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UNIVERSITY-INDUSTRY COLLABORATIONS IN AFRICA: A SYSTEMATIC REVIEW OF BARRIERS AND CHALLENGES TO SUCCESSFUL ENGAGEMENTS

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ABSTRACT

University-Industry collaborations in Africa have been identified as a vital component for economic growth, job creation, driving innovation, and societal development. The study aimed at identifying the barriers and challenges to successful university-industry collaborations in Africa. The study adopted a systematic review method. Following a search of the Google Scholar database and application of the exclusion criteria, 33 relevant articles were selected for an in-depth analysis. The review categorized barriers into Contextual barriers, university-related barriers and industry-related barriers. The study concluded that inadequate resources are a major barrier that affects the ability to implement partnerships, and hampers the trust and confidence of industries in collaborating with universities. Additionally, financial and human resource constraints can affect the ability of SMEs to form partnerships with universities. In addition, the role of governments is crucial in encouraging university-industry collaborations, in keeping with the concept of the Triple Helix model. The government needs to craft policies that encourage firms to collaborate with universities while providing tax incentives to those industries that have such collaborations. Furthermore, the government can enhance the development of university-industry collaboration through a direct role in providing funds for universities and R&D projects and a regulatory role that shapes intellectual property rights. Finally, the service sector and SMEs offer underutilized opportunities for partnerships with universities. Areas of future research were also discussed.

Keywords: Barriers, Challenges, systematic review, collaborations, university-industry, Africa

INTRODUCTION

Universities and businesses have always played separate and autonomous roles, but the significant changes in technology, the global economy, the environment, and society demand active collaboration, where knowledge transfer flourishes on the synergies created by their contacts. Universities have long been recognized as society's knowledge producers and repositories. A university's primary goal has always been to produce, share, and use knowledge while providing top-notch instruction and research to benefit the community and society. However, internal and external market demands have reframed the professed value of university activities and practices (Kadhila, Malatji. & Malatji, 2024; Ankrah and Al-Tabbaa, 2015; Rybnicek and Konigsgruber, 2019; Onyancha, 2024). To remain relevant and respond to contemporary community and global needs, higher education institutions

have had to strengthen and diversify how they engage with and serve the needs of society, stakeholders, partners, and the community (Boland, 2011).

Currently, partnerships and engagements are acknowledged and embedded in many universities' operations, functions, and missions (Rybnicek & Königsgruber, 2019). Partnerships have been defined as 'a deliberately designed, collaborative arrangement between different institutions, working together to advance self-interest and solve common problems' (Goodlad, 1988). Other broad definitions suggest that partnerships are considered a 'collaborative effort between two or more institutions of higher education, businesses, or social agencies, to obtain a shared objective' (Eddy, 2010). These joint ventures are referred to by many other terms, including collaborations, strategic alliances, joint ventures (Eddy, 2010), and academic engagements (Perkmann & Salter, 2012).

There are many positive benefits in forming partnerships for universities and industry alike (Atta-Owusu et al., 2021). Partnerships can support innovative teaching (Mamdani,2016); increase funding (Chapleo & Simms, 2010); contribute to research, teaching, and infrastructural development; and build knowledge transfer (Freeman et al., 2017). For industry, partnerships can aid future recruitment; provide access to new thinking and ideas, emerging research and practice; and leverage internal research capabilities (Rybnicek & Königsgruber, 2019). The benefits documented in the literature include mutual economic and research benefits, increased collaboration, and bridging the gap between theory and practice (Bodas & Verspagen, 2017; Falqueto et al., 2020; Ferns et al.,2019; Grudnoff et al., 2017; Harms et al., 2017; Law et al., 2021). Whilst there are many benefits to partaking in a partnership, there are also some common barriers experienced in partnerships.

Multinational companies can benefit from university-industry partnerships, to access student talent through industrial attachment, tax exemptions, and grants, and the financial and innovative advantages from early-stage research and development. Small and medium-sized enterprises (SMEs) seek to benefit from short-term gains such as product development, access to markets, and solutions to immediate problems or challenges (Ankrah and Al-Tabbaa, 2015; Perkmann, 2011; Tereschenko, Salmela, Melkko, Phang & Happonen, 2024; Marinho et al., 2020; Yusuf & Nabeshima, 2007).

Objectives of the Study

This study uses a systematic literature review to explore the barriers and challenges hampering successful university-industry collaborations in Africa. Extant literature reviews have analyzed the barriers and challenges hampering successful university-industry collaborations. However, the reviews have mainly enhanced the visibility of literature on university-industry collaboration in developed countries. Literature on university-industry collaborations in Africa is scarce and the reviews grounded on conceptual and empirical studies from Africa are less visible (Sassi & Mshenga, 2024; Zavale and Langa, 2018). This study seeks to fill this gap by reviewing the current literature on barriers and challenges to university-industry collaborations in Africa. The wide coverage of this study does not appear to have been previously reported in the literature, as most reviews have concentrated on Sub-Saharan Africa at any one time. Secondly, the

review focused on both university and industry barriers as well as contextual barriers, which gave a comprehensive view regarding university-industry collaborations. Importantly, the review provides gaps in the literature and suggests several avenues for future research. The review was practice-relevant as it provided insights on the barriers that hamper effective collaborations so that partnered organizations can develop strategies to counter the barriers.

The systematic literature review generated robust data needed to examine the following research questions:

RQ1: What are the forms of university-industry collaborations in Africa?

RQ2: What are the barriers and challenges of University-Industry collaboration in Africa?

RQ3: What are the implications for future research suggested by the findings?

METHODOLOGY

The study adopted a systematic literature review method. Systematic literature review establishes the state of current knowledge in the field (Hajrizi and Shaqiri, 2024). The study identified filters utilized were English only, with publication years from 2015 to 2024. The data collection started with the framing of the keyword selection. Several keywords, their combinations, and the value of the results for the study were tested and evaluated. Initial suggestions included "industry-university collaboration", "academic engagements", University-Industry interactions, University-Industry linkages, and "academia-industry" in Africa. The initial search of published peer-reviewed articles on barriers to university-industry linkages held by the Google Scholar database yielded 2,300 peer-reviewed journal articles. Databases such as Scopus, PsycINFO, Journal Storage (JSTOR), ScienceDirect, and Wiley were excluded.

The study imposed an exclusion criterion to confirm that a rigorous and correct dataset was obtained. Books and other forms of publication to avoid double-counting, including only peer-reviewed journal conceptual and empirical studies as well as conference proceedings, were removed from the list. Including only peer-reviewed papers ensured the quality and credibility of the reviewed papers. Papers that did not discuss university-industry partnership or collaboration in Africa were also excluded. The search was further reduced by excluding quadruple and quintuple papers. A final keyword list was derived for the data collection phase following multiple rounds of the above iteration. The screening phase of full papers removed contexts outside the scope, leaving 34 journal articles that formed the final sample.

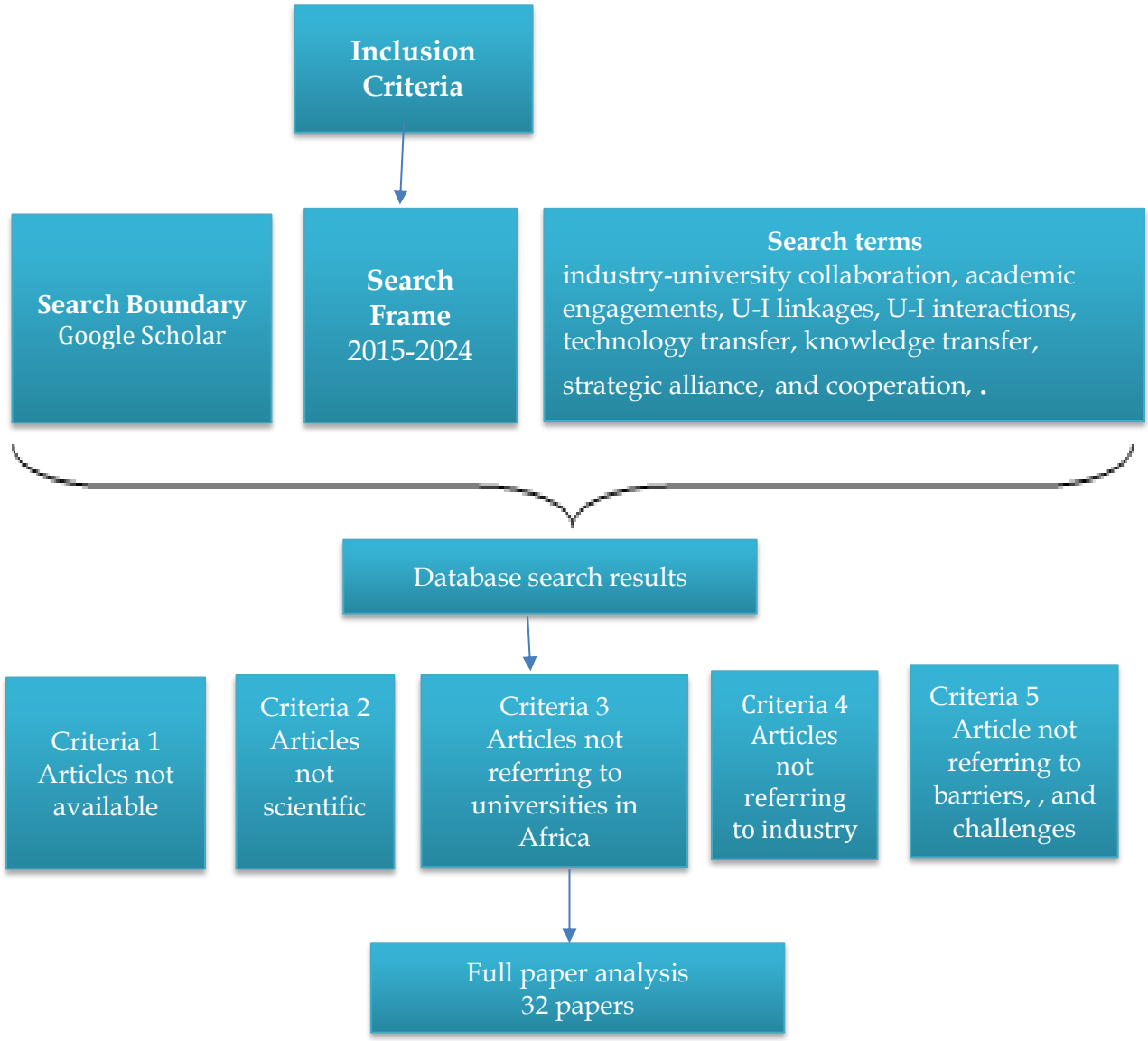

Figure 1: *Systematic Review adapted from Hajrizi and Shaqiri (2024)*

DATA ANALYSIS

After the data set was established, the study used a framework analysis (Ritchie & Spencer, 1994) which involved: (1) familiarization with the data, (2) identification of codes, (3) categorization of the themes namely contextual barriers, university-related barriers and industry-related barriers, (4) charting of data in a tabular of graphical format, and (5) mapping and interpretation of data

FINDINGS

Demographics of Selected Studies

The study categorized 34 studies based on the year of publication, methods used, and geographical location of the university-industry partnership.

The findings in Figure 1 indicated that there has been a rise in the number of paper

publications between 2015 and 2018, and a drop in 2019. Thereafter, there was an increase in 2020 and a steep decline in publication thereafter until 2023. There was a steep increase in the number of publications in 2024. The findings also revealed that a large proportion of the reviewed papers were published from 2020 onwards.

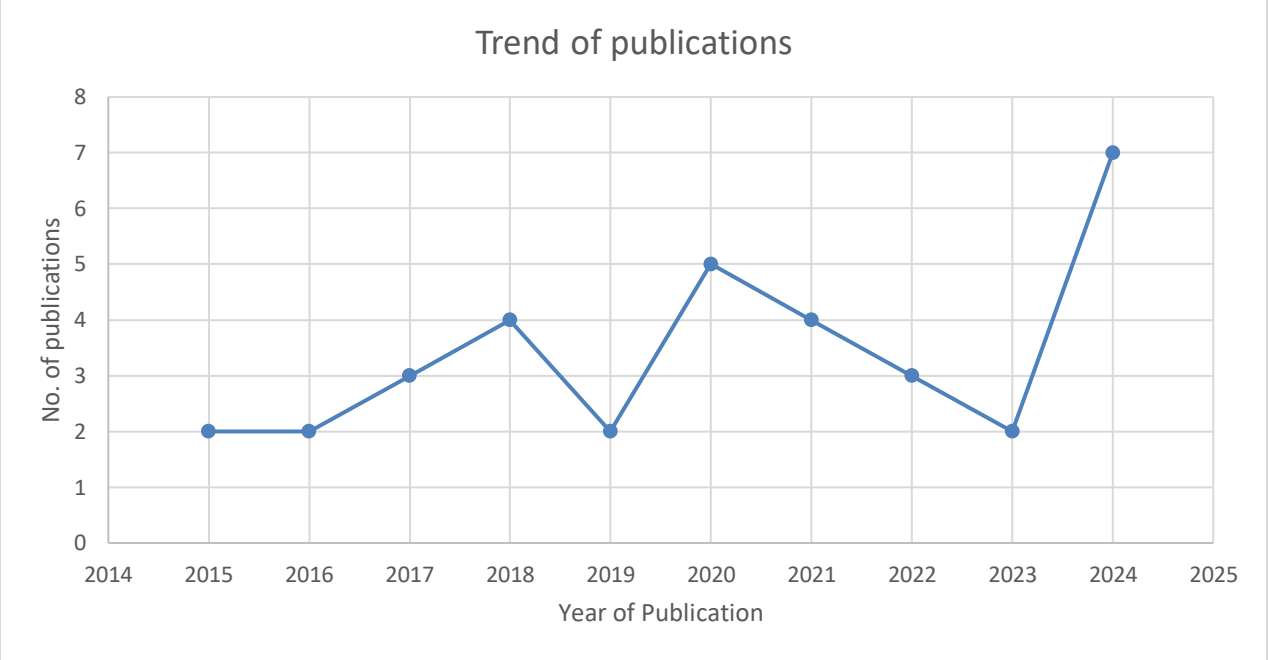

Figure 2: Publication trend for UIC

As regards the methodology adopted by the existing literature included in this review. The study findings as shown in Figure 3, revealed that the majority of the selected papers were empirical studies (85.3%), which employed qualitative, quantitative, mixed-method, and case study approaches, and conceptual publications accounted for 14.7%. The conceptual studies methodologies utilized inductive analysis, data development analysis, and meta-analysis.

With respect to geographic distribution, the majority of studies, as shown in Table 1, were carried out in Ethiopia (6 in total) followed by Nigeria (4 in total), which studies highlighted barriers and challenges from the perspective of academic staff, universities, and industry. The remaining nineteen studies were done in Uganda (3 in total), South Africa (3 in total), Ghana (2 in total), Zimbabwe (3 in total), and Kenya (2 in total). Rwanda, Botswana, Mozambique, Egypt, and Angola had only one article each across the reviewed literature. Six studies examined university-industry collaborations from the perspective of several African countries.

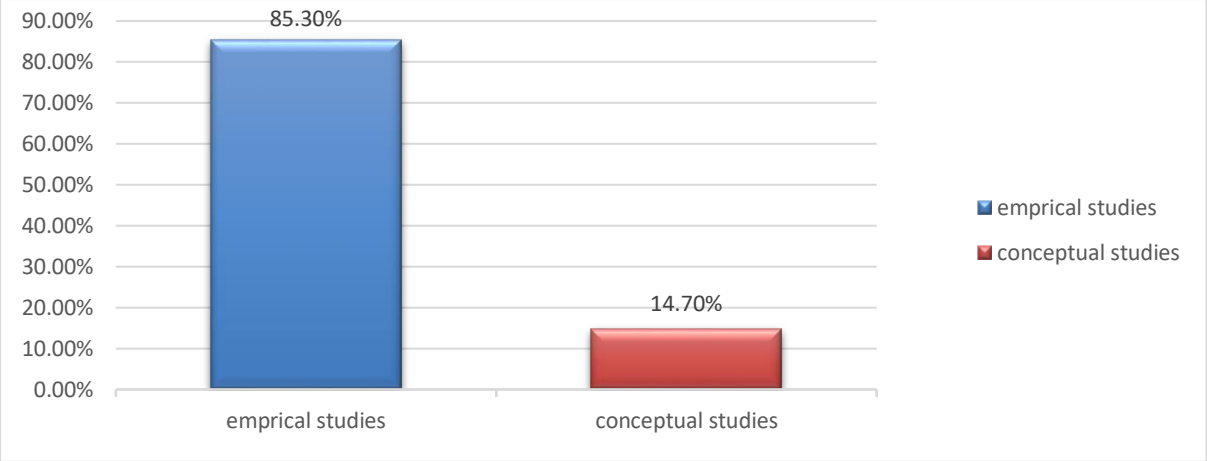

Figure 3: Methodology adopted by reviewed studies

Table 1: Number of Publications per Country

Country	**Number of Publications**
Ethiopia	6
Nigeria	4
Uganda	3
South Africa	3
Ghana	2
Zimbabwe	3
Kenya	2
Rwanda	2
Botswana	1
Egypt	1
Angola	1
Multiple countries	4
TOTAL	34

THEMATIC ANALYSIS

The study coded the selected studies around the research questions. For each research question, common features shared across multiple studies were coded and categorized into several themes. The barriers and challenges hampering successful university-industry collaborations were categorized into three: university-related barriers, industry-related barriers, and contextual barriers.

The review is not without limitations. Firstly, it is limited by the biases introduced as part of the inclusion and exclusion criteria for the selected studies. The review included full papers from 2015-2024 and considered only empirical and conceptual studies. It excluded potentially contributive theses and dissertations, books, non-English studies, non-academic reports, perspective articles, and opinion pieces which could contain more useful information. Secondly, the study narrowed the scope by considering studies found only in the Google Scholar database, excluding all other databases. Finally, the study categorized the barriers and strategies hampering university-industry collaborations in Africa into

specifically university-related barriers, industry-related barriers, and contextual barriers. The categorization excluded government related barriers. This study provides valuable information for the academic world, especially for university-industry collaborations in Africa.

FINDINGS

Forms of university-industry collaborations in Africa

The study found as shown in Table 2 that majority (48.3%) of the empirical studies were investigating barriers that hindered successful Teaching and Learning (T&L) partnerships in universities, another 27.6% focused on both T&L partnership and Research, Development and Innovation (RD&I) partnerships, while only 24.1% sought to understand the barriers and challenges facing RD&I partnerships.

Table 2: Forms of Partnerships discussed in Empirical Studies

Types of Partnership	Frequency	Percentage
T&L	14	48.3
RD&I	7	24.1
Both (T&L and RD&I)	8	27.6

The findings found that Teaching and Learning partnership efforts in the said universities included staff exchanges, short-term internships, work placement training of industry personnel, seminar and conference participation, graduate employability joint research publications, agricultural advice services, engineering service, consultancy services, scholarships curriculum development, continuing professional development, and joint supervision of PhD and Master's thesis. The purpose of Teaching and Learning partnerships was to support teaching and curriculum agendas to ensure that graduates are work-ready and are prepared to contribute to the social and economic prosperity of the nation.

The findings also revealed that the most popular collaborations were joint research, student placement, seminar and conference participation, research publication, training, and consultancy. Non-traditional forms of industry involvement in cloud sourcing, logistic optimization, networking, strategic co-funding, and strategic alliances were also discussed in Murairwa's (2021) study.

The Research, Development and Innovations (RD&I) collaborations discussed by the reviewed empirical papers included contract research, the co-development of new technologies, prototyping, patenting and IP licensing, incubation, technology transfer, creation of spin-offs, joint commercialization, industrial parks, and the development of international consortia for collaborative R&D.

Barriers and Challenges of University-Industry Collaborations

The study unraveled some major barriers and challenges to university-industry

collaborations in Africa. The study categorized the barriers into contextual barriers, university-related barriers, and industry-related barriers as shown in Table 3.

1. Contextual Barriers

The contextual barriers stem from the differing priorities and operational cultures of academic institutions and industries. Studies reveal that one of the significant barriers to university-industry collaboration is the misalignment of interests and expectations (Outambia & Belhcen, 2020; Kombo & Mwangi, 2018; El Hadidi & Kirby, 2017). Universities typically focus on long-term strategic partnerships, professional gains, students' learning processes, and academic freedom. Industries, on the other hand, are interested in applied research that leads to new or improved goods and services that can subsequently be produced on a large scale (Kitagaana, 2018; Alexander, Martin, Manolchev, & Miller, 2020). This leads to frustration as academic researchers struggle to align basic research and laboratory work with the immediate needs and expectations of industry partners, resulting in a lack of productive collaboration (Alexander, Martin, Manolchev, & Miller, 2020).

In academic settings, there is a strong emphasis on the dissemination of knowledge and open access, which often clashes with the proprietary interests of industry partners. Studies reveal that universities prioritize the publication of research findings to enhance academic reputation (Danquah, Onyancha & Avuglah, 2024), while industry partners seek to safeguard proprietary information to maintain competitive advantage (Siegel et al., 2003). The perceived risk of losing control over innovations can deter industries, especially in biotechnology, agribusiness and phytomedicine from embarking on collaborative projects that may otherwise yield substantial mutual benefit. The absence of formal definitions and cohesive legislative structures can lead to regulatory discrepancies and uncertainties (Razwinani, Tshikovhi, & Motaung, 2024)

Moreover, it can result in legal negotiations over IP rights that are protracted and complex, leading to a reluctance among industries to fully engage with academic institutions (Nsanzumuhire, Groot, Cabus, & Bizimana, 2021; Mafu, 2023). This fundamental clash can create obstacles in negotiations over intellectual property rights and licensing agreements, which may discourage potential collaboration (Mafu, 2023). Furthermore, weak institutional capacity to implement reforms at the national and regional levels, and the bureaucratic nature of many universities, slow down the process of establishing partnerships, as institutional regulations may require extensive negotiation and approval processes before any collaborative efforts can begin (Degaga, Abaineh & Senapathy, 2021).

2. University-related Barriers

Studies indicated that universities lack the institutional capacity to carry out successful university-industry collaborations. Many university-industry collaboration efforts in Africa suffer from chronic underfunding from the government and university management (Kitagaana, 2018; Murairwa, 2021; Razwinani, Tshikovhi & Motaung, 2024). A study by Degaga and Senapathy (2021) revealed that the budget for research accounted for only 1% of the universities' total budget in Ethiopia. Inadequate and unsustainable budget allocations hinder the ability of universities to engage in comprehensive research projects that meet industry needs. In addition, scarce resources mean scaled-back programmes,

diminished outreach to industry partners, and an overall inability to maintain cutting-edge curricula that foster the relevant skills needed for collaboration (Razwinani, Tshikovhi, & Motaung, 2024; Etamaru, Bisaso & Nakayiwa-Mayega, 2022). As a result, industries find it less compelling to engage with universities, perceiving them as unable to deliver the necessary expertise or results.

Studies also show that staff who run university-industry linkage offices or technology transfer offices have poor mastery of what is happening in the industry. Specifically, academic staff and researchers lack the technical and entrepreneurial skills necessary skills needed to navigate the commercialization landscape (Nsanzumuhire, Groot, Cabus, & Bizimana, 2021), leading to a gap in understanding how to effectively translate their research into products or services that industry stakeholders find valuable (Razwinani, Tshikovhi and Motaung, 2024; Kombo & Mwangi, 2018). In many universities, academic staff and researchers have relatively young ages and are inexperienced, which affects their interaction with the industry players effectively (Degaga and Senapathy, 2021; Kitagaana, 2018). This is in contrast to developed economies, where collaboration efforts are pursued by well-established senior researchers who work more prolifically with industry collaborators.

In addition to the lack of expertise, absence of well-established research infrastructure and physical facilities dedicated to research development and innovation, including laboratories, science parks, technology incubation centres, and testing facilities that could attract potential industry players (Murairwa, 2021; Degaga, Abaineh & Senapathy, 2021; Mulu, 2017). For universities, lack of dedication to engage with industry has been identified as a barrier to university-industry collaborations. A study by Kombo and Mwangi (2018) found that academic staff and researchers felt that at times, they would work hard in developing partnerships but would sometimes be left out when the institutions began to reap from the collaborations.

The reward and recognition system in African universities tilts the interests and efforts of the academic staff towards traditional discipline-based research activities. Failure to equitably incentivize partnership efforts has led to apathy by academic staff and scientific outputs taking precedent over outputs targeting industries or the community (Bidandi, Anthony, & Mukong, 2022; Nsanzumuhire, Groot, Cabus, & Bizimana, 2021). A study by Shittu, Owodunni and Olugasa (2019) found that academic staff across faculties in the University of Lagos paid little to no attention to commercialization, licensing of patents and establishment of spin-off companies that meet industry needs.

Finally, a heavy academic and administrative workload (Ayenew & Teklay, 2017; Shittu, Owodumni & Olugasa, 2019), internal misunderstanding and animosity amongst academic staff (Allu-Kangkum, & Ebohon, 2018), high attrition of experienced researchers and academic staff (Degaga, Abaineh & Senapathy, 2021), and an irrelevant curriculum that does not prepare students for collaborations affect collaboration performance (Alexander, Martin, Manolchev, & Miller, 2020; Nsanzumuhire, Groot, Cabus, & Bizimanan, 2021).

3. Industry-related Barriers

Industry-related barriers to university-industry collaborations often vary significantly between multinational corporations (MNCs), large companies, and small and medium-sized enterprises (SMEs), each facing unique challenges based on their operational structures and strategic objectives. For MNCs, a major barrier is the complex internal bureaucracy and the distinct management layers that can complicate decision-making processes regarding partnerships with universities (Lopes & Lussuamo, 2021; Alexander, Martin, Manolchev & Miller, 2020). The priorities of MNCs are often centered on global market strategies and immediate financial returns (Akenroye, Abubakre, Elbaz, Vishnu, Beka Be Nguema, Rana, & Falode, 2022; Allu-Kangkum, & Ebohon, 2018). Decisions on where to invest in R&D are made at the headquarters. Hence, partnerships are rarely made with local universities of the patent companies. Furthermore, multinationals are not interested in investing or collaborating with local academia, as they perceive them as poorly prepared to handle challenges presented by the knowledge economy (Adepoju& Adedeji, 2015; Degaga, Abaineh & Senapathy, 2021).

In contrast, SMEs focus on immediate operational needs and may not prioritize long-term research initiatives that do not yield quick returns. Additionally, SMEs may lack the human resources needed to dedicate personnel to work closely with academic teams, thereby missing out on the potential benefits of these partnerships. Another barrier is the fear of exposure to regulatory authorities, which undermines trust and hinders the development of successful collaborations (Mudzimba & Dube, 2024). SMEs that lack a scientific approach to problem-solving may experience difficulties in accessing funding and support from universities, which can be unintentional but reinforces the perception that academic institutions are more geared toward collaborating with larger, more established firms (mudzimba & Dube, 2024).

A major barrier that affects university collaborations with large companies is the knowledge of the university and what it could offer (Adepoju and Adedeji, 2015). Studies revealed that large companies did not know what the university could offer because of a lack of information or the lack of quality of information provided by universities (El Hadidi, & Kirby, 2017). On the other hand, universities have no platforms where they can communicate with firms or discuss potential partnerships (Outamha & Belhcen, 2020). Another barrier discouraging large firms, especially industrial firms from interacting with universities is the perception that universities do not have a thorough understanding of their line of business and their lack of practical knowledge. Industrial firms generally perceive that universities have little to offer, as the quality of research in the universities is low (Kayondo & Kamondo, 2024).

DISCUSSION

The systematic literature review focused on 34 full papers. The review established that university-industry collaborations in Africa are intended for Teaching and Learning, and Research, Development, and Innovation partnerships. The emphasis on publications on Teaching and Learning, which is the economic business of universities, may be due to pressure on universities to increase the employability and skills of their graduates, and the need to improve curriculum outcomes. To remain relevant and respond to societal and industry needs, universities must prioritize research, development and innovation.

Secondly, the findings revealed that scarce, unsustainable, and restricted resources were a major barrier for universities as well as industry. The lack of resources affected the ability of universities to implement partnerships with industry, hampered the trust and confidence of multinational companies and large industries in collaborating with universities. In addition, it affected the ability of SMEs to form partnerships with universities. Thirdly, Ethiopia accounted for the majority of the publications available on university-industry collaborations in Africa. This means that most of the African countries are underrepresented in research outputs. Finally, the review highlighted the unique challenges of university-SME partnerships. Universities, governments, and funding bodies should develop strategies that enhance these partnerships, cognizant of the fact that the majority of firms in Africa are SMEs.

IMPLICATIONS FOR FURTHER RESEARCH

The review will offer insights into research on university-industry collaborations in Africa that can inform future research directions. However, the review may not be relevant and applicable in situations where university-industry collaboration efforts are well-resourced and structures and systems have been established. As such, further research should examine the barriers and challenges facing established university-industry collaborations in Africa. The role of government is crucial in encouraging university-industry collaborations, in keeping with the concept of the Triple Helix model. As such, further studies should be done to understand the government-university-industry relationship.

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