Library and Information Research in South Africa: A Bibliometric Study

Swapan Kumar Patra

Abstract

South Africa is among one of the countries from the African continent that have comparatively mature Library and Information Science (LIS) education, training and well-developed research infrastructure. This study is an assessment of LIS research output from South Africa using different bibliometrics indicators. A total of 2,112 records (from the year 1975 to 2019) were downloaded from the Web of Science (WoS) database of Clarivate Analytics. The study has observed that LIS research in South Africa is growing in the recent years. It has further identified core journals where most of the research has been published. The authorship pattern has identified the productive authors and collaboration patterns among the authors. The key word analysis has identified the major research areas where most of the LIS research is being carried out. The institutional collaboration patterns show the productive institutes and their collaboration potential. The country level collaboration pattern shows that South African LIS scholars collaborate more with the scholars outside the continent. The study recommends focus research in this field and more inter and intra continental collaboration for the productive LIS research in the country.

Keywords: Library and Information Science, South Africa, Bibliometrics Study, Social Network Analysis, Africa

1. Introduction

Africa is a diverse continent in terms of its geography, socio-economic and demographic conditions. Some countries in the continents are categories as developing countries but there are many less developed countries in Africa, particularly in the sub Saharan region. Although, it has been noticed that, in recent years there has been an increasing activity in overall S&T publication from the continent (Patra &Muchie, 2017), in the global scenario the African continent's contribution in global S&T landscape stands far behind. In the similar line, Library and Information Science (LIS) research in the African continent is comparatively weak. Empirical evidences have suggested that LIS research is non-existent in many African countries. While in some African countries the LIS education and research is in a formative stage. Moreover, in terms of LIS research outputs as reflected from the global indexing and abstracting database (Web of Science and Scopus) research is concentrated only in a few countries for example in

Career Advancement Research Fellow, Tshwane University of Technology, Pretoria, South Africa
Email: skpatra@gmail.com; PatraSK@tut.ac.za

South Africa, Nigeria and Egypt and so on (Patra & Mahesh 2018). Rest other countries have very nominal contribution in global LIS research landscape.

In the year 1994, after the end of Apartheid regime and with the establishment of the democratic government, South Africa has taken number of initiatives for the overall development of Science and Technology (S&T) in the country. As a first major initiative South African Government adopted "White Paper on Science and Technology" in the year 1996. Accordingly, government of the Republic of South Africa identified the strategic areas of S&T. Government also initiatedselective promotion of technology areas of national importance. Moreover, the White Paper outlined the basis of S&T infrastructure for a conducive Research and Development (R&D) environment in the country for the employment generation, poverty elimination, sustainable development and overall economic growth (Patra &Muchie, 2018).

Along with the steps taken for the development of S&T infrastructure and facilities, initiatives were also taken to improve the conditions of South African public libraries sector. Government has taken several noteworthy steps to expandthe access of information for the general public.

Initiatives were taken to openthe doors of learning by creating a culture of reading and writing for the grassroot level. Government budget made the provision of conditional financial grant for the advancement of the libraries sector. According to the speech by the minister of culture Mr. E. N. Mthethwa "This provision has facilitated the transformation of libraries into instruments of learning, the aim of which is to eliminate illiteracy, eradicate inequality and promote social cohesion" *(The State of Libraries in South Africa* August 2015, Page 4).

Further the South African Government's initiatives can be seen from the following steps taken by the government in terms of the Legislative Framework adopted with the span of time (Table 1)

Table 1: Legislative Framework related the Development of LIS in South Africa

Name of the Act	Year
Copyright Act (No. 98 of 1978)	1978
Constitution of the Republic of South Africa (No. 108 of 1996)	1996
Legal Deposit Act (No. 54 of 1997)	1997
National Library of South Africa Act (No. 92 of 1998)	1998
South African Library for the Blind Act (No. 91 of 1998)	1998
Promotion of Access to Information Act (No. 2 of 2000)	2000
National Council for Library and Information Services Act (No. 6 of 2001)	2001
South African Community Library and Information Services Bill (2010)	2010
Protection of Personal Information (PoPI) Act (No. 4 of 2013)	2013
South African Public Library and Information Services Bill	2019

Source: Document Library - Library and Information Association of South Africa Available at https://www.liasa.org.za/page/doc_lib (accessed on 31st July 2020)

In this context, this study aims to map the LIS research in South Africa. It is mentioned above, South Africa is one of the most productive country in terms of LIS research in the African continent. Hence, this study aims to find the internal dynamics of South African LIS research landscape using bibliometrics and Social Network Analysis (SNA) tools.

To fulfill the research objectivefor mapping the LIS research in South Africa, this study aims to address the following research questions. What is the growth pattern of LIS research in South Africa? What are the trends of the core journals which publish the maximum numbers of the LIS research outputs? What are the collaboration patterns among the authors and institutes? Finally, the study comes up with the recommendations to strengthen LIS research in the continent.

2. Literature Review

The bibliometric research on LIS research output during (1980-2017) found that in Africa, South Africa and Nigeria were among the top 25 countries that are productive in LIS research (Hodonu-Wusu& Lazarus 2018). Asubiaro (2019) investigated LIS research output of the 54 African countries using the WoS data. The study observed that, African LIS research attracts very less external funding. Only about 4.43% of the LIS research from Africa got external funds. The study further showed that the African researcher's visibility in comparison to the global landscape was quite low. The African LIS research paper relatively less cited than their global counterpart. During that study period LIS research paper received 0.67 citation per paper per year. In terms of authorship patterns, single author papers declined in that study period. However, there was an increase in multi-authored research papers. This showed that, the collaboration among the researchers had increased. Although the collaboration with researcher outside the continent had increased but intra-Africa collaboration was very less (Asubiaro, 2019).

The analysis of subject-wise research pattern from the LIS research output showed that during 1996-2015 computer science related research was the most prominent field among African LIS researchers. Furthermore, there was difference in the research areas among the African countries. North African countries showed different features from the other part of Africa. North African countries'research output was more on computer science and its allied disciplines. However, other African countries' research focus was on the social science-related disciplines of LIS research.Moreover, the North African countries formed linkages and relationship aligned with the subjects that are theoretical and global in scope. The collaboration cluster analysis showed that colonial languages have influence on collaboration among African and non-African countries (Asubiaro & Badmus 2020).

The collaboration patterns of LIS researchers and citation influence of in sub-Saharan Africa between 1995 and 2016 shows that LIS research in sub-Saharan Africa were growing since 1995. The study by Onyancha, O. B. (2018) observed that foreign countries have enormously contributed to the evolution and progress of LIS research in the African region. However, research collaboration happens both regionally and globally. South Africa, Nigeria

and Kenya were the most active participants in LIS research collaboration in the region. The study further observed that international collaboration in LIS research in sub-Saharan Africa got more citations than other types of collaboration. So, the study recommended that there was need for sub-Saharan African researchers and institutions to formulate policies to create favourable environments for research collaboration (Onyancha 2018).

Among the South African LIS researchers, there is a general trend that they mostly publish in international journals. Moreover, patterns indicated that most researchers struggled to get published early in their careers (Maluleka &Nkwe 2020). Research trends through keywords analysis revealed that South African LIS research mostly focus around academic libraries, bibliometric,scientometrics, information literacy, citation analysis, open access and so on. (Hodonu-Wusu& Lazarus 2018). In terms of collaboration, South African LIS researchers were open to collaboration both within and outside the country. As seen from the research collaboration patterns of LIS teachers in South Africa, there are different influencing factors to enhance research collaboration in LIS in South Africa. The study by Maluleka et al. (2016) further identified the obstacles of effective collaboration in LIS research. These factors include bureaucracy, absence of funding, busy schedule of researchers, as well as physical distance between researchers. The findings further suggested that even though there are many problems of collaboration, majority of LIS researchers in South Africa thought that collaboration is beneficial in research and it should be encouraged (Maluleka, Onyancha, &Ajiferuke 2016).

With this brief background the study will fill the gaps in understanding the dynamics of LIS research in South Africa using different bibliometrics indicators.

3. Objectives

The objectives of this study are as follows:

1. To trace the literature growth pattern in the LIS subject areas from South African researchers;
2. To identify the core journals where most of the literature has been published;
3. To identify the research trends through keyword analysis;
4. To identify the authorship and author's collaboration patterns; and
5. To analysis the institutional and country collaboration patterns.

4. Methodology

In view of the objective stated above, the records were searched from the Web of Science (WoS) database of the Clarivate Analytics. The records were searched putting address of South Africa in the address search field of the database. The search string was: "ADDRESS: (South Africa) and the Timespan: 1975-2019". Database Indexes was: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI. Using the above search string, the search resulted: 364,451 records, which are authored by South African researchers.

The search was further refined by the records related to LIS areas only. So, the subsequent search string was: WEB OF SCIENCE CATEGORIES: (INFORMATION SCIENCE LIBRARY SCIENCE) and the Timespan: 1975-2019. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI. The search yield 2,112 records related to LIS research. The final analysis of this study is based on that retrieved set of records.

Social Network Graphs and the other indicators from the Social Network analysis was drawn using the Software UCINET Netdraw (Borgatti, Everett, & Freeman 2002), Gephi (Bastian, Heymann & Jacomy, 2009) and VoS Viewer (van Eck & Waltman 2009).

The study has the following inherent limitations. The study is based on only 2,112 records. This is because of WoS limited coverage of African LIS literature. So, a significant number of LIS research from the African continent is certainly a miss. The inclusion of other databases for example Scopus or some Africa centric database will perhaps yield a different picture.

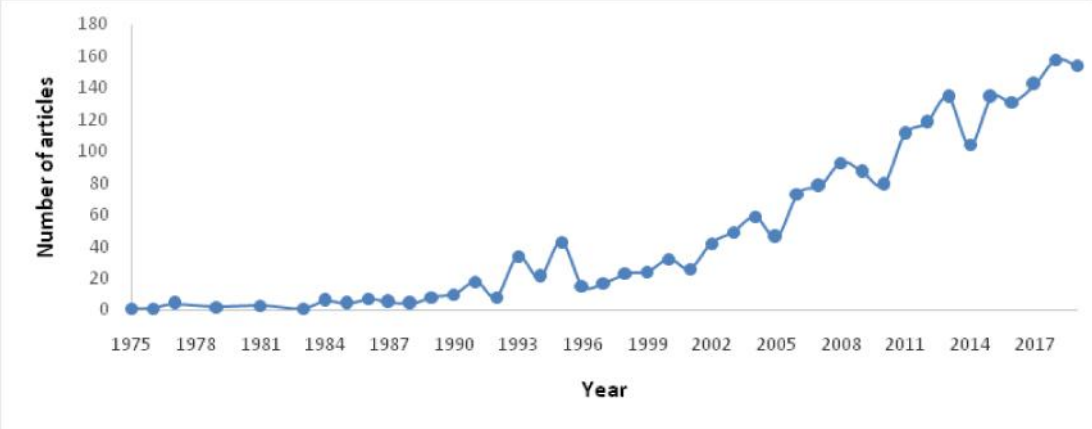
5. Results

The retrieved records were further analysed to get the following indicators; literature growth patterns, core journals, authorship patterns, authorship collaboration patterns, institutional and country wise collaboration patterns from the address of the articles.

5.1. Growth of Literature

A total of 2,112 records were downloaded from the Web of Science data base as categorised under the subject category "Library and Information Science". The figure 1 plots the year wise growth of LIS literature from South Africa. In the initial years there were very little growth of literature in the field. However, there was a good growth observed from the year 1996. Except the year 2014, there was a linear of publication was observed from South Africa. From the last couple of years trends, it can be observed that about 150 articles are published since last couple of years. Figure 1 shows the growth of LIS publications from South Africa.

Figure 1: Growth of LIS Publications from South Africa during 1975-2019



5.2. Core Journals

Identification of "Core Journals" is well developed concept in bibliometrics studies as well as in the "core" collection development in a particular field. Core journals are the journals which publish a significant number of articles in a given filed. According to the Bradford's Law of Scattering (Bradford 1985) literature published in a given field can be categorised in several group or zones with same number of articles as the core or nucleus (Nisonger 2007).

This study has identified that, there are altogether 310 journals publish 2,112 articles. Among them, 6 journals which have published about one third of the LIS literature from South Africa. These journals can be considered as 'core journals' from South African LIS research. These journals are *Electronic Library, Online Information Review, South African Journal of Information Management, Information Development, Libri, African Journal of Library Archives and Information Science*. Further, a total of 20 journals have published half of the total publication output from South Africa (Table 2).

Table 2: Publication in Top 20 Journals on South African LIS Research

Name of the Journal	Number of articles	Cumulative number of articles	Publisher	Publisher's Country
Electronic Library	227	227	Emerald Group Publishing Ltd.	United Kingdom
Online Information Review	171	398	Emerald Group Publishing Ltd.	Online Information Review
South African Journal of Information Management	103	501	African Online Scientific Information Systems (Pty) Ltd	South Africa
Information Development	84	585	SAGE Publications Ltd	United States
Libri	6	661	Walter de Gruyter	Germany
African Journal of Library Archives and Information Science	72	733	Archlib and Information Services Ltd	Nigeria
Scientometrics	63	796	Springer	Netherlands
Library Hi Tech	61	857	Emerald Group Publishing Ltd.	United Kingdom
Telecommunications Policy	54	911	Elsevier Ltd.	United Kingdom
Journal of Librarianship and Information Science	43	954	SAGE Publications Ltd	United Kingdom

South African Journal of Libraries and Information	43	997	Library and Information Association Science of South Africa (South Africa)	South Africa
Information Technology for Development	33	1030	Taylor and Francis Ltd.	United Kingdom
International Journal of Information Management	31	1061	Elsevier Ltd.	United Kingdom
Qualitative Health Research	31	1092	SAGE Publications Inc.	United States
Aslib Proceedings	29	1121	Emerald Group Publishing Ltd.	United Kingdom
Information Research-an International Electronic Journal	24	1145	Thomas Daniel Wilson	Sweden
Journal of Academic Librarianship	19	1164	Elsevier BV	United Kingdom
Library Trends	19	1183	Johns Hopkins University Press	United States
Records Management Journal	17	1200	Emerald Group Publishing Ltd.	United Kingdom
Telematics and Informatics	17	1217	Elsevier Ltd.	United Kingdom

Among the top 20 journals; *South African Journal of Information Management* published from South Africa, *African Journal of Library Archives and Information Science* published from Nigeria and *South African Journal of Libraries and Information Science* is from South Africa. This also shows the less coverage of African publication in WoS database. The inclusion of publications from the Africa will perhaps give a better picture of LIS research from the continent.

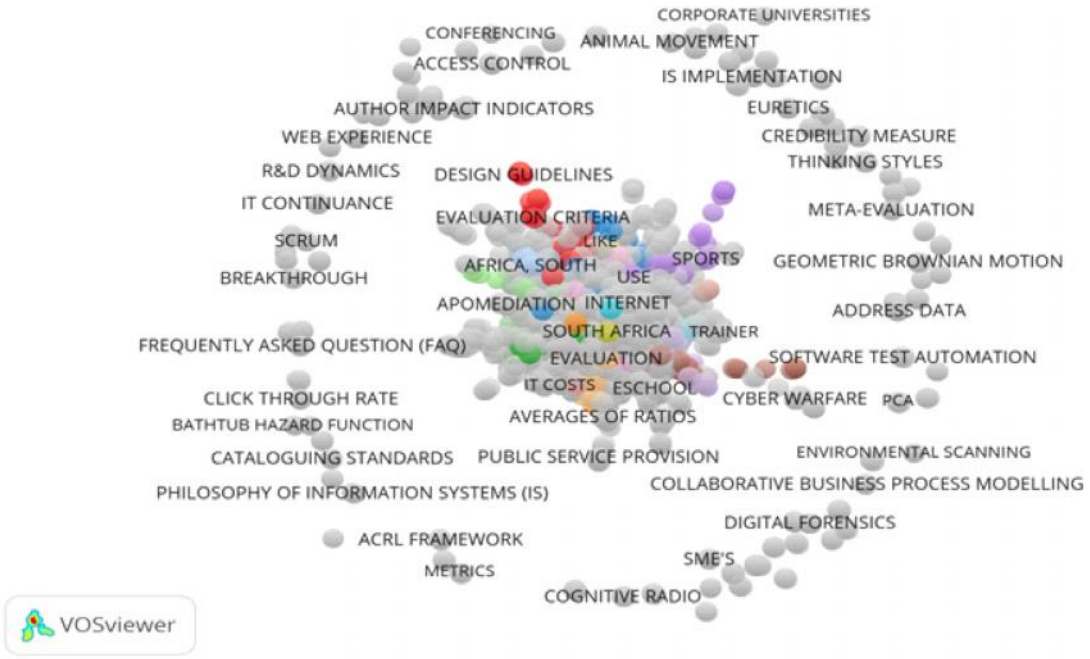
5.3. Research Trends through Keyword Analysis

In any scholarly publication, authors supply several keywords, terms or phrases. There keywords or terms are used to best describe the underlying theme of the research area (Ding et al. 2001). By counting the frequency of keywords, the research focus of any subject can be analysed (Huai and Chai 2018). So, Keyword analysis is an important research theme in bibliometrics studies (Wang & Chai 2018).Hence, Bibliometric indicators/approaches through keyword analysis is important to trace the growth and development of the subject. Further, the analysis of keywords can be helpful even for predicting the further development of the subject areas.

To analyze the content of the publications, this study has used co-word analysis techniques based on the author keywords. As it is discussed in the previous paragraph that, 'Co-word analysis' is a method used to identify themes and relationships between these within subject areas. Author keywords can be assumed to represent the content in a publication, in condensed form. Open source software VOS-viewer used to examine the keyword clusters and the relationships between the keywords' associations (Van Eck & Waltman 2011).

There are altogether 3,409 keywords consists of 97 clusters. The largest component consists of 2,957 keywords (Figure 2). The other components are quite small and perhaps represent isolated and less focused research areas. The most prominent keywords in this largest clusters are South Africa, Knowledge management, Internet, Libraries, Academic libraries, Information, E-government, Knowledge sharing, ICT, Information literacy, Digital libraries and so on.

Figure 2: Keyword Clustering



5.4. Authorship Patterns

This section deals with the authorship pattern and authorship collaboration patterns. Top 20 authors are listed in tables 3. Fourie, I. is the most productive author with 237 publication. His publications constitute about 11.17 percent of total South African publication portfolio. The second most productive author is du Preez, M. with 110 (5.19 percent of article). It is observed that the most productive authors are mainly from the universities where LIS teaching and research are being conducted. Although, South Africa has about 26 public universities, many of them do not have teaching and research facilities in LIS filed. Hence LIS teaching may be conducted beyond the well-established universities.

Table 3: Contribution of Papers of Top 20 Authors

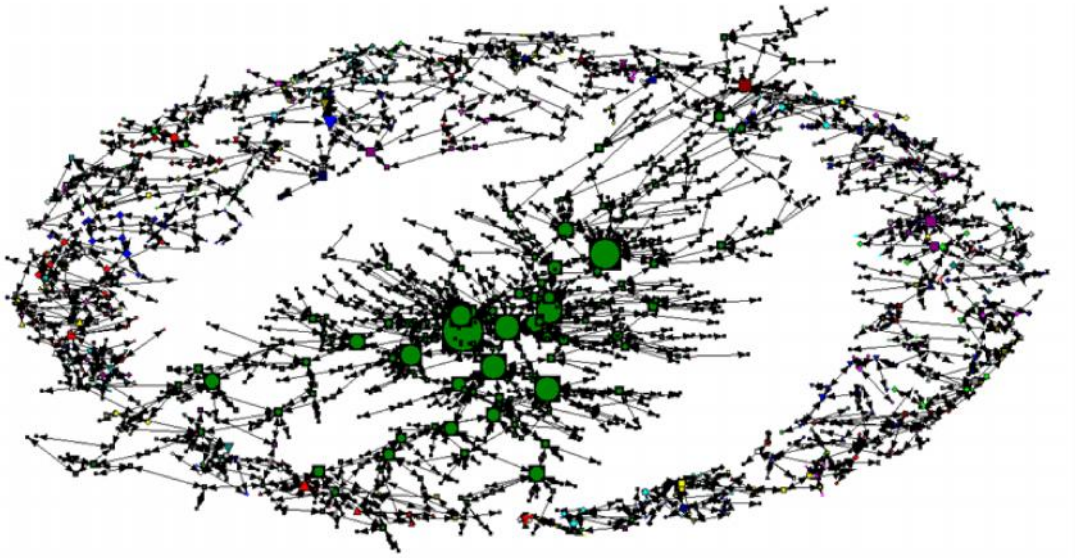
Sl. No	Name of the Author(s)	Number of Articles	Percentage of Articles	Institute
1.	Fourie, I.	237	11.17	University of Pretoria
2.	du Preez, M.	110	5.19	University of South Africa
3.	Ngulube, P.	44	2.07	University of South Africa
4.	Underwood, P. G.	41	1.93	University of Cape Town
5.	Onyancha, O. B.	37	1.74	University of South Africa
6.	Stilwell, C.	33	1.56	University of KwaZulu Natal
7.	Ocholla, D. N.	29	1.37	University of Zululand
8.	Dick, A. L.	26	1.23	University of Pretoria
9.	Mutula, S.	26	1.23	University KwaZulu Natal,
10.	Pouris, A.	25	1.18	University of Pretoria
11.	Pitt, D.	24	1.13	University of Cape Town
12.	Lor, P. J.	22	1.04	University of Pretoria
13.	Ngoepe, M.	22	1.04	University of South Africa
14.	Costas, R.	19	0.90	Stellenbosch University
15.	Mutula, S. M.	18	0.85	University KwaZulu Natal
16.	Nassimbeni, M.	18	0.85	University of Western Cape
17.	de Jager, K.	17	0.80	University of Cape Town
18.	Levine, N.	17	0.80	University of Cape Town
19.	Schutte, M.	16	0.75	University of Pretoria
20.	Sooryamoorthy, R.	14	0.66	University KwaZulu Natal

5.5. Authorship Collaboration Patterns

This section deals with the authorship collaboration patterns using Social Network Analysis (SNA) tools. According to Newman (2010) "A Network is, in its simplest form, is a collection of points joined together in pairs by lines. In the jargon of the field the points are referred to as vertices or nodes and the lines are referred to as edges" (Newman 2010). SNA is a very important research area and objects of interest for the researchers in a wide variety of discipline. For example, SNA is very popular to understand the underlying phenomenon in the physical, biological, social sciences and so on.

In this light, this study uses Social Network tools to understand the co authorship collaboration patterns. In co-authorship collaboration network, each author is considered as node and the collaborations are considered as the 'connections' or 'edges. According to SNA terms, this collaboration is "one mode" network because each author has given equal weightage in collaboration. In this analysis, open source software tools 'Gephi', 'UCINET Net draw' are used to draw the authorship collaboration pattern (Figure 3)

Figure 3: Network of Authorship Collaboration



Among the many other popular centrality measure of social network analysis. This section uses only one centrality measure, i.e., degree centrality. According to Newman (2010), perhaps degree centrality measure is the simplest and it is quite easy to understand. Degree centrality measure in a network is the degree of a vertex, counted by the number of edges connected to it. Although degree centrality is a simple centrality measure, it can be very informative. In a

social network, individuals who have more connections to many others actors in the network might have more influence. These actors have more access to information, or more prestige than thosewho have fewer connections in the network (Newman, 2010).

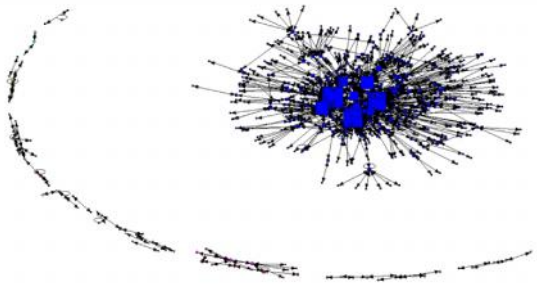
Table 4 : Centrality Measures of Top Collaborating Authors

Sl Number	Name of the author	Degree
1.	Ngulube, P.	30
2.	Fourie, I.	23
3.	Stilwell, C.	19
4.	Ocholla, D. N.	19
5.	Onyancha, O. B.	18
6.	Costas, R.	18
7.	Mutula, S.	15
8.	Ngoepe, M.	15
9.	Ocholla, D.	13
10.	Bwalya, K. J.	11
11.	Lubbe, S.	11
12.	de Jager, K.	11
13.	du Toit, A. S. A.	11
14.	Suleman, H.	11
15.	Brown, I.	10
16.	Mutula, S. M.	10
17.	Robinson-Garcia, N.	10
18.	Underwood, P. G.	10

5.6. Institutional Collaboration Patterns

The total of 2,112 articles of this study have been produced by a total of 3,408 institutes. Among them 730 (about 34%) are collaborative articles. These collaboration happens among 618 institutes. The collaboration network have 618 nodes (collaborating institutes) and 1,291 edeges (connections) among them. Figure 4 shows the collaboration patterns of the institutes.

Figure 4: Collaboration Maps of the Collaborating Entities



The institutional collaboration patterns (Figure 4) shows that the collabation has 35 different components. The largest component consists of 524 institutes. This is the largest collaboration cluster and the most prominent actor among this cluster is University of Capetown.

The centrality measures of collaborating entiry is presented in Table 5. The two centrality measures are presented here, 'Degree centality' and the 'Betweeness centrality'. As discussed above, the degree centrality measure is the most common and easy measures. The node or entity with higher degree centrality means it might have more influence than those with the less number of connections (Newman 2010). In the institutional level collaboration network, University of Cape Town is the most prominent in terms of collaboration followed by University of South Africa, University of Pretoria and Stellenbosch University and so on (Table 5). The different centrality measures of top institutions shows that South African universities are prominent in the collaboration. Universities collaborate with each other with very little collaboration happens ouside these institutes. Also, the institutes with LIS departments which impart education and training are the prominet institute of collaboration. Besides, the universities, Council of Scientific and Insutrial Research (CSIR) South Africa are quite active in collaboration.

Betweenness centrality is another measure of Social Network Analysis. Betweenness centrality, which measures the extent to which an actor or vertex lies on paths between other vertices (Newman 2010). The different betweenness centrality measures are presented in Table 5. The betweenness centrality measures of different institute are in the following order; University of Cape Town, University of South Africa, University of Pretoria, Stellenbosch University, University of Witwatersrand. It is important to note here that universities with higher degree of centrality have the higher betweenness centrality value with little variations.

Table 5: Different Centrality Measures Among the Institutes

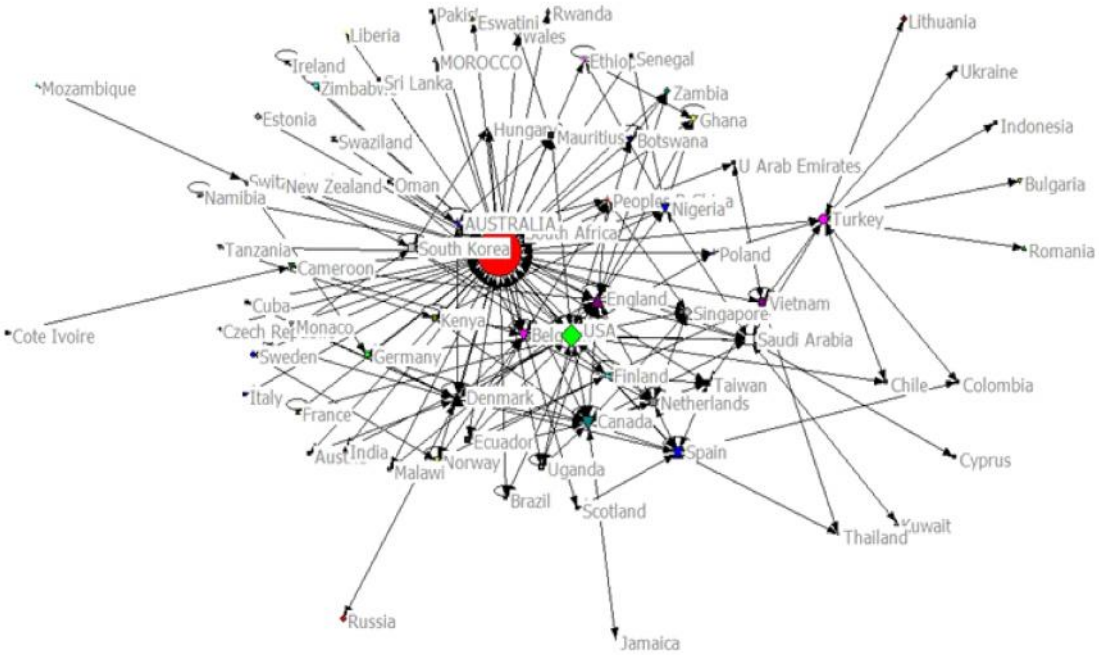
Sl.No	Name of the Institute	Degree of Centrality	Name of the Institute	Betweenness Centrality
1.	University of Cape Town	73	University of Cape Town	40385.43
2.	University of South Africa	65	University of South Africa	33401.75
3.	University of Pretoria	62	University of Pretoria	33108.34
4.	Stellenbosch University	43	Stellenbosch University	24902.1
5.	University of KwaZulu Natal	43	University of Witwatersrand	22222.19
6.	University of South Africa	37	University of KwaZulu Natal	21676.56
7.	University of Witwatersrand	30	CSIR, South Africa	15522.39
8.	University of Johannesburg	28	University of Johannesburg	14976.49
9.	University of Western Cape	23	University of South Africa	12382.12
10.	CSIR, South Africa	23	University of Western Cape	10121.41
11.	University of Zululand	22	North West University	9012.245
12.	North West University	20	University of Zululand	6198.449
13.	Leiden University	16	Leiden University	4461.933
14.	Cape Peninsula UnivTechnol	11	King Faisal University	4445.278
15.	University of Botswana	11	University Toronto	4148

5.7. Country Collaboration Pattern

Author's affiliation country was extracted from the author's address and mapped using SNA tools. South African LIS researchers mainly collaborate with the countries outside the African continent. In terms of collaborative articles are as follows: USA (183 affiliations), England (51 affiliations), Canada (45 affiliations), Denmark (11 affiliations), Belgium (25 affiliations), Spain (20 affiliations), Turkey (10 affiliations) and so on. Among the African countries South African institutes have the collaborative articles with the following countries with the decreasing order Nigeria (88 affiliation address) Kenya (31 institutes) Uganda (institutes) address and so on.

The collaboration pattern shows that LIS researchers from South Africa collaborate more with the institutes outside the continent (Figure 5) . Inter African collaboration is comparatively fewer than the global collaboration. In this case, African institutional collaboration needs to be strengthened. South African LIS research may act as an example for the other countries in the continent.

Figure 5 : Collaboration Maps of the Collaborating Countries in South African LIS Research



6. Conclusion

This study mapped Library and Information Science research in South Africa using bibliographic data from the Web of Science database. The study used different bibliometrics and Social

Network Analysis tools to map the literature growth patterns, core journals, authorship patterns, institutional collaboration patterns and so on.

From this study, it was observed that there is a growth LIS research from South Africa in recent years. However, South Africa needs more focused approach in LIS research to increase scholarly publications. Moreover, a comparative analysis with other countries from the African continent will give a better and more holistic picture of the strength and weakness of South African LIS research in the continent.

South African LIS research is mainly concentrated only within a few universities where there is teaching and research has been conducted. In this age of 4th Industrial Revolution LIS research and training may be promoted to catchup the 'digital divide'. Library and Information professional can take proactive roles in filling the information gap. So, cutting edge researches in these areas are need of the hour. In this context LIS teaching and research should be promoted in the other universities in South Africa.

Research cooperation among African countries may be promoted. South Africa may take lead in collaboration with other countries in the region as well as other countries in the continent. South African lesson may be acting as an example to the other countries in the continent.

References

1. Patra, S. K., & Muchie, M. (2017). Engineering Research Profile of Countries in African Union. *African Journal of Science, Technology, Innovation and Development, 9*(4), 449-465.
2. Patra, S. K., & Mahesh, G. (2018). The Slow Progress of Library and Information Science Research in Africa. *Journal of Scientometric Research, 7*(2), 107-113. doi: 10.5530/jscires.7.2.16
3. Patra, S. K., & Muchie, M. (2018). Research and Innovation in South African Universities: From the Triple Helix's perspective. *Scientometrics, 116*(1), 51-76.
4. *The State of Libraries in South Africa*. (August 2015). Pretoria: Department of Art and Culture, Republic of South Africa.
5. Document Library - Library and Information Association of South Africa Available at https://www.liasa.org.za/page/doc_lib accessed on 31st July 2020
6. Hodonu-Wusu, J. O., & Lazarus, G. N. (2018). Major trends in LIS research: A bibliometric analysis. *Library Philosophy and Practice, 2018*.
7. Asubiaro, T. (2019). How collaboration type, publication place, funding and author's role affect citations received by publications from Africa: A bibliometric study of LIS research from 1996 to 2015. *Scientometrics, 120*(3), 1261-1287. doi: 10.1007/s11192-019-03157-1

8. Asubiaro, T. V., & Badmus, O. M. (2020). Collaboration clusters, interdisciplinary, scope and subject classification of library and information science research from Africa: An analysis of Web of Science publications from 1996 to 2015. *Journal of Librarianship and Information Science*. doi: 10.1177/0961000620907958

9. Onyancha, O. B. (2018). Mapping collaboration and impact of library and information science research in sub-Saharan Africa, from 1995 to 2016. *Library Management, 39*(6-7), 349-363. doi: 10.1108/lm-06-2017-0059

10. Maluleka, J. R., & Nkwe, M. (2020). What Can We Learn from Prolific Researchers? Publication Patterns of the NRF-Rated Library and Information Science Researchers in South Africa. *International Information and Library Review*. doi: 10.1080/10572317.2019.1695177

11. Hodonu-Wusu, J. O., & Lazarus, G. N. (2018). Major trends in LIS research: A bibliometric analysis. *Library Philosophy and Practice, 2018*.

12. Maluleka, J. R., Onyancha, O. B., & Ajiferuke, I. (2016). Factors influencing research collaboration in LIS schools in South Africa. *Scientometrics, 107*(2), 337-355. doi: 10.1007/s11192-016-1846-0

13. Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). Ucinet for Windows: Software for social network analysis.

14. Bastian, M., Heymann, S., &Jacomy, M. (2009). *Gephi: an open source software for exploring and manipulating networks*. Paper presented at the Third international AAAI conference on weblogs and social media.

15. van Eck, N., & Waltman, L. (2009). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523-538.

16. S. C. Bradford, "Sources of Information on Specific Subjects," *Journal of Information Science* 10, no. 4 (1985): 176-80.

17. Nisonger, T. E. (2007). Journals in the Core Collection: Definition, Identification, and Applications. *The Serials Librarian, 51*(3-4), 51-73.

18. Ding, Y., Chowdhury, G. G., & Foo, S. (2001). Bibliometric cartography of information retrieval research by using co-word analysis. *Information Processing and Management, 37*(6), 817-842.

19. Wang, M., & Chai, L. (2018). Three new bibliometric indicators/approaches derived from keyword analysis. *Scientometrics, 116*(721-750).

20. Van Eck N J and Waltman L, Text mining and visualization using VOSviewer. ISSI Newsletter, 7(3) (2011) 50-54.

21. Newman, M. E. J. (2010). *Network: An Introduction*. Oxford New York: Oxford University Press.