

The Shifting and Changing Research Landscape and the Academic Librarian's Response

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Abstract

Research is increasingly changing due to among other reasons, technological advancement, funding models or policies, the general transitions on the international scene and lately, the Coronavirus disease (COVID-19). The dawn of COVID-19 has particularly transformed the conduct of research. Apparently, both opportunities and constraints are emanating from this epoch which researchers and academic librarians have to embrace. The study was conducted as a literature review to gather data for the study on how the research landscape is shifting in order to determine ways in which academic librarians could best serve researchers. Adequate research support is key to success in academia because research institutions are also ranked on the level and quality of their research output on ranking platforms. The author argues that the changing research landscape transforms the role of the academic librarian. The study findings indicate that trajectories in research have modified the role of the academic librarian from a supporter through collections and training, to a partner in the entire research life cycle. Suffice to say, any change process bears challenges which academic librarians may encounter in their quest to promote research, and these were determined in this chapter. The chapter ends with some insights about new and innovative ideas for the further promotion of research. The study adds value in understanding the trajectories in conducting research, and what academic librarians need to do in light of the changes, for the benefit of research.

Keywords: Research landscape; academic libraries; COVID-19; Fourth Industrial Revolution (4IR); South Africa

Introduction

The quest to find solutions to ever-growing societal challenges has resulted in the exponential increase in global research. Such challenges include, but are not limited to poverty, unemployment, diseases, underdevelopment, and inequality. Coupled with increased research is the issue of competition to find

solutions by countries and institutions. South Africa alone contributes about one percent of the world's research output, and this constitutes 10 percent in terms of the world citation impact (Bawa 2020). Not only is research linked to solving challenges, but also contributing to innovation. In this regard, research efforts have yielded positive results which have resulted in the development of organisations and countries. In the past, most research efforts were characterised by lengthy timeframes before meaningful results could be realised. The way in which knowledge is generated, has shifted much and changed with time. For instance, research turnaround times have shifted largely due to advances in technology, collaboration, and improved communication means (Porter & Hook 2020).

As way back as 2003, a Canadian research report indicated the need to collaborate in research in order to prevent what the report referred to as knowledge apartheid (AUCC 2003). In light of this statement, many authors can successfully collaborate on a single document. Related to this point is the issue of multidisciplinary and interdisciplinary research which has also witnessed a significant growth as research collaboration increases (Porter & Hook 2020:2). Already in the middle of 2020, Porter and Hook (2020:2) observe that there has been an immediate research response to COVID-19, which has resulted in 42,703 articles being published, 3,105 clinical trials, 422 datasets, 272 patents, 757 policy documents, and 156 grants at a global level. This enhances opportunities of finding solutions to challenges by using knowledge from a diverse perspective. The recent emergence of the Coronavirus scourge has further accelerated the need for more collaboration in research, as researchers from across the globe are battling to find a solution to this pandemic. Not only do researchers work on finding a cure or vaccine for COVID-19, but a lot of work has gone into developing lifesaving equipment such as ventilators, personal protective equipment, and screening tools and apps, among other initiatives.

These developments in research have resulted in a widening scope of the role of the academic librarian. New services and infrastructure such as Research Data Management (RDM) and Research Commons, have emerged in an effort by academic librarians to support research in line with the changing research landscape (Chiwere & Becker 2018; Chiwere 2020).

The main aim of this chapter is to determine shifts and changes in the research landscape and the academic librarian's response to the changes. The following questions were raised in order to help answer the main aim of the chapter:

- What are the trends in the research landscape?
- How has the academic librarian responded to the changes?
- Which challenges and opportunities are created by the shifting and changing research landscape for the academic librarian?

Methodology

Data for this study was gathered through a critical literature review of relevant previous studies based on the research questions of the study. The review focused on literature about changes in research, how the librarians have responded to the changes, challenges which were encountered, and opportunities presented by the shifts and changes in the research landscape. Suitable articles which were searched, using keywords such as 'research landscape,' 'academic librarians,' 'COVID-19,' and 'Fourth Industrial Revolution,' were downloaded from the researcher's university library databases. Searches were performed on the library's integrated platform, EBSCO Discovery Service (EDS), which links to all collections in the library. An effort was made to restrict the articles to those which were published during the past five years in order to ensure currency and relevance to the modern research environment. The search on EDS yielded 20 articles which were relevant and were used in the study, in addition to searches performed on professional organisation sites such as IATUL, USAf, and IFLA (International Federation of Library Associations and Institutions). However, three of the used sources fell outside the five years restriction, largely due to their relevance for the current study. In addition, discussions with librarians and researchers at the researcher's place of work, particularly during the 2020 open access week which ran from 19-25 October 2020, further enriched the knowledge of the researcher on the topic of the study.

Literature Review

In this section, a review of related literature, focusing on the topic and the study objectives was conducted. The review began with a focus on the South African research environment as a way to put the study into a proper context. The review ended with a focus on the shifts and changes in research librarianship.

The South African Academic Research Environment

The South African government places a strong emphasis on research and this is demonstrated by the amount of financial support which is channelled to universities and other research institutions (Onyancha 2018). A recent testimony of the South African government's respect for research is the appointment of a ministerial advisory committee on COVID-19. Porter and Hook (2020) describe this move as a return to reason, bringing most people's and government's trust of science, scientists, and experts back into the limelight. The South African COVID-19 committee had the task of advising the Minister of Health on research-based evidence about strategies to combat the Coronavirus pandemic. Furthermore, the government of South Africa recognises and funds research output through the Department of Higher

Education and Training, Science and Technology, and the National Research Foundation (NRF), among other key state funders. Universities on their part should also be commended for forming Universities South Africa (USAf), formerly Higher Education South Africa, which is a membership organisation. USAf speaks on behalf of member institutions about matters pertaining to research, teaching and learning, as well as community engagement (USAf 2019). In response to this noble cause of speaking with one voice on matters of mutual interest, the academic (university) library sector in South Africa formed, among other groupings, the Committee of Higher Education Libraries of South Africa (CHELSA) which enjoys a good working relationship with USAf. Among the legal and policy imperatives on research, the South African constitution recognises the rights of people to freedom of scientific research, as well as access to information (South African Government 1996).

A white paper on Science, Technology, and Innovation was developed to pave the way for greater efforts in research (Bawa 2020). This followed a national framework which was developed jointly by South Africa and the European Union (SA-EU 2018). One of the main principles of open science is that research results should be easy to find, accessible, interoperable, and reusable. Public universities in South Africa are established through statutes which give effect to the Higher Education Act of 1997. Universities further have research policies and strategies with which they conduct their research. As already pointed out in the introduction, South African universities compete favourably well with other big African economies such as Nigeria and Ethiopia and contribute 1 percent to the world's research output (Bawa 2020). In addition, South Africa has some of the most reputable universities in Africa, which are ranked highly on most ranking platforms. The academic libraries contribute in a great measure to the high profile ranking through their open access initiatives and the general promotion of research on campus.

COVID-19, the Fourth Industrial Revolution and Academic Libraries

We live in interesting times, which are also uncertain. The changes that have been taking place in scholarly communication are being accelerated in areas around COVID-19 research. Open Access models, rapid peer reviews, preprints, and next generation search technologies are all playing a role in accentuated ways as a part of this extreme situation (Porter & Hook 2020:20). According to Ocholla and Ocholla (2020), the Fourth Industrial Revolution (4IR) affects everything including research and libraries. The 4IR is a terrain which is characterised by a high adoption and use of technologies.

Whilst academic libraries in South Africa and globally began to pay attention to the demands of the 4IR as evidenced in the study findings of Ocholla and Ocholla (2020), a new terrain, a devastating flu-like virus known

as the Coronavirus emerged allegedly in China towards the end of 2019 (Porter & Hook 2020). Due to global movements of people for business and leisure, the pandemic was spreading like wildfire. As is now common knowledge, the virus has affected more than 200 countries, including South Africa (South African Government 2020a). According to Porter and Hook (2020), the virus moved from China to the West and has left a trail of destruction which will be felt for at least a generation. In order to put countries on high alert, the World Health Organisation declared COVID-19 a world pandemic (Chisita 2020). The South African government responded and invoked the Disaster Management Act of 2002 and declared a national state of disaster, published in Government Gazette No. 43096 on 15 March 2020 (South African Government 2020a). This paved the way for a national lockdown, announced by President Cyril Ramaphosa on 15 March 2020, which came into effect on 26 March 2020.

Academic libraries, among other institutions and organisations, closed their physical buildings. Fortunately, academic libraries had long established two sets of libraries – the physical library and the virtual library. In order to continue with business as demanded by their parent institutions, full attention shifted to the virtual libraries which comprise eBooks and eJournals. In sympathy with the sudden changes, South African publishers made available for free some of their online resources, in addition to online news and training support for librarians and users. In a survey of academic library services during the COVID-19 pandemic period, CHELSA (2020) notes a wide range of online user services which were available in support of the institutions' core business in teaching and learning, as well as research and community engagement. The survey's focus was on four areas, namely:

- business continuity plan;
- services;
- staff; and
- moving to post-lockdown (CHELSA 2020).

The survey results indicate a growth in Libchat services and other social media platforms, in line with the tenets of the 4IR. The results further reveal similar trends which were noted elsewhere in the world as recorded by IFLA (2020), Greenhall (2020), and others. There was also a notable shift from the traditional library services of collection development of mostly print resources (Raju & Schoombee 2014), to the acquisition of eBooks and related online materials. Prior to COVID-19, great efforts were underway to embrace the 4IR, as already alluded to. The government of South Africa, for example, formed a presidential commission on the 4IR. The commission identified six strategic areas: Investment in human capital; artificial intelligence; advanced manufacturing and new materials; the provision of data to enable innovation; future industries; and 4IR infrastructure (South African Government 2020b).

Of interest to these strategic areas is the provision of data to enable innovation. Librarians play a critical role in proper data management practices as this chapter will reveal further. In addition, the University of Pretoria acquired a robot known as Libby in 2019, which helps to answer library user inquiries (Thekiso 2019; Ocholla & Ocholla 2020). Other initiatives by academic librarians include the establishment of ChatBots and LibAnswers in order to help respond to growing and frequently asked questions (Fichter & Wisniewski 2017; Nawaz & Saldeen 2020).

The Growing Role of the Librarian in the Research Life Cycle Framework

In order to understand the shifts and changes in the research landscape in general, and in particular the role of the librarian, this chapter is informed by the research life cycle framework. This framework has been successfully applied in part or in full by researchers focussing on new roles of librarians in research such as Chiware (2020), Onyancha (2018), and Chung, Kwon, and Lee (2016). Although the research life cycle may slightly differ from one discipline to the other, there is a general consensus on key principle stages, namely idea generation or discovery, research proposal, conduct research, publish research, or results dissemination. At each stage of this research life cycle, a librarian is involved, starting with the identification of suitable sources of data to reuse, followed by an advisory on ethical issues and the development of a data management plan, after which the librarian then advises on data curation, metadata, visualisation, intellectual property, and finally, advice on open access, the assigning of persistent identifiers, and storage support matters (Chiware 2020; Chung, Kwon, & Lee 2016).

Based on this framework, other librarian roles emerged, such as the advisory and measurement of the research output, in order to determine its impact. In this regard, the International Association of University Libraries (IATUL) released a model in 2020 on how to train research support librarians in research impact matters. The model covers 11 areas, starting with that of bibliometrics, identifiers such as ORCID, traditional, and emerging metrics, the responsible use of metrics, publishing strategies, open research, benchmarking, rankings, equity, diversity, inclusion, and societal impact (IATUL 2020). This model provides an elaborated librarian's growing functional work area in research support.

Review of Shifts and Changes in Research Librarianship

Studies focusing on shifts and changes in the research landscape in general and in research librarianship in particular, have been conducted at varying degrees. Some studies have traced changes in specific research support and partnership matters such as research data management (Chiware 2020), bibliometrics

(Onyancha 2018), data sharing (Bangani & Moyo 2019), as well as new skills and positions (Ochola & Ocholla 2020). However, more comprehensive studies tracing changes in scholarly communication and research support have been conducted by scholars such as Pasipamire and Hoskins (2019), Ketchum (2017), Keller (2015), and Raju and Schoombee (2014). One of the major talking points in research is open science. Bawa (2020) defines open science by its characteristics, as an approach to research based on greater access to public research data which are enabled by information and communication tools and platforms, broader collaboration in science, including the participation of non-scientists, and the use of alternative copyright tools for diffusing research results. Key attributes of this definition are greater access, research data, information technology, broader collaboration, and the inclusion of non-scientists in the process which suggests equity and transparency in research.

In a study on data librarianship in South Africa, Chiware (2020) notes that developments in open science have imposed new skills demands on librarians. Chiware further posits that librarians need to have a good understanding of open science in order to be able to provide meaningful and relevant services. In this regard, Keller (2015) suggests that librarians should in fact see themselves as partners in research who provide services in the following five key areas:

- institutional repositories;
- open access;
- bibliometrics and the enhancement of research impact;
- support for research students; and
- research data management.

These are areas which are driven by open science, and they constitute shifts in research in general, and in research librarianship in particular. Raju and Schoombee (2014) argue that the changing higher education pedagogy, digitisation of scholarly content, and the increasing relevant technologies had a significant impact on the transformation of academic library services. Traditionally, academic libraries were known for offering services such as collection development, user training, reference services, and the dissemination of information (Nitecki & Davis 2019; Pasipamire & Hoskins 2019; Raju & Schoombee 2014), but due to shifts and changes in the research landscape, the support terrain has shifted significantly. Shifts in research support were marked by the introduction of research infrastructure through Research Commons and the institutional repositories (digital and open scholarship) to archive and disseminate research output (Ocholla & Ocholla 2020; Raju & Schoombee 2014). In the evolution of the scholarly communication, Ketchum (2017) traces eight topics of focus for librarian support in the shifting research landscape. The areas of focus are mapped around the research life

cycle and consist of funding, literature search, open access publishing, data management, copyright, documentation, dissemination, and metrics impact.

Although Onyancha (2018), in a study on 21st-century librarianship, focuses on bibliometrics and metrics, he concurs with Ketchum (above), on areas such as data management and the general support for researchers. Onyancha further marks the emergence of new librarian titles, arising as a result of the shift in research support. Such titles include 'Data services librarian,' 'Librarian: Research impact and Research Commons,' and 'Bibliometrics and research impact librarian.' Chiware (2020) also reveals new roles for librarians, like research data curator, data curation officer, and research and scholarly communication librarian. Furthermore, Chiware (2020) implores the library and information science schools to adjust their curriculums in order to educate and produce graduates who respond positively to the shifting and changing research landscape. Chiware advocates for mergers in courses with computer science and related courses so as to produce ready data professionals. His study reveals a lack of readiness and preparedness by librarians to embrace new roles.

Despite the exciting opportunities presented to librarians by the changing research landscape, there is a myriad of challenges to offer new services which are in demand. Keller (2015) posits that although there are generous kick-off schemes, it is usually time limited, even if the services are required on an ongoing basis. This results in the library management having to drop certain services in order to accommodate new and affordable ones. Yet another challenge is the lack of and therefore the need for relevant skills (Chiware 2020; Onyancha 2018) and the ability to adapt to change. Other challenges include limited personnel assigned to new roles, a lack of policy, a lack of commitment from researchers, and budgetary constraints (cf. Chiware 2020; Onyancha 2018; Pasipamire & Hoskins 2019; Keller 2015).

In some cases, librarians are generally invisible in the research life cycle (Pasipamire & Hoskins 2019). Raimondo, Harris, Nance, and Brown (2014) argue that providing research related services has challenges for librarians, some of which include time constraints and the interpretation of the scientific and legal language being used in some research disciplines. Pasipamire and Hoskins (2019) as well as Keller (2015) further bemoan the lack of partnership and collaboration among librarians and the faculty which in turn affect the quality of research support efforts. Some challenges are also related to a lack of proper infrastructure to support research and the general lack of institutional management support. Moyo and Mavodza (2016) cite image challenges relating to the faculty standings of librarians, which are usually coupled with inferiority complex issues.

With these challenges in mind, it is also important to look at the bright side and explore the opportunities which are presented to the librarian by the shifting and changing research landscape. Available literature indicates that new librarian positions and responsibilities have been created (Chiware 2020; Onyancha 2018; Robertson 2018; Ketchum 2017; Keller 2015; Raimondo *et al.* 2014). Mackenzie (2020) asserts that the COVID-19 pandemic was both highlighting and hastening the changing role of libraries, adding that librarians are innovative and creative in their responses. One other opportunity for librarians is the improvement of their qualifications, whether through formal studies or short learning programmes on new work trends such RDM, bibliometrics, and altmetrics (Chiware 2020; Onyancha 2018).

According to Onyancha (2018), university authorities are increasingly turning to librarians for information to address their research related needs, and this provides information professionals with an opportunity to re-position themselves as mission critical to their organisations. The shifts and changes in the research landscape have provided librarians with clear opportunities to add to the existing catalogue of services, new and innovative functions which respond positively to the new needs in an open science environment (Pasipamire & Hoskins 2019; Onyancha 2018). Keller (2015) advocates for the dropping off of some 'redundant' roles in order to accommodate new roles. There is also an opportunity to strengthen relationships with researchers, research administrators, and IT staff in order to strengthen research services. In the end of the collaboration, all stakeholders will be winners, including the broader society which stands to benefit from the knowledge that is created.

Findings and Discussions

Research has gone through major changes over the years and in order for research service supporters to be able to provide better support, it is critical to carry out regular formal reviews of the changing environment. This study explored shifts and changes in the research landscape and how academic librarians have responded to an avalanche of changes in the research culture. In particular, the study sought to answer the following key questions:

- What were the shifts in the research landscape?
- How did the academic librarian respond to the shifts and changes?
- What were the challenges encountered as well as opportunities presented to academic librarians by these shifts and changes?

In order to provide answers to these questions, a literature review of related works focusing on South Africa and other parts of the world was conducted. It is important to point out that, whilst the review did not aim to be comparative in terms of academic libraries in South Africa and elsewhere, there was a

similarity in most study findings (Chiware 2020; Bangani & Moyo 2019; Chiware & Becker 2018; Onyancha 2018). The findings of this study are presented and discussed below according to themes which emanated from the research questions.

Shifts and Changes in the Research Landscape

One of the major triggers of shifts and changes in research is arguably open science. According to Bawa (2020), open science is underpinned by the values of inclusiveness, mutuality and fairness, collaboration, transparency, and sharing. Governments and other research funders have introduced policies which require researchers to openly share research data as well as their final outputs (Chiware 2020; Bangani & Moyo 2019). Open science has provided librarians with clear opportunities to be actively involved in the research life cycle. Bawa (2020) shares seven areas of implementation of open science, namely open notebooks, data sharing, transparency in methodology, open access to publications, research evaluation systems, open-source codes, and open infrastructure. The curation of research data through repositories of data and completed research output such as theses and dissertations, journal articles, conference proceeding, and others, is one of the areas underlying the research landscape changes. Curation of data is part of the broader research data management services which are offered by academic librarians in South Africa and beyond, and are featuring prominently due to developments in open science (Chiware 2020:401). Yet another finding of the major trends in research is collaboration of researchers within and across disciplines, across institutions, and across countries (Bawa 2020; Porter & Hook 2020; Chiware & Becker 2018). Librarians play a critical advisory role in research collaboration in terms of where to publish, who to collaborate with, and the tracking of impact, using bibliometrics and altmetrics (Onyancha 2018). Other areas which top the list of changes in the research landscape include the emergence and growth in multidisciplinary and interdisciplinary research, funding, and policy (Bawa 2020; Bangani & Moyo 2019). Master's and Doctoral research outputs were characterised by an unprecedented volume (Onyancha 2018). In addition, ethical requirements in research outside the sciences was also growing in other fields of studies as librarians were assisting researchers with such compliance matters (Knight 2019).

The Librarian's Response to the Shifting and Changing Research Environment

Librarians are always in the forefront of innovation (Mackenzie 2020; Raju & Schoombie 2014). Their long history in working closely with faculty and researchers gives them an advantage to be able to embrace new services and roll them out to faculties, using already well-established lines of communication.

The study shows that the academic librarian in South Africa and beyond has positively responded to changes in the research environment. To begin with, librarians were learning new skills, either on the job or through formal studies (Chiware 2020; Chiware & Becker 2018; Onyancha 2018; Keller 2015). With the newly acquired skills, librarians rolled out services such as the development of institutional repositories of both data and other research outputs including journal articles, theses and dissertations, and conference proceedings, in order to enhance their discoverability and reuse. Librarians further assisted researchers with bibliometrics and metrics information requirements, including where to publish and who to collaborate with (Onyancha 2018; Keller 2015). Onyancha (2018) further argues that librarians help researchers with ranking information, registration, and the integration of researcher ORCIDs, registration on ResearchGate, and the creation of accounts on Facebook, and LinkedIn, among others. On campus, librarians are champions of open access celebratory events, as they bring together researchers, IT personnel, and research administrators to mark and celebrate their achievements in open science. This collaboration further helps to create an awareness about the importance of open scholarship.

Librarians further develop and host workshops for researchers and research students on topics which advance research. Regarding innovation, academic libraries in South Africa and globally are acquiring robots (cf. the University of Pretoria) and are championing 4IR initiatives on campus (Ocholla & Ocholla 2020). Librarians are also involved with policy development on areas such as open access, data policies, and related guidelines, in order to enhance compliance with funder mandates (Bangani & Moyo 2019) and the smooth running of research initiatives. Through the establishment of research infrastructure such as Research Commons, digital scholarship centres, open journal systems, and innovation hubs, libraries have become indispensable and integral to research. Graduate students and other researchers are finding libraries to be more user friendly and useful than ever before, a point also realised by Bangani, Moyo, and Mashiyane (2018) in a study on research spaces. In order to serve researchers and to better respond to the demands of open science, academic libraries are establishing new positions such as data librarians, digital humanities librarians, scholarly communications librarians, open scholarship directors, and others.

In addition, the library and information science schools were also responding to the shifts and changes in the research landscape, albeit in different measures, through the introduction of open science related courses (Chiware 2020). These courses equip librarians in new roles and those aspiring to be librarians, with skills which are necessary to master and discharge services which are demanded by researchers. In the COVID-19 and 4IR environment, librarians, being innovators and early adopters of new technologies as they

are, have added new tools and online services in order to easily reach out to their remote researchers (CHELSA 2020). This allowed libraries to provide an unbroken research service to their users, thus enhancing the confidence in the relationship and partnership between the librarian and the researcher.

On the whole, librarians are involved in the entire research life cycle and provide support for proposal writing, data management plans, how to apply and possible avenues for research funding, information gathering, the ethical clearance process, where to publish for maximum impact, the payment of article processing charges, research curation, and dissemination. With these functions and more, the academic librarian has become a valued partner, a catalyst, enabler, and contributor to the scholarship of research. In an era that is characterised by fake news and/or infodemic, the librarian has remained steadfast and is the first choice for the provision of scholarly information.

Challenges and Opportunities

Results indicate that there are both challenges and opportunities brought about by the new way of researching and supporting. On the one hand, the library's management has to contend with shortages of skilled workers (Chiwere 2020; Onyancha 2018) against a rising demand for new services. On the other hand, the constraints present librarians with an opportunity for upskilling through short as well as formal learning programmes (Ocholla & Ocholla 2020). Relevant skills will enable librarians to respond positively to the changing research landscape and earn the respect of researchers who are constantly looking up to them for support and advice. Chiwere (2020), however, indicates and acknowledges that, whilst there were only a few data related courses available, some library and information science schools were already offering the relevant courses, and this is quite commendable in view of the growing demand of open science related services.

The COVID-19 and 4IR environment further presents librarians with a perfect opportunity to refine their services despite the increased challenge for the requirement of new skills. Ocholla and Ocholla (2020) opine that a focus on competence requirements for the revolution would be pertinent. In spite of this opportunity, the online environment may also further promote inequalities regarding access. However, most universities are adopting a multimodal approach to their teaching-learning and research offerings. Regardless of the demand for new skills, the changing research environment is presenting librarians with an opportunity to expand their catalogue of services in research data management services and to work closely with researchers in research nodes and centres. Other important findings on challenges include the lack of budget, policy, as well as the commitment of researchers and institutional management. Budgetary constraints are likely to be exacerbated further by the

negative impact of COVID-19. Although the CHELSA survey results confirmed no budget cuts at the time (CHELSA 2020), academic libraries in South Africa and beyond will certainly feel the impact as institutions seek to save the jobs of those who are already on their payrolls. Libraries will have to respond by further repurposing their staff and resizing their collections.

Limitations of the Study

The study could have benefited from a mixed methods approach of data gathering. However, due to time constraints, the researcher only used literature review to gather data. In any event, the lockdown conditions in respect of the COVID-19 pandemic would have made other data gathering methods such as the use of questionnaires and interviews difficult, as some librarians were working from home with limitations of bandwidth and other related disruptions, particularly during the hard lockdown period in South Africa. These challenges would have affected the return rate or availability of targeted respondents. However, a great effort was made to select very informative articles for reviewing for the study, thereby making the research worth the while.

Conclusions

This chapter explored shifts and changes in the research landscape and how academic librarians had responded to the changes. The research shows that while changes were taking place mostly due to the emergence of open science, as well as government and funder mandates, librarians were responding by adding new research services to their functional areas. Librarians were further responding by acquiring new skills and the development of infrastructure in order to serve their communities better. The results further show specific changes in the research area as collaboration, data sharing, open access to publications, funding, policy, and data management, among others. These shifts, as the results show, have led to changes in the role of the academic librarian who now provides a set of new services. Some of the services on offer are the development of research data management plans, data curation, advisory on bibliometric and altmetrics, and support in the entire research life cycle (Jetten, Simons, & Rijnders 2019; Onyancha 2018; Keller 2015).

There are challenges which were noted in this chapter, and the study results indicate these challenges as high skills demands in order to be able to support research, a lack of supportive policies and guidelines, and budgetary constraints which are likely to be made worse by the negative impact of COVID-19. This is likely to hamper progress in the library *cum* faculty research partnership efforts. Regarding opportunities, this chapter indicates that the

shifting and changing research landscape has presented librarians with a chance to once again revive their careers in the face of freely available information, which previously was a preserve for librarians. Apart from the improvement of skills and infrastructure, librarians are now partnering with researchers in the research life cycle. In so doing, librarians have to some extent risen from just being collection developers and custodians of information, to becoming research and publishing partners through open journal systems and open repositories for open educational resources. This is once again earning them trust and respect on campus. Although the study focused on South African academic libraries, results show that the changes in research are global, and similar librarian efforts to meet the changes were noted.

Recommendations and Suggestions for Further Studies

As a recommendation, librarians should engage in graduate studies, particularly at Master's degree level so that they can have a good understanding of the research process and be able to support researchers better. This will also enable librarians to use the acquired skills to write, present, and publish about their work experiences. With that, South African academic librarians will be almost assured of a further improved image, leading to their recognition and qualification for faculty status as is the common practice in countries such as Tanzania and the USA.

A follow-up study might investigate the direct impact of COVID-19 on library research support. As lockdowns were introduced to mitigate the effects of the Coronavirus pandemic, most institutions in South Africa and beyond focused their energies on saving the academic project through online teaching and learning with limited paper-based support where possible. Similarly, librarians shifted their efforts to supporting the online modality of learning and teaching.

Final Remarks

Amid changes in the research landscape, academic librarians in South Africa and beyond have risen to the occasion by responding to the growing needs of researchers. Even with limited resources and skills, the services which are provided as revealed in this study, are quite commendable. With more training, academic librarians will be more poised to play a crucial role in research support, particularly in the context of the 4IR.

References

- AUCC (Association of Universities and Colleges of Canada). 2003. Research without (Southern) borders: the changing Canadian research landscape. A national roundtable on new directions in international research in Canada. Available at: <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/26216/119147.pdf>. (Accessed on 31 January 2021.)
- Bangani, S., & Moyo, M. 2019. Data sharing practices among researchers at South African Universities. *Data Science Journal* 18(28). 14 pages. <http://doi.org/10.5334/dsj-2019-028>
- Bangani, S., Moyo, M., & Mashiyane, DM. 2019. The utilization of library spaces by postgraduate students at a university in an African country. *Global Knowledge, Memory and Communication* 69(4/5):289–309. <https://doi.org/10.1108/GKMC-07-2019-0075>
- Bawa, AC. 2020. South African adventures open science. Academy of Science of South Africa. *Open Science*. 22 October 2020. Available at: https://drive.google.com/file/d/1cgKmSBIMDdDHjqBZDTwufFdK_n4Y8FGk/view?usp=sharing. (Accessed on 28 February 2021.)
- CHELSEA (Committee of Higher Education Libraries of South Africa). 2020. Report on COVID-19 survey. Unpublished report. Pretoria: CHELSA. Available at: <https://chelsa.ac.za/wp-content/uploads/2020/08/covid19survey.pdf>. (Accessed on 3 March 2021.)
- Chisita, CT. 2020. Libraries in the midst of the Coronavirus (COVID-19): Researchers' experiences in dealing with the vexatious infodemic. *Library Hi Tech News* 37(6):11–14. <https://doi.org/10.1108/LHTN-03-2020-0022>
- Chiware, ERT. 2020. Data librarianship in South African academic and research libraries: A survey. *Library Management* 41(6/7):401–416. <https://doi.org/10.1108/LM-03-2020-0045>
- Chiware, ERT. & Becker, DA. 2018. Research data management services in Southern Africa: A readiness survey of academic and research libraries. *African Journal of Library Archives & Information Science* 28(1):1–16.
- Chung, E., Kwon, N., & Lee, J. 2016. Understanding scientific collaboration in the research life cycle: Bio- and nonscientists' motivations, information-sharing and communication practices, and barriers to collaboration. *Journal of the Association for Information Science and Technology* 67(8):1836–1848. <https://doi.org/10.1002/asi.23520>
- Fichter, D. & Wisniewski, J. 2017. Chatbots introduce conversational user interfaces. *Online Searcher* 41(1):56–58.
- Greenhall, M. 2020. Covid-19 and the digital shift in action, Research Libraries UK Report. Available at: <https://www.rluk.ac.uk/wp-content/uploads/2020/06/Covid19-and-the-digital-shift-in-action-report-FINAL.pdf>. (Accessed on 3 January 2021.)
- IATUL (International Association of University Libraries). 2020. Research impact things: 11 research impact things are here for you! *IATUL Research Impact Things*. Available at: <https://iatulimpactthings.info/>. (Accessed on 15 January 2021.)

- IFLA (International Federation of Library Associations and Institutions). 2020. COVID-19 and the global library field. Available at: <https://www.ifla.org/covid-19-and-libraries>. (Accessed on 23 April 2021.)
- Jetten, M., Simons, ED., & Rijnders, J. 2019. The role of CRIS's in the research life cycle: A case study on implementing a FAIR RDM policy at Radboud University, the Netherlands. *Procedia Computer Science* 146:156-165. <https://doi.org/10.1016/j.procs.2019.01.090>
- Keller, A. 2015. Research support in Australian university libraries: An outsider view. *Australian Academic & Research Libraries* 46(2):73-85. <https://doi.org/10.1080/00048623.2015.1009528>
- Ketchum, M. 2017. The research life cycle and the health sciences librarian: Responding to change in scholarly communication. *Journal of the Medical Library Association* 105(1):80-83. <https://doi.org/10.5195/jmla.2017.110>
- Knight, J. 2019. The need for improved ethics guidelines in a changing research landscape. *South African Journal of Science* 115(11/12). Art. #6349. 3 pages. <https://doi.org/10.17159/sajs.2019/6349>
- Mackenzie, C. 2020. IFLA general assembly report of the president. Available at: <https://www.ifla.org/files/assets/hq/general-assembly/presidents-report-2020.pdf>. (Accessed on 12 November 2020.)
- Moyo, M. & Mavodza, J. 2016. A comparative study of information literacy provision at university libraries in South Africa and the United Arab Emirates. *Library Review* 65(1/2):93-107. <https://doi.org/10.1108/LR-06-2015-0069>
- Nawaz, N. & Saldeen, MA. 2020. Artificial intelligence chatbots for library reference services. *Journal of Management Information and Decision Sciences* 23(S1):442-449.
- Nitecki, DA. & Davis, MEK. 2019. Expanding academic librarians' roles in the research life cycle. *Libri* 69(2):117-125. <https://doi.org/10.1515/libri-2018-0066>
- Ocholla, DN. & Ocholla, L. 2020. Readiness of academic libraries in South Africa to research, teaching and learning support in the Fourth Industrial Revolution. *Library Management* 41(6/7):355-368. <https://doi.org/10.1108/LM-04-2020-0067>
- Onyancha, OB. 2018. Navigating the rising metrics tide in the 21st century: Which way for academic librarians in support of researchers in sub-Saharan Africa? *South African Journal of Libraries and Information Science* 84(2):1-13. <https://doi.org/10.7553/84-2-1762>
- Pasipamire, N. & Hoskins, R. 2019. Conceptualization and practice of research support: A proposed model for effective research support in Zimbabwean university libraries. *South African Journal of Libraries and Information Science* 85(1):12-23. <https://doi.org/10.7553/85-1-1819>
- Porter, SJ. & Hook, DW. 2020. Digital research report. How COVID-19 is changing research culture: landscape trends and cultural changes in the global research system. APO. 4 June 2020. Available at: <https://apo.org.au/node/306075>. (Accessed on 23 February 2021.)
- Raimondo, PG., Harris, RL., Nance, M., & Brown, ED. 2014. Health literacy and consent forms: Librarians support research on human subjects. *Journal of the Medical Library Association* 102(1):5-8. <https://doi.org/10.3163/1536-5050.102.1.003>

- Raju, R. & Schoombee, L. 2014. Research support through the lens of transformation in academic libraries with reference to the case of Stellenbosch University Libraries. *South African Journal of Libraries and Information Science* 79(2):27-38. <https://doi.org/10.7553/79-2-155>
- Robertson, S. 2018. Exploring the efficacy of training and development for liaison librarians at Deakin University, Australia. *Journal of Higher Education Policy and Management* 40(2):107-120. <https://doi.org/10.1080/1360080X.2018.1426370>
- SA-EU (South Africa and the European Union). 2018. Open science dialogue report. Available at: <https://drive.google.com/drive/folders/oB6w8fGuczXqMFpLbHVEQ2JPV1U>. (Accessed on 12 March 2021.)
- South African Government. 1996. Constitution of the Republic of South Africa. Available at: <https://www.gov.za/documents/constitution-republic-south-africa-1996>. (Accessed on 20 November 2020.)
- South African Government. 2020a. COVID 19/Novel Coronavirus: What is Coronavirus/COVID-19? Available at: <https://www.gov.za/covid-19/about/what-is-covid19#what>. (Accessed on 20 November 2020.)
- South African Government. 2020b. The 4th Industrial Revolution. Available at: <https://www.gov.za/speeches/president-cyril-ramaphosa-receives-recommendations-presidential-commission-4ir-6-aug-2020>. (Accessed on 20 November 2020.)
- Thekiso, R. 2019. University robot 'Libby' brings the future library closer. *University World News: Africa Edition*. 12 July 2019. Available at: <https://www.universityworldnews.com/post.php?story=20190708105508294>. (Accessed on 22 October 2020.)
- USAf. 2019. Who we are brochure. Available at: https://www.usaf.ac.za/wp-content/uploads/2020/04/USAF-brochure-_2019.pdf. (Accessed on 20 November 2020.)

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