

# The state of embedded librarianship in the university research processes in selected African academic libraries

Anna Leonard

*Department of Library, University of Namibia, Windhoek, Namibia*

Josiline Chigwada

*School of Interdisciplinary Research and Graduate Studies (SIRGS),  
University of South Africa, Pretoria, South Africa, and*

Gilbert Mushi

*Sokoine University of Agriculture, Morogoro, Tanzania*

## Abstract

**Purpose** – This study aims to examine the state of embedded librarianship in African academic libraries by exploring the extent of librarian embedment in research processes in selected academic libraries in Africa.

**Design/methodology/approach** – A survey was conducted to collect data using an online questionnaire. The study population was comprised of librarians who directly support researchers throughout the research process in the scholarly communication and information services sections. Purposive sampling was used to select librarians, and 63 responses were received from the target of 100. The collected data were analysed using the statistical package for the social sciences (SPSS) software, and content analysis was used to analyse open-ended questions.

**Findings** – The study results showed that the extent and nature of librarians' embeddedness in the research process vary across different university contexts in Africa. Challenges and areas of research skill gaps among librarians were identified, and propositions to address the research skill gaps were provided.

**Practical implications** – The study findings can be used as a framework for libraries to embed librarians in the research process. The study made recommendations with practical implications for library practitioners in academia, and institutions offering library and information science education, and the library management responsible for the research process.

**Originality/value** – A study brings a novel perspective by examining the state of embedded librarianship in the African context. Its contribution generates knowledge and insights that inform the development of effective embedded librarianship practices in African academic libraries to enhance research support services and advancement of scholarly research in the region.

**Keywords** Embedded librarian, Research embedded librarianship, Library user research, Faculty-librarian collaboration, Research partner, Research support, Academic libraries, Research libraries

**Paper type** Research paper

## Introduction

The concept of “embedded librarianship” has been a focal point of discussion within the library context for over a decade now, and it is considered a feasible route for the future of the profession (Bonanni and Vogus, 2022; Mushi *et al.*, 2022; Luca, 2019; Rowland *et al.*, 2014; Knapp, 2012). The emphasis on “embedded librarianship” emanates from the advancement of



information and communication technology, which has changed the mode of learning, information-seeking behaviour, the nature of scholarly communication, and publishing models that require new skill sets and competencies for the library user community (Mushi *et al.*, 2022; Chigwada, 2020). In addition, the demand for embedded librarianship in academic institutions is exalted because of the expectations for higher education institutions to produce students with transferable skills beyond the discipline competency (Burke and Tumbleson, 2016; Dewey, 2004; Ivey, 2003). Lifelong learning has also signified the need for collaborative efforts in academic institutions as well as responding to higher education development and challenges such as the rise of online learning, the increasing use of open educational resources, the need to improve digital literacy and the focus on student success (Burke and Tumbleson, 2016). Establishing strong work relationships between stakeholders is prevalent, especially among librarians, students, academics and researchers who need the librarian's information expertise. Against this background, the study aimed to explore the nature and extent of the embedment of librarians in research structures and processes in academic libraries in Africa. The study sought to answer the following objectives:

- (1) To determine the extent to which librarians are embedded into the research process in academic libraries in Africa;
- (2) To explore the nature and areas of embedment of librarians in research in African academic libraries;
- (3) To determine the competencies of librarians for embedment in research; and
- (4) To investigate the challenges faced by research-embedded librarians in academic libraries in Africa.

## Literature review

### *What is embedded librarianship?*

Embedded librarianship is taking librarians out of the library building and creating a new operational environment that encourages strong collaboration between librarians and researchers and teaching faculty who need an expert information provider (Pati and Majhi, 2019). The notion of embedded librarianship in academic librarianship is complex and diverse, and it involves increased interaction, collaboration and integration with the target community in addressing the strategic functions of an academic institution (Deja and Wójcik, 2021; Pati and Majhi, 2019). These issues are critical to teaching, learning and research, as well as the innovation and development of an academic institution. However, literature on embedded librarianship has mainly emphasised undergraduate course-specific support (information literacy), co-teaching and being physically attached to a specific academic faculty and department (Deja and Wójcik, 2021; O'Toole *et al.*, 2016). As such, literature on embedded librarianship beyond information literacy and physical attachment is a limited area of discussion in the available literature (Hoffman *et al.*, 2017).

Research is one of the key strategic directions for universities and higher education institutions, to which librarians can contribute. Librarians' roles have been transformed as new evolving responsibilities for librarians have been developed, centred on the different phases of the research cycle, such as bibliometrics, research evaluation, research support services, research data literacy and data management services and data visualisation support. Moreover, lately, there has been an emphasis on the need for skilling and re-skilling librarians to provide effective research support services (Brewerton, 2012; Mamtora, 2013; Onyancha, 2018). Recent literature, such as Burress *et al.* (2020), Hoffman *et al.* (2017) and Rowland *et al.* (2019), has shifted the focus of discussion from library research support to embedding librarians in the entire research cycle and processes. Embedding librarians

in academic research settings includes aspects such as providing references in high-traffic spaces across campus, providing research skills, collaborating in research projects with faculty, participating in learning and research policy development, participating in course programme development and assessment, co-teaching and providing workshops and webinars (Adams *et al.*, 2016; Burress *et al.*, 2020; Hoffman *et al.*, 2017). Furthermore, embedded librarian support can include identifying grant opportunities, assisting in grant writing, research data skill training, data management support (Burress *et al.*, 2020), collaborative systematic and scoping review and support and co-publishing with faculty members (Borrego *et al.*, 2018; Rowland *et al.*, 2019).

Furthermore, embedding librarians in research increases the frequency and depth of librarian-faculty interactions and enables a better understanding of the faculty's research needs through direct observation (Carroll *et al.*, 2020). The value additions and contributions of librarians in the research process are not deniable; that is why recent studies are advocating for the embedment of librarians into the entire research lifecycle and processes (Carlson and Kneale, 2011; Carroll *et al.*, 2020). Although there is excellent use and advocacy for embedded librarianship in academic institutions, the level of embedment differs amongst departments and librarians and approaches to embedment also differ based on the institutional context (Clyde and Lee, 2011) and the needs of the academic and research communities (Carlson and Kneale, 2011). Although embedding librarians into research processes accords them an opportunity to prioritise the skills they need to develop and be able to identify tools that may have implications for the research group (Carroll *et al.*, 2020), there are limited studies on librarians' embedment in the research process (Burress *et al.*, 2020; Hoffman *et al.*, 2017; Rowland *et al.*, 2019), especially in Africa.

#### *Role of the Librarian in the research process*

An embedded librarian can quickly adapt and integrate various research workflows and assist researchers throughout the research process. The person blends the roles of a researcher and a traditional librarian. Embedded librarianship helps librarians demonstrate their expertise in information finding and dissemination, leading to stronger connections and relationships between researchers and librarians (Chigwada, 2020; Carlson and Kneale, 2011). The library is becoming irrelevant, so librarians should be embedded in the research process to remain relevant to the research community they serve (Allen and Seaman, 2010). Furthermore, embedded librarians' duties include developing integrated learning modules for in-person or virtual courses, offering in-depth research support to academics, researchers, or students at all levels, and co-locating within colleges, research units, or customer units during office hours for a few to all of the week (Schulte, 2012).

#### *The extent of embeddedness in the research process*

During the research process, librarians work directly with researchers by collaborating on research projects as part of the research team. The librarians work with lecturers to develop their course materials and provide library resources to students throughout the course (Southern Wesleyan University, 2022). The librarian does not wait for the final product to be produced at the end of the research life cycle. However, they are part and parcel of applying the various information science practices to the research process (Ketchum, 2017). A librarian can work with data during the research process, where she or he assists with research data management services from when the researcher is applying for a grant until the data is archived and shared for reuse. For project-based embedded librarianship in the research process, the librarian should be able to identify the research needs of the faculty where librarians are partners in the research project (Carlson and Kneale, 2011). Furthermore, Brown *et al.* (2018) reviewed the evolution of research support services in academic libraries

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and discovered that librarians have skills in literature review, project management, research methods and data analysis. On the other hand, Borrego reviewed papers co-authored with librarians to assess their contributions and determine their skill set. It was discovered that librarians collaborating with researchers in writing papers are skilled in bibliometrics, meta-analysis, scoping and systematic reviews across the globe (Borrego *et al.*, 2018).

#### *Nature and areas of embedded librarianship in research*

The librarian is supposed to work with small groups of specialised users outside the physical library with significant involvement in their research topics and workflows. Robinson-Garcia and Torres-Salinas (2011) summarised the tasks of embedded librarians as follows:

- (1) Active mediation in publishing research papers where the librarian is responsible for managing drafts, preparing preprints and post-prints, sending articles for publication and communicating with journal editors.
- (2) Disseminating the publications, results and activities through developing strategies for promoting and disseminating papers, and open-access publishing, considering the copyright policy.
- (3) Organising and preserving research and study materials, data sharing and curation and developing data preservation policies.
- (4) They manage different researchers' platforms, such as online journals, funding agencies and curriculum management systems.
- (5) Support researchers and institutions in improving and reporting their productivity, visibility and impact of their research, such as by generating bibliometric reports and providing career development advice regarding research and publication policies.

The embedded librarian can offer research assistance by looking for information sources for the literature review and creating research guides that can be utilised throughout the research process (Pospelova *et al.*, 2018). In addition, librarians can assist researchers through information literacy programs by teaching them how to access various information resources and cite and reference them correctly. They can also participate in scholarly journal evaluation, develop bibliometric indicators and methodologies and evaluate science and research policy (de Jager *et al.*, 2016; Onyancha, 2018). The librarian's embedding in the research process is at its infancy stage in Africa (Machimbidza *et al.*, 2022; Mushi *et al.*, 2020a, b). There are limited services provided for research profiling, systematic and scoping reviews and research profiling (Shin, 2021). Studies such as Mushi (2021), Mushi *et al.* (2022) revealed that there is low adoption of RDM services in Africa.

#### *Librarians' competencies in the research process*

The research ecosystem is dynamic and continuously changes with technological advancement, resulting in complex research systems and processes. Librarians working in this ever-changing environment are presented with great opportunities for new and evolving roles. However, they need to be equipped with skillsets and knowledge in the evolving areas of embedded librarianship and complex research systems to remain relevant in the life of a researcher. Embedding librarians in research requires a strict selection process because librarians have high competencies in most areas of the research lifecycle and emerging research systems and tools such as proposal writing, data identification and management, data analytics and visualisation tools, information searching and systematic reviews are highly qualified for adequate embedment in research (Bernstein *et al.*, 2020; Mensah and

Owusu-Anasah, 2018). Some studies conducted in Nigeria by Mushi *et al.* (2022) and Mushi (2021) found that librarians are well-versed in communication and interpersonal skills, which are critical in order to embed and interact with researchers effectively. However, they have inadequate skills in the research cycle and lag in their understanding of trends in research practices. Shin (2021), in his study to assess the competencies of librarians embedded in the research process in South Korea, discovered that librarians have skills and knowledge at different stages of research processes.

### *Challenges faced by embedded librarians in the research process*

Librarians need to keep up-to-date with the users' needs to avoid losing touch between librarians and researchers. Because the information-consuming behaviour of researchers has shifted to the internet, they are no longer consulting librarians (Robinson-Garcia and Torres-Salinas, 2011). It has also been noted that librarians face the challenge of getting traction in the initial stages. In order to deal with that, there is a need to assess the readiness of the library staff and the organisation. This entails starting small by focussing on those who understand the concept as a pilot, then showing the value of the process, then scaling up, focussing on understanding faculty needs and not necessarily promoting the idea, and seeing how the faculty is facing challenges in knowledge discovery, information analysis and information management, then seeing how the librarians can help; and building relationships first by getting to know the people through doing things that are not related to library work as a way of winning them (Sharma *et al.*, 2014).

Librarians also need more resources and support from management. It is, therefore, essential to get more resources by advocating for an increase in the budget. There is also a need to strategically position staff and their responsibilities and give them value-added tasks. During staff re-organisation, there is a need to counsel staff as they adjust to their new duties (Sharma *et al.*, 2014). The librarian should prioritise opportunities and work with those that would impact the organisation's mission. There is a challenge of feeling isolated among librarians who might be too embedded, and library directors should be proactive by keeping embedded librarians connected with central library operations. The low adoption of emerging and research-tailored services in African libraries could be attributed to a lack of technology, the legal environment (Machimbidza *et al.*, 2022) and skills and knowledge (Machimbidza *et al.*, 2022; Mushi *et al.*, 2020a, b; Mushi, 2021). There might be a problem with workload balancing and burnout among the library staff and a need for more skills to do the activities of embedded librarianship (Sharma *et al.*, 2014; Agboola *et al.*, 2018). Lack of succession planning can be another stumbling block when a skilled librarian retires or leaves the organisation. There is, therefore, a need to have someone understudy the embedded librarian for continuity purposes. Library directors should also be able to evaluate the embedded librarian's work.

### **Methodology**

This study applied the quantitative online survey design to explore the extent and nature of the embedment of librarians in research structures and processes in selected academic libraries in Africa. An online survey design was suitable for this study because it is convenient and has the potential to collect large amounts of data efficiently, economically and within relatively short time frames (Regmi *et al.*, 2016). The study targeted librarians involved in supporting research at their respective universities, such as faculty/subject librarians, scholarly communication librarians, research support librarians and reference librarians working in academic libraries in Africa. However, because of the impracticality and complexity of managing and handling data from surveying all librarians involved in research

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support activities in Africa, the probability sampling methodology was adopted in this study by using the list-based sampling frame online probability sampling technique to allow for the generalisation of the findings to institutions in similar contexts (Wright, 2005).

An online survey questionnaire link was emailed to institutions and library consortiums in the selected countries. The survey consisted of 18 closed questions and one open-ended question. Sixty-three responses were obtained from the targeted 100, giving a response rate of 63%. The Statistical Package for the Social Sciences (SPSS) quantitative data analysis software analysed the survey data. A descriptive analysis was used to analyse the closed questions in which the data was presented through charts, tables and figures indicating frequencies and percentages of responses. The open-ended questions were analysed using thematic analysis by identifying themes and sub-themes from the open qualitative statements provided by the respondents, and verbatim quotes were provided to justify the argument made.

### **Findings**

The data was analysed thematically covering the main research activities in which embedded librarians are involved.

#### **Demographic characteristics**

The study involved 63 librarians—47 females and 16 males—from seven African countries. Demographic characteristics were assessed to provide an overview of the background of the respondents, as shown in [Table 1](#).

#### **Library and research support unit**

The survey indicates that most academic and research libraries support research services or scholarly communication through a particular unit or program. The results show that 40 (63%) respondents have a research support unit or program. In comparison, six (10%) respondents are not sure of the existence of such a service in their libraries, and 17 (27%) respondents indicate that their libraries do not have a research or scholarly communication support unit, as shown in [Figure 1](#).

#### **Embedded librarianship in research**

We investigated the embedded librarianship in research, focussing on the critical activities in the research life cycle, namely, generating research ideas, research funding, research data management, conducting research and communicating research results.

##### *Research ideas*

The findings reveal that the average participation of the librarians in generating research ideas is 35 (55%) respondents who work with researchers from the early stage of the research life cycle. However, 20 (32%) respondents show that researchers come to the library with their ideas, while eight (13%) respondents are not involved in generating research ideas, as shown in [Figure 2](#).

[Figure 2](#) presents the level of librarians' involvement in supporting individual researchers in generating research ideas. The survey further investigated librarians' involvement in generating research ideas at the level of university or organisation research teams. The results show that 35 (56%) respondents are not involved in these teams, while 28 (44%) respondents generate research ideas in the organisation's research teams.

Variables	Categories	Frequency (N)	Percentage (%)	
Gender	Female	47	74	
	Male	16	26	
Age	20 years or below	0	0	
	21–25 years	1	2	
	26–30 years	1	2	
	31–35 years	6	10	
	36–40 years	18	29	
	41–45 years	10	14	
Country	46 years and above	27	43	
	Nigeria	32	52	
	Tanzania	14	20	
	Namibia	9	13	
	South Africa	2	4	
	Zimbabwe	3	5	
	Kenya	2	4	
	Uganda	1	2	
	Education levels	Certificate	0	0
		Diploma	0	0
Advanced Diploma		0	0	
Bachelor degree		10	16	
Master degree		27	42	
PhD		21	34	
Type of Library	Associate Professor	4	6	
	Full Professor	1	2	
	Academic	61	96	
Job title	Research Library	2	4	
	Research Librarian	10	16	
	Scholarly Communication	6	10	
	Reference Librarian	13	20	
	Digital Curator Librarian	4	6	
	Subject/Faculty Librarian	12	19	
	Academic librarian	4	6	
	University Librarian	6	8	
	ICT's Librarian	1	2	
	E-Librarian	1	2	
	Serials librarian	1	2	
	Library officer	1	2	
	Library Assistant	1	2	
Head of Library	1	2		
Processing Librarian	2	3		

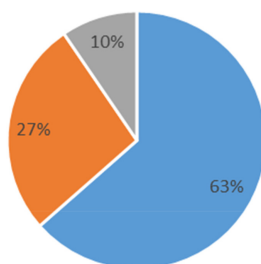
**Table 1.**  
Demographic  
characteristics of the  
respondents ( $N = 63$ )

**Source(s):** Table by authors

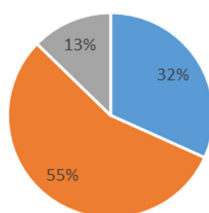
Apart from direct participation in generating research ideas, librarians are directly linked to research activities through standard library services. The survey indicates that 93.7% librarians (59 respondents) support researchers in finding information sources concerning their research ideas, and 71.4% (45) of respondents mainly provide Internet and electronic devices and support researchers in open access services as shown in [Figure 3](#).

#### *Librarians and research fund sources*

Assisting with research funding sources is an essential service that embedded librarians should provide to researchers and research teams. However, the findings show that 29 (44%) respondents know about funding sources. In comparison, 34 (56%) respondents need to be

**Research support unit**

■ Yes ■ No ■ Not sure

**Source(s):** Figure by authors**Figure 1.**  
Library research  
support unit ( $N = 63$ )**Generating research ideas**■ Researchers come to the library with their ideas  
■ Involved in generating research ideas  
■ Not involved in generating research ideas**Source(s):** Figure by authors**Figure 2.**  
Research  
ideas ( $N = 63$ )

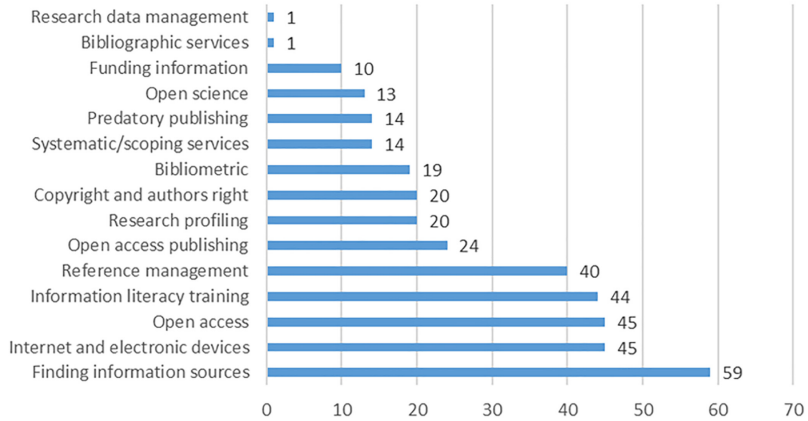
made aware of different sources of research funds they can propose to the researchers for their projects. Meanwhile, the findings show that only 19 (30%) respondents indicated helping researchers find funding sources for their projects.

**Research data management (RDM) services**

Embedded librarianship in research requires knowledge of RDM, which covers many activities during the active stage of the research process, such as writing a data management plan (DMP), collecting, clearing, analysing and storing data for future use. However, the findings reveal that 27 (43%) respondents do not provide RDM services, 13 (21%) respondents were not sure of the availability of RDM services in their library, and 23 (36%) respondents indicated that they provide RDM services.

The findings showed the type of RDM services offered by a few libraries (23:36% respondents) in African academic and research libraries. The findings show that 23 (100%) respondents provide data repositories and data publishing services, and 21 (%) respondents

### Library services to researchers



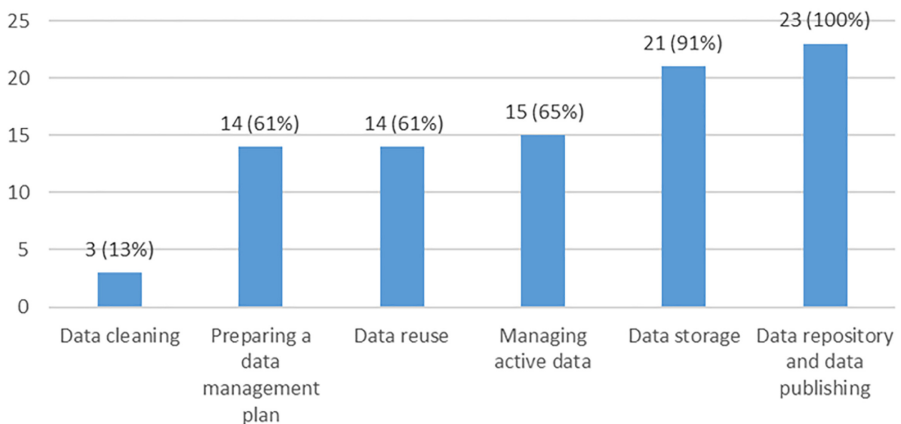
**Figure 3.**  
Library services to  
researchers (N = 63)

Source(s): Figure by authors

provide data storage services. Other services offered include preparing DMP, cleaning, managing operational data and reusing data as shown in Figure 4.

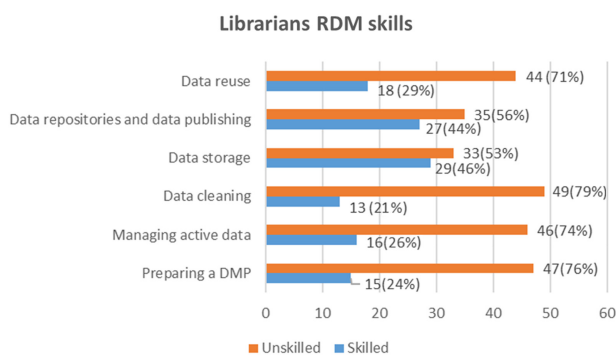
The RDM skills of the librarians were further investigated on a Likert scale of one (1) to four (4), whereby one indicates unskilled, two somewhat skilled, three skilled and four very skilled. This study refers to one and two as unskilled and three and four as skilled. The findings show that many librarians need to be more skilled in different RDM knowledge areas. For example, Figure 5 shows that 49 (79%), 47 (76%), 46 (74%) and 44 (71%) respondents need to be more skilled in data cleaning, preparing a DMP, managing operational data and data reuse, respectively. However, the results indicate that some librarians are more skilled in data storage (29:46% respondents), data repositories and data publishing (27:44% respondents) (see Figure 5).

### RDM services offered to the researchers



**Figure 4.**  
RDM services offered  
to researchers (N = 23)

Source(s): Figure by authors



Source(s): Figure by authors

Figure 5.  
Librarians' perceived  
RDM skills (N = 63)

### *Librarians and active stage of conducting research*

Embedded librarianship requires skills that a librarian can actively engage in when conducting research. The study findings reveal that the perceived skills of librarians in conducting research vary among different skill areas. Twenty-five (25:40%) respondents indicated they were skilled in research proposal writing, 14 (22%) respondents were skilled in grant proposal writing and 29 (45%) were skilled in data analysis and tools, while 30 (48%) respondents indicated they were skilled in hypothesis formulation, designing and managing a research project. Moreover, highly skilled areas indicated by the respondents are research methodology and data collection techniques (37:60%), literature review and presentation (40:65%) and reference management (35:56%). The lowest librarians' skills indicated are scoping and systematic review.

### *Communicating research results*

This research stage has several roles in which embedded librarians can participate. First, the survey investigated the skills of librarians in communicating research results as shown in Figure 6.

### Research communication skills



Source(s): Figure by authors

Figure 6.  
Research  
communication skills

The highest indicated skilled areas are research report and journal article writing (33:53% respondents) and open access publishing (30: 48% respondents). The findings show that 47 (76%) respondents perceived themselves as unskilled in evaluating research performance and bibliometrics, 42 (68%) respondents are unskilled in predatory publishing identification, 40 (65%) respondents are unskilled in open science and 37 (60%) respondents indicated being unskilled in the area of copyright and authors' rights.

*Level of embedded librarianship in research*

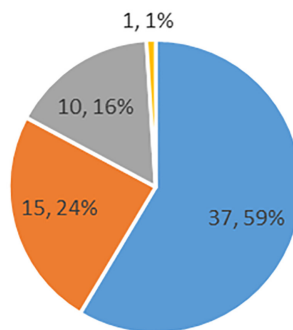
The level of embedded librarianship in research in academic and research libraries in selected African countries was investigated and categorised into four parts: formal embedment, ad-hoc involvement, both on a formal and ad-hoc basis and information services to researchers. Formal embedment refers to a librarian hired by an organisation full-time and continuously (Carlson and Kneale, 2011). On the other hand, ad-hoc involvement is a project-based strategy of librarian embedment in research (Carlson and Kneale, 2011). Finally, informal embedment is where the librarian works with researchers without formal structures and properly defined responsibilities. Therefore, both the formal and ad-hoc bases mean that there are formal structures for research embedment. However, where necessary, librarians are integrated into short-term research projects because of the skills they possess.

The study findings, as portrayed in Figure 7, show that 37 (59%) of respondents indicated their level of embedded librarianship on both a formal and ad-hoc basis; 15 (24%) of respondents indicated formal embedded; 10 (16%) of respondents indicated ad-hoc involvement; and 1% of respondents indicated information services for researchers.

*Challenges of embedded librarianship in research*

The library's working environment and resources are essential in building embedded librarianship in research and other fields of expertise. Therefore, the challenges faced by librarians in academic and research libraries in selected African countries were explored. The results show that the most challenging factors are a lack of relevant knowledge and skills

**Level of embedded librarianship**



- Both formal and ad-hoc basis
- Ad-hoc involvement
- Formal embedded
- Information services for researchers

Source(s): Figure by authors

**Figure 7.**  
Level of embedded librarianship (N = 63)

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(35 respondents), a lack of support from the management (33 respondents), inadequate technological infrastructure (32 respondents), limited training opportunities for librarians (25 respondents), a lack of established approaches and workflow (24 respondents) and a lack of understanding of research trends (22 respondents).

### *Towards embedded librarianship in research*

The study findings indicate the low involvement of librarians in research activities, despite their potential roles in a complete research life cycle. Meanwhile, the new research trends have embedded librarianship in research, particularly in academic and research libraries, adding value to library services and librarianship as researchers. In their own words, librarians in the selected academic and research libraries in African countries suggested re-skilling librarians, services and operations through constant training and retraining of embedded librarians for optimum performance at duty stations. Furthermore, they suggested that there is a need for management support, the provision of necessary facilities and an enabling environment to improve on the already acquired knowledge. One of the respondents had the following to say:

[ . . . ] The necessary infrastructures should be made available, and the librarians should acquire the knowledge and skills with which to use the infrastructures to render embedded library services efficiently and effectively (Respondent 1).

The respondents also mentioned reviewing, formulating and implementing policies enhancing embedded librarianship in academic and research libraries. Moreover, the collaboration between the library, research office and faculties was also raised by the respondents as follows: “*more support from management and the research office as well as faculties* (Respondent 2), where in some of the organisations they do not work together in research projects (see [Figure 3](#)). Finally, respondents also suggested that librarians should be more proactive in understanding new trends in research and librarianship in general.

The library’s working environment and resources are essential in building embedded librarianship in research and other fields of expertise. Therefore, the results show that the most challenging factors are lack of relevant knowledge and skills (35 respondents), lack of support from the management (33 respondents), inadequate technological infrastructure (32 respondents), limited training opportunities for librarians (25 respondents), lack of established approaches and workflow (24 respondents) and lack of understanding of research trends (22 respondents).

## **Discussion of the findings**

This study aimed to determine the extent to which librarians are embedded into the research process in academic libraries in Africa, explore the nature and areas of embedment of librarians in research in African academic libraries, and investigate the challenges faced by research-embedded librarians in academic libraries in Africa.

### **The extent of librarians’ embedment in research**

Technology advancements enable more collaborative, shared and data-intensive research. As a result, a new scholarly communication ecosystem emphasises open access to all outputs before they are published ([Adams et al., 2017](#)). Libraries at research-based institutions are increasingly aligning themselves to address the needs of the complex research ecosystem by employing the embedded librarian paradigm to enhance collaboration on research projects with the professors they support or to serve as an essential part of a research team. These partnerships take

different forms depending on the type of research and the researchers' needs. Still, they often include applying library science concepts and methodologies to the study.

The study findings indicate that a few academic and research libraries have embedded librarians in the research process because of the transformation to new services; new positions in librarianship, such as digital curator, research data librarian, scholarly communications librarian and research librarian, have been introduced in academic/research libraries in Africa. As a way of responding to the needs of researchers, the results of this study, as indicated in [Figure 1](#), reveal that 63% of libraries have established research and scholarly communication support units at their libraries. The results also show that librarians are formally embedded in the research process, with 57% adopting a hybrid approach of formal and project-based embedment, whereas 25 respondents are officially employed and integrated into research. These findings have been validated by the propositions of librarians' job titles, such as research librarians (6%), scholarly communications librarians (10%), digital curators (6%) and researcher data librarians (3%), respectively. Therefore, the evolution of new librarians' job titles reflects the nature of embedment and their roles in research. Furthermore, 49% of the librarians collaborated with researchers to generate research ideas. However, the level of embedment needs to be strengthened in African libraries.

#### **Nature and areas of librarians' embedment in research**

Considering the areas of embedment of librarians in research, the study discovered that librarians have carried out different roles in research; the most outstanding activities are the more transformative classical librarians' jobs such as finding information sources (93.7%), providing Internet and electronic devices for conducting research, information literacy and open access publishing. Similar findings were observed by [Abrizah \*et al.\* \(2016\)](#), that librarians play a significant role in teaching information literacy, providing access to library resources and conducting research searches. The findings of this study support the claim made by [Shin \(2021\)](#) that librarians' roles are becoming more significant than the classical liaison responsibility. However, the most emerging functions of librarianship, such as research profiling, bibliometrics, systematic and scoping review, research data management and identification of research funding information for researchers, are the minor services offered by librarians who participated in this study. These findings contradict the findings by [Ma \*et al.\* \(2018\)](#) in their scoping review, which revealed that most libraries across the globe provide writing skills, systematic reviews, copyright and intellectual property, research data management and bibliometrics.

Although most participants indicated that their libraries do not provide research data management (43%), those that do offer RDM services offer services such as data repositories and publishing, data storage, managing operational data and preparing data management plans. The findings of this study share similar sentiments that many libraries in Africa still need to adopt RDM services in practice, which is not so common in developing countries ([Machimbidza \*et al.\*, 2022](#); [Mushi \*et al.\*, 2020a, b](#)). The low adoption of research data management services in African libraries could be attributed to a lack of technology, the legal environment ([Machimbidza \*et al.\*, 2022](#)) and the skills and knowledge ([Machimbidza \*et al.\*, 2022](#); [Mushi \*et al.\*, 2020a, b](#); [Mushi, 2021](#)) required for the implementation of RDM.

#### **Competencies of librarians' embeddedness in research**

Librarian research and communication skills and knowledge are critical for librarians to provide excellent research support, collaborate with researchers and ensure the compelling success of embedded librarianship. For instance, librarians with high competencies in

proposal writing, data identification and management and information searching in systematic reviews are highly qualified for adequate embedment in research (Bernstein *et al.*, 2020; Mensah and Owusu-Anasah, 2018). The study also found that librarians are skilled in research proposal writing, data analysis and various tools for analysing data, formulating hypotheses and designing and managing a research project. Respondents also indicated that they are skilled in research methods and data collection techniques, literature review and presentation and reference management. These findings contrast with the results of Federer *et al.* (2018) and Mushi *et al.* (2022) that librarians are not competent enough in research management skills, data collection techniques, data analysis and presentation, proposal writing, referencing software, journal paper writing, literature reviewing and presentation and research questions and hypothesis formulation. The level of competency in different areas of embedded librarianship can be attributed to the respondents' qualification levels. In this study, 42% of respondents had a PhD, and 34% had Master's qualifications, where skills in research processes are taught. The study findings support Brown *et al.* (2018), who also found that librarians have skills in literature review, project management, research methods and data analysis. Shin's (2021) analysis of articles where librarians collaborated with researchers to determine the level of contributions by librarians also concluded that librarians have the skills and knowledge at different stages of research processes.

On the other hand, while there are high competencies among librarians and collaborative papers between librarians and researchers on bibliometrics, meta-analysis, scoping, and systematic reviews across the globe (Borrego *et al.*, 2018), the situation is different in Africa. The present study observed respondents' skill gaps in scoping and systematic reviews, bibliometrics, grant writing, and research data management. Since these are emerging practices in research and the roles of librarians, libraries in Africa must consider the upskilling and re-skilling of librarians as a serious matter that must be addressed urgently. In addition, universities offering librarianship courses should transform their curriculum to address emerging competencies in librarianship.

### Challenges faced by embedded librarians

Embedded librarians experience challenges when collaborating and providing services to researchers. This study revealed that the lack of skills and training opportunities in emerging roles to support research is a critical concern in African libraries. This was also reflected in the question regarding the level of competencies in different areas, where librarians revealed gaps in trending research areas and merging roles such as bibliometrics, research data management, systematic and scoping review, and grant funding. The findings of this study share similar sentiments with Mushi *et al.* (2022) and Mushi (2021), that although librarians are well versed in communication and interpersonal skills, which are critical in order to embed and interact with researchers effectively, they have inadequate skills in the research cycle and understanding of trends in research practices. To address the skills gap, lack of knowledge and limited training opportunities, the authors recommend that higher education institutions offering librarianship courses in Africa transform their curriculum to cater for the required competencies in research-embedded librarianship.

In addition, librarians in Africa expressed that a lack of technological infrastructure (such as data storage, data visualisation tools and data repositories) and proper approaches and workflows in libraries hinders the complete embedment and success of librarians in research. With sufficient funding for libraries to provide adequate technological research infrastructure, librarians will find it easier to embed themselves in researchers' day-to-day research practices. The efficient structures and policies that can guide the daily activities of an embedded librarian are other critical factors that, in absentia, can complicate the transition of a librarian from the traditional liaison responsibility into an embedded librarian in the day-

to-day activities of researchers. The findings of this study corroborate the results from other scholars, such as [Carlson and Kneale \(2011\)](#) and [Shin \(2021\)](#), that the lack of established approaches, paths, policies and guidelines and technological infrastructure hinder libraries' efficient embedment of librarians into research processes.

### **Limitations**

This study used a cross-sectional study to determine the embedment of librarians in research over a short period, which may have affected the depth of the data reported. Future research should consider using a longitudinal survey design to establish the nature of the embedment of librarians in research over time and address the gaps posed by the cross-sectional study design applied in this study. In addition, the study provided the perspectives of librarians about the services, roles and competencies of embedded librarianship; the viewpoint of researchers is necessary to give a different view of librarians embedded in research processes and researchers' lives, which may add value to the model of librarian research embedment in libraries. Furthermore, the study provided a general overview of librarians' roles and levels of embedment in research. However, from the literature review, the researchers observed gaps in the literature on the contributions and roles of librarians in conducting scoping, systematic reviews and bibliometric studies in Africa and developing countries.

### **Conclusion**

This study aimed to establish the level and nature of research librarians' embedment in African academic libraries. The study found that although a few libraries in Africa attempt to embed librarians in research by establishing new positions and units, the extent of librarian embedment still needs to improve in academic/research libraries in Africa. Furthermore, the study revealed that librarians provide different services as embedded librarians based on the research cycle and have competencies in various stages of the research cycle. However, there have been some observed gaps in competencies among librarians in emerging research trends and support services for researchers in bibliometrics, scoping and systematic review, grant writing and research data management. Considering the evolving research ecosystem that requires new competencies, librarians must understand the new research ecosystem by enhancing their abilities, expertise and attitudes that professionals will increasingly need. Therefore, continuous upskilling and re-skilling are essential to maintaining and acquiring competencies as new research opportunities arise.

### **Recommendations**

The study made recommendations that have practical implications for library practitioners in academia, research contexts and higher education institutions offering library and information science education in Africa. The roles and competencies described in the study should provide practical information for working librarians considering embedding techniques, and this can serve as a model for formal embedded librarianship programs and inspire other librarians to think about developing new skills to support embedding responsibilities. Moreover, this study recommends that library managers provide sufficient funds for training programs for librarians, attend conferences and seminars and provide the adequate IT infrastructure that is required to support librarians' embedment in research. The study also recommends that higher education institutions in Africa offering library and information sciences programs transform the curriculum to include courses that address the emerging trends and competencies of research for librarians to excel in integration into research processes and practices. It is also recommended that librarians embedded in the research process and working with researchers keep abreast of the

emerging roles needed to effectively support researchers and keep their skills up to date to remain competitive and to support the changing requirements and expectations of their employers. Finally, the study proposes that libraries in Africa should develop proper approaches, policies, workflows and guidelines to aid librarians in embedding research into their daily routines.

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### Corresponding author

Josiline Chigwada can be contacted at: [chigwaj@unisa.ac.za](mailto:chigwaj@unisa.ac.za)

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