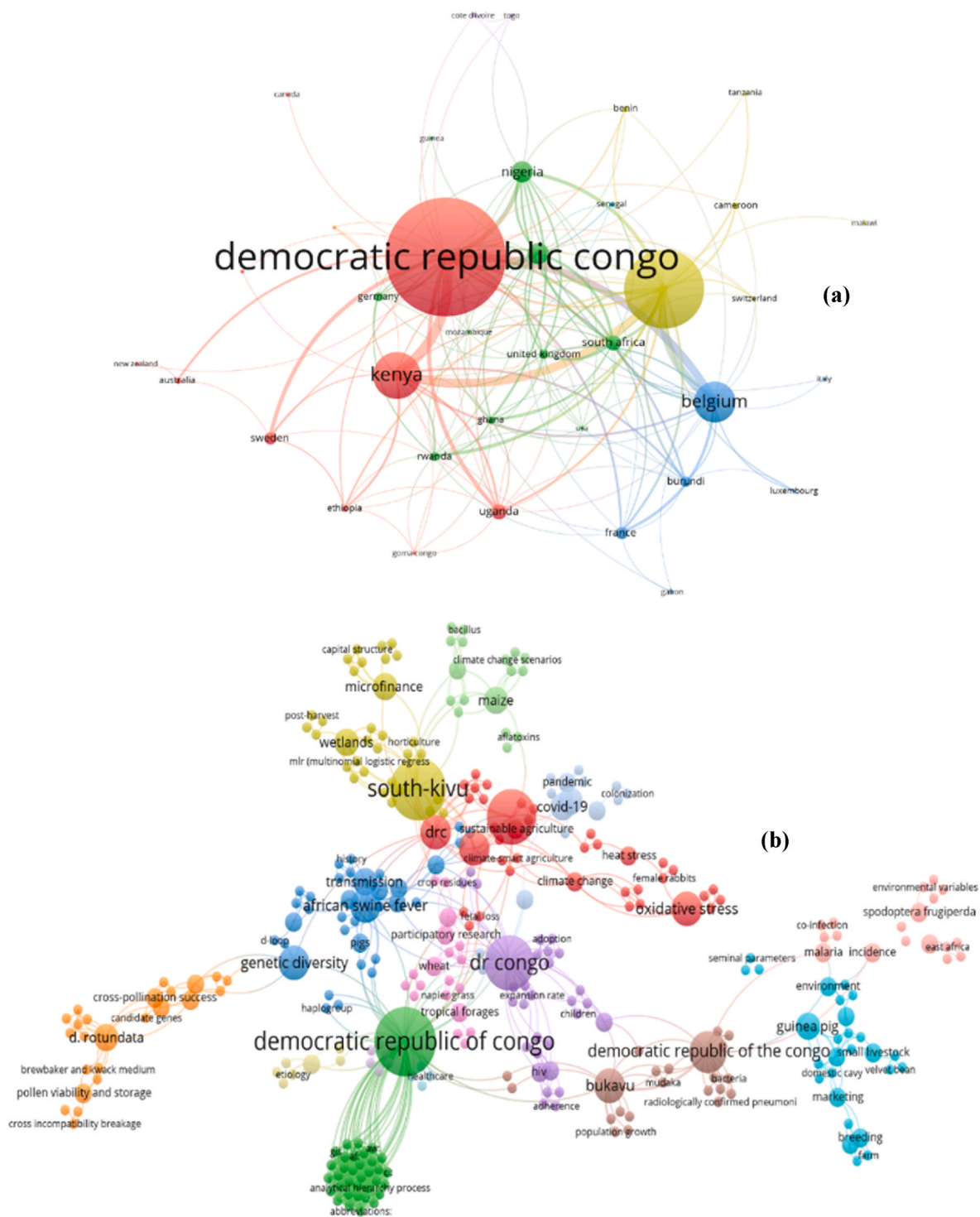


Fig. 5. The partner countries that support UEA Bukavu in research and word cloud of the keywords developed and used by the researchers (the thematic groups are represented by different colors).

encompasses studying the impact of changes in land use and occupation on the services provided by wetlands, the prevalence of pests (especially insect pests), and changes in species abundance. It is also crucial to analyze the response of both animal and plant species to these changes. Although a study has been initiated on the effects of temperature changes on rabbit behavior, there is currently a lack of documentation on other animal species in the area. Additionally, while changes in land use and occupation are mentioned, their consequences on the distribution of ecosystems (e.g., wetlands, mountain forests, agroecosystems,

etc.) remain insufficiently documented. Future research should address these existing themes and bridge the knowledge gaps in the region. It is important to establish multidisciplinary studies that connect the aforementioned themes. For example, exploring the interplay between changes in land use and occupation and the valorization of crop residues, investigating the link between sexual violence in rural areas and declining agricultural production, and understanding the relationship between chronic diseases and patient age. Fig. 5a presents the partner countries of the UEA in research and global wordcloud of keywords

(Fig. 5b).

The additional findings regarding the relationships between authors, institutions, and their collaborations are presented in the supplementary data file. All the results obtained and the hypotheses proposed provide evidence that young institutions like UEA persist in delivering services in education and research within challenging conflict and post-conflict contexts, aiming to enhance institutional visibility.

Although this study highlights the evolution within these institutions, it is important to acknowledge the persistent limitations and constraints they face. These constraints can be of various types and originate from different sources. These comprise changing people's incentives, that attract the best faculty members, need the best leaders. The quality control through hiring, too much change creates no gain by pay a top salary have to be emphasized. Incentive of raising research income and reducing the number of committees, while clarifying the relationship between administrative and academic staff are also few off issues that should be addressed. Senior researchers have also the high obligation to start training junior scholars in management when they are young. Another challenging aspect to address is the role of the government. In fact, other is to tell "no" to government. University leaders should not lie down when things are not going on well but should be able to tell Government so, hire a scholar as a leader. Give the leader plenty of power (or do not bother hiring one) by letting the leader pick his or her own team is also one of issue to address. As mentioned in the beginning of this chapter, supporting students through the financial aid or providing flexibility through digital services, and strategic external partnerships are important keys to reinforce in the future.

While the length of leadership is frequently criticized, it remains an important aspect to examine in the future. Based on finding and discussion made, one can advised that, it is evident that making sure the leader stays at least five years and preferably more for a university leader who is an indicator of positive project development and vision, enabling the successful realization of ambitions and projects. Indeed, in post for much less than five years is unlikely to have the institution's best interests at heart. Nevertheless, the Vice-chancellors should not overstay in an institution for too long.

This study has two limitations. Firstly, the exchanges and discussions mainly focused on a few interactions with rectors/vice-chancellors, professors, and leaders of selected local institutions in the region, predominantly from the DRC, Burundi, Uganda, and Kenya. It was not exhaustive in engaging with all academic authorities from institutions in the region to capture a comprehensive perspective. However, it is noteworthy that the study acknowledges the first author's firsthand experience as the vice chancellor of a young university in the region, as well as his leadership role in a regional organization of university institutions. Secondly, this study exclusively presents the results of UEA publications available in the Scopus database. Other databases, such as Web of Science and JSTOR, may contain additional publications not included in Scopus. However, it is highly likely that the majority, if not all, of the institution's publications are covered by this database.

4.3.1. Study limitation

Discussing the revitalization of institutions in regions with low development rates, poverty, where the main interest is not research-related but rather the utilization of research products, and where political and financial situations, conflicts hinder research and teaching development, it is difficult to assert that all concepts behind the development and enhancement of research in young SSA institutions have been fully documented and demonstrated in this study. Therefore, it is considered here as merely the first step towards establishing criteria for what is being done and could be done in these young institutions. Another constraint may arise from the choice of the case study, which may not reflect the typical vision of an institution in the region. Although these constraints are acknowledged, the study nonetheless merits recognition for providing guidance and direction to other institutions.

Implementing strategies for revitalizing research in universities involves various practical approaches. These include building capacity through training programs for faculty members and staff, developing modern research infrastructure, creating funding opportunities through internal grants and external partnerships, fostering collaborative partnerships with national and international institutions, implementing supportive policies to streamline research processes and incentivize excellence, engaging with local communities through participatory research projects, promoting interdisciplinary collaboration through research centers and institutes, nurturing a culture of research excellence through publication support and mentorship programs, and establishing systems for monitoring and evaluating research outputs. By adopting these measures, universities can strengthen their research programs, elevate their academic standing, and contribute to regional development efforts.

5. Conclusion

Young universities in sub-Saharan Africa (SSA) face the imperative to continuously enhance their programs, teaching quality, and learning facilities in order to effectively compete on a global scale. The competition is intensifying, and achieving a favorable position in world rankings requires concerted efforts. These universities find themselves at a critical juncture and must pursue an agenda that brings about transformative changes in their current state of affairs. To embark on this journey towards excellence, these institutions must prepare and equip the upcoming generation with necessary skills and knowledge for life-long learning. Young universities in SSA can strengthen their institutional position by embracing innovation and continuous improvement. UEA in the DRC serves as a notable example, emerging amidst armed conflicts region to achieve significant development. Despite challenges, UEA has fostered collaborations, nurtured young researchers, and gained global recognition, with a Nobel laureate among its faculty member or alumni, showcasing progress in challenging contexts.

Advocate for the development and implementation of supportive policies at both institutional and governmental levels are however to be suggested. This could include lobbying for increased funding for research, streamlining administrative processes to facilitate research activities, and implementing policies to promote research excellence and innovation. By advocating for conducive policy environments, young universities can create the necessary conditions for research revitalization and sustainable growth. Emphasizing the importance of knowledge sharing and collaboration among universities, research institutions, industry partners, and government agencies must be highlighted. This paper suggests and encourages the establishment of collaborative networks, research consortia, and joint projects to leverage expertise, resources, and infrastructure; while facilitate exchange programs, workshops, and conferences to promote cross-disciplinary collaboration and foster a culture of research excellence. By promoting collaboration and knowledge sharing, young central African universities can enhance their research capacity and address complex societal challenges more effectively.

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N.G. Mushagalusa: Writing – review & editing, Writing – original draft, Project administration, Methodology, Funding acquisition, Conceptualization. **B.G. Chuma:** Writing – review & editing, Writing – original draft, Software, Formal analysis, Data curation, Conceptualization. **M.J. Mondo:** Writing – review & editing, Writing – original draft, Conceptualization. **B.R. Ayagirwe:** Writing – review & editing, Writing – original draft. **S.S. Ndjadi:** Writing – original draft,

Supervision, Data curation. **K. Karume:** Writing – review & editing, Writing – original draft, Validation. **F.M. Ngonjo:** Writing – review & editing, Writing – original draft, Funding acquisition.

Declaration of competing interest

The author declares that there are no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssaho.2024.100974>.

Abbreviations

UEA	Université Evangélique en Afrique
YU	Young University
SSA	Sub-Saharan Africa
CEPAC	Community of Pentecostal Churches in Central Africa
ECC	Eglise du Christ au Congo
UCB	Université Catholique de Bukavu
UOB	Official University of Bukavu
HPI	Higher Pedagogical Institute
SEO	Search engine optimization

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Overall, the analysis performed has enabled us to condense the key elements and findings into the following components described in the paragraph below: We aim to provide a response to the following question: “How to revitalize and establish research in young universities?” Revitalizing and establishing research at Sub-Saharan African universities requires a comprehensive and multifaceted approach. The most key strategies that help in the endeavor are: (a) Investment in research infrastructure as adequate funding should be allocated to universities to enhance their research infrastructure. This includes providing laboratories, research equipment, and resources necessary for conducting high-quality research. It is essential to bridge the infrastructure gap and ensure universities have the necessary facilities to support diverse research disciplines. (b) The YU should focus on capacity building and training by enhancing the research, capacity of faculty members and students is crucial. This can be achieved through targeted training programs, workshops, and seminars on research methodologies, data analysis, scientific writing, and grant proposal writing. Additionally, universities can establish mentorship programs to pair experienced researchers with early-career academics to provide guidance and support. (c) Collaboration and partnerships have to be reinforced. These YUs should ensure collaboration between African universities and international research institutions can foster knowledge exchange, promote joint research projects, and facilitate access to funding

opportunities. Partnerships with industry and government agencies can also create avenues for applied research and address real-world challenges. (d) Another important think is research funding and research ethics and integrity. Indeed, governments, international organizations, and private sector entities should increase funding for research in Africa. Establishing research grants, scholarships, and fellowships specifically targeted towards African researchers can incentivize and support research initiatives. It is important to prioritize long-term sustainable funding that enables researchers to carry out impactful and continuous research. The evidence of collaboration with organizations like RUFORUM serves as a clear indication (Okalany et al., 2016; Uwituze et al., 2016). Upholding high standards of research ethics and integrity is crucial for building trust and credibility (Lochona, 2004; Abolarin & Babalola, 2020). Establishing robust research ethics committees, implementing guidelines for responsible conduct of research, and promoting transparency and accountability in research practices are essential for ensuring the quality and reliability of research outputs. Publications, disseminations, and policy support are also one of the key points to highlight. In fact, encouraging researchers to publish their work in reputable international journals and creating platforms for highlighting African research can enhance visibility and recognition. Establishing open-access repositories and encouraging researchers to disseminate their findings through conferences, seminars, and public lectures can contribute to knowledge sharing and dissemination. Another approach is to enhance the prestige of local journals by implementing stricter scientific standards,

making them more receptive to the global community. Governments should develop supportive policies and frameworks that prioritize research and innovation. This includes providing incentives for universities to engage in research, allocating a significant portion of national budgets to research and development, and creating an enabling environment for intellectual property rights protection.

Finally, enhancing (i) research culture and recognition, (ii) mentorship and collaboration, and (iii) research prioritization is paramount. Cultivating a culture of research excellence necessitates creating an environment those values and acknowledges research contributions. Recognizing achievements through awards, grants, and promotions can inspire researchers and attract talent to academia. Mentorship programs linking experienced researchers with young scholars offer guidance, support, and collaborative opportunities. Encouraging interdisciplinary collaboration within and between institutions fosters innovation and addresses complex research questions. Identifying research priorities aligned with national development goals ensures targeted and impactful research efforts. Engaging stakeholders from various sectors in setting research agendas promotes research addressing societal needs. By implementing these strategies and fostering a conducive research ecosystem, African universities can rejuvenate research as a cornerstone of academic excellence, knowledge creation, and societal development.