AFRICAN JOURNAL OF LIBRARY, ARCHIVES AND INFORMATION SCIENCE

VOLUME 30   NUMBER 1   APRIL   2020

CONTENTS

Scientific Research in West Africa and the Impact of International Collaboration: An Analysis in Scopus Database, 1997-2017

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Abstract

This study analysed the trend of West African research output, the effect of population size and its relative global share during the period 1997 - 2017. The patterns and impact of intra-regional and inter-regional research collaboration on West Africa research output were also assessed. Results show that all West African countries have generated noticeable growth. The West African share of global research has continued to increase over the years. However, West African volume of research output remains small if its global share is to be realised for the benefit of its population. Results show that the research output through collaborative research among West African countries is minimal. The impact of inter-regional collaboration in West African research output is higher than that of intra-regional collaboration. The findings presented in this study suggest that West African countries must invest more in research and improve their research production abilities through a collaborative effort.

Keywords: West Africa, Research Output, Collaboration, Population Size

Introduction

Scientific research in West Africa has been transforming over the last decades. One of the major indicators of scientific research is the research output, which contributes to the existing body of knowledge. Research outputs are the avenue for the determination of the cumulative research area of institutions and are measured by the number of articles published by these institutions (Okagbue, Atayero, Oguntunde, Opanuga, Adamu, and Adebayo, 2018). A reliable approach to study scientific research output is to examine the scientific publications contained in bibliometric databases (Blom et al. 2015). Bibliometrics has been known as a tool for assessing and mapping the state of science in institutions, countries, and regions.

So far, there have not been too many bibliometric studies analysing science in West Africa. Most of the studies carried out focused on Africa as a whole (Narvaez-Berthelemot, Russel, Arvanitis, Waast, and Gaillard, 2002); Tijssen 2007; Pouris and Pouris, 2009; Pouris and Ho (2014); Confraria and Godinho 2015; Blom, Lan, and Adil, 2015; Sooryamoorthy, 2018). Although few studies have focused on West Africa such as Mêgnigbêto (2013a), who examined the scientific research in West Africa from 2001-2010, using data from the Web of Science database. Defor, Kwamie, and Agyepong (2017) examined the pattern and trend of peer-reviewed Health Policy and Systems Research (HPSR) publications in West African countries. Other studies on West Africa are those of Aaron, Wilson and Brown (2010) and Nwagwu (2016). There have also been bilometric studies on specific countries in West Africa such as (Eniayejuni, 2018; and Odeyemi, Bamidele, and Adebisi, 2019.)

Despite that, a few studies have highlighted the development of science in West Africa to the best my knowledge, no study has provided an overall analysis of West African research output over time, the effect of population size, and its relative global

share. In addition, no study has been conducted to assess the patterns and impact of intra-regional and inter-regional research collaboration on West African research output. Thus, this study seeks to conduct an overall analysis of the trend of West African research output, the effect of population size and its relative global share during the period 1997 - 2017. The patterns and impact of intra-regional and inter-regional research collaboration on West Africa *research output* were also assessed. The study seeks to answer the following research questions:

- What is the trend of West African research output
- What is the West African share of global research
- How does population size affect the research output in West Africa?
- How does intra-regional and inter-regional collaboration affect West Africa's research output?
- What are the current scientific research areas in West Africa?

Methods

The study focuses on West Africa, a sub-region comprising fifteen countries, with an estimated population of about 367 million (Worldometers, 2017). West Africa is one of the five regions in the continent of Africa. It consists of fifteen countries who are members of a regional economic organization, ECOWAS. Out of the fifteen countries, four (Nigeria, Sierra Leone, Ghana, and Gambia) are former British colonies, Eight (Benin, Burkina Faso, Cote d'Ivoire, Guinea, Mali, Niger, Senegal, and Togo) are former French colonies, two (Guinea-Bissau and Cape Verde) are former Portuguese colonies, and Liberia was created by citizens of the United States of America for free black slaves. Hence, three international languages are distinguished in the region: English, Portuguese and French (African Union, 2019).

Given that, there is no citation database in West Africa, this study opted to use the Scopus database as the source of data. Scopus database was used due to its comprehensiveness. Scopus is the largest abstract and citations database that tracks and analyses peer-reviewed literature. It has strong coverage with citation data and bibliographic data. Scopus covers more than 49 million records including several journals, books, proceedings, covering research topics across all scientific and technical disciplines (Aghaei et al., 2013; Scopus, 2018; Barrot, 2017; Bornmann and Marx, 2014).

The data for this study was gathered from the Scopus database on June 17, 2019. Documents that are classified as articles published between 1997 and 2017 were downloaded for all West African countries. Firstly, Data for West Africa was retrieved using the Boolean operators. Then Data for each West African country was sourced individually for their research output, co-authorship, and scientific research area. The data gathered from the Scopus database was processed using the data management software program, SPSS, and Excel spreadsheets.

Population data were retrieved from worldometers (Worldometers, 2017).

Findings

The findings are reported in the following categories: The trend of research output, the share of global research, effect of population size on West African research output, the intra-regional and inter-regional collaboration of West Africa research output and current scientific research areas in West Africa.

The Trend of West African Research Output

Table 1 shows the research output from the fifteen West African countries in alphabetical order. To capture the trends in West African research output, data were presented in an aggregate manner for the entire study period of 1997-2017. Data was further segregated into a seven- year period, under three periods of 1997-2003, 2004-2010, and 2011-2017.

Overall, West Africa produced 109, 878 articles during the 21 years of 1997-2017. There was an average of 7,550 articles per country in West Africa within a range of 0 to 66403 publications. Six countries made the most significant contributions to West Africa's research output. Nigeria led all other West African countries by producing more than half (60.43%) of all articles from West Africa. Ghana follows but not very closely, with a 12.54% share of all articles from the region. Senegal had the third-

highest articles with 6.96%. Burkina Faso, Cote d'Ivoire, and Benin had 4.82%, 4.67%, and 3.83% share respectively. Apart from the six most prolific countries that together contributed approximately 93% of the total research output from West Africa, all other countries contributed below a 3% share of the total West African research output.

The delineated period analysis shows that during the first period (1997-2003) 15,668 articles originated from West Africa. Nigeria was the prominent producer, producing more than half (54.36%) of research output during this period. The remaining major contributors were Senegal (9.86%), Ghana (9.29%), Cote d'Ivoire (6.78%), Guinea (4.82%), Burkina Faso (4.61%), and Benin (3.42%), who jointly contributed another 33.97% of the total research output in West Africa. Gambia, Mali, Niger, and Togo contributed 2.76%, 2.48%, 2.29% and 1.87% respectively. All remaining countries (Sierra Leone, Guinea-Bissau, Liberia, and Cape Verde) contributed less than 1% of the total research output in the region.

Table 1: Research output of West African countries, 1997-2017

Country	Overall 1997-2017		3rd Period 2011-2017		2nd Period 2004-2010		1st Period 1997-2003	
	N	%	N	%	N	%	N	%
Benin	4322	3.93	2577	4.26	1209	3.58	536	3.42
Burkina Faso	5293	4.82	3039	5.03	1532	4.54	722	4.61
Cape Verde	243	0.22	184	0.30	47	0.14	12	0.08
Cote d'Ivoire	5131	4.67	2415	4.00	1653	4.89	1063	6.78
Gambia	1948	1.77	905	1.50	611	1.81	432	2.76
Ghana	13774	12.54	9267	15.34	3051	9.03	1456	9.29
Guinea	3139	2.86	1514	2.51	870	2.58	755	4.82
Guinea-Bissau	506	0.46	285	0.47	140	0.41	81	0.52
Liberia	362	0.33	301	0.50	45	0.13	16	0.10
Mali	2744	2.50	1513	2.50	843	2.50	388	2.48
Niger	1748	1.59	886	1.47	503	1.49	359	2.29
Nigeria	66403	60.43	36022	59.61	21861	64.72	8520	54.38
Senegal	7646	6.96	3978	6.58	2123	6.28	1545	9.86
Sierra Leone	760	0.69	538	0.89	129	0.38	93	0.59
Togo	1617	1.47	905	1.50	419	1.24	293	1.87
Total West Africa	**109878**		**60430**		**33780**		**15668**	

By the second period (2004-2010), research output in West Africa more than doubled from the previous period (1997-2003), showing significant growth. This growth is in line with the growth in research output for most West African countries. Countries such as Benin, Burkina Faso, Cape Verde, Ghana, Liberia, Mali, and Nigeria more than doubled their research output from the previous period. The second-period analysis also shows that Nigeria contributed the largest share of West African research output with a 64.72% share followed by Ghana (9.03%), Senegal (6.28%), Cote d'Ivoire (4.89%), Burkina Faso (4.54%), and Benin (3.58%).

The recent years of 2011-2017 recorded a dramatic growth in West Africa research output. Research output in West Africa grew to 60, 430 showing a percentage increase of 79% and 286% from the second and first periods. All West African countries showed a significant increase in their research output from the first and second periods. The major contributors in this period were Nigeria (59.61%), Ghana (15.34%), Senegal (6.58%), Burkina Faso (5.03%), Benin (4.26%), and Cote d'Ivoire (4.00%). Mali, Guinea, Gambia, Togo, and Niger contributed 2.5%, 2.5%, 1.5%, 1.5%, and 1.47% respectively. The rest countries contributed less than 1% of the total research output in West Africa.

West African Share of Global Research

Figure 1 presents the world and West African research output, 1997-2017. The evolution in Figure 1 shows a rising trend in both world and West African research output. West African research output more than quadrupled between 1997 and 2017, with more than 80% of articles published after 2005.
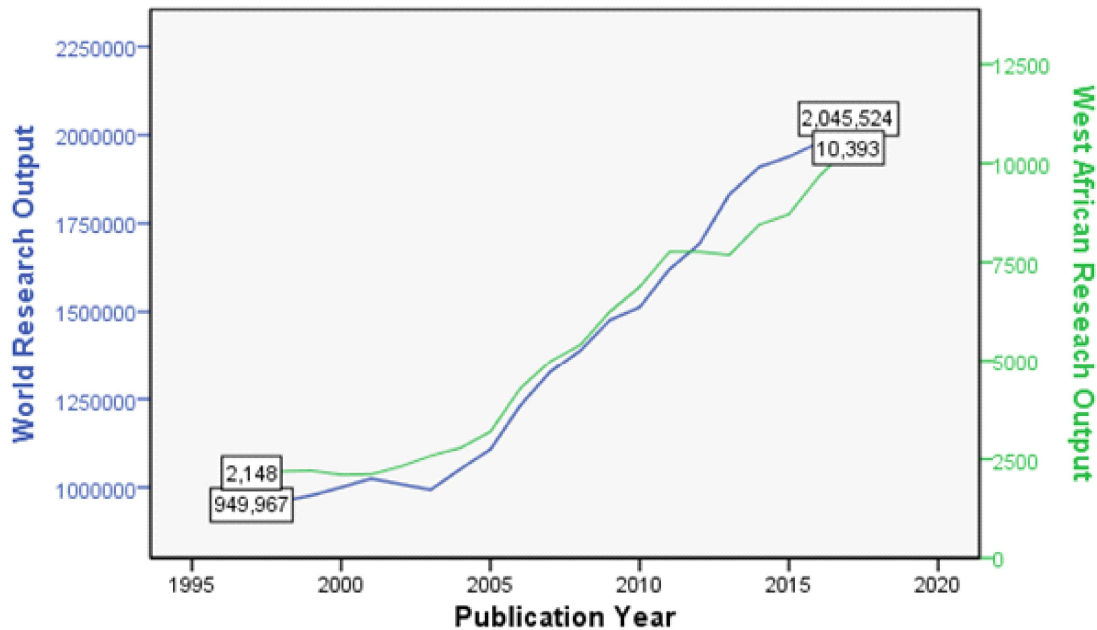

Figure 1: World and West Africa research output

Figure 2 presents the percentage of the West African share of global research. As shown in Figure 2 West African share of the world's article count has continued to increase with a mixed growth pattern. West African global share of published articles grew from 0.23% in 1997 to 0.51% in 2017.
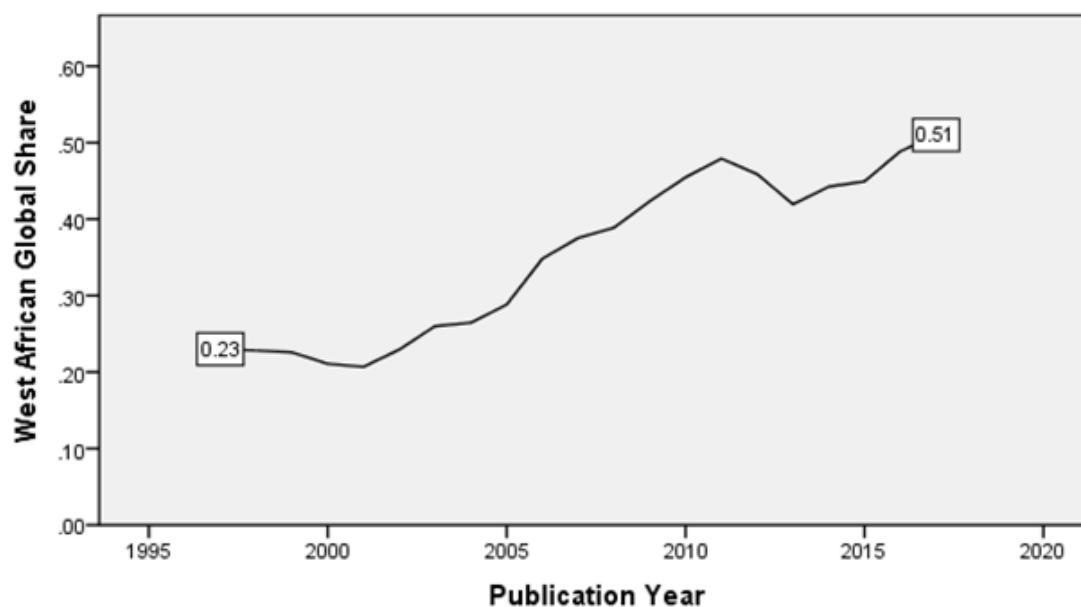
Figure 2: West African share of global research

Effect of Population Size on West Africa Research Output

Table 2 shows the research output, population size and the relative regional share (RS) and global share (GS) of West African countries in alphabetical order.

Table 2: West African Research output, Population size, and its Relative Regional and Global Share

Country	Research Output 1997 -2017			Population Size 2017		
	N	RS	GS	N	RS	GS
Benin	4322	3.93	0.01	11175692	3.04	0.15
Burkina Faso	5293	4.82	0.02	19193382	5.22	0.25
Cape Verde	243	0.22	0.00	546388	0.15	0.01
Cote d'Ivoire	5131	4.67	0.02	24294750	6.61	0.32
Gambia	1948	1.77	0.01	2100568	0.57	0.03
Ghana	13774	12.54	0.05	28833629	7.84	0.38
Guinea	3139	2.86	0.00	12717176	3.46	0.17
Guinea-Bissau	506	0.46	0.00	1861283	0.51	0.02
Liberia	362	0.33	0.00	4731906	1.29	0.06
Mali	2744	2.50	0.01	18541980	5.04	0.25
Niger	1748	1.59	0.01	21477348	5.84	0.28
Nigeria	66403	60.43	0.23	190886311	51.93	2.53
Senegal	7646	6.96	0.03	15850567	4.31	0.21
Sierra Leone	760	0.69	0.00	7557212	2.06	0.10
Togo	1617	1.47	0.01	7797694	2.12	0.10
Total West Africa	**109878**		**0.38**	**367565886**	**100.00**	**4.87**
Total World	**29026436**		**100.00**	**7550262101**		**100.00**

Regional Share (RS),
Global Share (GS)

The global and regional share analysis shows that Nigeria maintained its dominance among West African countries in terms of both research output and population size. Nigeria produced more than half (60.43%) of the total research output and comprised more than half (51.93%) the total population size of West Africa. Approximately 33% of research output in West Africa comes from five other countries: Ghana, Senegal, Burkina Faso, Cote d'Ivoire, and Benin who jointly comprised 27% of the total West African population.

The global share (GS) analysis in Table 2 shows that West Africa comprises approximately 5% of the world's population and contributed 0.38% of the total article in Scopus, 1997-2017. It is evident from this that the West African global research share is ten times lower than its global population share.

The regional share analysis in Table 2 shows an interesting observation with respect to the dimension of West African research output and population size. The research output of West African countries is very much in line with their population size. Countries with high population size produce more research output.

The Intra-Regional and Inter-Regional Collaboration of West Africa Research Output

In assessing the intra-regional research collaboration of West African research output, Table 3 provides country X's contributions to country Y's research output. There has been a significant level of research collaboration among most West African countries. Nigeria and Ghana had the highest level of collaborations with 650 research collaborations. Other countries with a high level of collaborations are Burkina Faso and Senegal with 437

collaborations, Burkina Faso and Mali with 297 collaborations. Despite the high level of collaborations between these countries, the influence of their collaboration on each country's research output differs. For instance, Nigeria contributed 4.7% of Ghana's total research output while Ghana contributed only 1% of Nigeria's total research output. Burkina Faso contributed 5.7% of Senegal's total research output while Senegal contributed 8.3% of Burkina Faso's total research output. Burkina Faso contributed 10.8% of Mali's total research output while Mali contributed 5.6% of Burkina Faso's total research output.

Countries with a high level of influence on other countries' research output include the Gambia, which contributed 16.2% of Guinea-Bissau's total research output. Benin contributed 12.3% of Togo's total research output; Burkina Faso contributed 11.6% of Togo's and 10.8% of Mali's total research output. Senegal contributed 10.6% of Niger's and 10% of Guinea-Bissau's total research output. All other countries contributed less than 10.5% to other country's research output.

In assessing the inter-regional research collaboration of West Africa research output, as observed in Table 3, collaboration with countries outside West Africa have greatly influenced West Africa's research output. The first collaborator for all West African countries falls outside the West African region. Gambia had the highest influence from a foreign collaborator, with 67% contribution from the United Kingdom (UK). This was followed by Guinea-Bissau with 66% from Denmark and Liberia with 57% from the United States (US). Except for Nigeria who had 6% influence from its first foreign collaborator. All other West African countries had 19% and above influence from their first foreign collaborator.

Table 3: West African countries' contributing to one another's research output, 1997 –2017

X		BJ	BF	CV	CI	GM	GH	GN	GW	LR	ML	NE	NG	SN	SL	TG
Benin (BJ)	N		233	0	196	31	216	57	15	3	140	75	293	212	8	199
	%		5.4	0.0	4.5	0.7	5.0	1.3	0.3	0.1	3.2	1.7	6.8	4.9	0.2	4.6
Burkina Faso (BF)	N	233		0	283	87	284	88	28	6	295	168	168	437	19	188
	%	4.4		0.0	5.3	1.6	5.4	1.7	0.5	0.1	5.6	3.2	3.2	8.3	0.4	3.6
Cape Verde (CV)	N	0	0		1	0	3	3	0	0	2	1	3	5	0	0
	%	0.0	0.0		0.4	0.0	1.2	1.2	0.0	0.0	0.8	0.4	1.2	2.1	0.0	0.0
Cote d'Ivoire (CI)	N	196	283	1		40	153	65	19	9	120	46	145	205	10	105
	%	3.8	5.5	0.0		0.8	3.0	1.3	0.4	0.2	2.3	0.9	2.8	4.0	0.2	2.0
Gambia (GM)	N	31	87	0	40		100	26	82	2	102	14	119	115	9	11
	%	1.6	4.5	0.0	2.1		5.1	1.3	4.2	0.1	5.2	0.7	6.1	5.9	0.5	0.6
Ghana (GH)	N	216	284	3	153	100		61	26	17	146	72	650	166	30	76
	%	1.6	2.1	0.0	1.1	0.7		0.4	0.2	0.1	1.1	0.5	4.7	1.2	0.2	0.6
Guinea (GN)	N	57	88	3	65	26	61		15	13	58	23	56	99	29	23
	%	1.8	2.8	0.1	2.1	0.8	1.9		0.5	0.4	1.8	0.7	1.8	3.2	0.9	0.7
Guinea-Bissau (GW)	N	15	28	0	19	82	26	15		1	19	2	21	50	1	14
	%	3.0	5.5	0.0	3.8	16.2	5.1	3.0		0.2	3.8	0.4	4.2	9.9	0.2	2.8
Liberia (LR)	N	3	6	0	9	2	17	13	1		5	2	27	9	18	1
	%	0.8	1.7	0.0	2.5	0.6	4.7	3.6	0.3		1.4	0.6	7.5	2.5	5.0	0.3
Mali (ML)	N	140	295	2	120	102	146	58	19	5		137	131	251	8	58
	%	5.1	10.8	0.1	4.4	3.7	5.3	2.1	0.7	0.2		5.0	4.8	9.2	0.3	2.1
Niger (NE)	N	75	168	1	46	14	72	23	2	2	137		112	182	4	31
	%	4.3	9.6	0.1	2.6	0.8	4.1	1.3	0.1	0.1	7.9		6.4	10.4	0.2	1.8
Nigeria (NG)	N	293	168	3	145	119	650	56	21	27	131	112		158	61	73
	%	0.4	0.3	0.0	0.2	0.2	1.0	0.1	0.0	0.0	0.2	0.2		0.2	0.1	0.1
Senegal (SN)	N	212	437	5	205	115	166	99	50	9	251	182	158		26	92
	%	2.8	5.7	0.1	2.7	1.5	2.2	1.3	0.7	0.1	3.3	2.4	2.1		0.3	1.2
Sierra Leone (SL)	N	8	19	0	10	9	30	29	1	18	8	4	61	26		8
	%	1.1	2.5	0.0	1.3	1.2	3.9	3.8	0.1	2.4	1.1	0.5	8.0	3.4		1.1
Togo (TG)	N	199	188	0	105	11	76	23	14	1	58	31	73	92	8	
	%	12.3	11.6	0.0	6.5	0.7	4.7	1.4	0.9	0.1	3.6	1.9	4.5	5.7	0.5	

Table 4: Foreign countries contribution to West African countries research output, 1997–2017

Country	1st Collaborator	2nd Collaborator	3rd Collaborator	4th Collaborator	5th Collaborator
Benin	France (1252, 29%)	Belgium (512, 12%)	US (455, 11%)	UK (376, 9%)	Germany (345, 8%)
Burkina Faso	France (1733, 33%)	US (709, 13%)	UK (633, 12%)	Germany (459, 9%)	Belgium (434, 8%)
Cape Verde	Portugal (104, 43%)	Spain (57, 23%)	UK (37, 15%)	US (29, 12%)	Brazil (27, 11%)
Cote d'Ivoire	France (1738, 34%)	US (566, 11%)	Switzerland (457, 9%)	UK (345, 7%)	Germany (304, 6%)
Gambia	UK (1312, 67%)	US (557, 29%)	Belgium (270, 14%)	Netherlands (204, 10%)	Switzerland (178, 9%)
Ghana	US (2634, 19%)	UK (2228, 16%)	South Africa (928, 7%)	Germany (882, 6%)	Netherlands (748, 5%)
Guinea	Australia (1012, 32%)	US (706, 22%)	UK (473, 15%)	France (357, 11%)	Spain (263, 8%)
Guinea-Bissau	Denmark (331, 66%)	Sweden (122, 24%)	UK (108, 21%)	Gambia (81, 16%)	US (80, 16%)
Liberia	US (206, 57%)	UK (58, 16%)	France (32, 9%)	Canada (30, 8%)	Switzerland (28, 8%)
Mali	US (872, 32%)	France (724, 26%)	UK (361, 13%)	Kenya (240, 9%)	Switzerland (210, 8%)
Niger	France (577, 33%)	US (384, 22%)	UK (174, 10%)	Belgium (127, 7%)	Germany (104, 6%)
Nigeria	US (4231, 6%)	UK (3574, 5%)	South Africa (2979, 4%)	Malaysia (1672, 3%)	Germany (1412, 2%)
Senegal	France (2858, 37%)	US (1039, 14%)	UK (513, 7%)	Belgium (367, 5%)	Cameroon (276, 4%)
Sierra Leone	US (274, 36%)	UK (223, 29%)	China (100, 13%)	Germany (52, 7%)	Switzerland (46, 6%)
Togo	France (465, 29%)	US (162, 10%)	Germany (100, 6%)	Belgium (65, 4%)	Switzerland (62, 4%)

An interesting observation emerged when comparing the intra-regional collaboration (Table 3) and inter-regional collaboration (Table 4). It was observed that West African countries contribute only a small percentage to each other's research output as compared to the contributions made by foreign countries. For instance, despite Nigeria's huge volume of research output, contributions of other West African countries to Nigeria's research output were below 0.5%, while the US contributed 6%, and the UK contributed 5%. Gambia who had the highest influence from a foreign collaborator, with a 67% contribution from the UK had its highest regional contribution from Senegal with a 5.9% contribution. Others with high contributions from foreign countries include Guinea-Bissau, which had 66% from Denmark (foreign) but 16.2% from Gambia (regional). Liberia had 57% from US (foreign) but 7.5% from Nigeria (regional). Even countries with high regional influence had their highest influence from foreign collaborators. For instance, Togo had 12.3% from Benin but 29% from France (foreign). The influence of foreign countries on West African countries is higher than the influence of West Africa countries on each other's research output.

Current Scientific Research Areas in West Africa

The current scientific research foci of West Africa during the study period are presented in Table 5. Most West African countries had published in the 27 research areas (according to Scopus database classification). Research areas that had a minimum of 7,000 publications were considered. Seven research areas had more than 7,000 publications.

Medicine topped the list with 43,318 article publications. The others were Agricultural and Biological Sciences (26,414), Biochemistry, Genetics and Molecular Biology (12,236), Social Sciences (12,080), Environmental Science (10,673), Immunology and Microbiology (9,981) and Engineering (7,238).

Scientific research in Medicine was centralized in Nigeria with 55.16% of the total publications. Other important countries in this regard were Ghana (11.93%), Senegal (8.54%), Burkina Faso (6.0%), and Cote d'Ivoire (5.49%). In Agricultural and Biological Sciences, Nigeria topped with (58.14%), Ghana (11.66%), Benin (6.98%), Senegal (6.74%), and Burkina Faso (5.64%) were ahead of other countries in the region.

In Biochemistry, Genetics and Molecular Biology research, West African relied mostly on Nigeria with 59.67%. Other countries in this regard include Ghana (10.87%), Senegal (6.42%), Burkina Faso (5.33%), Cote d'Ivoire (4.72%), and Benin (4.59%). Other countries had less than 3.6%. Nigeria and Ghana led West Africa in Social Sciences with 61.35% and 21.22% respectively. In Environmental Science, Nigeria had 58.03% and Ghana 17.24%. Other countries had less than 6%. The leading countries in Immunology and Microbiology were Nigeria (40.01%), Senegal (12.59%), Ghana (12.39%), Burkina Faso (9.98%), Cote d'Ivoire (6.91%), and Gambia (6.23%).

In Engineering West Africa relied mainly on Nigeria with 75.31%. Apart from Ghana with 11.04%, other countries had less than 4%.

Table 5: Research Area of West African countries, 1997 - 2017

	Medicine		Agricultural and Biological Sciences		Biochemistry, Genetics and Molecular Biology		Social Sciences		Environmental Science		Immunology and Microbiology		Engineering	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Benin	1454	3.36	1843	6.98	562	4.59	290	2.40	521	4.88	495	4.96	119	1.64
Burkina Faso	2598	6.00	1489	5.64	652	5.33	376	3.11	546	5.12	996	9.98	139	1.92
Cape Verde	42	0.10	86	0.33	17	0.14	34	0.28	52	0.49	11	0.11	12	0.17
Cote d'Ivore	2377	5.49	1416	5.36	578	4.72	266	2.20	369	3.46	690	6.91	288	3.98
Gambia	1419	3.28	293	1.11	430	3.51	66	0.55	47	0.44	622	6.23	8	0.11
Ghana	5170	11.93	3081	11.66	1330	10.87	2563	21.22	1840	17.24	1237	12.39	799	11.04
Guinea	1533	3.54	871	3.30	419	3.42	253	2.09	268	2.51	487	4.88	91	1.26
Guinea-Bissau	400	0.92	77	0.29	92	0.75	15	0.12	17	0.16	169	1.69	2	0.03
Liberia	229	0.53	45	0.17	29	0.24	72	0.60	34	0.32	35	0.35	10	0.14
Mali	1442	3.33	831	3.15	396	3.24	197	1.63	253	2.37	526	5.27	38	0.53
Niger	578	1.33	646	2.45	231	1.89	157	1.30	278	2.60	191	1.91	57	0.79
Nigeria	23894	55.16	15356	58.14	7301	59.67	7411	61.35	6194	58.03	3993	40.01	5451	75.31
Senegal	3699	8.54	1780	6.74	785	6.42	498	4.12	639	5.99	1257	12.59	246	3.40
Sierra Leone	422	0.97	154	0.58	73	0.60	113	0.94	53	0.50	83	0.83	19	0.26
Togo	898	2.07	363	1.37	127	1.04	73	0.60	91	0.85	131	1.31	55	0.76
Total	**43318**	**100.00**	**26414**	**100.00**	**12236**	**100.00**	**12080**	**100.00**	**10673**	**100.00**	**9981**	**100.00**	**7238**	**100.00**

Discussion

The findings on the research output in West African countries reveal a noticeable growth from the years 1997 to 2017. By the second period of analysis, the total research output in West Africa more than doubled from the previous period. Eight of the fifteen countries increased their research output by more than 100%. This trend continued to the third period where the total research output in West Africa increased by 79% from the second period and 286% from the first period. This trend indicates that West Africa's research outputs are increasing over the years.

An analysis of the research output in West African countries reveals that the research output in West African countries is relative to its population size. The research output of West African countries strongly correlates with its population size. Countries with high population size were found to produce more research output. This is evident from previous studies (Luo, Liang, Gong, Bao, Huang, and Jia, 2015). 2015; Cheng and Zhang 2013), where it was found population size strongly correlated with research output.

West Africa represents almost 5% of the world's population, despite West African's vast population; it only contributes 0.38% of the total research article in Scopus, 1997-2017 indicating that West African global research share is ten times lower than its global population share. Despite the noticeable growth in West African's research output, West African global research share is well below the world average. Though West African contribution to global knowledge has increased quite dramatically from 0.23% share in 1997 to 0.51% in 2017; however, the share of West African research output at the global level remains low. West Africa's share of the world's scientific output remained below the world average. This low share can be attributed to insufficient research funding as similarly noted by Tijssen (2007), and Megnigbeto (2016).

Scientific research output in West Africa as noted in the study is more concentrated in Medicine. Similarly, Mêgnigbêto (2013a) also noted that research in West Africa is produced mainly in medical and health sciences. This can be attributed to the study of Nwagwu, (2016), who noted that Medicine is a local discipline, often addressing challenges that exist in the immediate environment and that researchers are naturally responding to the needs of the local and immediate community.

Scientific research output in West Africa is largely dependent on a few countries. Nigeria, Ghana, Senegal, Burkina-Faso, and Cote d'Ivoire. Nigeria alone contributed more than half of the publications. The second major contributor was Ghana but it was far lower than the percentage share of Nigeria. The leadership demonstrated by Nigeria has both demographic and economic roots. Nigeria contributes the largest share of West African total research output and population size. This is evident from the study of Megnigbeto (2013a) who reported that Nigeria is the leader of knowledge production in West Africa, as Nigeria accounts for more than half of West African research output and demography.

It is also significant that the level of research collaboration among most West African countries has impacted greatly by boosting the research output of other West African countries. This analysis is in line with that of Onyancha and Maluleka (2011); Hoekman, Frenken and Tijssen (2010); Onyancha and Ocholla (2007) which found that a country's total research output is greatly boosted by its neighbours. A different scenario emerged when assessing the research collaboration of West African countries with non-West African countries. It was observed that foreign collaboration plays a big role in the production of knowledge in West Africa. The research output through collaborative research among West African countries is minimal as compared to foreign collaboration. This implies that collaboration with researchers from other parts of the world helps increase West Africa's research output. This illustrates the remark of Mêgnigbêto, (2013c) that collaboration within West African countries is weak or negligible. However, this is in contrast to the report of Adam, King, and Ma (2010) which revealed that countries belonging to the same geographical region tend to collaborate more with each other than they did with countries outside their region.

Collaborative research has drastically increased international co-authorship in scientific publications, resulting in a rapid increase in the number of international co-authored articles in all fields and disciplines (Low, Ng, Kabir., Koh and Sinnasamy, 2014; Pouris and Ho, 2014). Prathap (2013) explained that scientific collaboration has brought about greater co-authored articles, which has

increased the overall number of research output. An increase in research output tends to advance scientific knowledge. As noted by Eniayejuni (2018) "researchers need to collaborate and publish more to yield impactful research and to advance scientific knowledge which will be assessed for national science policies and development".

Conclusion

Over the years, West African contribution to global knowledge has increased quite dramatically. Although all West African countries have made gains in the last decade. Only a few countries were responsible for the growth and development of the bulk of knowledge production in West Africa. The regional top six countries were Nigeria, Ghana, Senegal, Burkina Faso, Cote d'Ivoire and Benin. The combined share of these countries is about 88% of the total West Africa research output and about 80% of total West Africa population.

The research output of West African countries is very much in line with its population size. Countries with high population size were found to be more productive than countries with lower population size. The share of West African research output at the global level remains low as compared to their global population share.

Research preferences and specialisation in all research areas were dominated by Nigeria. Other prolific countries were Ghana, Senegal, Burkina Faso, Cote d'Ivoire, and Benin. The key research areas were Medicine, Agricultural and Biological Sciences, Biochemistry, Genetics, and Molecular Biology, Social Sciences, Environmental Science, Immunology and Microbiology and Engineering.

West African research appears to be more dependent on inter-regional collaboration than intra-regional collaboration. The impact of foreign collaboration in West African research output is higher than that of regional collaboration. Since knowledge-creation is increasingly dependent on collaborative efforts and research is known as a driver of economic growth and political development, West Africa must increase their collaborative effort to increase their research output, West African countries must invest more in research and improve their research production abilities to further strengthen socio-economic development in the sub-region.

References

Aaron, G. J., Wilson, S. E., and Brown, K. H. (2010). Bibliographic Analysis of Scientific Research on Selected Topics in Public Health Nutrition in West Africa: Review of Articles Published from 1998 to 2008. *Global Public Health*, 5 (S1), S42-S57.

Abbas, A., Avdic, A., Xiaobao, P., Hasan, M. M., and Ming, W. (2019). University-Government Collaboration for the Generation and Commercialization of New Knowledge for Use in Industry. *Journal of Innovation and Knowledge*, 4 (1), 23-31.

Adams, J., King, C., and Ma, N. (2010). Global Research Report. *Africa. Leeds, UK: Evidence, a Thomson Reuters business*.

African Union, Member States, (2019). Retrieved 15th June 2019, <https://au.int/en/member_states /countryprofiles2>

Aghaei, Chadegani, A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M., and Ale Ebrahim, N. (2013). A Comparison between Two Main Academic Literature Collections: Web of Science and Scopus Databases. *Asian Social Science*, 9 (5), 18-26.

Barrot, J. S. (2017). Research Impact and Productivity of Southeast Asian Countries in Language and Linguistics. *Scientometrics*, 110 (1), 1-15.

Baskaran, A. (2017). UNESCO Science Report: Towards 2030. *Institutions and Economies*, 125-127.

Blom, A., Lan, G., and Adil, M. (2015). *Sub-Saharan African Science, Technology, Engineering, and Mathematics Research: A Decade of Development*. The World Bank.

Bornmann, L. and Marx, W. (2014). How to Evaluate Individual Researchers Working in the Natural and Life Sciences Meaningfully? A Proposal of Methods Based on Percentiles of Citations. *Scientometrics*, 98 (1), 487-509.

Cheng, T., and Zhang, G. (2013). Worldwide Research Productivity in the Field Of

Rheumatology from 1996 to 2010: A Bibliometric Analysis. *Rheumatology*, *52*(9), 1630-1634.

Confraria, H. and Godinho, M. M. (2015). The Impact of African Science: A Bibliometric Analysis. *Scientometrics*, *102* (2), 1241-1268.

Defor, S., Kwamie, A., and Agyepong, I. A. (2017). Understanding the State of Health Policy and Systems Research in West Africa and Capacity Strengthening Needs: Scoping Of Peer-Reviewed Publications Trends and Patterns 1990–2015. *Health Research Policy And Systems*, *15* (1), 55.

Eniayejuni, A. (2018). Impact of Scientific Productivity and Trend on Publication Output of Nigerian Authors in Web of Science from 2006 to 2016. *African Journal of Library, Archives and Information Science*, *28* (1).

Groboljšek, B., Ferligoj, A., Mali, F., Kronegger, L. and Igliè, H. (2014). The Role and Significance of Scientific Collaboration for the New Emerging Sciences: The Case of Slovenia. *Teorija in praksa*, *51* (5), 864-883.

Hoekman, J., Frenken, K. and Tijssen, R. J. (2010). Research Collaboration at a Distance: Changing Spatial Patterns of Scientific Collaboration within Europe. *Research Policy*, *39* (5), 662-673.

Lan, G., Blom, A., Kamalski, J., Lau, G., Baas, J. and Adil, M. (2014). A Decade of Development in Sub-Saharan African Science, Technology, Engineering, and Mathematics Research. *Elservier., editor. World Bank*.

Low, W. Y., Ng, K. H., Kabir, M. A., Koh, A. P., and Sinnasamy, J. (2014). Trend and Impact of International Collaboration in Clinical Medicine Papers Published in Malaysia. *Scientometrics*, *98* (2), 1521-1533.

Luo, X., Liang, Z., Gong, F., Bao, H., Huang, L. and Jia, Z. (2015). Worldwide Productivity in the Field Of Foot and Ankle Research from 2009–2013: A Bibliometric Analysis of Highly Cited Journals. *Journal of Foot and Ankle Research*, *8* (1), 12.

Megnigbeto, E. (2013a). Scientific Research in West Africa: A Global View (2001–2010). *ISSI Newsletter*, *9*, 6-11.

Mêgnigbêto, E. (2013b). International Collaboration in Scientific Publishing: The Case of West Africa (2001–2010). *Scientometrics*, *96* (3), 761-783.

Mêgnigbêto, E. (2013c). Scientific Publishing in West Africa: Comparing Benin with Ghana and Senegal. *Scientometrics*, *95* (3), 1113-1139.

Narváez-Berthelemot, N., Russell, J. M., Arvanitis, R., Waast, R. and Gaillard, J. (2002). Science in Africa: An Overview of Mainstream Scientific Output. *Scientometrics*, *54* (2), 229-241.

Nwagwu, W. E. (2016). A Decade of Biomedical Research in West Africa (2005–14) A Bibliometric Analysis of the Ten Most Productive Countries in MEDLINE. *Journal of Higher Education in Africa/Revue de l'enseignement supérieur en Afrique*, *14* (1), 43-83.

Odeyemi, O. A., Odeyemi, O. A., Bamidele, F. A., and Adebisi, O. A. (2019). Increased Research Productivity in Nigeria: More to be Done.

Okagbue, H. I., Atayero, A. A., Oguntunde, P. E., Opanuga, A. A., Adamu, P. I., and Adebayo, A. O. (2018). Exploration of Research Areas of Universities in Nigeria based on Scopus Subject Document Classification. *Int. J. Educ. Info. Technol*, *12*, 117-123.

Onyancha, O. B. and Maluleka, J. R. (2011). Knowledge Production Through Collaborative Research in Sub-Saharan Africa: How Much Do Countries Contribute to each other's Knowledge Output and Citation Impact?. *Scientometrics*, *87* (2), 315-336.

Onyancha, O. B. and Ocholla, D. N. (2007). Country-Wise Collaborations in HIV/AIDS Research in Kenya and South Africa, 1980–2005. *Libri*, *57* (4), 239-254.

Pouris, A. and Ho, Y. S. (2014). Research Emphasis and Collaboration in Africa. *Scientometrics*, *98* (3), 2169-2184.

Pouris, A. and Pouris, A. (2009). The State of Science and Technology in Africa (2000–2004): A Scientometric Assessment. *Scientometrics*, *79* (2), 297-309.

Prathap, G. (2013). Second-Order Indicators for Evaluating International Scientific Collaboration. *Scientometrics*, *95* (2), 563-570.

Sooryamoorthy, R. (2018). The Production of Science in Africa: An Analysis of Publications in the Science Disciplines, 2000–2015. *Scientometrics*, *115* (1), 317-349.

Tijssen, R. (2007). Africa's Contribution to the Worldwide Research Literature: New Analytical Perspectives, Trends, and Performance Indicators. *Scientometrics*, *71* (2), 303-327.

Toivanen, H. and Ponomariov, B. (2011). African Regional Innovation Systems: Bibliometric Analysis of Research Collaboration Patterns 2005–2009. *Scientometrics*, *88* (2), 471-493.

Worldmeters, World Population, (2017). Retrieved 15th February 2018, <http://www. worldo meters. info/world-population/western-africa-population/>

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Perceptions and Use of the Virtual Library by Undergraduates at the International University of Management, Namibia

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Abstract

The purpose of this paper is to investigate the perceptions and use of the virtual library by undergraduate students at the International University of Management, Namibia. This study used the quantitative research approach. Two hundred and eighty-six (286) copies of a self-administered questionnaire, comprising closed and open-ended questions were used to collect data from the students. In addition, a semi-structured interview schedule was used to collect data from the Reference Librarian. The findings revealed that most users were aware of the virtual library; however, the level of awareness was relatively higher than the use. Further, the study observed that the pattern of use differed in terms of frequency, preference and location of access. The study also established that most respondents perceived the virtual library as useful and easy to use. Some of the challenges hindering the effective use of the virtual libraries range from Internet interruption, inadequate computers in the library to lack of skills required for virtual library use, were established.

Introduction

The role of the library in an academic institution is to be an integral and active part of the educational process in supporting teaching, learning and research by providing timely access to quality, authentic and relevant information resources and services (Uwakwe, Shidi and Abari, 2016). In this era of information, technology has become the means for academic libraries to fulfil their role. No library can claim to fully meet its users' needs if it does not embrace technology. Undeniably, in the quest to meet the ever-evolving information needs and varied topography of the communities they serve, virtual libraries (VL) have found their place as the pillar of efficient and effective service delivery in academic libraries.

A virtual library, as described by Uwakwe, Shidi and Abari (2016), is a library with no physical boundaries. Ape (2011) opines that virtual libraries are internet rooted and information resources, brought to end users through electronic networks. Mudhol and Vasanth (2009) describe it as a collection of resources available on one or more computer systems, where a single interface or entry point to the collections is provided. In essence, VL implies no sense of physical location, whether for the end user or for the source, as the user can access information from anywhere and the information can

be held anywhere (Kaur, 2015; Mudhol and Vasanth, 2009).

The term virtual library has attracted the interest of users because of the increasing medium called the WWW (World Wide Web), making VL the most reachable and important source of information in the world and may replace or complement traditional library. Undoubtedly, technology has become more pervasive and the web has grown into the standard mechanism for delivering library content and service, prompting libraries to develop websites they term virtual libraries, which serve as extensions of their services into the networked environment that deliver similar content and services as their physical counterparts, even though electronically (D'Angelo, 2001; Verma and Verma, 2014).

Virtual libraries have changed the traditional focus of librarians and are indeed 'the new vision of the libraries of the future' (Koganuramath, 2007). To embrace this 'new vision', the International University of Management (IUM) library made great effort to build a virtual library. A variety of information resources and services are made available remotely to the students through the VL for access and use. Like most modern libraries, the IUM library is committed to providing access to online and print resources to support teaching, learning and research. The development of a virtual library at IUM was done with users in mind, to reach a wider clientele, harmonise services and resources across various IUM campus libraries, and provide unlimited access to users without any geographical barrier, among others. However, no study has been carried out since the inception of a virtual library to establish how it is perceived and used by targeted users and whether the users are aware of how their information needs can be met by the virtual library. This study, therefore, aimed to establish how undergraduates at IUM perceive and make use of the virtual library. The specific objectives of this study included establishing awareness of IUM's virtual library among undergraduate students, pattern of use, perception and the challenges faced when accessing and using the virtual library.

Literature review

There is a misconception about the term 'virtual library'; some relate it to World Wide Web, others term it as a collection of Universal Resource Locator (URL) on a webpage, whereas others term it as a synonym of digital or electronic library. As a result, the terms 'electronic', 'digital' and 'virtual' library have been used synonymously (Gbaje, 2007), despite the fact that their meanings differ. An electronic library consists of electronic materials and services such as e-journals, e-books, video tapes and CD-ROM, accessible by any medium such as a computer; it may be stored in an offline server or online, and it can be accessed remotely via computer network. A digital library, on the other hand, is a collection of digital computing, storage and communication machinery with content and software, delivered digitally over computer networks. Conversely, virtual libraries consists of both digital and electronic libraries existing virtually (Verma and Verma, 2014; Tenant, 1999 as cited in Gbaje, 2007). In simpler terms, digital and electronic libraries can exist without a virtual library, but a virtual library cannot exist without a digital and/or electronic library (Gbaje, 2007).

Gapen (1993) describes a virtual library as "the concept of remote access to the contents and services of libraries and other information resources, combining an on-site collection of current and greatly used materials in print and electronic form, with an electronic network which gives access to, and delivery from, external worldwide library and commercial information and knowledge sources."

Pointing out the benefits of a virtual library, Veeranjaneyulu, Jadhav and Devi (2015); Burke (2009) highlight that VLs eliminate physical boundaries, allow round-the-clock availability, simultaneous access of the same resources, simplify information retrieval as users are able to search terms (words, phrases, titles, names and subjects) in an entire collection, provide user-friendly interfaces, give clickable access to its resources, save space compared to the traditional libraries, and provide user assistance services such as e-reference, interlibrary loan, technical assistance, etc. Kaur (2015) agrees with Veeranjaneyulu, Jadhav and Devi (2015), as his study found that VLs promote the use of information and solutions to challenges of traditional libraries, such as storage and accessibility. To Baidwan and Tandon (2015); Mairaj and Naseer (2013), the concept of library services has changed from physical to virtual, as libraries are aware of the technological needs of

their users, whose preference to search for information is more inclined to the web or virtual environment than the physical library.

Gowda and Shivalingaiah (2009) establish that the use of virtual resources in a library depends on the type of Information Technology (IT) infrastructure. In a different study, Tlakula and Fombad (2017) found that the awareness, accessibility and level of use of VL was low among undergraduate students. Tlakula and Fombad (2017) further found that students were confused about the difference between library virtual resources and web-based internet sources, which could be due to the fact that training was mostly once-off during orientation in the first year. Similarly, Madukoma (2015) found a limited level of awareness of virtual reference services among library users at Babcock University. To improve use of virtual services, the study recommended increase in awareness education through various school seminars, use of library and study skills lessons and training of reference librarians on the use of modern library technologies.

Moyo (2008) asserts that in order to fully utilise resources of a virtual library, patrons working in a virtual environment require assistance, which is achieved through virtual reference services. Virtual users become frustrated when they fail to receive assistance, as they are mostly outside the confinement of a physical library they would have been able to physically consult a librarian for assistance. Ashaver and Bem-Bura's (2013) study confirm this statement when they observed students' frustration at the lack of a library staff to assist in a virtual environment. Ashaver and Bem-Bura (2013) thus recommend staff or libraries find a way to assist students to use virtual services whenever required.

There is a divided opinion on the perceived usefulness of academic libraries, especially e-resources. A study by Matusiak (2012) concluded that library users, especially students, perceive academic libraries as not useful. On the contrary, Bakare, Bamigboye and Chiemenem (2015) found that students perceived library e-resources as useful. Assessing library users' perception on library resources and services is of outmost importance (Omeluzor and Akinwoye, 2016), as it determines – to a large extent – the level of information resources

usage in academic libraries, serving as a measuring and evaluation parameter to improve library resources and services (Ashaver and Bem-Bura, 2013).

A library (physical or virtual) exists to meet the information needs of its users through the provision of timely, relevant and authentic information. It is, however, important to point out that having a well-resourced library and enabling seamless accessibility to these resources does not guarantee optimal use, as intended users' perception may have an influence on its use. This statement is affirmed by Omeluzor and Akinwoye (2016), whose findings infer that users' perceptions influence the use of library resources. Oyewo and Bello (2014) found that virtual resources are not adequately used because undergraduates have negative attitudes towards them. To maximise the use of virtual or online learning resources, their study recommends improved training on computer literacy skills for students, and that library staff should encourage students to effectively use virtual or online resources.

The constraints of students to access and use virtual or electronic resources, as observed by Arshad and Ameen (2018); Oyewo and Bello (2014); Omeluzor and Akinwoye (2016), include cyber restrictions, lack of advanced searching skills, lack of guidance on use, slow connectivity, poor computer literacy skills, lack of awareness and insufficient resources in various study areas. Similarly, Zarghani, Eskrootchi, Hoseini, Noorishadkam, Golmohammadi and Mostaghaci (2015) attribute the inadequate use of virtual libraries to the lack of awareness about their existence.

Methodology

Applying the quantitative research approach, 287 participants (286 students and one librarian) were chosen from a population of 1 001. The population consisted of 1 000 Faculty of Education students and one librarian from the Dorado-City campus of the International University of Management (IUM). The Faculty of Education was selected on the basis that it has the largest number of students in the institution. Conversely, Dorado-City campus was suitable for the study because it has the largest number of education students and these students have more access to Internet facilities than other campuses and can therefore access VLs. The sample of 286 was

determined by applying Slovin's sample deterministic formula, $n = N / (1 + N (e)^2)$, with an error margin of 5%.

Using the non-probability sampling technique, one librarian and 286 students were purposively selected. The librarian was interviewed and the self-administered questionnaire was handed out to students. The librarian was purposively selected on the basis that she was responsible for attending to virtual reference services and training users on virtual services; hence, she is knowledgeable on the nature of VL activities and related student issues. To confirm some of the issues raised by the librarian in the interview session, the researchers attended some training sessions to observe the librarian training on the VL and how students responded. At random, the researchers observed a cross section of the participants using the VL. Using a cross section of the sample and observing them at random was necessary to prevent the researchers' presence from influencing the behaviour of the participants. Furthermore, the data were gathered by administering the questionnaire to the 286 participants. The questionnaire mostly comprised closed-ended questions and a few open-ended questions.

It is worth mentioning that before the data collection instruments (interview protocol, questionnaire and observation checklist) above were applied, the researchers tested the validity and reliability of these instruments through a pilot study, consisting of 35 undergraduate students. Items tested in the pilot study included comprehension of the items on the data collection instruments, the level of difficulty of the questions of the instruments and interpretation of the items of the instruments.

Results and Discussions

Out of the 286 participants, 206 participants responded to the questionnaire, which amounted to a 72% response rate. Since the response rate was above 50%, it was representative enough of the sample's position on the items under study. This is confirmed by Mugenda and Mugenda (2013), who stated that a response rate above 50% is appropriate for statistical reporting.

The results of the data analysis indicated that 96% of the respondents were aware of VLs, 32% of these respondents were made aware of VLs through library orientation, 23% through library training sessions, 16% through library staff, 10% through friends and classmates, 9% through library web pages, 6% through lecturers and 4% through library e-mail alerts/bulleting/posters. It is surprising to note that only 6% of the students were made aware of VLs by lecturers, considering the level (or expected level) of interaction between students and lecturers.

On pattern of use, the study found out that 18.0% of the respondents used the VL daily, 10.2% used it weekly, an encouraging 35.4% of the respondents use the VL several days a week, 5.8% use it monthly, 24.8% used it only when necessary and 4% of the respondents did not respond to this item. The response is promising, as 63.6% of the response is termed acceptable (i.e. daily, weekly and several days in a week). However, it is worth noting and acting on the 32.4% response that falls under the categories of monthly and when necessary.

EBSCO Discovery Service was the mainly (30%) used virtual resource, followed by OPAC (26%) and electronic journals (23%). Virtual reference services were the least used (9%) virtual resource. The factors contributing to low usage of virtual reference services were not considered in this study.

The study also sought to examine the location where respondents mostly accessed the VL. The study found that a majority (66%) used the University Library, 8% within the University and 22% indicated that they accessed the VL from home. Others (4%) indicated anywhere including other libraries.

Regarding the purpose for accessing the VL, the four reasons are listed in Table 1. Among these four, 52% of the respondents indicated completing assignments as their preferred purpose for using VLs; 72% indicated finding personal information was their least purpose for using the VL. Similar findings were reported by Okongo (2014). Table 1 below presents the finding.

Table 1: Purpose and preference for using the VL

Respondents' Preference	Purpose			
	Research assignments	Completing information	Personal assistance	Requesting
Most preferred	71 (37%)	101 (52%)	8 (4%)	10 (5%)
Moderately preferred	86 (44%)	66 (34%)	15 (8%)	31 (16%)
Slightly preferred	26 (13%)	21 (11%)	39 (20%)	83 (43%)
Less preferred	7 (4%)	4 (2%)	60 (31%)	50 (26%)
Least preferred	4 (2%)	2 (1%)	72 (37%)	20 (10%)

Regarding the perception of usefulness, most of the respondents (49.9%), perceived virtual library as useful, 23.7% perceived it as very useful, 22.2% perceived it as fairly useful and 7.2% perceived it as not useful. Despite the fact that this finding is congruent with those of Bakare, Bamigboye and Chiemenem (2015), it contradicts Matusiak's (2012) findings that library users, especially students, do not perceive academic libraries as useful.

In terms of the user friendliness of the VL, 93% of the respondents perceived the VL as user friendly, 33% perceived the VL as very easy to use, 42 % perceived the VL as easy to use, and 18% perceived it as fairly easy to use. However, 7% perceived the VL as not easy to use. The negative or low perception responses (not easy to use) should be acted upon, as it is an indication of underlying factors, such as the lack of training, that influence this perception. A system perceived not easy to use may hinder users from services associated with the system.

Responding to whether the participants received training to access and use the VL, a majority (61.7%) of them, responded 'yes', while 32.5% indicated that they never received training. Notwithstanding that the percentage of respondents who never received training was lower than those who received training; it was still a significant number (32.5%). Regarding the effect of library training, 89% of those who received training indicated that it influenced them to use the VL. In a consistent response, 90% of those who did not receive training indicated that they were VL illiterate and had no information about it.

In terms of the challenges of accessing the VL, 81% of the respondents confirmed they encountered challenges while accessing the VL. The challenges encountered included inadequate computer skills, lack of appropriate training, lack of support from library staff, inadequate computers, internet interruption, restrictions to download certain items and information overload. Among these challenges, inadequate computers in the library and Internet interruption were the most encountered by students. This study confirms the findings of Omeluzor and Akinwoye (2016) on challenges of accessing the VL.

Conclusion

This study investigated the perceptions and use of the virtual libraries by undergraduate students at the International University of Management. The findings revealed that most users were aware of virtual libraries, even though the awareness means differed. The study found that the level of awareness was relatively higher than the use, although the difference was not acute. This implied that the gap between awareness and use could easily be reduced if prevailing challenges were addressed. Furthermore, the study found that the pattern of use varied in terms of frequency, preference and location of access. Most respondents made use of the virtual library several days a week for the purpose of completing assignments and they accessed the virtual library through the University Library. This could be an indication that most users did not have personal computers and Internet outside the University, or that they prefer to use the library in between their classes.

Findings also revealed that most respondents perceived the virtual library as useful and easy to use, although a few of the respondents perceived it differently.

Recommendations

Based on the prevailing challenges of virtual library adoption, access and usage, this paper makes the following recommendations:

- Libraries need to employ marketing and promotion strategies, regular awareness sessions, offer regular information literacy training, have collections that are dynamic and capable of meeting the information needs of the students so as to realise adoption and optimal usage of the VL.
- The University Management should work at improving the Information Technology infrastructure, including internet in order to enable smooth access and use of the VL.
- Though this study addressed the knowledge gap that existed on the IUM virtual library user behaviour, future research studies that focus on a different group of library users like the postgraduate students, part-time students or the faculty should be undertaken to get further insight into library user behaviour.

References

Ape, R. (2011). Information Communication Technology (ICT) and Libraries, In Ape, R. (Ed), *Modern Library Instruction for Higher Education.* Makurdi, NG: Midan Enterprise, pp. 85-100.

Arshad, A., and Ameen, K. (2018). Academic Scientists' Scholarly Use of Information Resources in the Digital Environment: Perceptions and Barriers. *Global Knowledge, Memory and Communication*, 67(6/7), 467-483.

Ashaver, D., and Bem-Bura, M. D. (2013). Students' Perception of Library Services in Universities in Benue State. *IOSR Journal of Research and Method in Education*, 1(5), 41-48.

Baidwan, K. and Tandon, D. (2015). Virtual Reference Services in PGIMER Library: User and Library Staff Point of View. *International Journal of Next Generation Library and Technologies,* 1(1), 123 -130.

Bakare, D. O., Bamigboye, B. O., and Chiemenem, M. C. (2015). Students' Perception of E-Resources in an Academic Library: The Federal University of Agriculture, Abeokuta Experience. *Information Impact: Journal of Information and Knowledge Management*, 6(1), 105-116.

Burke, M. (2009). E-Libraries and Distance Learning. In M. Khosrow-Pour, D.B.A. (Ed.), *Encyclopaedia of Information Science and Technology, Second Edition*. Hershey, PA: IGI Global, pp. 1349-1353. doi:10.4018/978-1-60566-026-4.ch213

D'Angelo, B. J. (2001, September). Assembling and Managing Virtual Libraries. *Information Today,* 37 (5), 1.

Gapen, D. Kaye. (1993). The Virtual Library: Knowledge, Society, and the Librarian. In Saunders, Laverna M. (Ed.), *The Virtual Library.* Westport, CT: Meckler, pp. 1-4.

Gbaje, E. S. (2007). Implementing a National Virtual Library for Higher Institutions in Nigeria. *LIBRES: Library and Information Science Research Electronic Journal*, 17 (2), 1-15.

Gowda, V., and Shivalingaiah, D. (2009). Attitude of Research Scholars towards Usage of Electronic Information Resources: A Survey of University Libraries in Karnataka. *Annals of Library and Information Studies,* 56 (3), 184-191.

Kaur, A. (2015). Role of Virtual Libraries in Learning Process. In S. Thanuskodi (Ed.), *Handbook of Research on Inventive Digital Tools for Collection Management and Development in Modern Libraries*. Hershey, PA: IGI Global, pp. 42-52. doi:10.4018/978-1-4666-8178-1.ch003

Koganuramath, M. (2007). Virtual Library: An Overview. *INFLIBNET*, 535-542. [Online] http://hdl.handle.net/1944/1430 [Accessed 20 January 2019].

Madukoma, E. (2015, August). *Users' Perception of Electronic Reference Services in Babcock University Library, Ilishan-Remo, Ogun State, Nigeria*. Paper Presented at the IFLA WLIC Conference, Cape Town, South Africa. [online] http://library.ifla.org/id/eprint/1302 [Accessed 5 March 2019].

Mairaj, M. I., and Naseer, M. M. (2013). Library Services and User Satisfaction in Developing Countries: a Case Study. *Health Information and Libraries Journal*, 30 (4), 318-326. doi: 10.1111/hir.12038

Moyo, L. M. (2008). The virtual Patron. *Science and Technology Libraries*, 25 (1-2), 185-209.

Mudhol, M. V., and Vasanth, N. (2009, December). The Virtual Library: Virtually a Reality? In *Second International Conference on Computer and Electrical Engineering*. 2, pp. 283-285. doi: 10.1109/ICCEE.2009267

Mugenda, O. M. and Mugenda, A. G. (2013). *Research Methods: Quantitative and Qualitative Approaches*. Nairobi, Kenya: ACTS Press.

Namugera, L. (2017). Users' Awareness, Perceptions and Usage of Makerere Library Services in the Main and Selected Branch Libraries. *Qualitative and Quantitative Methods in Libraries*, 3 (3), 741-758.

Okongo, A. N. (2014). *Access and Utilization of Digital Information Services in Academic Libraries: The Case of University of Nairobi* (Master's Thesis). University of Nairobi, Kenya.

Omeluzor, S. U., Akibu, A. A., and Akinwoye, O. A. (2016). Students' Perception, Use and Challenges of Electronic Information Resources in Federal University of Petroleum Resources Effurun Library in Nigeria. *Library Philosophy and Practice (E-Journal)*. 1428. http://digitalcommons.unl.edu/libphilprac/1428 [Accessed 2 May 2019].

Oyewo, R. O., and Bello, G. R. (2014). Students' Accessibility and Utilization of Electronic Information Resources in the Library: A Case Study of Selected Monotechnics in Oyo State. *Information Technologist (The)*, 11(1). https://www.ajol.info/index.php/ict/article/view/109512 [Accessed 6 January 2019).

Uwakwe, C., Shidi, H., and Abari, G. M. (2016). Perception of Library and Information Science Students on the Use of Virtual Library at the Benue State University Library. *Journal of Advances in Library and Information Science*, 53(1), 89-95.

Veeranjaneyulu, K., Jadhav, V. S., and Devi, Y. U. (2015). Role of Academic Librarians in the Virtual Library Environment. *Indian Journal of Information, Library and Society,* 28 (1-2), 4-11.

Verma, M. K. and Verma, N. K. (2014). Concept of Hybrid, Digital and Virtual Library: A Professional Approach. *InfoLib*, 7 (14), 19-23.

Zarghani, M., Eskrootchi R., Hoseini A. F.,Noorishadkam M, Golmohammadi A., and Mostaghaci M. (2015). Virtual Library: An Essential Component of Virtual Education. *Journal of Medical Education and Development.* 10 (1), 36-46.

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A Bibliometric Analysis of Nigeria's Research Performance, 1901-2016

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Abstract

A bibliometric analysis of Nigerian publications indexed in Scopus database over a 115-year period, 1901 to 2016 was carried out. The study elucidated Nigerian research performance, publication trends, publications patterns and collaboration patterns at national and international levels. A total of 95,304 publications were analysed with underlying bibliometric indicators and statistics. Results show a steady increase in Nigerian publications after independence; predominant article publications compared to conference papers and reviews as well as frequent collaboration within the country when compared to outside the country; and that most research publications in Nigeria emanate from universities. It is therefore suggested that there is need for more research activities and collaboration within and especially outside the country to enhance effective research productivity.

Keywords: Nigeria, Bibliometrics, Scholarly Communication, Publication Pattern, Scopus.

Introduction

Research is key to development and productivity of any nation. In this twenty-first century, developed countries periodically assess their research performance and productivity for sustainable national growth and development of innovation systems and modern knowledge. Research outputs are mostly disseminated through publications (Okiki, 2013). Publication can be in textbooks, book chapters, conference papers, journal articles and technical reports. The journal articles are mostly used to assess and evaluate research performance. In bibliometric analysis, experts count the number of papers written by researchers, universities, countries/regions and disciplines over a specific period to measure productivity (Ani and Onyancha, 2012). A bibliometric analysis has been a common and acceptable research method for the assessment of research performance and productivity (Ho, 2014). The bibliometric analysis basically involves the quantitative statistical analysis of documents with an underlying principal assumption that scholars' published papers reflect their scholarly activities when their publications are subjected to quantitative analysis (Moed, 2002). It is used to measure scientific output, impact and collaboration based on the number of publications, usually interpreted as proxies of the indicators (Waltman and Noyons, 2018). Bibliometric studies are sometimes interpreted with other metrics to make a good research policy (Moed, 2005).

Problem Statement

Studies have shown that limited studies were carried out on the evaluation of Nigerian publications output. These studies include Nigerian publications indexed in Web of Science (WoS) in the fields of arts and humanities and social science between 2002 and 2007 (Nwagwu and Egbon, 2011); publications from Nigerian universities indexed in WoS, 2000 - 2010

(Ani and Onyancha, 2012); WoS indexed library and information science research publications in Nigerian universities (Ani and Okwueze, 2016); and cancer research publications in Nigeria from PubMed database during the period of 2008 to 2012 (Salisu and Ojoye, 2015). These studies tend to address publications output in specific disciplines or national institutions or a specific research interest/field. However, this study seeks to conduct an in-depth analysis of Nigerian research performance using publications output indexed in the Scopus database from 1901 to 2016.

Scopus is the largest curated abstract and citation database of peer-reviewed literature. The use of Scopus as data source has proven suitable and is preferred over other citation databases because of its wider coverage (Chinchilla-Rodríguez, López-Illescas, and de Moya-Anegón, 2012; Mongeon and Paul-Hus, 2015, and Majid, Chang, Hnin, Ma and San, 2015).

Objectives of the Study

The broad objective of this study is to evaluate Nigeria's research performance over a 115-year period (1901 to 2016) via indexed articles in Scopus database with underlying bibliometric indicators and statistics. The specific objectives are to:

(i) examine the trend and pattern of growth of Nigerian publications output;

(ii) analyse the publication patterns, and collaboration patterns among Nigerian universities;

(iii) identify national leading universities in terms of publications output and collaboration rate; and

(iv) analyse the collaboration patterns at international level.

Methodology

The study adopted bibliometric techniques and indicators to explore the research activities in Nigeria from 1901 to 2016. Publications data were extracted from Scopus. Even though Scopus was launched by Elsevier in 2004 as an alternative to Web of Science owned by Thomson Reuters, all predated publications were collated and indexed in the Scopus database. The search involved using the Document Search Tab with the Option Affiliation (Affiliation Country) and the keyword 'Nigeria'. A publication was attributed to Nigeria if there was an author address that reflected the country name. The first evidence of publication from Nigeria was an article paper published in British Medical Journal in 1901, titled: *Preliminary note on an unclassified type of West African fever*.
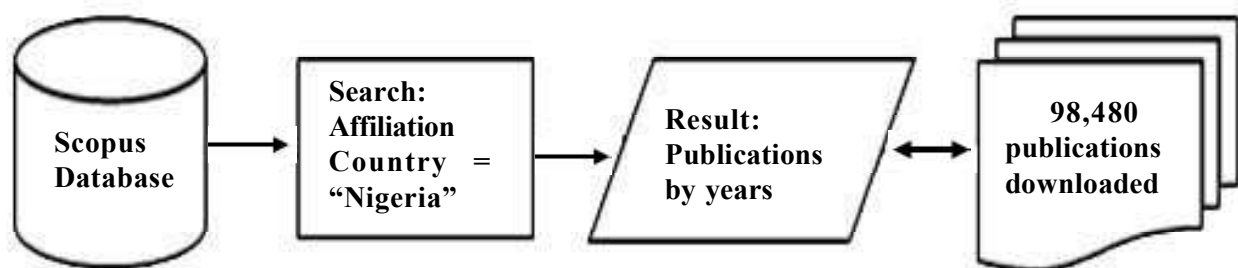

Figure 1: Schematic diagram showing searching of Scopus for publications by Nigerian authors

Each publication record was saved under the following column headings: authors, title, year, source title, volume, issue, article no., page start, page end, page count, cited by, DOI, link, affiliations, authors with affiliations, references, publisher, document type and source. Publication output and citation count are indicators among the performance indicators generally considered to be objective and quantitative when measuring research output and impact (Pienta, 2004 in Ani and Onyancha, (2012)). Basically, this study deployed these two indicators and their derivatives in measuring research outputs and impact. A total of 98,480 records were downloaded.

Data cleaning and standardisation was carried out such as institution's name disambiguation (i.e. harmonising old and new names of institutions), correction of misspelled institution's name, eliminating of duplicate entries, correction of wrong attribution of publication (e.g. article with Nigerian institution name assigned Niger), reclassification of publications from research centres/institutions/teaching hospitals to their parents' institutions (e.g. papers from University College Hospital was assigned to University of Ibadan) and so on. These processes pruned the total publications to 95,304 publications. Afterwards, a script was written using R-statistical programming language to present the data in a suitable form for data analysis.

Results

Nigeria's total publications output over the years cumulated to 95,304 publications in 115 years (1901 - 2016); they were delineated into a 10- year period, starting from 1901 to1910. The total number of universities established over the periods was 127 universities.

Table 1: Number of Publications in Nigerian Universities from 1901 to 2016

Publication period	Total publications (%)	Number of established universities	Cumulative number of established universities
1901-1910	13 (0.01)	–	–
1911-1920	18 (0.02)	–	–
1921-1930	63 (0.07)	–	–
1931-1940	70 (0.07)	–	–
1941-1950	108 (0.11)	1	1
1951-1960	557 (0.58)	1	2
1961-1970	1,401 (1.47)	5	7
1971-1980	6,026 (6.32)	11	18
1981-1990	12,563 (13.18)	12	30
1991-2000	11,332 (11.89)	14	44
2001-2010	29,329 (30.77)	58	102
2011-2016	33,824 (35.49)	24	126
Total	**95,304**	**126**	

As expected, Table 1 shows an increasing trend from less than 1% in the period 1901 to 1910, to 35.49% during the period 2011-2016 except during the period 1991-2000, when there was a decline. A few publications were recorded before the period the first university, University of Ibadan (formerly known as University College, Ibadan) was established in 1948. Those publications were from authors whose affiliations were research centres/institutions/hospitals/foreign institutions. Thereafter, the establishment of the first and successive universities over time brought significant increase in publications

output. During the period 1991 – 2000, despite an additional 14 universities that were established and cumulatively 44 universities, there was a drop in publications output. This could be attributed to a 27% shrink in higher institutions budgetary allocation during this period (Saint, Harnett and Strassner, 2003).

There has been an exponential growth in number of publications in the 21st century. Publications within these periods (2001 – 2016) cumulatively constituted 66.3% of the total publications. The table below presents the proportion of publications based on the predefined document types by the Scopus. The document types include abstract report, article, article in press, book, book chapter, conference, editorial, erratum, letter, note, report, review, short survey, and other publications. Publications classified as other publications are those that are not specified by Scopus.

Table 2 shows significant variation in publication of the document types ranging from predominance of article papers with 85.4%, then conference papers of 4.9% and review papers of 3.3% down to minuscule values for editorial, short survey, erratum, book, abstract report and report while unspecified papers constituted 1.6%. The dominance of journal articles is in conformity with the study by Fiala and Ho (2015) in which article papers accounted for 62.6%.

Table 2: Number of Publications by Document Type in Nigerian Universities

Document type	Number of publications (%)
Abstract Report	18 (0.0)
Article	81,407 (85.4)
Article in Press	689 (0.7)
Book	83 (0.1)
Book Chapter	1,334 (1.4)
Conference Paper	4,659 (4.9)
Editorial	222 (0.2)
Erratum	90 (0.1)
Letter	1,545 (1.6)
Note	466 (0.5)
Report	3 (0.0)
Review	3,112 (3.3)
Short Survey	159 (0.2)
Other publications	1,517 (1.6)
Total	**95,304**

Universities Publications Output

This section analysed output from Nigerian universities. There are a total of 126 universities which were established between 1948 and 2016, where 74 are public universities –37 universities each were owned and funded by federal government and state governments respectively, while the other 52 universities were privately owned by missionaries or private individuals. The Nigerian universities' total publications output comprises 83,484 papers in 68 years which is equivalent to 87.6% of the entire Nigerian publications output as at 2016. Table 3 presents the statistics of bibliometric indicators used: University Total Publication (Univ.TP): total publications from each university; First Author (FA): total number of publications that members of the university were posited as first author; Single author (SA): total number of publications that the member of the university solely authored; Average Citation per Publication (ACt/P) and Average Publication per Year (AP/Y) were also deployed to normalise the variation across the board.

Table 3: Top 25 Prolific Nigerian Universities

Rank	Year founded	University	Univ.TP (%)	FA (%)	SA (%)	Total citation	ACt/P	AP/Y
1	1948	University of Ibadan (UI)	17,092 (20.5)	9,488 (55.5)	3,992 (23.4)	143,227	8.4	251.4
2	1962	Obafemi Awolowo University (OAU)	8,286 (9.9)	4,754 (57.4)	1,957 (23.6)	55,307	6.7	153.4
3	1960	University of Nigeria Nsukka (UNN)	7,544 (9.0)	4,320 (57.3)	1,979 (26.2)	41,963	-5.6	134.7
4	1962	Ahmadu Bello University (ABU)	6,386 (7.6)	3,780 (59.2)	1,359 (21.3)	39,347	6.2	118.3
5	1962	University of Lagos (UNILAG)	6,287 (7.5)	3,575 (56.9)	1,372 (21.8)	37,401	-5.9	116.4
6	1970	University of Benin (UNIBEN)	5,108 (6.1)	3,038 (59.5)	1,165 (22.8)	26,479	-5.2	111.0
7	1975	University of Ilorin (UNILORIN)	3,859 (4.6)	2,092 (54.2)	841 (21.8)	20,975	-5.4	94.1
8	1975	University of Port Harcourt (UNIPORT)	2,746 (3.3)	1,634 (59.5)	498 (18.1)	21,513	7.8	67.0
9	1975	University of Calabar (UNICAL)	2,493 (3.0)	1,415 (56.8)	473 (19.0)	16,259	6.5	60.8
10	1981	Federal University of Technology, Akure (FUTA)	2,341 (2.8)	1,397 (59.7)	439 (18.8)	11,907	-5.1	66.9
11	1988	Federal University of Agriculture, Abeokuta (FUNAAB)	2,109 (2.5)	1,291 (61.2)	240 (11.4)	9,720	-4.6	75.3
12	1975	University of Jos (UNIJOS)	1,924 (2.3)	1,042 (54.2)	351 (18.2)	13,003	6.8	46.9
13	1990	Ladoke Akintola University of Technology (LAUTECH)	1,892 (2.3)	1,232 (65.1)	134 (7.1)	10,726	-5.7	72.8
14	1975	University of Maiduguri (UNIMAID)	1,798 (2.2)	1,108 (61.6)	227 (12.6)	12,240	6.8	43.9
15	1983	Lagos State University (LASU)	1,542 (1.8)	852 (55.3)	209 (13.6)	9,379	6.1	46.7
16	1992	Nnamdi Azikiwe University (UNIZIK)	1,532 (1.8)	862 (56.3)	174 (11.4)	8,167	-5.3	63.8

17	1982	Olabisi Onabanjo University (OOU)	1,496 (1.8)	865 (57.8)	238 (15.9)	10,195	6.8	44.0
18	1991	University of Uyo (UNIUYO)	1,434 (1.7)	866 (60.4)	233 (16.2)	10,337	7.2	57.4
19	1975	Bayero University Kano (BUK)	1,410 (1.7)	691 (49.0)	294 (20.9)	6,920	-4.9	34.4
20	2002	Covenant University (CU)	1,394 (1.7)	943 (67.6)	217 (15.6)	3,680	-2.6	99.6
21	1980	Federal University of Technology, Owerri (FUTO)	1,286 (1.5)	736 (57.2)	324 (25.2)	7,843	6.1	35.7
22	1992	Delta State University (DELSU)	1,131 (1.4)	561 (49.6)	381 (33.7)	3,369	-3.0	47.1
23	1979	Rivers State University of Science and Technology (RSUST)	1,106 (1.3)	584 (52.8)	253 (22.9)	5,226	-4.7	29.9
24	1982	Ekiti State University (EKSU)	913 (1.1)	476 (52.1)	219 (24.0)	2,873	-3.1	26.9
25	1982	Federal University of Technology, Minna (FUTMINNA)	898 (1.1)	508 (56.6)	153 (17.0)	3,370	-3.8	26.4

Univ. TP%: share in 83,484 publications; %FA, %SA: share in each university.

The total Nigerian publications were 95,304 with the total citations of 583,237. Therefore, the average number of citations to Nigerian publications amount to 6.1. Adopting Moed's (2002) study approach in measuring citation impact, the column ACt/P in the table gives the relative citation impact of the publications from Nigeria compared to the average citation rate of the Nigerian universities publications. Thus, the threshold value for relative comparison is 6.1. The negative ACt/P value indicates that the particular university's citation is below the average citation rate of Nigerian publications. This measure showed that only 16 (12.5%) of the universities were above the benchmarked average citation rate of Nigerian publications, and 11 universities (i.e. 8.6% of the 12.5%) were among the 25 top universities, namely UI, UNIPORT, UNIUYO, OOU, UNIMAID,

UNIJOS, OAU, UNICAL, ABU, FUTO and LASU in descending order. The ranking reflect the position of each of Nigerian universities' research performance and productivity in terms of publication output.

It is an undisputable fact that most of the federal universities were at the forefront due to the numerous privileges they enjoyed from the federal government and others.

Nigeria's Publications Collaboration

Table 4 shows the overall proportion of collaborated publications in Nigerian Universities over the 115-year period (1901-2016). The Table shows the trends of number and percentage share of publications in various collaborations over the 115 year- period (1901- 2016).

Table 4: Number and Percentage Share of Collaborated Publications in Nigeria, 1901 – 2016

Publication period	Total papers	No collaboration		Collaborated publications					
				Total		Domestic		International	
		Number	% Share	Number	% Share	Number	% Share	Number	% Share
1941 - 1950	108	106	98.1	2	1.9	2	1.9	0	0.0
1951 - 1960	557	482	86.5	75	13.5	58	10.4	17	3.1
1961 - 1970	1,401	985	70.3	416	29.7	304	21.7	112	8.0
1971 - 1980	6,026	3,488	57.9	2,538	42.1	2,086	34.6	452	7.5
1981 - 1990	12,563	6,695	53.3	5,868	46.7	4,846	38.6	1,022	8.1
1991 - 2000	11,332	4,477	39.5	6,855	60.5	5,364	47.3	1,491	13.2
2001 - 2010	29,329	7,725	26.3	21,604	73.7	17,510	59.7	4,094	14.0
2011 - 2016	33,824	7,506	22.2	26,318	77.8	18,138	53.6	8,180	24.2

Publications with multiple authors tend to increase over the periods at the expense of single-authored publications. Domestic and international collaborations were on increase over the periods. Notably, in the period 2011-2016, significant increases in international collaboration were observed while domestic collaboration fell short.

Collaborating Countries

A total of 203 countries collaborated with the Nigerian authors till 2016. The top 20 collaborating countries from 1901 -2016 is shown in Table 5. The outstanding two countries with topmost collaboration were the United States and the United Kingdom.

They contributed 5,397(5.7%) and 4,848 (5.1%) publications of the 95,304 total publications respectively. These publications accounted for 66.6% of the publications that were co-authored with international communities. Following the top two countries were South Africa, Germany, Malaysia, China and India that contributed at least a thousand papers. The least number of publications was recorded in Sweden with 412 papers (0.4%).

The total collaborated publications from Africa were 8,123 publications which is approximately half of the 15,368 total international collaboration publications as shown in Table 6. Collaboration among the neighbouring West African countries was very low as it was not as frequent as in the case of the USA and Canada (Aumuller and Rahm, 2011). Generally collaboration with African countries was quite low except for South Africa.

Table 5: Top 20 International Collaborating Countries with Nigerian Authors (1901 to 2016

Country	Collaborated papers	*% of total international collaboration (15,368)	*% of total publications (95,304)
United States	5,398	35.1	5.7
United Kingdom	4,848	31.5	5.1
South Africa	2,653	17.3	2.8
Germany	1,523	9.9	1.6
Malaysia	1,398	9.1	1.5
China	1,210	7.9	1.3
India	1,206	7.8	1.3
Canada	902	5.9	0.9
Italy	885	5.8	0.9
Australia	734	4.8	0.8
Japan	716	4.7	0.8
France	705	4.6	0.7
Ghana	619	4.0	0.6
Netherlands	600	3.9	0.6
Brazil	591	3.8	0.6
Kenya	583	3.8	0.6
Thailand	510	3.3	0.5
Switzerland	508	3.3	0.5
Cameroon	485	3.2	0.5
Sweden	412	2.7	0.4

Note: * A paper may be counted in various countries, thus the sum is not 100%.

Table 6: Top 10 International Collaborating Countries with Nigerian Authors in Africa

Country	Collaborated Papers	*% of Total International Collaboration (15,368)
South Africa	2,653	17.3
Ghana	619	4.0
Kenya	586	3.8
Cameroon	485	3.2
Uganda	394	2.6
Tanzania	304	2.0
Benin Republic	262	1.7
Egypt	247	1.6
Ethiopia	210	1.4
Botswana	174	1.1

Note: *A paper may be counted in various countries, thus the sum is not 100%.

There were 5,213 (6%) single-authored publications, and 78,271 (94%) multiple-authored publications out of the 83,484 total collaborated publications. This study also observed collaborated publications within the same universities (37%), between national universities (33%), and between national universities and international universities (24%). Table 7 shows the number and ratio of collaborated publications by Nigerian universities. All the most productive universities for total publications were also top ranked in collaborating publications. University of Ibadan the foremost of all, followed by Obafemi Awolowo University then University of Nigeria and so on. The intra-university publications from these productive universities range from 40% to 60% of their respective total collaborated publications.

Table 7: Number and Ratio of Collaborated Publications by Nigerian Universities

| Universities | Univ.TP | *Univ. CP (%) | Collaboration publications | | International (Ratio) |
| | | | Nigerian universities collaboration | | |
			Intra-Univ. (Ratio)	Inter-Univ. (Ratio)	
University of Ibadan	17,092	13,094 (15.7)	6,471 (0.5)	3,166 (0.2)	3,457 (0.3)
Obafemi Awolowo University	8,286	6,329 (7.6)	3,145 (0.5)	1,436 (0.2)	1,748 (0.3)
University of Nigeria	7,544	5,593 (6.7)	2,929 (0.5)	1,456 (0.3)	1,208 (0.2)
Ahmadu Bello University	6,386	5,027 (6.0)	2,461 (0.5)	1,397 (0.3)	1,169 (0.2)
University of Lagos	6,287	4,922 (5.9)	2,292 (0.5)	1,377 (0.3)	1,253 (0.3)
University of Benin	5,108	3,944 (4.7)	2,253 (0.6)	1,015 (0.3)	676 (0.2)
University of Ilorin	3,859	3,040 (3.6)	1,206 (0.4)	1,016 (0.3)	818 (0.3)
University of Port Harcourt	2,746	2,261 (2.7)	1,136 (0.5)	719 (0.3)	406 (0.2)
University of Calabar	2,493	2,020 (2.4)	894 (0.4)	598 (0.3)	528 (0.3)
Federal University of Technology, Akure	2,341	1,899 (2.3)	823 (0.4)	539 (0.3)	537 (0.3)
Federal University of Agriculture, Abeokuta	2,109	1,869 (2.2)	105 (0.1)	1,271 (0.7)	493 (0.3)
Ladoke Akintola University of Technology	1,892	1,758 (2.1)	416 (0.2)	961 (0.5)	381 (0.2)
University of Maiduguri	1,798	1,583 (1.9)	643 (0.4)	563 (0.4)	377 (0.2)
University of Jos	1,924	1,580 (1.9)	665 (0.4)	422 (0.3)	493 (0.3)
Nnamdi Azikiwe University	1,532	1,358 (1.6)	359 (0.3)	707 (0.5)	292 (0.2)
Lagos State University	1,542	1,333 (1.6)	343 (0.3)	587 (0.4)	403 (0.3)
Olabisi Onabanjo University	1,496	1,258 (1.5)	433 (0.3)	566 (0.4)	259 (0.2)
University of Uyo	1,434	1,206 (1.4)	405 (0.3)	518 (0.4)	283 (0.2)
Covenant University	1,394	1,177 (1.4)	417 (0.4)	341 (0.3)	419 (0.4)
Bayero University	1,410	1,116 (1.3)	198 (0.2)	444 (0.4)	474 (0.4)

Note: *A paper may be counted in various universities, thus the sum is not 100 %.

Univ. CP: total collaborated publications from each university.

Univ. CP%:   share in 83,484 publications.

Discussion

The findings of this study show that in the earlier periods of the colonial era, the country's publications output was relatively low, while at the country's independence in 1960, the publications output was about 0.58% with only University of Ibadan (formerly, University College Ibadan) present at that time. Immediately after independence, there was a steady rise in publications output over the next three decades with the significant increase in numbers of established universities to 30 universities being a key factor in this increment.

The year 1999 marks a milestone in the country's history, which signified an end to clustered military regimes and the ushering in of a democratic government and governance. The upsurge in publications output that was experienced in the period of 2001 to 2016 which can be attributed to strategic educational policies and reforms that took place, such as reinstatement of university autonomy with increased funding for the university system, establishment of more federal and state universities and licensing of more private universities (Saint, Harnett and Strassner, 2003).

This study's outcome revealed that article publications predominated over the periods, constituting not less than 80% of the publications in each period interval. The article publications output were at the peak value of 5,460 (90.6%) publications and 10,516 (92.8%) publications in both the 1971-1980 and 1991-2000 periods respectively. Even though 1991-2000 saw a downward trend in publications output of 9.8%, article publications output also dropped by 3.6% while some other publications types were slightly affected. Subsequently, there has been a steady increase over the period to 2016.

The study also affirms that most research activities and publications output in Nigeria come from the university system (Okonedo, 2015). The total publications from the Nigerian universities amounted to 87.6% (83,484) of the entire country's publications. The result revealed that the first generation universities (i.e. universities founded between 1948 and 1962) namely UI, OAU, UNN, ABU and UNILAG were the foremost in research publication output. They contributed around 47% of the Nigerian universities' publications. The next ten include all the second generation universities (i.e. universities founded between 1970 and 1975). Some state-owned universities such LAUTECH and LASU were among the top performers and remarkably, Covenant University which was ranked 20th despite her young age, stands out among other private universities. The leading position of the first generation universities is not surprising, especially UI, being the oldest university, it has larger postgraduate studies enrolments and may also enjoy special benefits of more grants, collaboration from international communities than others (Ani and Onyanche, 2012).

Interestingly, first authorship indicator in Table 3 showed that all the topmost ranked universities (except Bayero University with 49%) had at least 50% of their publications positioned as first author. Single authorship was relatively high among the top tier productive universities ranging from 11% - 34% in which first generation universities were between 22% and 26% single author papers, indicating higher capacity of independent research. Low single authorship (7%) was recorded in LAUTECH which is relatively low compared with other top ranked universities, and around 19 (35%) private universities have no single-handedly authored paper.

Each institution's average annual publication was also evaluated. This average metric was used to normalise the large disparity in volumes of publications among the universities – ratio of years of university's existence till 2016 to total numbers of publications. This gives meaningful comparison of research publications across the board. Data revealed that just 11.8% of Nigerian universities published an average of 50 papers per year in which all the first generation universities ranked at the top, followed by UNIBEN which had more than 100 papers per annum. Next was CU with an average of 99.6 papers, UNILORIN 94.1 while FUNAAB, LAUTECH, UNIPORT, FUTA, UNIZIK, UNICAL and UNIUYO had between 75 to 57 papers annually. Observably, CU which was founded in year 2002 had outgrown older universities and her contemporaries in publication output – despite being a private institution which enjoys little or no benefit of research funds and grants as public universities.

Research collaboration enhances research visibility and outreach (Chinchilla-Rodríguez et al., 2012). Collaboration within the university system

shows that nearly 50% of the Nigerian universities co-authored with their peers from the same universities with ranges between 20% and 30% of their total collaborated publications. It was observed that inter-university collaborations were relatively high, especially for universities with low total publications output. The overall analysis shows that the percentage of collaboration between universities (33%) was much higher than that between countries (24%), which is in line with the study of Li and Ho (2008).

International collaboration indices showed that Nigeria co-authorship ratio is 67% but much lower than co-authorship of Saudi's publications (81.1%) and Egyptian publications (88.0%) (Shehatta and Mahmood, 2016; Shehatta and Mahmood, 2017). The first evidence of international collaboration was 1951 - 1960 period, as low as 3.1% collaborated publications were recorded. The outstanding two countries with topmost collaboration were the United States and the United Kingdom which contributed a little above one-tenth of the total publications. Other top ranked collaborators were Germany, Malaysia, China and India which conforms with previous studies that the United States, the United Kingdom, Germany, France, Italy, China and India are prominent features in bilateral research publications especially the United States and the United Kingdom which are the top collaborators (Chinchilla-Rodríguez, López-Illescas and Moya-Anegón, 2012; Fiala and Ho, 2015; Shehatta and Mahmood, 2016). Further analysis shows that Malaysia, China, India and South Africa are emerging top research partners with Nigeria. Their growth rate in the last six years compared with sixteen years before, as shown in Table 6, has been tremendous especially Malaysia which could overtake the United States and the United Kingdom in the nearest future if the pace continues.

Conclusion

The publications outputs of Nigeria have shown a steady upward trend over the years, especially with an exponential growth rate of about 96% during 2001 – 2016. That is, almost twice the output as compared to 1901-2000. Evidence from the study showed that 95,300 total publications were predominantly article publications, and accounted for 85.4% of the total

publications. Interestingly, academic institutions have played a significant role in research activities, contributing enormously in publications output especially articles as shown in the study.

Research collaboration has been a key factor that increased Nigerian publications output, including the collaboration among national peers and collaboration with international peers. This key factor is effectively promoting publications output, increasing research visibility and impact.

The findings from this study must be studied alongside other types of indicators to have a full grasp of the context of study and proper interpretation, taking into account the national research system and the structure of the academic system. This will ensure a balanced analytical approach to the study with proper interpretation and facilitate a well-informed discussion about the outcome of the analysis.

Finally, there is an on-going academic campaign for institutional repositories and national publication databases in the country to which this study also adds its voice. Evidently, there is need for national literature databases that fully promote domestic papers and represent the national research interest which would define the national publication activity rather than the Scopus database that much denotes international publication activity.

References

Ani, O. E. and Okwueze, E. U. (2016). Bibliometrics Analysis of Publication Output in Library and Information Science Research in Nigerian Universities 2000-2014. *Nigerian Libraries*, *49* (1-2) 10–12.

Ani, O. E. and Onyancha, O .B. (2012). An Informetric Analysis of Research Output in Nigeria with Special Reference to Universities: 2000-2010. *Mousaion, 30* (1) 142—157.

Chinchilla-Rodríguez, Z., López-Illescas, C. and de Moya-Anegón, F. (2012). Biomedical Scientific Publication Patterns in the Scopus Database: A Case Study of Andalusia, Spain. *Acimed*, *23* (2), 219-237.

Fiala, D. and Ho, Y. S. (2015). Twenty Years of Czech Science: A Bibliometric Analysis. *Malaysian*

Journal of Library and Information Science, 20 (2),85-102.

Ho, Y. S. (2014). Classic Articles on Social Work Field in Social Science Citation Index: A Bibliometric Analysis. *Scientometrics, 98* (1): 137-155.

Li, Z., and Ho, Y. S. (2008). Use of Citation per Publication as an Indicator to Evaluate Contingent Valuation Research. *Scientometrics, 75*(1): 97–110.

Majid, S., Chang, Y. K., Hnin, N.A., Ma, W.K. and San, Y.W. (2015). Analyzing Publishing Trends in Information Literacy Literature: A Bibliometric Study. *Malaysian Journal of Library and Information Science, 20* (2), 51-66.

Moed, H. F. (2002). Measuring China Research Performance. *Scientometrics,* 53 (3), 281–296.

Moed, H. (2005). Citation Analysis in Research Evaluation. *Springer Science and Business Media.* 346 p.

Mongeon, P. and Paul-Hus, A. (2015). The Journal Coverage of Web of Science and Scopus: A Comparative Analysis. *Scientometrics, 106* (1), 213-228.

Nwagwu, W. and Egbon, O. (2011). Bibliometric Analysis of Nigeria's Social Science and Arts and Humanities Publications in Thomson Scientific Databases. *The Electronic Library, 29* (4), 438-456.

Okiki O. E. 2013. Research productivity of Teaching Faculty Members in Nigerian Federal Universities: An Investigative Study. *Chinese Librarianship: an International Electronic Journal, 36*: 99-118.

Okonedo, S. (2015). Research and Publication Productivity of Librarians in Public Universities in South-West, Nigeria. *Library Philosophy and Practice (e-journal),* 1297 [Online]. http:/

/digitalcommons.unl.edu/libphilprac/1297 [Accessed 7 May 2018]

Saint, W., Hartnett, T. A. and Strassner, E. (2003). Higher Education in Nigeria: A Status Report. *Higher Education Policy,* 16: 259-281.

Salisu, S. A. and Ojoye O.T. (2015). Bibliometric Analysis of Cancer Publications in Nigeria during 2008 – 2012. *International Journal of Library and Information Science, 7*(3), 69-76.

Shehatta, I. and Mahmood, K. (2017). Bibliometric Patterns and Indicators of Research Collaboration of Egyptian Health Scientists: 1980 – 2014. *Malaysian Journal of Library and Information Science. 22* (2), 45-65.

Shehatta, I. and Mahmood, K. (2016). Research Collaboration in Saudi Arabia 1980–2014: Bibliometric Patterns and National Policy to Foster Research Quantity and Quality. *LIBRI, 66*(1), 13-29.

Waltman, L. and Noyons, E. (2018). Bibliometrics for Research Management and Research Evaluation, CWTS: Universiteit Leiden.

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Design and Evaluation of Intelligent Commodity Market Information Monitoring System for Rural Farmers and Traders in Ethiopia

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Abstract

Market information in Ethiopia is not readily available to rural farmers and traders. Currently, the existing market system allows intermediaries to decide the market price of the product unfavourably to the farmers. On the other hand, traders cannot not access market-oriented commodities that can be sold at good prices. This paper attempts to design SMS (short message service) based intelligent market information monitoring system that acts as a platform where farmers and traders can share market information in various market domains. The development of the system followed a Rapid Application Development (RAD) approach where testing and evaluation is performed for accuracy, efficiency, usability, acceptance and performance on two crucial aspects of the system: SMS gateway and Query Understanding Engine (QUE). The evaluation and test result of the system is promising. It is found to be that 95% (Accuracy), 89.2% (efficiency), 90.21 (SUS score) and 3.9 seconds (Mean Average performance/speed) is registered. Moreover, User Acceptance Testing (UAT) evaluation showed that it is 'Accepted' for use. It showed that such kinds of systems can solve the problems of lack of easily accessible market information by rural farmers and traders this shows that the system can contribute significantly to improving the accessibility of market information for rural farmers and traders in Ethiopia.

Keywords: *Commodity Market, Market Information, User Acceptance Testing (UAT), Rural Farmers*

Introduction

In Ethiopia, most of the citizens depend on agriculture and its products. Small-scale farmers in rural Ethiopia (GebreSelassie and Bekele, 2012) practise agriculture, which dominates the country's economy. The rural farmers produce market oriented commodities in addition to the foods used for their own consumption. The existing market information system is not favorable and it has left behind both rural farmers and traders. It allows the intermediaries (broker) to decide the prices for the commodities to the farmer unfavourably. On the other hand, the system does not allow the trader to access quality and market oriented products from the producer that can be sold at good prices. In between, the intermediaries are benefitting more than the actual producer, without adding any value to the product.

Accessing agricultural commodity market information is challenging for these participants, especially for the rural farmer, who produces with a lot of effort and cost. Providing easily accessible market information related to the commodities they produce is basic due to the fact that a farmer who benefited from his produce (after satisfying his food need) would have improved the economic, social life and livelihood of his families and himself.

A current scenario that provides commodity market information is by means of using telephone calls, using the mass media, reading magazines and searching websites (ECX, 2010). An existing attempt of using their mobile phones to reach each marketing center is costly and tiresome. Market information notification via mass media is not amenable to both of the marketing participants, in that the information does not address all market areas for each marketing product, and also it is hard to notice information on prices, levels of demand and supply in the markets for such products. The information transmitted on television, for example, does not give enough information to the seller and buyer so that they can bargain to gauge on the prices, quality and quantity of the products they offered to one another. An attempt to use web-based applications is impossible because of limited or high cost of Internet access, poor infrastructure and an illiterate population. Such challenges leave mobile SMS (short message service) applications as a better option for use by rural farmers and traders in accessing commodity market information. SMS/short text messaging (on a GSM network) is a readily available medium that can provide viable solutions for market information like prices of commodities, demand and supply.

There are three major reasons to use SMS as a better communication channel these days especially for rural farmers and traders. Firstly, a SMS application does not require users to adhere to a strict syntax. Secondly, it does not demand high literacy levels on the individual user; it requires only basic literacy skills i.e. it requires reading and writing with few words and numbers. Lastly, the required information can be accessed in their own language from mobile phones available in their hands.

SMS based systems have been applied for a variety of purposes. Health workers in some African countries used SMS based systems to provide diagnosis and treatment services and send educational messages to users via text messages. The Food and Agriculture Organisation (FAO) is using SMS based applications via mobile phone to communicate agricultural reports with field workers (Jaiswal, 2011). The farmers' union in Zambia and rural farmers in Kenya are using text messages via SMS to share market related information with buyers in their own language (Chemweno and Oboko,

2012). Even though SMS based systems are at the infant stage in Ethiopia, many companies are using text messages for sending notification and awareness information to end users. Full SMS based applications are rarely available in Ethiopia to provide information for their services. There are only two SMS based applications, which are made available and accessed through mobile phones to provide information to their target customers (Alemu, 2019). The Agricultural Transformation Agency (ATA) is using Interactive Voice Response (IVR) System to deliver agricultural knowledge and advice and cultivation tips to rural farmers via their mobile phones, whereas the Commercial Bank of Ethiopia (CBE) is using SMS based banking system to enable customers to access their account, make fund transfers and payments and check their balances from their mobile.

Use of mobile SMS to monitor agricultural commodity market information is a viable method to address the current information gap to make the farmers reap the benefit from their produce and improve their lives. In poor African countries like Ethiopia, where there are no media to provide up-to-date marketing information, mobile based SMS applications are highly required. The exploitation of mobile phones and its economic efficiency that can bring to a change in the Ethiopian market system is a good opportunity in these days (Ethio-Telecom Report, 2017, Mittal and Mehar, 2012). Therefore, in this research project, the choice of SMS based systems is highly advisable as it overcomes the easily accessible market information problems of the rural farmers and traders. The research is focused on the possibility of designing an easily accessible SMS based agricultural commodity market information platform where rural farmers and traders can have a direct information access for each other to share, monitor and manage market information in various market domains in which they are interested.

The main objective of this study is to design and develop SMS based automatic and intelligent commodity market information monitoring system platform; test and evaluate the prototype system for accuracy, efficiency, usability, acceptability and performance.

Therefore, the study aimed to answer the following research questions:

1. Can mobile phone SMS be used to solve the lack of easily accessible market information

problems of rural farmers and traders?

2. How one could design and develop mobile phone SMS based market information monitoring system engine, that is effective and efficient, usable and acceptable by the target users?

Research Design

The research population included farmers, traders, system and marketing experts. The researchers purposely selected 20 participants amongst whom were five market experts, five farmers, five traders and five system experts. They were used in consulting, interviewing, data collecting, testing and evaluating the system. The participants were selected based on meeting the objective of the study and accessibility to the researchers.

The data used in this study was gathered from system outputs, test cases, and evaluation checklists. System Usability Scale (SUS) questionnaire (Brooke, 1996), UAT test case template by the San Francisco State University (SFSU) (Thomas, 2000) and database recording for queries sent in and responses sent out by the system were used as convenient data collection methods. SUS questionnaire and UAT test cases were used for calculating usability and user acceptance respectively. Database records were used for determining accuracy, efficiency and performance of the system.

The developed prototype system was tested and evaluated for accuracy, efficiency, usability and acceptance. The overall evaluation was mainly performed on the two crucial functional aspects of the system, QUE and SMS gateway. Determining the accuracy of the system was conducted by comparing responses of the system to expected responses, i.e. how many of the queries sent by users are correctly understood by the Query Understanding Engine (QUE) and correct responses are sent to the user.

This can be computed by assigning a binary value of '1' if the user finds correct responses by

$$\text{Accuracy} = \frac{\text{The number of correct responses determined by the system}}{\text{The number of expected responses stored in the database}} \quad (1)$$

the system for his queries and '0' if he/she does not

Efficiency of the system was evaluated by measuring how much time taken by the system to correctly understand user queries and send correct responses to the user. The overall relative efficiency was used in the study as it measures the success of the system relative to all users. The equation can thus be represented as follows (Justin, 2015):

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$$\text{Overall Relative Efficiency} = \frac{\sum_{J=1}^{R} \sum_{I=1}^{N} n_{ij} t_{ij}}{\sum_{J=1}^{R} \sum_{I=1}^{N} t_{ij}} \times 100\% \quad (2)$$

Where:

N = the total number of tasks (queries)

R = the number of users

n_{ij} = The result of task i by user j; if the user successfully completes the task, then $n_{ij} = 1$, if not, then $n_{ij}=0$

t_{ij} = The time spent by user j to complete task i. If the task is not successfully completed, then time is measured until the moment the user quits the task.

This serves to measure and evaluate users' impression of the overall ease of use of the system being tested. Usability (test for satisfaction) involves task level1 and test level satisfaction approaches. The test level satisfaction was used as it measures the system's usability from the perspective of all users (testers) at the end of the test session than individual user tasks unlike task level satisfaction approach. SUS is a test level satisfaction method that is used for testing and evaluation of usability in this study to measures the perception of usability of the system by the users (Sauro, 2011). SUS is a 10-question item, and its value for the whole respondents is calculated as follows.

$$\frac{\sum_{n=1}^{n} 2.5 \sum ((\times^{+ve} - 1) + (5 - \times^{-ve}))}{n} \quad (3)$$

To determine whether or not the software system has met the requirement specifications and criteria, UAT test cases are prepared based on UAT test case template by the San Francisco State University (SFSU) and given to users for testing. Test cases were developed based on test scenario, test steps, parameters, expected result, and actual result fields. alpha testing1 (Leung and Wong, 1997) was used to test for the acceptance of the ten alpha testers who were comprised of the working organization. They have been given trainings to use the system and set them to test cases against the test scenario. Based on the results of testers, the research team then had to decide whether to accept or reject the system. In addition, the system was developed following the Rapid Application Development (RAD) methodology with testing and evaluation was performed iteratively.

RAD entertains more user participation, little or no user resistance with fast development feature which were the reasons for selection. Java Scripts with GlassFish server were the familiar programming tools for the development. Generally, the development process continued until highest evaluation metrics were achieved and end users' level of satisfaction was believed to be maximised. The overall evaluation based on final version was presented as a final result in this study. Meanwhile, the conceptual design (architecture) of the system was redesigned at every stage of the system level and a final version was drawn. Moreover, the researchers tried to interpret the results found in the experimentation and forward their conclusions.

System Design

This section discusses the design of functional modules of the system; the system's architecture and design assumptions and constraints.

The system consisted of the design and integration of SMS gateway, Query Understanding Engine (QUE), database and web interface. The architectural design of the system shown in Figures 1 and 2 included the design and development of these key modules into the system.

SMS gateway: SMS Gateway acts as an interface between the computer system and the mobile phone and is responsible for receiving user queries and messages and sends back the requested message from the system to the end user. Since the services of SMS gateway are delivered by the existing telecom service provider, SMS gateway design considers only technical configuration to connect to our system.

Query Understanding Engine (QUE): The QUE is responsible for fetching query messages from the database, analysing (process) the transactions (the message) and storing the processed data back to the database. And then the processed message (as a response) is fetched and delivered by SMS gateway to the user via SMS. The QUE handles incoming queries in natural language (Amharic) and responds after performing intelligent internal operations. This internal operation involves accepting queries (keywords) sent from user, converting these queries into formal SQL queries; these are then applied against the database. The user sends messages to the QUE based on a pre-specified syntax (easy to be converted to keywords) that show the sender's interest in either the price of a product in a given market or their interest to a product for sale or buying at specified market location. In this study, methods from paper (Chemweno and Okobo, 2012) was adapted and improved the design of the QUE to receive all incoming messages based on the format "[INTENTION] [PRODUCT] [MARKET]" which is suitable for the processing by the QUE and to the underlined language Amharic. The INTENTION specifies the intention of the sender, i.e. price inquiry, placing offer to sell or offer to buy. PRODUCT stands for the agricultural commodity that the sender is inquiring about or intending to buy or sell. MARKET refers to the market place that the sender is interested in. Sometimes, the QUE may not understand all incoming users' queries. These are un-understood messages which can be easily monitored from the dashboard by the system administrator who apply human touch to provide their understanding of user's intention and it will become active for processing. This will help to reduce the messages that go unanswered. The overall process is shown in figures 1, 2 & 3.

Database: A database stores incoming messages (user queries), prices, sent messages, unprocessed data, and other system transactions.

Web interface: Web interfaces acts as dashboard where a system administrator monitors everything over there. The web-interface is used to view un-understood messages, incoming and outgoing messages, transactions and reports.
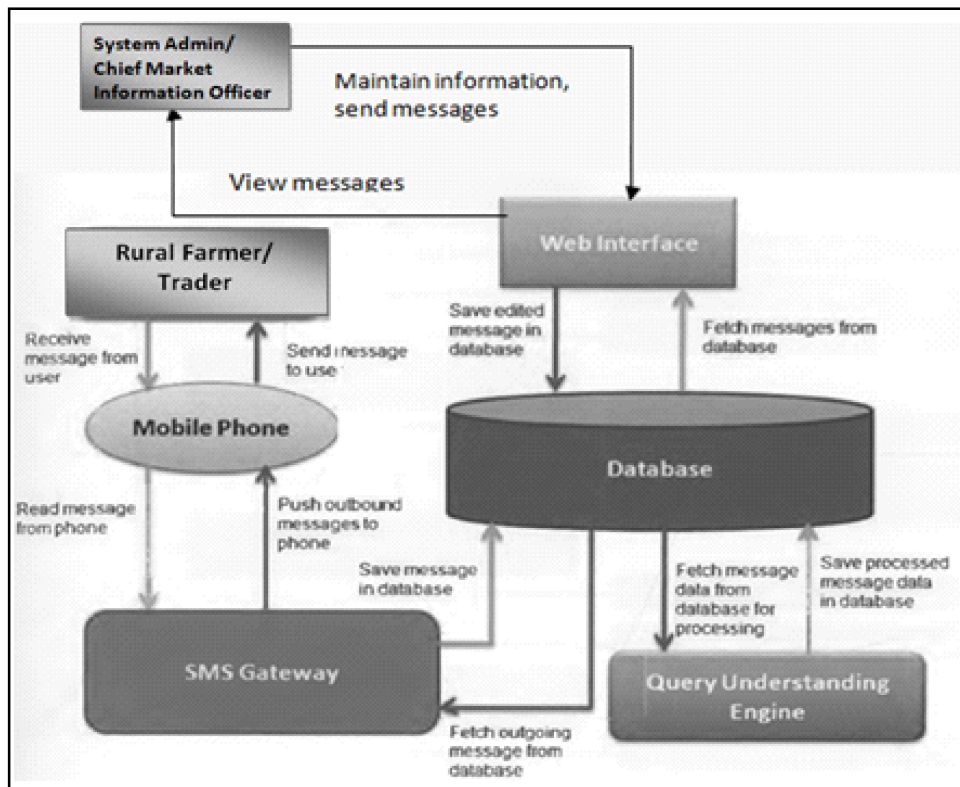
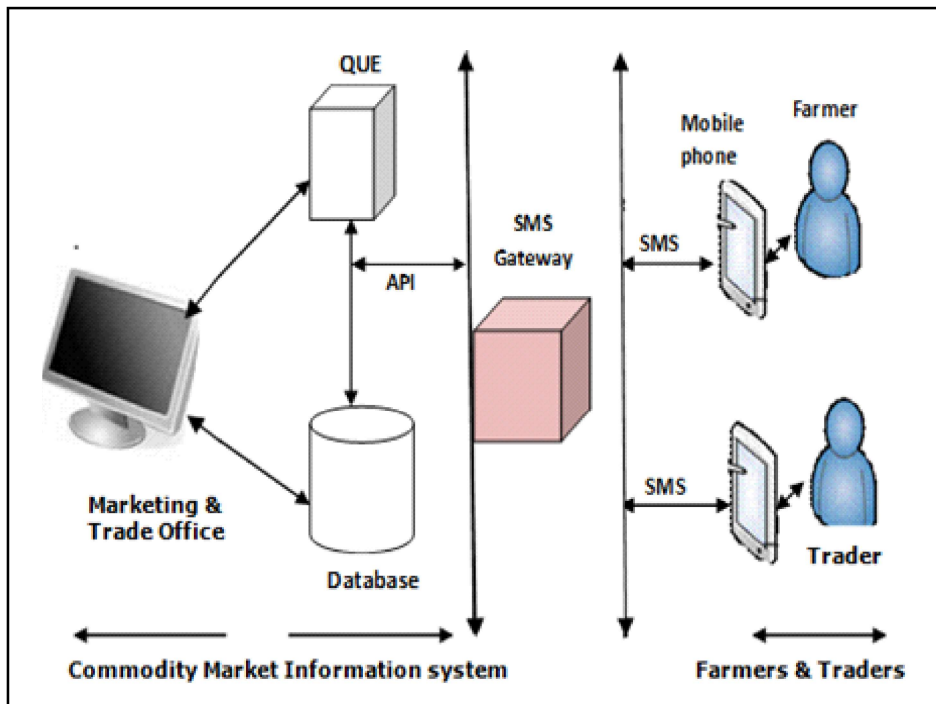**Fig. 1:** Integrated components of the prototype (model) of the system

Fig. 2: Architectural Design of the System
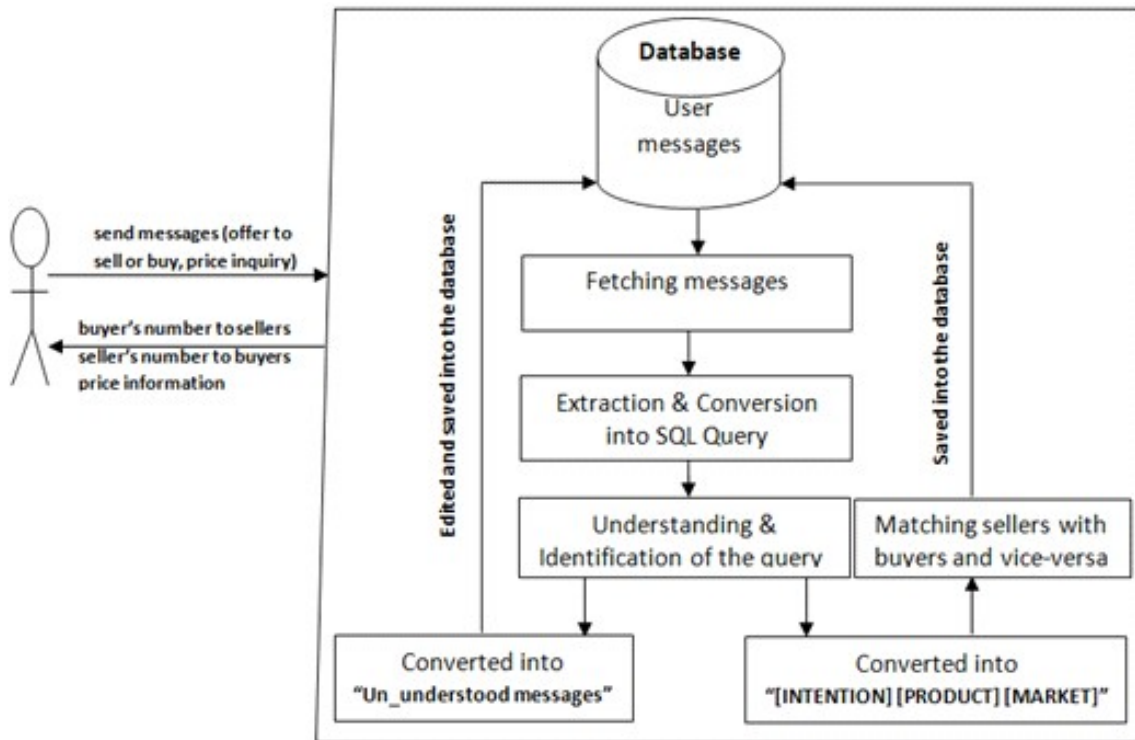
Fig. 3: Intelligent operations of the system

Conceptual Framework and Basic Assumptions: In Ethiopia, rural farmers live and work in areas where access to education is limited. Designing systems of this kind for use by users in these areas will have a usability problem. In order to address such challenges, the study proposed and formulated a conceptual framework that guides the design and development of the system. Pictorial representation of the framework is shown in Figure 4.

Fig. 4: Conceptual framework of the system. Adapted from (Alemu, 2010)).

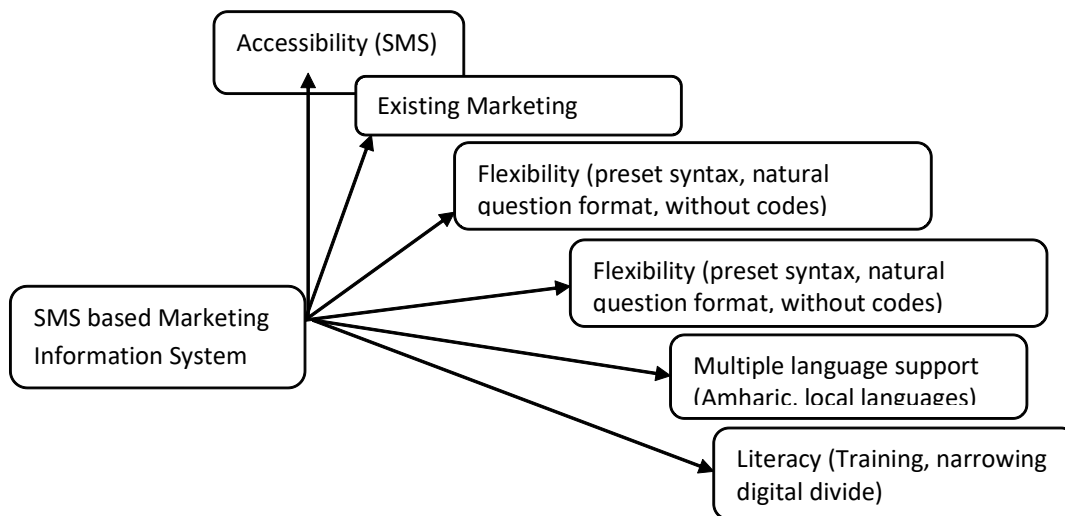Accessibility entails the availability of ubiquitous media that the system is looking for to easily support the market information needs of the user. Hence, SMS, as easily available channel, is taken due to the fact that it does not require sophisticated technology skill to provide an information access to the farmers. Providing services of the system through their own local language is believed to be significant for the usability of the system. The framework should prioritise the use of a predefined-syntax where users can communicate in a more flexible manner. The framework addressed the usability design of the system based on the assumption that the system requires low-level literacy skills such as reading and writing in their own languages from their mobile phones.

Results and Discussions

This section highlights the results of testing and evaluation of the system, particularly the two crucial parts of the solution: SMS gateway and query understanding engine (QUE). Testing and evaluation of the system includes functional evaluation, accuracy, usability, acceptability and performance. Respondents who participated in testing and evaluations were few in number. However they participated across all previous versions of the prototype system including the final version. The testing and evaluation results based on the final versions are presented below.

Functional Evaluation

This section presents the evaluation of the functional activities related to SMS gateway and QUE for performing their intended tasks successfully or not. The evaluation was conducted as follows.

Send offers to sell or buy: From the total collection of twenty offer messages sent by users in which ten offers were "being buy" and the remaining were "being sell", it was inspected that all the twenty well-formed offers were received and processed correctly. In addition to this, the system identified and correctly processed contacts of sellers to the matching offers by buyers and contacts of buyers to the matching offers by sellers.

Inquire product prices: Evaluating price inquiry involved sending messages that have an intention of inquiring for prices of different commodities with a format "Price Maize Bure"/ in Amharic, "Ë– `F a,". The prices were the first recorded form in the database and with prior knowledge of the prices, messages were sent to query the system for these known prices. The results were impressive with all the ten inquiries yielding correct results.

Edit un-understood messages: Messages that were not classified to one of {offer to sell, offer to buy, price inquiry} were classified as un_understood and saved in un_understood messages. Editing involved a human touch by the system administrator and updating the record with a resolution message. A set of ten messages were edited and saved back to the database. All the messages edited were properly saved in the form they were edited to the proper database table.

In general, design and development of the system mainly focused on creating the platform that provided a bridge services ("not just a broker") whereby a rural farmer is be able to place offers for their products and intend to sell and on their part, traders were able to advertise commodities they wished to buy from farmers. These offers to sell and buy were matched by the system with buyers receiving contacts of sellers and sellers receiving contacts of buyers. At this point, the two parties could communicate using their phones and strike a deal. The system also helped users to make price inquiries on a specific product. Meanwhile, if there are messages that are not understood by the QUE, it forwards to un_understood message for a further human touch. Figure 5 shows the pseudocode for the overall operation of QUE.

Usability Evaluation

Accuracy: The accuracy (effectiveness) of the system is measured by evaluation how the Query Understanding Engine (QUE) correctly understands many of the queries sent by users and correct responses are sent to the user. The result showed that from twenty well-formed queries sent to the system,

```
Begin
    User:    Send offers to buy
             Send offers to sell
             Send price inquiries
    System: Match offers to buy with offers to sell
             Send buyers no to sellers or sellers no to buyers
             Send price of a product to requesters
             Send un understood message for further editing
End
```

Fig. 5: Pseudocode for QUE

the system correctly understood, processed and sent correct responses to only nineteen of them. The error is marked due to un_understood messages. It was also inspected that for correctly edited and processed offer or price inquiry messages, the system result showed 100% correct.

$$\text{Accuracy} = \frac{19}{20} \text{X}100\% = 95\%$$

Efficiency: Out of twenty users who used the system to send offers to sell or buy and inquire prices of a commodity, the system resulted as shown in Table 1. The table shows the user performed two different tasks (Task 1 and Task 2) at different times and the time taken by the user to successfully perform his/her task using the system. These raw data were collected from the system database via a web interface. Using equation 2, the overall relative efficiency is calculated for both tasks separately as follows.

Table 1: Time statistics for Task 1 and 2

User	Task 1: send offers to sell or buy (n_{ib})	Time taken(t_{ij})	$n_{ij}t_{ij}$	Task 2: inquiring prices (n_{ij})	Time taken (t_{ij})	$n_{ij}t_{ij}$
1	1	4	4	1	3	3
2	0	5	0	1	2	2
3	1	4	4	1	5	5
4	1	5	5	1	2	2
5	1	4	4	0	2	0
6	0	3	0	1	3	3
7	1	4	4	1	5	5
8	0	3	0	1	3	3
9	1	5	5	1	3	3
10	1	4	4	1	3	3
11	1	5	5	1	5	5
12	1	5	5	0	2	0
13	1	6	6	1	4	4
14	1	5	5	1	3	3
15	1	6	6	1	3	3
16	0	3	0	1	4	4
17	1	7	7	1	4	4
18	1	4	4	1	4	4
19	1	3	3	1	3	3
20	1	5	5	1	4	4

As shown in table 1, most users were successfully completing their tasks (marked as 1) i.e. the system received their offers, processed successfully, and saved into the database. However others were not successful (marked as 0) because of two reasons: one, there exists an un-understood messages in the database such that the QUE quits transaction; secondly, being an SMS application, this system's performance depends to some extent on the speed of the mobile operator in delivering SMS messages. The overall relative efficiency is calculated for both tasks separately as follows using equation 2.

Overall relative efficiency (using Task1)

$$= \frac{(1*4) + (0*5) + (1*4) + \cdots + (1*4) + (1*3) + (1*5)}{90} X100\% = 84.44\%$$

Overall relative efficiency (using Task2)

$$= \frac{(1*3) + (1*2) + (1*5) + \cdots + (1*4) + (1*3) + (1*4)}{63} X100\% = 94.03\%$$

As we have seen here, users were more efficient in performing task 2 than task one. This is because the price information saved in the database was prior knowledge and was updated by the expert or system administrator. So that there will be less possibility of error of processing than users performing Task 1. The mean average overall efficiency of the system is found to be 89.23%.

Usability (satisfaction): Usability measures all aspects of a system that determine user satisfaction, user perception and overall ease of use. For this test, results were collected through questionnaire and analysed using the standard SUS formula as shown in equation (3). Out of 20 respondents who were involved in usability testing, the average SUS was found to be 90.21%. This result showed the system is easy to use and is more likely recommended for use.

UAT Evaluation

After successfully completing the UAT test cases, every tester provided their test results. An actual result, which a tester gets after performing the test, was documented along with the test case during the test execution phase. After performing the tests, the actual result was compared with the expected result and the deviations (if any, is known as defect) were noted. The defect goes through the defect life cycle and the testers address the same after fix. While in each test, after getting the actual result, the test scenario was given a "PASS" or "Fail" mark.

Table 2 presents the final version UAT test results by ten testers. If the test had marked with at least one 'fail' in one of the test case, the developer has gone back to fix bugs, errors and defects that cause 'fail' mark. In such a case, the test had passed three UAT test iterations before the final UAT test version with no 'fail' mark and critical comment is produced. The overall UAT test result showed that the system is accepted for delivery/use.

Performance Evaluation

Being an SMS application, this system's performance depends to some extent on the speed of the mobile operator in delivering SMS messages and the existing Telecom infrastructure. As the performance tested by ten users as shown in Table 1, the average time it registered for sending offers to sell or buy and inquiring prices were 4.5 and 3.35 seconds respectively. While the system is being practical, it is believed that the performance might be better with messages sent during off working hours and the night. With further optimisation, the system could perform even better. As per the knowledge of the researchers, there were no systems of which the evaluation was made to compare them to a system with which the one developed in this research project.

Table 2: Final UAT Test Results

S/N	Test Scenario/case	Test Step	Expected Result	Actual result	Pass/Fail
1	Test and check users can send offers to sell or buy	Open the SMS application and send offers to the system	The system should be able receive inputs and process successfully	The system receives inputs and process successfully	PASS
2	Test and check the system store / receive incoming messages (offer to sell or buy, price inquiries)	Log into the system and send messages	The system should be able to store/ receive messages sent from users	The system stored/ received messages sent from users	PASS
3	Test and check that the QUE understand incoming messages and label those that don't understood it	Log into the system and send test messages	The system should be able to under-stand messages	The system under-stood test messages and label them successfully	PASS
4	Test and check the system respond to user queries	Open the SMS application and send offers and inquiring prices	The system should be able to respond to user queries	The system respon-ded successfully to user queries	PASS
5	Check that the system help the admin to edit un-understood messages	Log into the system and edit un_understood messages	The system should be able to help the admin such un_understood messages	The Admin edited un_understood messages and properly saved in the form they were edited	PASS

Conclusion and Recommendation

As more mobile phones become available in the hands of rural farmers, SMS based systems are the better tool for their information access. SMS based agricultural commodity market information monitoring systems are designed and developed to solve the problems of lack of easily and readily accessible commodity market information by rural farmers and traders in Ethiopia. SMS based systems can give appropriate solutions to provide market information timely. This kind of system does not require sophisticated skill; low-level literacy users including rural farmers can easily utilise them. The result of testing and evaluation of the system has met the objective of the study. The system can play a significant role in improving the livelihood of rural farmers and traders in Ethiopia. The researchers highly recommend that future researchers should improve the system in the areas of additional transactions such as analysing and predicting trade volumes, market flows, market predictions and growing conditions.

References

Alemu, T. A. (2019). SMS Based Agricultural Information System For Rural Farmers. In Advances Of Science and Technology: 6th EAI International Conference, ICAST 2018, Bahir Dar, Ethiopia, October 5-7, 2018, Proceedings, Vol. 274, P. 366). Springer.

Brooke, J. (1996). SUS-A Quick and Dirty Usability Scale. Usability Evaluation in Industry, 189 (194), 4-7.

Chemweno, K. and Oboko, R. (2012). SMS Based Rural Agricultural Markets Monitoring Information System in Kenya (Doctoral Dissertation, Master's Thesis in Computer Science, University Of Nairobi, Kenya).

ECX, (2010). "Aboutus.Aspx," Ethiopian Commodity Exchange (ECX), [Online]. Available: Http://Www.Ecx.Com.Et/Pages/Aboutus.Aspx. [Accessed 10 June 2018].

Ethio-Telecom, (2017). Report, "Ethiopia-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses," Ethio-Telecom, Addis Ababa. Https://Www.Researchandmarkets.Com/Reports/4418557/Ethiopia-Telecoms-Mobile-and-Broadband#Rela0-4421320. [Accessed February 2018].

Gebre-Selassie, A., and Bekele, T. (2012). A Review of Ethiopian Agriculture: Roles, Policy and Small-Scale Farming Systems. In: C. Bell and J. Prammer. Edited by C. Eder, D. Kyd-Rebenburg, and J. Prammer. Global Growing Casebook: Insights into African Agriculture, 36-65.

Jaiswal, P. K. (2011). SMS Based Information Systems. University of Eastern Finland School of Computing Master's Thesis, 71p.

Justin M., (2015). "Usability Metrics – A Guide to Quantify the Usability of Any System,". [Online]. Available: Https://Www. Usabilitygeek. Com/Usability-Metrics-A-Guide-To-Quantify-System-Usability/. [Accessed 21 December 2018].

Leung, H. K., and Wong, P. W. (1997). A Study of User Acceptance Tests. *Software Quality Journal*, 6 (2), 137-149.

Mittal, S. and Mehar, M. (2012). How Mobile Phones Contribute To Growth Of Small Farmers? Evidence from India. *Quarterly Journal of International Agriculture*, 51(892-2016-65169), 227-244.

Sauro, J. (2011). "Measuring Usability with the System Usability Scale (SUS)," [Online]. Available: Https://Measuringu.Com/Sus/. [Accessed 17 Nov. 2018].

Thomas P. (2000). UAT Test Case Template by the San Francisco State University. Https://Usersnap.Com/Blog/User-Acceptance-Testing-Example/. [Accessed 7 March 2017].

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Big Data Research Outputs in the Library and Information Science: South African's Contribution using Bibliometric Study of Knowledge Production

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Abstract

The focus of this study was to evaluate research production in Library and Information Science (LIS) on big data and South African's contribution from 1992-2019. As advancement in technological innovation is changing the methods of digital collection development and dissemination of information in the fourth industrial revolution, big data technology will be reshaping library management systems through big data. Big data is defined as information overload due to the volume, varieties, velocity and veracity of the data which must be processed to get value. It is also useful information for efficient decision making or business intelligence. The data collection methods utilised bibliometric analysis as an intuitive approach to map research focus in big data and LIS contribution, by visualising the outputs using data harvesting capability of Web of Knowledge to export titles, authors, abstract, all keywords, citations, journal sources and bibliographies for further analysis. We performed bibliometric coupling, co-citation analysis, with a total dataset (n = 8,415), h-index =104, and an average citation per output (ACP=97). The findings showed that the LIS scholars contributions were very low (h-index = 29) and (ACI =15.47), and the USA (n=112,) China (n=45) and India (n=25) were the top leading countries in LIS and big data. The contribution of South Africa was very low (n=4). This research underscores that LIS big data contribution is very important for archiving and providing information services to manage petabytes data and information with automated controlled index terms and big data metadata management.

Keywords: Data Archiving, Bibliometrics, Big Data, Controlled Index Terms, Metadata Management, Faceted Classification, Web Archiving

Introduction

The proliferation of information technology (IT) has created another challenge of information explosion known as big data. The availability of the Internet and mobile technology infrastructure is set to change how future library services are rendered perpetually. This will require libraries to respond to an uncontrollable growing speed of data accumulation. Currently, libraries are facing inevitable shockwave owing to informatisation of knowledge which library services must respond to, using custom-made library applications (Weihong et al. 2012). Library and Information Science (LIS) has a huge role to play in this era of big data. Part of such a role involves how to manage big data, data processing and classification and big data archiving. It will require specialised technologies (hard and software) and training to deploy embryonic technologies to curate, manage and archive big data for research and other information services. As recently reported, the LIS challenges are also complex, not only in how to handle the high volume of big data (Gulgec, Shahidi and Matarazzo, 2017) but also in the ability to create agile metadata

management. Therefore, most libraries will need to go beyond the traditional archiving practices into advanced practices which might require technological integration for big data archiving.

The significance of big data in improving and making libraries more agile has not been fully explored. To underscore the importance of a paradigm shift in the LIS field due to technological advancement and its alignment in the profession, the UK national archives and the Netherlands national library are now involved in web archiving (Di Pretoro and Geeraert, 2019). Web crawling is one of the most commonly adopted methods to harvest information on the websites for archiving. It is stated that most national libraries and archives are collaborating to work on web archiving (Di Pretoro and Geeraert, 2019). While web crawling cannot be equated with big data mining, it is a commendable effort to engage in web archiving, which is beyond the traditional archival practices. Owing to the complexity of technical know-how that is required to undertake a big data project, LIS should revisit the curriculum and training processes. The curriculum could be adjusted to teach basic big data metadata management and cloud services applications in the LIS profession. A previous study has expressed the importance of embedding big data training in the library and information science discipline (Munshi, 2016).

The library's collection development principle applies to managing big data, except that in big data, there is a problem of how to manage speed and a large volume of such data. The librarians' abstracting and indexing skills and reference management prowess are central to big data management. Librarians can be equipped with basic skill needed to use big data technologies and software for enhancing information services, faceted classification, collection development, and building controlled index terms and ontology. This paper conducted a bibliometric analysis of libraries' current alignment of big data technology with the Library and Information Sciences (LIS) based on the research outputs in big data.

Undoubtedly, the LIS profession is undergoing a "big data paradigm shift" because of the proliferation of information technology such as the Internet of Things (IoT), cloud computing and big data. The "big data" has also brought much

confusion even within the LIS profession. For example, an article published in *Library Review* attempted to propose a thorough definition of big data as "information asset with high volume, velocity and variety which requires specific analysis methods and technology to transform the value" (De Mauro, Greco and Grimaldi (2016) of such large dataset. In contrast to this definition, big data only becomes useful information when the business intelligence has been extracted due to processing, mapping and reduction of either petabytes or zettabytes of data into manageable information asset that can help organisations or libraries make informed decisions. Besides the volume, variety and velocity, one of the characteristics of big data is the veracity and value. The veracity denotes the quality of a dataset (Jeble, Kumai and Patil, 2018) which refers to the factual and accuracy of the data, and the values, which is the business intelligence that will be derived from processing such huge amount of data for decision making.

Literature Review

The importance of big data in various research domain is growing, such as big data and cyber-physical and social systems (Wang et al., 2018), Internet of things (IoT) and bigdata (Sun et al., 2018) and in the LIS field, an assessment of data analytics from the prism of bigdata has been linked with LMS and policies (Chen et al., 2015). But the question remains how do you define big data architecture (Demchenko, De Laat, and Membrey, 2014), without exacerbating inherent confusion of what is the actual characteristics of big data? This study defined five major characteristics of big data with the usual "5 Vs" Volume, Velocity, Variety, Veracity and Value. A massive data (5 gigabytes) which is volume, in different format (variety), but, such data size which does not require hyper computational speed processing (velocity), to generate or perform data collection, irrespective of the fact that it is valuable cannot be referred to as a big data. Therefore, big data required deployment and uses of a supercomputer that is the capability of performing approximately zettabyte (1 trillion gigabytes) of calculations per nanosecond. The library function must be exposed to advances in technology such as big data (Wang, Xu, Chen, and Chen, 2016), because of the crucial role the libraries play in information

organisation and management. Such role might include using big data for curating materials (Teets and Goldner, 2013), as it seems libraries are not catching up with opportunities big data advancement present, albeit its challenges in data processing, collection management and storing etc. (Golub and Hansson, 2017; Shan and Gang, 2013). Yet, the big data can significantly improve libraries' innovation in service delivery (Cuifeng, 2013; Simoviæ, 2018).

Big Data

One of the reasons the library and information profession must take significant interests in big data hinges on the fact that the profession is an information society whose currency of transactions is aggregated data. However, despite the enormous potential of big data to enrich the information society due to its value, this data must be mined, processed and reduced to usable quantity for decision making as business intelligence. By definition, big data presents a huge challenge to the LIS professions due to big data five Vs namely: size, velocity, volume, variety, veracity, and how to authenticate its veracity to derive the intended values. What makes big data are the five "Vs" characteristics, howbeit, big data is multidisciplinary (Hu and Zhang, 2017) and the LIS profession role is particularly vital to achieving knowledge organisation of big data. For example, Aydin, Akkineni and Angryk's (2016) study examined the method of modelling and indexing philosophy and physics of space and time trajectory (spatio-temporal) data, not just in a relational database, but in a non-relational repository. Their study concluded that using the indexing structure and data model has advantages. Therefore, libraries could combine their knowledge of building controlled index terms with the mapping of big data to develop an algorithm to handle automatic big data indexing.

Big Data Technologies and LIS Skills Requirements

The ability of the academic libraries to use their technical prowess in combination with software such as Python, JavaScript and R is vital for handling big data. A librarians' ability to use JavaScript functions to (map, filter, and reduce) big data will assist the library to have manageable data needed for knowledge organisation. The question remains

whether South African LIS professionals are ready to explore how High-Performance Computing (HPC) and parallel programming or application could speed up the libraries' ability to collect and process zettabytes of data. For example, the Centre for High-Performance Computing in Cape Town usually allocates 24 nodes per users, who are registered under a principal research leader in a university. Findings indicated that parallel programming would substantially increase the ability to process data as the HPC take advantage of the distributed memory of the system (Yildirim, Ozdogan and Watson, 2016). De Mauro Greco and Grimaldi (2016) indicate some of the impact of big data in the LIS profession in terms of collection and organisation of information. Nevertheless, there are specific and complex aspects of big data that the LIS professional must focus attention on as the profession cannot afford to adopt a "catch me if you can" approach to big data while the librarians are expected to deploy software in processing information resources in this era of big data. This study was conducted using bibliometrics to analyse big data outputs within the domain of library and information science in the Web of Science and Scopus.

Problem Statement

The growth of databases has become exponential to the point of the term big data being used (Patel, Birla and Nair, 2012) because a vast amount of the world information is stored in the databases. However, the problem of the exponential growth of databases has not been solved even with the introduction of big data. For example, there are relational and non-relational, structured query language (SQL) and non-structured (NoSQL) databases that host data from different provenances/sources, formats and complex information architecture. Therefore, librarians must apply their skills to ensure knowledge organisation by processing petabytes volume of data with such velocity, veracity and variety that must be harvested from various provenances. Although technology such as Hadoop may help to solve some of the problems of storing big data compared to traditional or legacy data storing system, Hadoop in itself does not resolve big data metadata management issues such as controlled index terms, faceted classification regarding big data without the library and information professional's prowess.

Arguably, the librarians have to use their data management knowledge and apply such relevant skills in big data metadata management. This might require the ability to programme software to handle automatic indexing of curated data. Furthermore, this paper argues that bibliometric analysis could be useful in identifying indexed terms for knowledge organisation (Hjorland, 2013). As such, the ability of LIS professionals to manage big data metadata is vital for the project owners to derive maximum benefit, which is expected from processing big data. For example, one of the reasons Google search engines is so effective is because of extensive resources descriptions of libraries and metadata management. Search queries results are a result of already developed controlled vocabularies, faceted classification algorithms and controlled index terms, all of which are essential for search result accuracy. Controlled vocabularies are essential owing to different research fields (computer science, engineering, social science, etc.) collaborating and working on big data.

Resulting from the challenges mentioned above, librarians will require training/retraining to handle algorithms and agile software that can handle semi or automatic indexing based on predefined controlled index terms. Christensen (2017) suggests that the systemic indexing will use previous search terms to handle iteration of subsequent indexing processes. Furthermore, a study in Amsterdam indicated that metadata is now the regular currency to pay for communication (van Dijck, 2014), more importantly, due to unique problems presented by big data because of the volume, veracity and varieties of the information from different sources/provenances and the nature of the information architecture. This study carried out this bibliometric analysis to map LIS big data research outputs to facilitate access to, and efficient use of a large amount (yottabytes) of data which requires teraflops of computational processing power to analyse. The bibliometric analysis is a useful approach to measure knowledge production in a field of study or particular subjects. This approach has been used by other scholars to analyse indicators such as authorship, collaboration and publication trends and sources of the journal (Cobo Serrano, 2018). Similar studies on big data in medical science have been carried out.

The main aim of this study was to conduct a bibliometric analysis of big data outputs in the domain of library and information science by mapping trends, and growth of scholarly contributions of the LIS scholars, as well as ascertain the contribution of South Africa to big data.

Objectives of the Study

- To assess global big data research trends based on the countries' outputs.
- To find out the library and information science research productivity on Big Data.
- To find out the area of LIS focus on Big Data and its implication for future research trajectories.
- To find out South African scholars' contributions and outputs on LIS and Big Data.

Research Methodology

The searches were limited to four databases on the Web of Science (WoS) Knowledge repository Core Collection. The data was indexed in the Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts and Humanities Citation Index (A and HCI) from 1975-2019, and the Emerging Sources Citation Index (ESCI) from 2015-2019. The data presented was based on the global output across all fields of studies/research areas in the Web of Science. The composition of the extracted LIS outputs types dataset was; articles ($n = 221$), editorial material ($n = 51$), book review ($n = 33$), review ($n = 12$), and conference proceedings ($n = 4$). The title was used as the field tag for the search strategy and separated our search terms with a Boolean operator "OR", to enable us to achieve highest possible recall ratio and recall precision based on all the controlled index terms in the databases. The controlled index terms used were "big data" (TI="big data" OR TI="big-data" OR TI= "bigdata"), and also the Boolean operator "OR". The timespan was limited from 1956 to 2019 October. One of the reasons why "massive data" was not included in the search strings was based on this paper definition of big data, and as alluded to from literature about the five "Vs" that make up big data, and such relative term "massive data" does not equal to "big data". This technique was adopted by (Ajibade and

Mutula, 2019). Furthermore, a related study on green innovation used a single search string (Albort-Morant, Henseler, Leal-Millán, and Cepeda-Carrión, 2017), and "project management (Cobo Serrano, 2018). There were 8, 415 outputs based on the search criteria, with h-index=104, ACP=97 (average citation per item), STC=81,645 (sum of times cited). For the analysis, the extracted data was imported from the search criteria into the desktop, and data cleaning was performed and the output analysed. Some 322 big data outputs were published in 88 LIS journals across 396 institutions from the WoS databases. A sample of 396 organisations was used as the unit of analysis to analyse output, citations and collaboration pattern. Subsequently, for the type of analysis, bibliographic coupling was used based on document, organisations and sources of the outputs.

Findings and Discussions

Outputs by Year

The LIS research outputs by year which are indexed in the SSCI, A and HCI, and ESCI in the Web of Science core collection databases (see methodology) span ten years from 2011-2019. Year 2019 accounted for 41 outputs (12.733%), 2018, 68 outputs (21.429%), 2017, 73 outputs (22.671%), 2016, 59 outputs (18.323%), 2015, 39 outputs (12.112%), 2014, 23 outputs (7.143), 2013 and 2012, 8 outputs each which accounted for (2.484), and 2011 LIS research outputs on big data were 0.621%. The highest output by the LIS research on big data was in 2017, which accounted for 22.671%, which is very low relative to other outputs from other fields. The distribution of outputs based on the language of publications were English, 292 (90.683%), Spanish, 14 (4.348%), Portuguese, 5 (1.553%), German, 4 (1.242%), Catalan and Hungarian, 3 each (0.932%), and French, 1 (0.311%).

Bibliometric Mapping and Network Clustering

The two predominant models used to present the result visualisation were clusters and network mapping. Thus, the visualisation of the bibliometric mapping and network analysis were presented based on the following models.

Mapping of Network:

$$v\left(x_{i, \ldots\ldots}, \mathrm{x}_n\right) = \sum_{i<j} s_{ij} \parallel x_i - x_j \parallel$$

base on the following constraint

$$\frac{2}{\mathrm{n}(n-1)} \sum_{i<j} \|x_i - x_j\| = 1,$$

Using this metric, the n represents the network node, and the x_i represents the location of node i, and $\|x_i\text{-}x_j\|$ denotes the geometry of distances between the nodes i and j.

Clustering:

For the clustering, techniques adopted for this paper, data are denoted as follows:

c_i represents assigned nodes, $\delta(c_i, c_j)$, function = 1 if $ci = Cj$ and 0 other, and γ denotes the resolution parameter that determines the details of the clustering (Van Eck and Waltman, 2014), meaning the value of γ determines the level of clustering details; hence, the model is expressed as:

$$V\left(c_i, \ldots, \mathrm{c}_n\right) = \sum_{i<j} \delta\left(c_i, c_j\right)\left(s_{ij} - \gamma\right)$$

As $\delta(x_i, x_j)$ equals 1 if $x_i = x_j$ and 0

$$V(x_1, \ldots, x_n) = \frac{1}{\gamma} \sum_{i<j} (1 - \delta(x_i, x_j))\left(\frac{1}{\gamma} \frac{2mc_{ij}}{c_i c_j} - 1\right)$$

and because $\delta(xi, xj)$ equals 1 if $xi = xj$ and 0

$$\hat{V}(x_1, \ldots, x_n) = -\frac{\gamma^2}{2m} V(x_1, \ldots, x_n) + \frac{1}{2m} \sum_{i<j}\left(\frac{2mc_{ij}}{c_i c_j} - \gamma\right)$$

Outputs Institutions using Clustering Network Analysis

Previous studies have established that articles within the same areas of study or focus of interests are often or are likely to be cited together (Hjorland, 2013). Liao, et al. had carried out a visualisation analysis of big data and medical research (Liao et

al., 2018). However, since there are 189 clusters in this study, the authors only examined the top clusters which are outputs in red, dark blue, purple, sky blue, green and light brown below (see figure 1). Data in Table 1 suggests that the top two countries accounted for forty-one and a half percent (41.5%) of the output, yet the same two countries (the USA and China) had 51.5% of the total citation per countries with the USA in the first place (43.8%), and China outputs accounting for almost eight percent (7.7%). Although Canadian outputs were ranked 7th in the total contributions, they accounted for 12.4% of the total citation. Therefore, we concluded that citation analysis presented significant statistical inferences to measure outputs visibility, relevance and impact by the citation analysis.

Table 1: Co-authorship Outputs by Countries and Institutions

Co-authorship by Country					Co-authorship by Institution			
countries	TCC	TCPP (%)	TLS		Institutions	TCI	TCPP (%)	TLS
USA	112	2671 (43.8)	53		Wuhan University	8	37	5
China	45	472 (7.7)	32		City University Hong Kong	6	50 (0.9)	4
India	25	143 (2.3)	15		Massey University	6	41	2
Spain	20	66 (1.1)	1		Kent State University	5	73 (1.3)	6
England	18	240 (3.9)	11		Sun Yat Sen University	5	76 (1.3)	2
Germany	14	153 (2.5)	12		University of Illinois	5	15	4
Canada	13	759 (12.4)	7		MIT	4	26	2
South Korea	12	239 (3.9)	10		Nanjing University	4	23	0
Taiwan	12	43 (0.7)	6		San Diego State University	4	186 (3.3)	2
Brazil	10	36 (0.6)	2		University Cincinnati	4	1293 (23.0)	7
Netherlands	10	122 (2.0)	7		University Malaya	4	231 (4.1)	0
New Zealand	10	59 (1.0)	5		Copenhagen Business Sch.	3	76 (1.3)	0
Australia	9	137 (2.2)	8		Delft University Technology	3	22	0
Denmark	7	135 (2.2)	4		Drexel University	3	5	0
France	7	61 (1.0)	7		Erasmus University	3	15	1
Italy	7	168 (2.8)	3		Georgia State University	3	1266 (22.5)	2
Finland	6	44 (0.7)	5		king Abdulaziz University	3	20	1
Pakistan	6	51 (0.8)	14		NYU	3	136 (2.4)	0
Ireland	5	57 (0.9)	3		Simon Fraser University	3	43	1
Malaysia	4	231 (3.8)	5		Southern Lazio	3	110 (2.0)	6
Saudi Arabia	4	26 (0.4)	8		Stanford University	3	28	1
South Africa	4	4 (0.1)	0		University Arizona	3	1308 (23.2)	2
Algeria	3	3 (.0)	1		University Carlos iii Madrid	3	25	0
Liechtenstein	3	39 (0.6)	3		University Cassino	3	110 (2.0)	6
Portugal	3	21 (0.3)	0		University Liechtenstein	3	39	0

Sweden	3	60 (1.0)	4	University North Carolina	3	102 (1.8)	0
Switzerland	3	4 (0.1)	6	University Oberta Catalunya	3	9	0
UAE	3	55 (0.9)	2	University Roma tor Vergata	3	110 (2.0)	6
				University Tennessee	3	65 (1.2)	3
				University Virginia	3	29	1
				University Waikato	3	35	2
				University Wisconsin	3	29	0

TCPP = Total Citations per Paper;

TLS = Total Link Strength;

UAE = United Arab Emirates

TCC = Total Output Count per Country

TCI = Total Co-Authorship Output Count per Institution

Global Trend of LIS Co-authorship Distributions by Countries and Institutions

Table 1 shows the percentage distribution of the top 15 co-authorship contributions from countries and top 5 Institutions. The citation analysis is a vital measure to evaluate the outputs and performances as a quantitative metric to rank visibility, influence and impact of institutions. Mishra et al. (2018) note that to rank journal significance, citation analysis is effective. The University of Arizona output (n=3) was ranked in the sixth place based on the total outputs. However, when the citation metrics were used as a unit of impact analysis, the same accounted for more than twenty-three percent (23.2%), thus ranking the university contributions in the first place. The University of Cincinnati outputs (n=4) was in the fourth place but ranked second (23%) using the citation index. In the third place was the Georgia State University outputs (n=3) which accounted for twenty-two and a half percent (22.5%) of the LIS outputs on big data. Institutions from the 80th to 189th clusters had one output each in the WoS outputs. In South Africa, there were only three institutions with one output each, and the Cape Peninsula University of Technology was in the 8th cluster possibly because of its co-authorship with an institution in that cluster. The University of KwaZulu-Natal was in the 170th clusters, and the University of Stellenbosch was in the 184th cluster as a single entity.

Outputs by Journal Sources for Big Data in the LIS Field

The clustering of bibliometric data aggregates and groups articles with the same aims and area of focus together (Mishra et al., 2018). The Big Data publications within the LIS discipline were published from 88 journals which comprised 21 clusters and 1255 network links. Out of these, 76 journals items were not connected or linked within the cluster. This suggests that authors had not cited the outputs in these 76 journals from the other journal. However, based on the argument of Horjland (2013), this could be because the area of focus was not closely related, or as a result of low outputs on big data research in LIS. Nevertheless, the library profession cannot be exempted from researching these technologies as its impact in the LIS profession is inevitable. The different network colour indicates journals publishing outputs in a similar or the same areas of interest (Hjorland, 2013; Anne, 2019). Unfortunately, none of the known South African journals were visibly represented in these clusters.

Fig. 1: Outputs based on the Bibliographic Coupling Network (the network colour indicated journal which articles have been cited within the network

Bibliographic coupling analysis is an important technique for identifying collaboration, rankings, clusters of contributions by the most influential and active authors and journals (Ferreira, 2018). Co-citation and bibliographic coupling are essential to tracking research focus and changes in a field of study (Chang, Huang and Lin 2015). Despite the usefulness of co-citation and bibliographic coupling, the visualisation depicted an indirect relationship; thus making it less accurate in comparison with a citation analysis (Van Eck and Waltman, 2017). Nevertheless, co-citation and bibliographic coupling can be useful for understanding the intellectual structure of research trajectories.

Citation Analysis

The citation analysis showed that from the 8, 415 global outputs on big data, 48,917 citing articles had cited these outputs 81, 645 times. However, the total output by the library and information science outputs were 322 articles. The citing articles could be used as a measure to find out the prominence of a study's areas on a particular subject and how other researchers perceived the authority of such a particular topic. This analysis indicated that in the citation report, other researchers citing articles had cited one or more of these articles (items) in the citation report analysis. The system extrapolated that out of 38,116 total citing articles, Library and Information Science accounted for 3.030% which is 1155 total record (citing article). This is in comparison to Computer Science which was in the first place with 11,262 records representing 29.547% outputs of the total 38,116 total citing articles. Engineering was second place with 8,161 other articles citing their outputs, which accounted for 21.411%, and telecommunications was in the third place with 3,754 citing articles that accounted for 9.849% of the total

citing articles. The Science and Technology research area was in the fourth place with 2,548 citing article, accounting for 6.685% of the total 38,116 citing articles.

Data regarding South Africa scholars' contribution suggested an uptake in research interest in big data as some institutions were collaborating with other researchers worldwide based on 147 outputs from Scopus database (see table 2, co-authorship). The justification for including this dataset was that, while South African scholars had 40 outputs from WoS, their outputs from the Scopus were more. However, there was a limitation to the Scopus dataset, because it did not show LIS contributions specifically, but Social Sciences and Humanities. The output was cited 1,266 times from the Web of Science Core Collection citation reports, the library and information

Co-authorship by institutions: (selected institutions with at least three outputs on big data)

Scopus Big Data Collaboration with South African Scholars

One of the innovative attempts adopted by this study was to use field-weighted citation impact (*fci*) to test the co-authorship distribution of countries' outputs as a unit of analysis using a small sample to see if it would serve as an insightful indicator to measure collaboration. Although Reller (2016) used it (*fci)* to measure the field-weighted citation impact as an indicator for field-based differences in citation, we inferred that the same could be used to measure collaboration impact, as we replaced the field of study with countries, but still used the citations distributions as the unit of analysis (see table 4). Our findings concluded that *fci* is a valid indicator to measure the performance and influence of an output based on co-authorship and collaboration. The data indicated that although South Africa's outputs were many, the FCI of Netherlands were three (*fci* = 3) indicating that the Netherlands outputs on big data in the LIS had been cited 200% more than the world average.

Table 2: Top Countries collaborating with South African institutions

Rank	Countries and territories	Outputs (TPCC)	Citations per Publication	Field-Weighted Citation Impact	Citation Count (TCCP)
1.	South Africa	111	4.0	0.88	439
2.	United Kingdom	10	16.3	2.00	163
3.	Australia	7	9.3	1.83	65
4.	Netherlands	5	15.4	3.08	77
5.	United States	5	9.2	1.20	46
6.	Belgium	2	0.5	0.00	1
7.	Germany	2	2.5	0.41	5
8.	Sweden	2	1.0	0.64	2

Table 2 shows countries collaborating with South Africa based on the top 100 countries output in Scopus analysis. Other collaborating countries had one output each with South African scholars these were not included. Furthermore, beyond the citation analysis, we examined the field-weighted impact of the citation (see table 2) to determine the ratio of the total citations received by each country's

contributions vis-à-vis their collaborative outputs with South African institutions and scholars. Other studies (Salimi, 2017) used the field-weighted citation impact (FCI) as a metric to present the impact of citation ratio as denominator's outputs vis-à-vis the total expected citation based on the average of the selected unit of analysis (subject field, citation, outputs etc.). Based on these metrics (FCI = 1), where the FCI is

equal to one, we suggested that the citation analysis be performed as expected. Consequently, a figure below one indicated that the outputs performed relatively lower below average for the global average as would the case for South Africa citation analysis. However, the output by Germany, Belgium and Sweden can be ignored due to low co-authorship outputs with South Africa. Nevertheless, we inferred that the FCI for South Africa was lower because big data research uptake in South Africa is relatively low especially in the LIS field, in comparison with South Africa and the UK, Netherlands and the USA.

In contrast to the Scopus data, there were only 40 outputs (n = 40) from the WoS, with h-index = 8; STC = 993; CA= 956; ACI = 24.83 in total. However, the citation distribution from 2008 to 2016 were one hundred and fourteen (STC =114), while 2017's citations surpassed that with (STC = 204), 2018 (STC-227), and 2019 (STC =194), and the yearly total average citation per year from 2008-2019 was above eighty (ACY = 82.75). Although the analysis showed an increasing interest in big data, the only limitation to this metric was the inability to generalise as statistically significant due to the limited sample.

Conclusion

The contributions of the library and information studies field and the contribution of the scholars in the field to big data are presented in this study. Our findings showed the extent and contributions of journals in the LIS field and the focus of publications on big data. Most importantly, the findings highlighted the diminished research trends on certain aspects of big data technologies such as cloud computing, internet of things, amongst other key variables. The big data outputs from the African scholars were limited in scope and volume. Most of the LIS big data outputs have not addressed techniques and technologies to facilitate big data collections, mapping, filtering and reduction. Nevertheless, the ability of the LIS scholar to map, filter and reduce big data content will assist them in creating faceted classifications, automatic controlled indexing terms and big data metadata management. The study recommends LIS focus on big data metadata management for solving some of the challenges of controlled indexing terms. Furthermore, ontology and classification and how it might be applicable in the

big data should be examined. This may require the ability of scholars in the LIS to use some of the big data analytics software to perform data scrubbing, mapping, and processing. The study reveals that the contribution of South Africa to studies on big data was very low.

References

Ajibade, P., and Mutula, S. M. (2019). Bibliometric Analysis of Citation Trends and Publications on E-Government in Southern African Countries: A Human-Computer Interactions and IT Alignment Debate. *Library Philosophy and Practice* (E-Journal), 2234(Winter 2019), 1- 19. Retrieved From Https://Digitalcommons. Unl. Edu/Libphilprac/2234/

Albort-Morant, G., Henseler, J., Leal-Millán, A., and Cepeda-Carrión, G. (2017). Mapping the Field: A Bibliometric Analysis of Green Innovation. Sustainability, 9 (6), 1011.

Aydin, B., Akkineni, V., and Angryk, R. A. (2016). Modeling and Indexing Spatiotemporal Trajectory Data in Non-Relational Databases. In Managing Big Data in Cloud Computing Environments (pp. 133-162). IGI Global.

Blummer, B., and Kenton, J. M. (2018). Big Data and Libraries: Identifying Themes in the Literature. *Internet Reference Services Quarterly*, 23 (1-2), 15-40.

Chang, Y. W., Huang, M. H., and Lin, C. W. (2015). Evolution of Research Subjects in Library and Information Science Based on Keyword, Bibliographical Coupling, and Co-Citation Analyses. *Scientometrics*, 105 (3), 2071-2087.

Christensen, H. D. (2017). Rethinking Image Indexing? *JASIST*, 68 (7), 1782-1785.

De Mauro, A., Greco, M., and Grimaldi, M. (2016). A Formal Definition of Big Data Based on its Essential Features. *Library Review*, 65 (3), 122-135.

Di Pretoro, E., and Geeraert, F. (2019). Behind the Scenes of Web Archiving: Metadata of Harvested Websites. ABB: Archives Et Bibliothèques De Belgique - Archiefen Bibliotheekwezen In België,

Brussel: Archief- En Bibliotheekwezen in België, N.D., In Press, Trust And Under-standing: The Value Of Metadata In A Digitally Joined-Up World, Ed. By R. Depoortere, T. Gheldof, D. Styven and J. Van Der Eycken, 106, pp.63-74. Ffhal-02124714

Chen, H. L., Doty, P., Mollman, C., Niu, X., Yu, J. C., and Zhang, T. (2015). Library Assessment and Data Analytics in the Big Data Era: Practice and Policies. Proceedings of the Association for Information Science and Technology, 52 (1), 1-4.

Cobo Serrano, S. (2018). Producción Científica Internacional Sobre Gestión De Proyectos En El Área De Información Y Documentación: 1996-2015. *Investigación Bibliotecológica*, 32 (75), 125-144.

Cuifeng, H. (2013). Library Services Innovation and Development in the Era of Big Data [J]. The Library, 1.

Demchenko, Y., De Laat, C., And Membrey, P. (2014). Defining Architecture Components of the Big Data Ecosystem.

Ferreira, F. A. (2018). Mapping The Field of Arts-Based Management: Bibliographic Coupling and Co-Citation Analyses. *Journal of Business Research*, 85: 348-357.

Golub, K., And Hansson, J. (2017). (Big) Data in Library and Information Science: A Brief Overview of Some Important Problem Areas. *Journal of Universal Computer Science* (Online), 23 (11), 1098-1108.

Gulgec, N. S., Shahidi, G. S., Matarazzo, T. J., And Pakzad, S. N. (2017). Current Challenges with Bigdata Analytics in Structural Health Monitoring. *In: Structural Health Monitoring and Damage Detection*, Volume 7 (pp. 79-84). Springer, Cham.

Hjørland, B. (2013). Citation Analysis: A Social And Dynamic Approach to Knowledge Organization. *Information Processing and Management*, 49(6), 1313-1325.

Hu, J., And Zhang, Y. (2017). Discovering the Interdisciplinary Nature of Big Data Research Through Social Network Analysis and Visualization. *Scientometrics*, 112 (1), 91-109.

Jeble, S., Kumari, S., and Patil, Y. (2018). Role of Big Data in Decision Making. *Operations and Supply Chain Management-An International Journal*, 11 (1), 36-44.

Mishra, D., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Dubey, R., and Wamba, S. (2016). Vision, Applications and Future Challenges of Internet of Things: A Bibliometric Study of the Recent Literature. *Industrial Management and Data Systems*, 116 (7), 1331-1355.

Mishra, D., Gunasekaran, A., Papadopoulos, T., and Childe, S. J. (2018). Big Data and Supply Chain Management: A Review and Bibliometric Analysis. *Annals of Operations Research*, 270 (1-2), 313-336.

Munshi, U. M. (2016). Management of Phytophthora–A Deadly Plant Pathogen. *Current Science*, 110 (12), 2213.

Patel, A. B., Birla, M., and Nair, U. (2012, December). Addressing Big Data Problem Using Hadoop and Map Reduce. In: 2012 Nirma University International Conference on Engineering (Nuicone) (Pp. 1-5). IEEE.

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F., and Zeng, X.-J. (2018). A Bibliometric Analysis and Visualization of Medical Big Data Research. Sustainability, 10 (1), 166.

Shan, J., and Gang, W. (2013). The Enlightenment of Big Data For Library [J]. Library Work and Study, 4.

Simoviæ, A. (2018). A Big Data Smart Library Recommender System for an Educational Institution. *Library Hi Tech*.

Sun, G., Chang, V., Guan, S., Ramachandran, M., Li, J., and Liao, D. (2018). Big Data and Internet of Things – Fusion for Different Services and its Impacts. *Future Generation Computer Systems*, 86: 1368-1370.

Reller, T. (2016). Elsevier Publishing – A Look at the Numbers, and More. *Key Journal*. Pp. 1-7.

Salimi, N. (2017). Quality Assessment of Scientific

Outputs Using The BWM. *Scientometrics*, 112 (1), 195-213.

Teets, M., and Goldner, M. (2013). Libraries' Role in Curating and Exposing Big Data. *Future Internet*, 5 (3), 429-438.

Van Dijck, J. (2014). Datafication, Dataism and Dataveillance: Big Data Between Scientific Paradigm and Ideology. *Surveillance and Society*, 12 (2), 197-208.

Van Eck, N. J., and Waltman, L. (2017). Citation-Based Clustering of Publications Using Citnetexplorer and Vosviewer. *Scientometrics*, 111 (2), 1053-1070.

Wang, C., Xu, S., Chen, L., And Chen, X. (2016). Exposing Library Data with Big Data Technology: A Review. Paper Presented at the 2016 IEEE/ACIS 15th International Conference on Computer and Information Science (ICIS).

Wang, X., Wang, W., Yang, L. T., Liao, S., Yin, D., and Deen, M. J. (2018). A Distributed HOSVD Method with its Incremental Computation for Big Data In Cyber-Physical-Social Systems. *IEEE Transactions on Computational Social Systems,* 5 (2), 481-492.

Weihong, F., Chenhui, L., Xingwang, Z., Xiaozhu, Q., and Zikuan, G. (2012). How do Libraries Need" Big Data"? [J]. *Library Journal*, 11. [Online]Available: Http://En.Cnki.Com.Cn/ Article_En/Cjfdtotal-TNGZ201211017.Htm

Yýldýrým, A. A., Özdoðan, C., and Watson, D. (2016). Parallel Data Reduction Techniques for Big Datasets. In: Big Data: Concepts, Methodologies, Tools, and Applications (pp. 734-756). IGI Global.

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Organisational Culture, Interpersonal Trust and Incentives as Predictors of Knowledge Sharing By Healthcare Providers in Gombe State, Nigeria

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Abstract

This study examined the predicting effect of organisational culture, interpersonal trust and incentives on the knowledge sharing of secondary healthcare providers in Gombe State, Nigeria. The total enumeration technique was used because the population of 665 healthcare providers was not so large. A questionnaire designed for this study was administered to the 665 healthcare providers, out of which 467 copies were found valid for analysis, giving a response rate of 70 percent. The results showed that organisational culture, interpersonal trust and incentives had significant correlations with knowledge sharing of the respondents. Also, there was a joint significant predicting effect of organisational culture, interpersonal trust and incentives on the knowledge sharing of the respondents. Furthermore, structured organisational culture, good interpersonal trust and availability of incentives enhanced the knowledge sharing of these healthcare providers. The study therefore recommended that hospital board managers should take cognisance of these to promote knowledge sharing among healthcare providers.

Keywords: Organisational Culture, Interpersonal Trust, Incentives, Knowledge Sharing Healthcare Providers.

Introduction

The secondary healthcare institution is the second level of healthcare delivery in Nigeria. This institution has healthcare providers working at the specialist hospitals, general hospitals and cottage hospitals in Nigeria. The secondary healthcare is the level at which patients from the primary healthcare are referred for further treatment. Unlike the primary and tertiary levels of healthcare, the secondary level of healthcare in Gombe State Nigeria has all categories of healthcare providers. These healthcare providers include: doctors and dentists, nurses and mid-wives, hospital laboratory scientists, hospital laboratory technicians, pharmacists, pharmacists technicians, community health extension workers, community health officers, radiologists and other healthcare providers who assist these.

Workers at the secondary level need to share knowledge, skills, experiences and insights, so that diseases can be prevented and better practices in curative measures shared to help patients. All these secondary healthcare providers depend on knowledge to provide quality services to their patients. This is because the healthcare sector is knowledge-driven. When what is known is not shared among healthcare providers, such knowledge cannot be used to forestall future mistakes by the healthcare providers. Furthermore, there are changes taking place within the healthcare sector that will require knowledge to be constantly shared and updated. Buttressing the need for healthcare providers to share knowledge, WHO (2005) has observed that 'there are knowledge

gaps among and within countries and this can only be bridged by the development of an environment that encourages the creation, sharing and effective application of knowledge to improve health. However, for knowledge to be shared by healthcare providers there are factors that may predict whether knowledge may be shared or not within the various healthcare facilities they work in. Such factors are organisational culture, interpersonal trust and incentives, among others, which this study investigated in the secondary healthcare institutions in Gombe State, Nigeria.

Knowledge sharing, according to Usoro, Sharratt, Tsui and Shekhar (2007), is a process of communication whereby two or more people are involved in the exchange of knowledge. This procedure requires that knowledge be supplied by a source, followed by the interpretation of the knowledge by one or more persons who have received the knowledge. The output of the process is the creation of new knowledge.

One of the factors that may influence knowledge sharing among healthcare providers is organisational culture. It encompasses the commonly held beliefs, attitudes and values of an organisation. It is also the collaborative programming of the mind that distinguishes one group from another (Hofstede, 1980).From studies (Adolfsson and Aneheim, 2016; Andriessen, 2006), it is clear that organisational culture is a major factor that needs to be considered because it may either enhance or hamper knowledge sharing practice. The general culture of an organisation may have influence on knowledge sharing.

Similarly, interpersonal trust is another issue that may influence knowledge sharing. Usoro, Sharratt, Tsui and Shekar (2007), citing Fukuyama (1998), regarded trust as the expectation that arises within a community of regular, honest and cooperative behaviour, based on commonly shared norms on the part of the members of the community.

The importance of interpersonal trust among healthcare providers has been demonstrated in studies such as that of Anatasia (2013) where trust has significant influence on knowledge sharing. The need for interpersonal trust among healthcare providers is important because trust has to do with the confidence one health provider has in other

colleagues for knowledge to be freely shared between them.

Incentive is another factor that needs to be considered if knowledge sharing may become a regular practice in any healthcare organisation. Andriessen (2006) pointed out that incentives and rewards denote all things people derive from behaving in a certain way. Therefore, incentive schemes are rewards and recognition which an organisation may offer its employees to enhance the sharing of knowledge.

Statement of the Problem

Gombe is located in the North-Eastern region of Nigeria, within the expansive savannah. According to the report of the Gombe State's Human Resources for Health Policy (2014), Gombe state has few training institutions and is in a disadvantaged position to attract adequate number of critically needed health professionals because of its limited resources. In addition, is the worrisome situation of having poor access to information and knowledge sources. Another problem is that the health sector loses its staff due to brain drain. This is a situation where a significant number of health professionals leave the public service after being trained by the state government. This situation leads to knowledge flight and critical operational knowledge is not shared. Furthermore, formalised knowledge sharing practice is not put in place because of poor knowledge sharing behaviour of the healthcare providers. It is therefore important that the healthcare system in Gombe State, just like any other healthcare system, implements knowledge management practices, strategy and principles to deal with these challenges by being able to tap into the large reserves of healthcare providers' knowledge, experiences and insights.

The objective of this paper was to examine whether organisational culture, interpersonal trust and incentives can predict knowledge sharing by healthcare providers in Gombe State. The specific objective of the study was to find out the relative and composite contributions of organisational culture, interpersonal trust and incentives to the prediction of knowledge sharing by the healthcare providers in Gombe State. The study answered specific research question and hypothesis.

The research question was: What is the relative contribution of organisational culture, interpersonal

trust and incentives to the prediction of knowledge sharing by the healthcare providers in the secondary healthcare institutions in Gombe State? The only research hypothesis for the study was:

H_o: Organisational culture, interpersonal trust and incentives will not jointly predict knowledge sharing of the healthcare providers in the healthcare institutions in Gombe State.

Literature Review

Organisational culture, interpersonal trust and incentives are factors that are important to consider for the explanation of knowledge sharing among healthcare providers. Sibte and Abidi (2007) noted the complexity of the dynamics of knowledge sharing, involving an active interplay of determinants such as culture, community, incentives, medium, context and needs. Therefore, the organisational culture obtainable in one place may positively or negatively influence the sharing of knowledge. For instance, the result of the study of Adolfsson and Aneheim (2016) identified organisational culture as seen to be supporting continuous sharing of knowledge among workers in two psychiatric healthcare organisations in Sweden.

Bamgboje-Ayodele and Ellis (2015) research findings revealed that the hierarchical nature of the Nigerian society supported central decision making thus influencing knowledge management practices in Nigerian organisations. Al-Alawi, Al-Marzooqi and Mohammed (2007) found out that factors like organisational culture, interpersonal trust, rewards among others contribute to knowledge sharing. Other studies like that of Karthiravelu, Mansor, Ramayah and Idris (2014) as well as Yong-Mi (2011) established that knowledge sharing practices are influenced by institutional structures. Further studies by Stock, Mcfadden and Gowen (2017) have shown that organisational culture is related to the effective sharing of knowledge.

Borum (2010) noted that interpersonal trust is a willingness to accept weakness or risk based on the expectations of another person's behaviour, a very important concept of human behaviour, which affects our interactions with opponents and competitors, as well as with allies and friends. It can be argued that interpersonal trust is partly

responsible for pressuring competitors to become allies or, if betrayed, enemies.

Lee and Osong's (2014) study established that reciprocity, behavioural control and trust were factors that affected hospital employees' knowledge sharing intention, knowledge behaviour and innovation behaviour. Anatasia's (2013) investigation also revealed that there was significant evidence regarding the significance of trust in the clinics and its development based on knowledge sharing among healthcare providers there in the private clinics in Greece. Other studies such as:Wei-Li, Bi-Fen, Chien-HsinandRyh-Song (2009);Ding, Atsushi and Choi (2018) supported these studies.

In knowledge sharing people desire to recover something for what they have contributed as a cost, for example, time, energy, potential loss of ownership and power which is referred to as external motivation. Incentives can be divided into tangible and intangible forms. Tangible incentives are things like money, gifts, promotion, and access to information. Less tangible incentives are exemplified in things as enhancement of reputation and public praise. Intangible incentives, however, have lasting more effect than tangible incentives (Andriessen, 2007).

The International Council of Nurses, International Hospital Federation, International Pharmaceutical Federation, World Confederation for Physical Therapy, World Dental Federation and World Medical Association (2008) noted that policy makers and managers within the healthcare system have turned their attention to using incentives to improve the recruitment, motivation and retention of healthcare professionals.

This study was anchored on the reviewed literature which showed that there could be a relationship between knowledge sharing and various factors including organisational culture, interpersonal trust as well as incentives. However, no literature has been able to put the three factors together to predict knowledge sharing in the healthcare system in Nigeria. This is the gap filled by this study.

Research Methodology

The study adopted a descriptive survey research design of the correlational type. The study population comprised all the 665 healthcare providers in the 20 secondary healthcare institutions in Gombe State,

Nigeria. The total enumeration technique was used to cover all the 665 healthcare providers because the population size was not too large.

The questionnaire designed to collect data for this study was tagged: "Organisational Culture, Interpersonal trust, Incentives and Knowledge Sharing (OCITIKSS)". It comprised four parts (A, B, C and D.) The response format is a four point Likert scale: 4=strongly agree, 3=agree, 2=disagree and 1=strongly disagree. These were adapted from Usoro (2007), Cameron (1986) and Lin (2006) respectively.

In addition, a pre-test was carried out on 30 healthcare providers to validate the reliability of the questionnaire. Cronbach-Alpha was used to determine the reliability coefficient. The questionnaire had a high reliability since the reliability coefficients were all above 0.70. Data collected from the field were analysed using simple correlation, multiple regressions and one-way analysis of variance (ANOVA) with the help of Software Package for Social Science (SPSS).

Findings

The gender distribution of the 467 respondents revealed that 192 (41.1%) were males while 271 (58.0%) were females. Most of the healthcare providers were within the age range of 20-50 years (93%). Out of the 467 healthcare providers 222 (47.5%) were nurses and mid-wives which is the highest number of healthcare providers that participated in the research. Doctors and dentists were 59 (12.8%), medical laboratory scientists were 41 (8.7 %), medical laboratory technicians were 11 (2.4%), pharmacists were 35 (7.5%), pharmacist technicians were 8 (1.7%), community health officers were 50 (10.7%) and others were 66 (14.1%).

Table 1: Relative Contributions of Organisational Culture, Interpersonal Trust and Incentives to the Prediction of Knowledge Sharing by the Healthcare Providers

Variable	Unstandardised Regression Coefficients		Standardised Regression Coefficients		
	B	Std. Error (B)	Beta	T	Sig. P
(Constant)	23.270	1.401		16.609	.000
Organisational culture	.197	.016	.488	12.202	.000
Interpersonal trust	.110	.029	.152	3.804	.000
Incentives	.001	.001	.043	1.082	.280

Table 1 presents the summary of the relative contributions of organisational culture, interpersonal trust and incentives to the knowledge sharing of the healthcare providers in healthcare institutions in Gombe State. The table shows that two out of the three variables (organisational culture (B= 0.197, t=12.202, p<0.05) and interpersonal trust (B=0.110 t= 3.804, p<0.05) predict knowledge sharing of the healthcare providers while incentives (B=0.001, t=1.082, p>0.05) do not significantly predict knowledge sharing of the respondents. Out of the three predictors, organisational culture has the highest relative contribution to knowledge sharing (Beta=0.488), followed by interpersonal trust (Beta=0.152) and incentives (Beta=0.043). This implies that organisational culture contributed 48.8% and interpersonal trust contributed 15.2% and incentives 4.3% to the prediction of knowledge sharing of the healthcare providers.

Table 2: Composite Contributions of the Three Variables to the Prediction of Knowledge Sharing

R	R Square	Adjusted r square	Std. Error of the estimate
0.511[a]	0.261	0.256	6.98824

Anova

Model		Sum of squares	Df squares	Mean	F-ratio	Sig. P
1	Regression	7990.079	3	2663.360	54.537	.000[b]
	Residual	22610.820	464	48.835		
	Total	30600.899	464			

A. Dependent variable: knowledge sharing

B. Predictors: (constant), organisational culture, interpersonal and incentives.

Table 2 presents the summary of the composite contributions of organisational culture, interpersonal trust and incentives to the prediction of knowledge sharing among the healthcare providers in the healthcare institutions in Gombe State. From table 2 the test of the hypothesis shows that organisational culture, inter-personal trust and incentives have jointly predicted the knowledge sharing of the healthcare providers (F=54.537, df=3; 464, P<0.05). More so, the value of adjusted R-Square = 0.256 which is the coefficient of determination of the multiple Linear Regression Model used. This means that 25.6% of the variation in knowledge sharing of the healthcare providers is explained by the Linear combination of organisational culture, inter personal trust and incentives of the respondents. The standard error of the estimate was 6.9882 indicating that the three variables represent a reasonably strong predictor of knowledge sharing of the healthcare providers. It was also found out that there was significant multiple correlation among organisational culture, interpersonal trust, incentives and knowledge sharing of the healthcare providers (R=0.511, P<0.05).

Discussion

One of the findings of this present study is that knowledge sharing has significant correlation with organisational culture, interpersonal trust and incentives of the secondary healthcare providers in Gombe State, Nigeria. This result is supported by Jacobs and Roodt (2011), the studies of Sensuse et al. (2014),Kokanuch and Tuntrabundit (2017), Mannion and Davies (2018) which all found that there is a positive correlation existing between organisational culture and knowledge sharing. In addition, Al-Alawi and Al-Marzooqi (2009) established that trust, communication, information systems, rewards and organisational structure are positively related to knowledge sharing in organisations.

The study also found that organisational culture, interpersonal trust and incentives significantly have combined predicting effect on knowledge sharing of healthcare providers in the secondary healthcare institutions in Gombe State, Nigeria. The value of adjusted R-Square which is 0.256 implies that 25.6% of the variance in knowledge sharing of the respondents is explained by the linear combination of their organisational culture, interpersonal trust and incentives in the secondary healthcare institutions in Gombe State, Nigeria. Furthermore, organisational culture contributed 48.8 percent; interpersonal trust contributed 15.2 percent to the prediction of knowledge sharing by the respondents. Organisational culture contributed the most to the knowledge sharing of the healthcare providers followed by interpersonal trust. Similarly, some studies that corroborated the findings of this research include

Tsai (2011) who reported from the findings of the study on hospital nurses in Taiwan that organisational culture is positively correlated to leadership behaviour.

Furthermore, the study found that two out of the three variables namely: organisational culture and interpersonal trust significantly predict knowledge sharing among the healthcare providers. Out of all the predictors, organisational culture had the highest relative contribution to knowledge sharing followed by inter-personal trust and then incentives. The findings revealed that organisational culture had the highest relative contribution to the knowledge sharing of healthcare providers in the secondary healthcare facilities followed by interpersonal trust and then incentives.

This result is supported by Ojo (2016) referring to Bassey (2012) who examined the antecedents and influence of organisational elements on Knowledge Management in knowledge intensive organisations. The findings revealed that there is a significant relationship between organisational elements and the KM process.

In addition the findings of Al-Basaidi and Olfman (2017) revealed that, human factors (related to knowledge healthcare providers and the peers) have a significant and direct impact on the intention to share knowledge. The result of research by Al-Basaidi and Olfman agrees to the findings that there is relative contribution of organisational culture, interpersonal trust and incentives on knowledge sharing. The result of this current study showed that organisational culture had the highest relative contribution and this result is corroborated by some other studies.

McManus (2016) also carried out a research with the aim of providing an investigative look at the factors that influence the willingness of employees to share knowledge within an organisational context. The factors the paper highlighted were critical to influencing the willingness to share knowledge include, but were not limited to culture, leadership, reward, information and communication technology, perception, working communication technology, working communities, reciprocity and psychological contract. This also corroborates the findings of the current study.

Similarly the study of Al-Alawi, Al-Marzooqi and Mohammed (2007) agrees with the findings of this study that critical factors like organisational culture, interpersonal trust, rewards among others contribute to knowledge sharing. The study of Karthiravelu, Mansor, Ramayah and Idris (2014) established that knowledge sharing practices are influenced by institutional structures. This has to do with the organisational culture of the healthcare institution. Other studies such as that of Stock, Mcfadden and Gowen (2017) buttressed the findings of this study that organisational culture is related to the effective sharing of knowledge.

Some past studies have shown that interpersonal trust was significant in knowledge sharing which agrees with the result of this study. For instance, Seo, Kim, Chang and Kim (2016) found that trust has a positive influence on knowledge sharing. In addition, Wu, Lin, and Yeh (2009) have corroborated the findings of this study as they found out that employees perceived interpersonal trust of either a colleague or superior as positively related with their knowledge sharing behaviour. This means interpersonal trust is a critical factor when it comes to knowledge sharing in fact Assem and Pabbi (2016) found that lack of trust in the healthcare system they studied was one of the barriers to knowledge sharing.

Although in this study the contribution of incentives was not so strong. However, previous studies have shown incentives to be significant in knowledge sharing, for example, McManus (2016) carried out a research with the aim of providing an investigative look at the factors that influence the willingness of employees to share knowledge. The factors the paper highlighted were critical to influence the willingness to share knowledge include, but were not limited to culture, leadership, reward among other factors highlighted. The interpretation of this is that the healthcare providers in the secondary healthcare facilities in Gombe State are still affected by the availability of incentives to share knowledge even though the result was not so significant. The implication of this is that where there are various types of incentives to encourage the healthcare providers, more knowledge will be shared.

Conclusion

Organisational culture, interpersonal trust and incentives have significant and positive relationships with the knowledge sharing of healthcare providers

in the secondary healthcare institutions in Gombe State, Nigeria. It is therefore recommended that the Hospital Management Board and the Ministry of Health should encourage a friendly organisational culture that is communal in nature, a good interpersonal trusting relationship and ensure the availability of adequate incentives such as acknowledgement letters, bonuses, opportunities for trainings among others which are very important for knowledge sharing practice to be enhanced among the health providers in the healthcare institutions in Gombe State, Nigeria.

References

Adolfsson, V and Aneheim-Ulvenas, E. (2016). *Organisational Culture and its Significance for Knowledge Sharing: A Case Study of a Psychiatric Healthcare Organisation.* M.A. Thesis. Lund University, Sweden.

Al-Alawi, A. I. N. Marzooqi, N. Y. and Mohammed, Y. F. (2007).Organisational Culture and Knowledge Sharing: Critical Factors. *Journal of Knowledge Management*, 11 (2), 22-42

Al-Busaidi A. and Olfman L. (2017). Knowledge Sharing through Inter-Organisational knowledge Sharing Systems. *Vine Journal of Information and Knowledge Management,* 47 (11), 10-136

Anastasia, R. (2013). *Knowledge Sharing and Trust in the Private Healthcare Sector*. MSC Thesis, International Hellenic University, Thesaloniki

Andriessen, J .H. E (2006). To Share or not to Share that is the Question: Conditions for the willingness to Share Knowledge. [Online] http ://www. Tudelftn/live/libranes [Accessed 5 September 2012]

Bamgboje-Ayodele, A. and Ellis, L.(2015). Knowledge Management and the Nigerian Culture. African Journal of Information Systems, 7 (1), 1 -20.

Borum, R. (2010). The Science of Interpersonal Trust. *Mental Health Law and Policy*, Faculty Publications, 574

Cameron, K. S. and Quinn, R. E. (1999).Diagonising and Changing Organisational Culture. [Online] http://faculty.mu.edu.sa/public/uploads/1360857498 [Accessed 5 August 2014]

Chennamaneni, A. (2006) Determinants of Knowledge Sharing Behaviours: Developing and Testing an Integrated Theoretical Model. [Online] http: //.dspace. uta.edu./ bitstream/ hardte [Accessed 10 April 2012]

Davenport, T. H. and Prusak, L. (1998). Working knowledge: How Organisations Manage what they Know.[Online]http://www. acm. org/ ubiquity/book/t davenport_1.html [Accessed 19 January, 2018]

Ding, W. Atsushi, A. and Choi, E. (2018). Relationships between Interpersonal Trust and Knowledge Sharing in Work Place: The Meditational Role of Prosocial Motives. *International Business Research,* 11 (8), 149

Hongbo L. and Zuopeng, J. Z. (2017). Incentives for Knowledge Sharing: Impact of Organisational Culture and Information Technology. Enterprise Information Systems, 11 (9), 1416-1435

International Council of Nurses; International Hospital Federation; International Pharmaceutical Federation; World Confederation for Physical Therapy; World Dental Federation and World Medical Association. (2008). Guidelines: Incentives for Health Professionals [Online] http://www.who.int/workforce.alliance/documents/incentivesguidelines.EN.pdf [Accessed 21April, 2017]

Jacobs, E.J. and Roodt, G. (2011). The Mediating Effect of Knowledge Sharing between Organisational Culture and Turn Over Intentions of Professional Nurses. [Online]www.scielo.org.za/sceilo.php? script= sciarttextandpid=52071 [Accessed 21 April 2017]

Karthiravelu, S. R.; Mansor, N. N. A.; Romayah, T.; Idris, N, (2014). Procedia- Social and Behavioural Sciences. 129, 119-126

Kirsimarja, B. and Aino, K. (2015). Knowledge Based View of the Firm-Theoretical Notions and Implications for Management.

[Online]www.lut.fi/documents/10633/109602/tijo-valintakoeartikkeli-2015.pdf/9c16a 83f.c588-458e-90d7-0a148/deeo4e6 [Accessed 21 April 2017]

Lee, H. S. and Hong, S. A. (2014). Factors Affecting Hospital Employees' Knowledge Sharing Intention and Behaviour and Innovation. *Osong Public Health and Research Perspectives,* 5 (3), 148-155.

Lin, H. (2007). Effects of Extrinsic and Intrinsic Motivation on Employee Knowledge Sharing Intention. *Journal of Information Science,* 33 (2), 135-149.

McManus, P. (2016). *Examining the Factors to Knowledge Sharing within an Organisational Context.* Doctoral Colloquium, Irish Academy of Management, Dublin

Ministry of Health Gombe (2014). Gombe. State Human Resources for Health. Ministry of Health Gombe.

Ojo, O. A. (2016). Knowledge Management in Nigerian Universities: A Conceptual Model. *Interdisciplinary Journal of Information, Knowledge and Management,* 11: 331-345

Sensuse, D. J. Rohajawanti, S.; Sucahyo, Y.G.; Rohajawanti, S. Rizqi, H. and Anggia P. (.2018). Understanding Organisational Culture for Healthcare Quality Improvement. *BMJ* 363 [Online] https//doiorg/10.1136/bmj.k4907 [Accessed 11 August 2019].

Seo, H. M. Kim, M. C. Chang, K. and Kim, T. (2016). Influence of Interpersonal Trust onInnovative Behaviour of Service Workers: Mediating Effects of Knowledge Sharing. *International Journal of Innovation Management,* 20 (2), 165

Sibte, S. and Abidi, R. (2007). Healthcare Knowledge Sharing: Purpose, Practices and Prospects. [Online] http://www.springerlink.com/content/Doi:10/007/1978-0-387 [Accessed 1 November 2011]

Stock, C. N. McFadden, K. L. and Gowen III, C. R. L. (2017).Organisational Culture, Knowledge Management and Patient Safety in U.S. Hospitals. *Quality Management Journal,* 17 (2), 7-26

Usoro, A. Sharratt, M.W. Tsui, E. and Shekar, S. (2007). Trust as an Antecedent to Knowledge Sharing in Virtual Communities of Practice. *Journal of Knowledge Management Research and Practice*, 5: 199-212.

Wei-Li, W., Bi-Fen, H., Chien-Hsin, L. and Ryh-Song, Y. (2009). Interpersonal Trust and Knowledge Sharing: Moderating Effects of Individual Altruism and a Social Interaction Environment. *Social Behaviour and Personality: An International Journal*, 37 (1), 83-93

WHO (2005). Bridging the Know- Do Gap: Meeting or Knowledge Translation in Global   Health. A Conference of the World Health Organisation held in Geneva, Switzerlandon October 10th-12th 2005. [Online] http://www.who.int/kms/WHO_EIP_KMS_2006_2.pdf
 [Accessed 5 August 2014]

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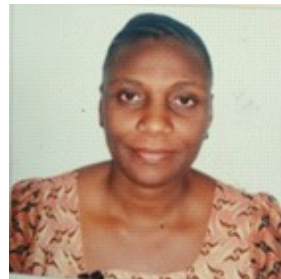
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Library Information Resources Use as Predictors of Academic Performance of Library and Information Science (LIS) Undergraduates in Nigeria: Implications for Academic Libraries

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Abstract

The study examined library information resources use by library and information science (LIS) undergraduates in Nigeria and ascertained the relationship with the academic performance of the students. The ex-post facto research design was used and 1,526 LIS undergraduates studied. Primary and secondary data collected were analysed using descriptive and inferential statistics. Print library information resources were mostly used and there was a statistically significant relationship between LIS undergraduates' use of library information resources and academic performance. The study established that library information resources use predicts academic performance. University libraries therefore should provide resources to enhance the undergraduates' performance.

Introduction

Advances in information and communication technologies (ICT) have brought about the explosion of information sources. Information sources ranging from print to electronic formats are easily accessible on the web through the Internet using mobile or other technologies. Academic libraries also collect and provide many information resources to support teaching, research and learning activities in the academic communities. Library and information science (LIS) undergraduates are expected to be equipped with relevant skills and techniques while in the university (Librarians' Registration Council of Nigeria, LRCN, 2017). Therefore, like other undergraduates, they engage in academic activities such as standard structured lectures, assignments, group discussions, seminars, writing term papers, continuous assessments, and examinations. These necessitate the LIS undergraduates to effectively utilise the information resources available to them while engaged in all these activities which are used in the evaluation of their overall performance, culminating in their academic performance.

Academic performance can be defined as the extent to which undergraduates obtain their educational objectives, goals, and outcomes. These include performance measured regarding practical examinations, continuous assessments and assessment of essays, practical exercises, and

reports. Usually, the Grade Point Average (GPA) is used to express the academic performance of undergraduates. That is, the overall performance of each undergraduate in an academic programme is determined by the mean of marks obtained from courses offered after the programme terminates (Richardson, Abraham, and Bond, 2012).

Evidence abounds of the encouraging contributions of the library to the academic performance of undergraduates. Assessment in action project by the Association of College and Research Libraries (ACRL, 2017) showed that students who made use of the library in some ways, for example, accessing online databases and interlibrary loan, achieved better grades than those who did not utilise the library. Shrestha (2008) had earlier reported that undergraduates who regularly use library resources understand that the available information resources in the library are more all-inclusive and scholarly than what most websites offer. Kot and Jones (2015), in a study at Georgia State University, demonstrated that using library information resources has a desirable effect on the academic performance of undergraduates. An earlier study conducted by Wong and Webb (2011) lends credence to this submission.

Although undergraduates use the university library, the studies by Soria, Fransen and Nackerud (2013) and Wenborn (2018) are suggestive of the fact that they do not obtain all the information they need and thus, rely less on the library as the primary source for accessing information. Traditionally, undergraduates use the library to either read or borrow books but in this technology age, their expectations of the library are changing. Users look forward to being able to learn anywhere with continuous access to library information resources and materials in various formats. The implication of this is that within and outside the library, undergraduates must be able to use the information and have information resources delivered to them irrespective of their locations. This study, therefore, is an investigative study into how LIS undergraduates make use of library information resources to support learning in their pursuit of academic success.

Statement of the Problem

Attempts have been made over the years to identify factors that can influence the academic performance of undergraduates, and the use of the library was not left out. Evaluation of the academic performance of undergraduates is crucial in the assessment of the quality of education received in the university. It is crucial for the accreditation of professional courses like library and information science (LIS). Academic libraries have not demonstrated the value adequately in complementing the university in achieving the goals and expectations. Thus, analysing the connections between library information resources use and academic performance of LIS undergraduates would provide academic libraries with evidence-based data that can inform improved service effectiveness and efficiency. It is against this backdrop that this study set out to investigate library information resources use as a predictor of academic performance with the intent of enhancing learning and thus improving the academic performance of LIS undergraduates in Nigerian universities.

Literature Review

Studies have shown that academic libraries recognise the importance of the academic performance of students (ACRL, 2017). There is a general opinion that the library supports students' academic performance and researchers have suggested investigations into the correlation between the library interactions or use of the library by undergraduates and their GPA (ACRL, 2010; Lance, Rodney and Schwarz, 2010). One of the earliest studies, Kramer and Kramer (1968), researched the relationship between the grades and retention of freshmen students at California State Polytechnic College, Pomona and library borrowing data. They found positive correlations between higher grades, retention and borrowing library materials. Most research in recent times used extensive national data as measures of library impact on the higher education sector (Kuh and Gonyea, 2003; Gratch-Lindauer, 2007; Emmons and Wilkinson, 2011). The subjects of the studies were single institutions that mostly concentrated on the use of library information resources and grades of students to determine the academic performance (Goodall and Pattern, 2011; Wong and Webb, 2011).

Strang (2015) looked into the circumstances that made students choose to use the library resources available to them for research and assignments and

highlighted seven reasons. There is access to a vast array of resources either through the library or at the library and opportunities to read books and journals in print or electronic formats. Although students use the Internet, they prefer using library information resources because they trust the quality of the resources and find it comfortable and convenient to look for information in the library. Students can find accurate and reliable information through libraries' online resources. The students could ask for assistance from the 'Ask library staff' on the library website and get quick answers to their questions with directions to needed materials. Students also chose to use the library because of the conducive and enabling environment to study and do research. The opportunity to accurately cite the information resources used and availability of the Internet and Wi-Fi facilities make studying easier.

Library Information Resources Use and Academic Performance of Undergraduates

The academic library plays a vital role in students learning experience by providing access to information resources. Attesting to this, Hamade and Al Yousef (2010) examined information resources use by LIS postgraduates at Kuwait University by the use of citation counts of references in their research papers. The findings revealed that journal articles, web pages, and books are the most preferred information resources used by the students. Wong and Webb (2011) discovered significant associations between the number of books checked out of the library by students and their GPA at graduation. Rather than using the customary academic library assessment, Wong and Webb (2011) reported an experimental project undertaken by the Hong Kong Baptist University Library (HKBU) by sampling up to 8,701 pairs of data. The study was able to demonstrate positive impact on the learning outcomes of undergraduates by establishing a statistically significant relationship between the use of library materials and the CGPA of undergraduates. A strong association was also discovered by Cox and Jantti (2012) between library information resources use and student grades at the University of Wollongong Library. The investigation was carried out by analysing resource usage data for book loans and online resources used by the undergraduates in

the university using a database called 'Library Cube' which was used to link library use, demographic and academic performance data of the undergraduates.

Brown and Malenfant (2015) noted that higher education effectiveness and quality of LIS undergraduates is increasingly becoming a concern for academic libraries. The academic libraries contribute to assessments in the universities by documenting the value of academic libraries through the creation of approaches, strategies, and practices, hence, promoting their institutions' goals and missions. They noted further that academic libraries could establish the relationship between the various aspects of the library services and factors that influence academic performance by providing an evidence-based demonstration of the various contributions of libraries to the learning and success of undergraduates.

Association of College and Research Libraries (ACRL, 2017) in the recently completed assessment in action team projects that comprised of 55 higher education institutions in North America demonstrated the relationships between the library and undergraduates' academic success. Firstly, undergraduates, who received library instruction as part of their courses, demonstrated better information literacy competencies and achieved better grades than those who did not receive the library instruction-related course. Secondly, library spaces and research rooms foster a social and academic relationship among students. Thirdly, the use of instructional games in the library was to enhance students' engagements, information literacy skills, and improve the attitude of the students toward the library and the staff. Thus, as rightly stated earlier by Wong and Webb (2011), academic libraries, especially in the developing countries, must demonstrate the contributions of library use to student academic performance empirically and, ultimately, to the overall effectiveness of the university.

Walberg's Theory of Educational Productivity

Several authors including Maehr and Sjogren, 1971; Beck, 1978; Sternberg, 1998) have proposed theories that serve as a foundation for understanding factors that influence academic performance of undergraduates. One such tested theory is Walberg's Theory of Educational Productivity (Walberg, 1981).

Walberg identified eight factors that influence student's performance: student ability; motivation; quality of instruction; the quantity of instruction; the socio-psychological environment of the classroom; education-stimulating conditions in the home; peer group and exposure to mass media. Later on, McGrew and Evans (2004) grouped these critical variables identified by Walberg into three. The first three variables (ability, motivation, and age) reflect the characteristics of the student; the fourth and fifth variables indicate instruction (quantity and quality), while the other four variables (classroom climate, home environment, peer group, and exposure to media) represent aspects of the psychological environment.

Student characteristics are essential for academic performance, but they only comprise a small portion of the learning equation. More specifically, psychological environment variables influence about 92% of the time students spend outside class (Walberg, 2003). In summary, if all these key variables are adequately combined in the learning equation, the undergraduates will be academically successful, and their academic performance will be enhanced. Hence, the factor under consideration, library information resources use, is categorised into the supplementary or supportive group, which, according to McGrew and Evans (2004), represents the psychological environment of students. For this reason, the appropriate combination of library information resources use in the learning equation in addition to student characteristics and instruction could significantly influence the academic performance of LIS undergraduates in Nigeria.

Aims of the Study

The study aims to examine the extent of library information resources use by library and information science (LIS) undergraduates in Nigerian universities and ascertain the relationship with the academic performance of the undergraduates. Analysing the connections between library information resources use and academic performance would provide academic libraries with evidence-based data. It could also inform service improvements and efficiencies, the development of new services, and the allocation of resources for a positive impact on the academic performance of undergraduates and all other library users in general.

Research Questions

The following research questions were posed for the study:

(i) What is the frequency and purpose of library use by undergraduates in Nigerian universities?

(ii) What are the print and electronic library information resources available in the library for LIS undergraduates in Nigerian universities?

(iii) What is the frequency of use of the available print and electronic library information resources by LIS undergraduates in Nigerian universities?

Hypothesis

The only research hypothesis for the study was:

H_o: There is no significant relationship between the use of library information resources and academic performance of LIS undergraduates in Nigerian universities.

Research Methods

The descriptive survey design of *ex-post facto* type was employed for the study. It enabled the researchers to establish the relationship between library information resources use and academic performance of the undergraduates. The multi-stage procedure was adopted and 23 Nigerian universities (federal – 12, state – eight and private – three) (see Appendix) accredited by the Librarians' Regulation Council of Nigeria (LRCN, 2016) to offer LIS degree programme in the six geopolitical zones were purposively selected. The population of the 200 to 400 Levels LIS undergraduates was 7115 (see Appendix). The universities were stratified by university ownership in the six geopolitical zones. One federal university was randomly selected from each of the six zones, while five state and three private owned universities were randomly selected from each of the five and three geopolitical zones that have universities offering LIS degree programme respectively (See Table 1). The stratification and

random selection ensured equal representation of universities in all the zones and university ownerships. Proportionate sampling technique was used to select 40% of the LIS undergraduates (1526) that were studied.

The data collection instruments used were the questionnaire (adapted from Shrestha, 2008) and the university records bearing the Cumulative Grade Point Average (CGPA) of the undergraduates. The internal reliability of the questionnaire measured by Cronbach's Alpha analysis was 0.959. Data collected for this study were analysed using descriptive statistics like percentages, frequencies, mean, standard deviation and inferential statistics.

Table 1: Stratification of university ownership by geopolitical zones

Ownership/ Geopolitical Zones	North Central	North East	North West	South East	South-South	South West	Total	Number of universities selected
Federal	2	3	2	2	2	1	12	**6**
State	2	–	1	2	2	1	8	**5**
Private	–	–	–	1	1	1	3	**3**
Total	4	3	3	5	5	3	23	**14**

Findings of the Study

It is evident from the findings presented in Fig. 1 that all the respondents used the library at different times and for different purposes. All the respondents visited the library at least once a week to attend to continuous assessments (do their assignment) ($\bar{x}$ = 4.47, SD = 0.67), to browse books on the shelves or read newspapers ($\bar{x}$ = 4.23, SD = 0.62) or study alone ($\bar{x}$ = 4.00, SD = 0.82). However, almost half of the respondents had never used the facilities in the university libraries like photocopying services, checked out/return books, retrieved specific item (46.6%) or used the library for relaxation/ entertainment (46.5%) while 69.8% of the LIS undergraduates did not visit the library to ask question from library staff which had the least mean score ($\bar{x}$ = 1.85, SD = 1.42).
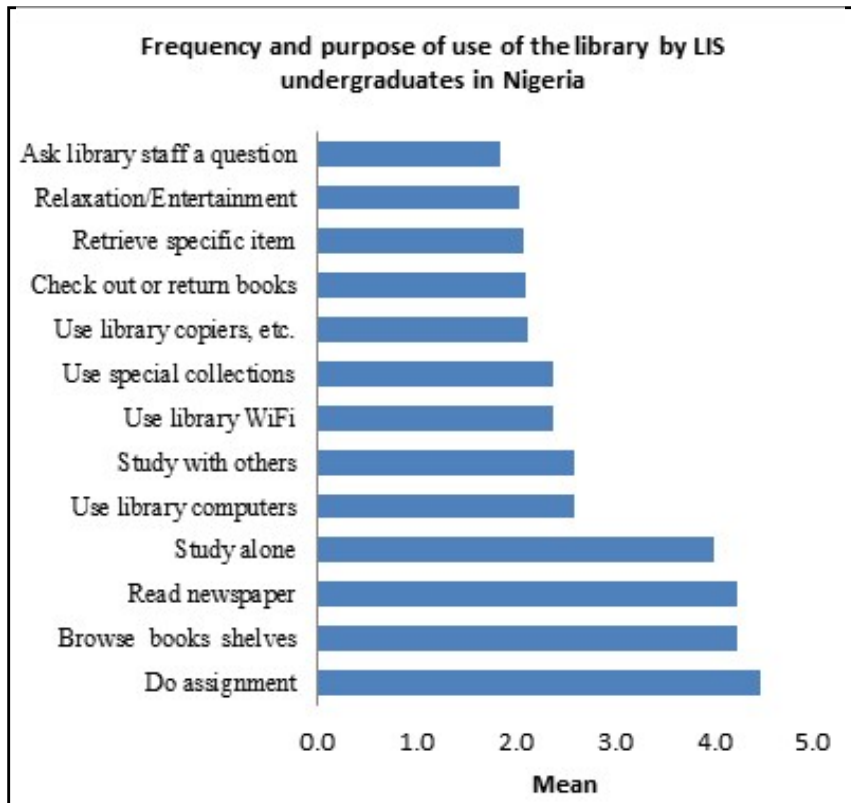
Fig. 1:   Frequency and purpose of use of the library by LIS undergraduates in Nigeria

Figure 2 shows that 85.7% of the respondents visited the library at least once in a week to use manuscripts/special collections and newspaper/ magazine, 85.6% used archival materials while 66.6% of the respondents made use of books respectively. In addition, more than half of the respondents (57.2%) visited the library to use textbooks. However, only 19.1% and 14.3% of the respondents visited the library at least once a week to use grey literature and journals respectively while none of the respondents visited the library to use projects, theses and dissertations. This pattern of print library information materials use by the respondents is similar in all the universities, as shown in Table 2. In the private universities category, all the respondents in Benson Idahosa University (BIU) visited the library at least once a week to use manuscripts/special collections followed by 89.5% respondents from Adeleke University (AU) while 87.2% and 87.1% of respondents from Kwara State University (KWASU) (state universities category) and Ahmadu Bello University (ABU) (federal universities category) also used it respectively. None

of the respondents in any of the university categories visited the library to use projects, theses or dissertations while less than 15% of all the respondents in all the universities except BIU and AU visited the library to use journals.

Considering the frequency of use of electronic library information resources by the respondents, Figure 3 shows that most of the respondents rarely used electronic information resources made available by the library. The most frequently used electronic library resources were used by less than 20% of the respondents at least once a week. They were e-archival materials, library website and e-projects/e-theses/e-dissertation and e-manuscripts/e-special collections. The least used electronic library resources were e-reference materials like encyclopaedia, dictionary (1.3%), e-newspaper/e-magazine (4.3%) and e-textbooks (5.4%). This pattern is similar in all the university categories, as shown in Table 3.

In the federal universities category, respondents in University of Calabar (UNICAL) (68.4%) used e-archival materials, library website

and e-project/thesis/dissertation while only respondents in KWASU (37.5%) in the state universities category used at least one of the electronic library information resources. None of the respondents in the private universities category used any of the electronic library information resources except Madonna University (MU) (13.3%) that used eManuscript and special collections.
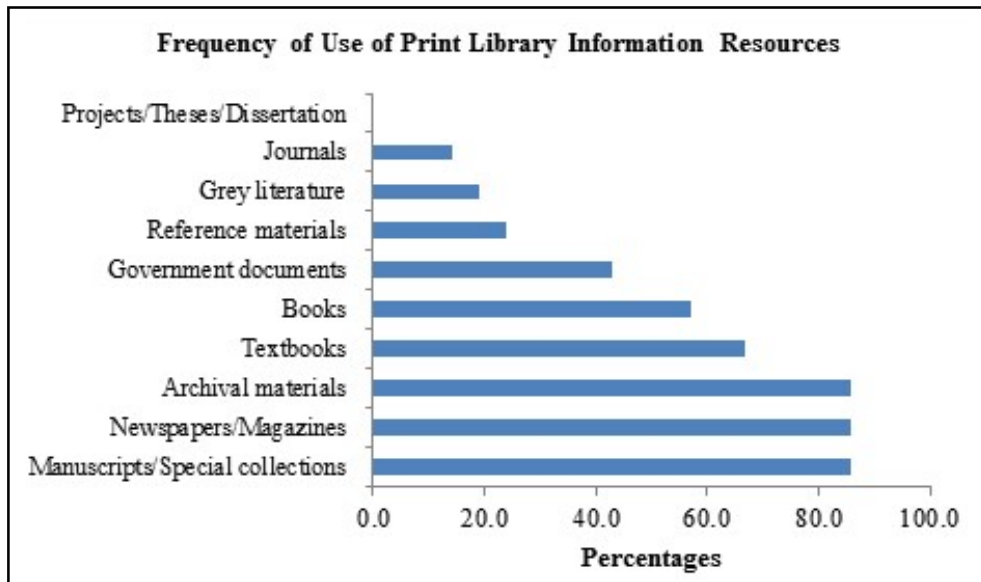

Fig. 2: Frequency of Use of Print Library Information Resources by LIS Undergraduates in Nigerian Universities
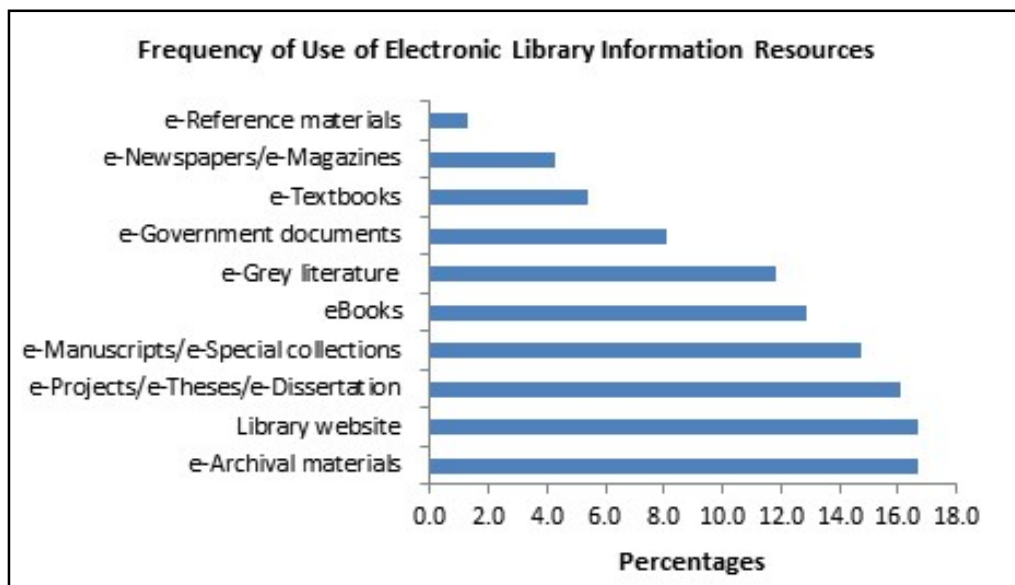

Fig. 3: Frequency of Use of Electronic Library Information Resources by LIS Undergraduates in Nigerian Universities

Table 2: Use of Print Library Information Resources by LIS Undergraduates in Nigerian Universities

S/N	Universities	N	MS		NM		AR		T		B		GD		RM		GL		J		PTD	
			N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	ABU	70	61	87.1	60	85.7	61	87.1	48	68.6	40	57.1	30	42.9	15	21.4	3	4.3	10	14.4	0	0.0
2	ATBU	331	284	85.8	282	85.2	284	85.8	221	66.8	188	56.8	141	42.6	77	23.3	71	21.5	48	14.4	0	0.0
3	UNICAL	79	67	84.8	67	84.8	67	84.8	54	68.4	45	57.0	36	45.6	18	22.8	16	20.3	11	13.9	0	0.0
4	UI	57	49	86.0	50	87.7	49	86.0	36	63.2	33	57.9	22	38.6	15	26.3	12	21.1	8	14.0	0	0.0
5	UNILORIN	38	32	84.2	33	86.8	32	84.2	25	65.8	22	57.9	16	42.1	10	26.3	7	18.4	5	13.7	0	0.0
6	UNN	46	39	84.8	40	87.0	39	84.8	29	63.0	28	60.9	17	37.0	14	30.4	9	19.6	6	13.9	0	0.0
7	AAU	156	134	85.9	133	85.3	133	85.3	106	67.9	89	57.1	70	44.9	36	23.1	31	19.9	22	14.3	0	0.0
8	IMSU	134	115	85.8	116	86.6	116	86.6	88	65.7	76	56.7	57	42.5	32	23.9	25	18.7	20	14.6	0	0.0
9	KWASU	47	41	87.2	41	87.2	41	87.2	29	61.7	26	55.3	18	38.3	12	25.5	8	17.0	7	14.7	0	0.0
10	TASUED	118	100	84.7	101	85.6	100	84.7	80	67.8	68	57.6	52	44.1	29	24.6	23	19.5	17	14.1	0	0.0
11	UMYU	134	114	85.1	114	85.1	114	85.1	90	67.2	78	58.2	57	42.5	33	24.6	26	19.4	19	13.8	0	0.0
12	AUE	19	17	89.5	16	84.2	16	84.2	13	68.4	10	52.6	9	47.4	3	15.8	4	21.1	3	15.8	0	0.0
13	BIU	5	5	100.0	4	80.0	5	100.0	4	80.0	2	40.0	3	60.0	0	0.0	2	40.0	1	20.0	0	0.0
14	MUA	15	12	80.0	13	86.7	12	80.0	9	60.0	9	60.0	6	40.0	5	33.3	2	13.3	2	13.3	0	0.0
	N	1249																				

Keys

AR – Archival materials   B – Books   GD – Government documents   GL – Grey literature   J – Journals   MS – Manuscripts/Special collections   NM – Newspapers/Magazines   PTD – Projects/Theses/Dissertations   RM – Reference materials   T – Textbooks

Table 3: Use of Electronic Library Information Resources by LIS Undergraduates in Nigerian Universities

S/N	Universities	N	eArch. Material		Lib. Website		eProject/ Thesis/Diss		eManus./ Spec. Coll		eBooks		eGrey Literature		eGov. Documents		eTextbooks		eNewspaper/ Magazines		eRef. Materials	
			N	%	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%
1	ABU	70	0	0.0	0	0.0	0	0.0	9	13.4	0	0.0	0	0.0	0	0.0	25	36.2	30	43.5	0	0.0
2	ATBU	331	96	29.1	102	31.0	86	26.0	52	15.8	69	20.9	72	21.8	41	12.4	0	0.0	0	0.0	17	5.1
3	UNICAL	79	54	68.4	54	68.4	54	68.4	12	15.2	42	53.2	36	45.6	27	34.2	15	19.0	15	19.0	0	0.0
4	UI	57	26	45.6	24	42.1	24	42.1	8	14.0	17	29.8	18	31.6	9	15.8	27	47.4	10	17.5	0	0.0
5	UNILORIN	38	19	50.0	23	60.3	23	60.3	6	15.5	20	53.4	12	32.8	15	39.7	2	5.2	1	1.7	0	0.0
6	UNN	46	1	2.0	1	2.0	1	2.0	6	14.0	1	2.0	1	2.0	1	2.0	0	0.0	0	0.0	0	0.0
7	AAU	156	0	0.0	0	0.0	0	0.0	22	14.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8	IMSU	134	0	0.0	0	0.0	0	0.0	19	14.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9	KWASU	47	18	37.5	18	37.5	18	37.5	7	14.6	14	29.2	12	25.0	9	18.8	5	10.4	5	10.4	0	0.0
10	TASUED	118	0	0.0	0	0.0	0	0.0	17	14.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
11	UMYU	134	0	0.0	0	0.0	0	0.0	19	14.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
12	AUE	19	0	0.0	0	0.0	0	0.0	3	15.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
13	BIU	5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
14	MUA	15	0	0.0	0	0.0	0	0.0	2	13.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		1249																				

Level of Academic Performance

To determine the level of the academic performance of LIS undergraduates in Nigeria, the respondents were asked to state their CGPA for the previous session (2016/2017). The self-reported CGPAs of the undergraduates were then validated using the academic records collected from each university that bears the CGPA of the undergraduates. The level of the academic performance of the respondents based on their CGPA is presented in Table 4.

Table 4: Breakdown of the Data on CGPA from the LIS Departments

	200L		300L		400L		Total	
CGPA	N	%	N	%	N	%	N	%
1st Class Grade	9	0.7	8	0.6	11	0.9	**28**	**2.2**
2nd Class Upper Grade	177	14.2	113	9.0	154	12.3	**444**	**35.5**
2nd Class Lower Grade	229	18.3	152	12.2	203	16.3	**584**	**46.8**
3rd Class Grade	56	4.5	68	5.4	44	3.5	**176**	**14.1**
Pass Grade	7	0.6	6	0.5	12	1.0	**25**	**2.0**
Total	**478**	**38.3**	**347**	**27.8**	**424**	**33.9**	**1249**	**100**

Table 4 showed that the level of the academic performance of close to half of the respondents (46.8%) fell within the 2nd Class Lower grade, 35.5% were within the 2nd Class Upper grades while 14.1% of the respondents were within the 3rd Class. Those within 1st Class and Pass grades were 2.2% and 2.0% respectively. It is therefore evident from the result that the academic performance of the majority of the respondents is on the average.

Test of the Hypothesis

The null hypothesis postulated was tested at 0.05 level of significance using the Spearman's correlation. From the analysis in Table 5, there was a statistically significant relationship between the use of library information resources and academic performance with $p = .001$ ($p<.05$). Moreover, the table also revealed that there was a correlation ($r_s = -.099$) between the use of library information resources and academic performance. Therefore, the hypothesis was rejected.

Table 5: Spearman's Rank-Order Correlation Table showing the Relationship between Library Information Resources Use and Academic Performance of LIS Undergraduates in Nigerian Universities

			CGPA	LIRU
Spearman's rho	CGPA	Correlation Coefficient	1.000	-.099[**]
		Sig. (2-tailed)	.	.001
		N	1249	1249
	LIRU	Correlation Coefficient	-.099[**]	1.000
		Sig. (2-tailed)	.001	.
		N	1249	1249

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

All the respondents used the library at different intervals and for different purposes but mostly used print library information resources. The findings of this study showed that all the respondents used the library at different intervals and for different purposes. The purpose of their visit was to browse books on the shelves or study alone while all of the respondents visited the library at least once a week to do their assignments. However, the majority of the LIS undergraduates did not make use of charging services, and reprographic services, provided by the library; neither did they visit the library to ask questions from library staff. These findings corroborate previous studies (Odeh, 2012; Lee, Paik and Joo, 2012; Lacoviæ, 2014; Olajide and Adio, 2017) on the use of library information resources, the frequency of visits and purpose of use of the library.

Furthermore, the study revealed that all the LIS undergraduates made use of the library information e-resources like journals, projects/theses/dissertations, reference materials (e.g., encyclopaedia, dictionary), books and textbooks online. However, in all the universities, the LIS undergraduates mostly visited the library to use print information resources like manuscripts/special collections, newspaper/magazine, archival materials, books, and textbooks but rarely visited the library to use grey literature, journals and projects/thesis/dissertation. It could be because most journals are now available through open access and are easily accessible to the undergraduates (Owusu-Acheaw and Larson, 2014; Dumebi, 2017). It could also be that the undergraduates do not have access to projects/thesis/dissertation in their university libraries. It is essential also to note that the use of textbooks by the LIS undergraduates in all the universities except BIU is not as high as other library information resources. It is an indication that the undergraduates prefer digested information rather than seeking information from texts.

Although the LIS undergraduates mostly visited their university libraries to use print library information resources, the findings indicated that the undergraduates' preferred electronic information resources to print. This submission is contrary to Yamson, Appiah and Tsegah (2018) findings that the majority of the undergraduates in their study preferred

to use print library resources. However, the finding of this study is in tandem with Madondo, Sithole and Chisita (2017) opinion, that, undergraduates continue to rely on electronic resources because they are made available by libraries at no cost to them. Accessibility to a vast array of library information resources, either print or electronic, reliable online sources through the library, assistance from library staff, conducive and enabling environments are some of the reasons that make undergraduates use the library (Strang, 2015).

In this study, there is a statistically significant relationship between the use of library information resources and academic performance. This relationship indicates that the more the LIS undergraduates use the library's information resources, the more significant the impact it has on their academic performance. This lends credence to Walberg Educational Productivity Theory that the appropriate combination of library information resources use in the learning equation could significantly influence the academic performance of LIS undergraduates. This finding also supports an earlier study at Georgia State University, United States of America, where it was found that the use of library information resources has a positive impact on the academic performance of undergraduates (Kot and Jones, 2015). The observation of Wong and Webb (2001) in their study further substantiates the credibility of this finding.

The findings also showed that the LIS undergraduates utilised both the print and the electronic resources available in the library, and most of the information resources used were related to their academic activities. Thus, with better learning processes, the use of library information resources would have a more significant impact on the academic performance of the undergraduates. This implies that within and outside the library, undergraduates can make use of information and can have information materials delivered to them irrespective of their locations. The professional ways in which these information resources are organised can help undergraduates in accessing and retrieving information needed for their learning.

Moreover, the exploration by Kelly, Montenegro, González, Jara, Alarcón, Saurina and Cano (2014), of the relationship between the use of library information resources and learning outcomes by undergraduates, led to the discovery that the use of electronic information resources provided by the

library has an impact on undergraduates' learning outcomes. Shrestha (2008) had earlier noted that undergraduates who regularly use the library understand that the information resources that are available in the library are more reliable, comprehensive and scholarly than what most websites provide. Thus, the use of library information resources can greatly enhance purposeful learning and improve the academic performance of undergraduates and help academic libraries to fulfil their core mission (Soria, Fransen and Nackerud, 2013).

Conclusion and Recommendation

The study has demonstrated that the use of library information resources predicts the academic performance of the LIS undergraduates in Nigeria. University libraries therefore should be well equipped with both print and electronic information resources to provide up-to-date information to undergraduates in a professional way in order to enhance students' academic performance. This study has established the relationship between the use of library information resources and academic performance, thus providing evidence-based data for academic libraries. In light of this, the study, therefore, recommends that:

1. It is expedient for academic libraries to acquire up-to-date print and electronic information resources that can support the academic activities of the LIS undergraduates.

2. Academic libraries in Nigeria should also endeavour to have these information resources available in different formats that are easily accessible to the undergraduates.

3. University libraries need to be well equipped with both print and electronic information resources to provide up-to-date information to undergraduates in a professional way to enhance their performance.

4. Improved funding and effective use of library information resources are critical to improving the academic performance of under-graduates.

References

Association of College and Research Libraries. (2010). *Value of Academic Libraries Comprehensive Research Review and Report.* Researched by Megan Oakleaf. Chicago: Association of College and Research Libraries, 2010. [Online] www.acrl.ala.org/value [Accessed 27 September 2015].

Association of College and Research Libraries. (2015). *Academic Library Contributions to Student Success: Documented Practices from the Field*. Prepared by Karen Brown. Contributions by Kara J. Malenfant. Chicago: Association of College and Research Libraries. [Online] http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/value/contributions_report.pdf [Accessed 14 December 2016].

Association of College and Research Libraries. (2017). *Academic Library Impact on Student Learning and Success: Findings from Assessment in Action Team Projects*. Prepared by Karen Brown with contributions by Kara J. Malenfant. Chicago: Association of College and Research Libraries. [Online] http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/value/findings_y3.pdf [Accessed 8 April 2019].

Beck, A.T. (1978). *The Depression Inventory*. Philadelphia: Centre for Cognitive Therapy.

Cox, B. And Jantti, M. (July 17 2012). Discovering the Impact of Library Use and Student Performance. EDUCAUSE Review Online. [Online] http://er.educause.edu/articles/2012/7/discovering-the-impact-of-library-use-and-student-performance [Accessed 14 December 2016].

Dumebi, O. (2017). Awareness and Use of Online Information Sources among University of Ibadan Students. *International Journal of Library Science*, 6(2) 37-41. [Online] doi: 10.5923/j.library.20170602.02 [Accessed 14 December 2018].

Emmons, M. and Wilkinson, F.C. (2011). The Academic Library Impact on Student Persistence. *College and Research Libraries*, 72 (2) 128-49.

Gratch-Lindauer, B. (2007). Information Literacy-Related Student Behaviours. *College Research Library News,* 68 432-441. [Online] http://crln.acrl.org/content/68/7/432.full.pdf+html [Accessed 14 December. 2016].

Hamade, S.N. and Al Yousef, S. (2010). The Use of Information Resources by LIS Graduate Students in Kuwait. *Library Review*, 59(5) 360-369. [Online] http://dx.doi.org/10.1108/00242531011047055 [Accessed 8 April 2019].

Kelly, N., Montenegro, M., González, C., Jara, M., Alarcón, R., Saurina, E. and Cano, F. (2014). Exploring the Relationship between Undergraduate Students' Use of Library Resources and Learning Outcomes. *Proceedings of Library Assessment Conference. Building Effective, Sustainable, Practical Assessment. Oregon, Washington 4th-6th August 2014.*

Kot, F.C. and Jones, J.L. (2015). The Impact of Library Resource Utilization on Undergraduate Students' Academic Performance: A Propensity Score Matching Design *College and Research Libraries,* 76(5) 566-586. [Online] doi: 10.5860/crl.76.5.566 [Accessed 8 April 2019].

Kramer, L.A. and Kramer, M.B. (1968). The College Library and the Drop-Out. *College Research Library.* 29 310-312. [Online] doi:10.5860/crl_29_04_310 [Accessed 8 April 2019].

Kuh, G.D. and Gonyea, R.M. (2003). The Role of the Academic Library in Promoting Student Engagement in Learning. *College and Research Libraries,* 64:256-282. [Online] doi:10.5860/crl.64.4.256 [Accessed 8 April 2019].

Lacoviæ, D. (2014). Students' Information Behaviour and the Role of Academic Library. *Libellarium*, 7 (1) 119 - 139.

Lance, K.C., Rodney, M.J., and Schwarz, B. (2010). The Impact of School Libraries on Academic Achievement: A Research Study based on Responses from Administrators in Idaho. *School Library Monthly*, 26 (9) 14-17.

Lee, J.Y., Paik, W. And Joo, S. (2012). Information Resource Selection of Undergraduate Students in Academic Search Tasks. *Information Research,* 17 (1).

Librarians' Registration Council of Nigeria. (2016). List of Approved/Accredited Nigerian Universities Offering Library and Information Science Programmes. [Online] www.lrcn.gov.ng [Accessed 23 August 2015]

Librarians' Registration Council of Nigeria. (2017). *Library and Information Science Curriculum and Benchmark.* Ondo: Obamoluwa Press and Publishers.

Madondo, T., Sithole, N. and Chisita, C.T. (2017). Use of Electronic Information Resources by Undergraduate Students in the Faculty of Management and Administration at Africa University, Mutare, Zimbabwe. *Asian Research Journal of Arts and Social Sciences,* 2 (2) 1-12.

Maehr, M.L. and Sjogren, D. (1971). Atkinson's Theory of Achievement Motivation: First Step toward a Theory of Academic Motivation? *Review of Educational Research*, 41: 143-161.

McGrew, K.S., and Evans, J. (2004). *Expectations for Students with Cognitive Disabilities: Is the Cup Half Empty or Half Full? Can the Cup Flow Over?* (Synthesis Report 55). Minneapolis, MN: University of Minnesota, National Centre on Educational Outcomes. [Online] http://education.umn.edu/NCEO/OnlinePubs/Synthesis55.html [Accessed 4 Febuary 2016].

Odeh, A.Y. (2012). Use of Information Resources by Undergraduate Students and its Relationship with Academic Achievement. *International Journals of Libraries and Information Studies.* 62(3) 222-232. [Online] https://doi.org/10.1515/libri-2012-0018 [Accessed 4 Febuary 2016].

Olajide, O. and Adio, G. (2017). Effective Utilisation of University Library Resources by Undergraduate Students: A Case Study of Federal University Oye-Ekiti, Nigeria. *Library Philosophy and Practice (e-journal)*. 1503. [Online] http://digitalcommons.unl.edu/libphilprac/1503 [Accessed 26 September 2018].

Owusu-Acheaw, M. and Larson, A.G. (2014). Effective Use of Library Resources: A Case

Study of Business Students of Koforidua Polytechnic, Ghana. *Information and Knowledge Management,* 4 (12). [Online] www.iiste.org [Accessed 2 June 2016].

Shrestha, N. (2008). *A Study on Students' Use of Library Resources and Self-Efficacy.* Kathmandu: Central Department of Library and information Science. [Online] http://eprints.rclis.org/22623/1/NinaShrestha.pdf [Accessed 14 December 2016].

Soria, K.M., Fransen, F. and Nackerud, S. (2013). Library Use and Undergraduate Student Outcomes: New Evidence for Students' Retention and Academic Success. *Libraries and the Academy*, 13 (2) 147–164.

Sternberg, R. J. (1998). Abilities are Forms of Developing Expertise. *Educational Researcher*, 27 (3) 11-20.

Strang, T. 2015. *Why College Students Choose to Use Library Resources*. CENGAGE Learning. [Online] http://blog.cengage.com/category/achievement-and-outcomes/library-programs-and-outreach/ [Accessed 2 June 2016].

Walberg, H. J. (1981). *A Psychological Theory of Educational Productivity*. In F.H. Farley and N.U. Gordon (Eds.), Psychology and Education. Berkeley, CA: McCutchan.

Wong S.H. R. and Webb, T. D. (2011). Uncovering Meaningful Correlation between Student Academic Performance and Library Material Usage. *College and Research Libraries,* 72 (4) 361–370.

Wenborn, C. (April 11, 2018). *How technology is changing the future of libraries*. Wiley. [Online] https://www.wiley.com/network/librarians/library-impact/how-technology-is-changing-the-future-of-libraries [Accessed 8 April 2019].

Yamson, G.C., Appiah, A.B. and Tsegah, M. (2018). Electronic vs. Print Resources: A Survey of Perception, Usage and Preferences among Central University Undergraduate Students. *European Scientific Journal*, 14(7) 291-304. [Online] Doi: 10.19044/esj.2018.v14n7p291 [Accessed 8 April 2019].

Appendix

List of approved/accredited universities in Nigeria offering Library and Information Science programmes

S/N	Universities	University Ownership	Geopolitical Zones	Year of Establishment	200L	300L	400L	Undergraduates Population
1	Abubakar Tafawa Balewa University, Bauchi (ATBU)	Federal	NE	1988	62	54	118	234
2	Ahmadu Bello University, Zaria (ABU)	Federal	NW	1962	420	218	277	915
3	Bayero University, Kano (BUK)	Federal	NW	1975	244	225	220	689
4	Federal University of Technology, Minna (FUTM)	Federal	NC	1982	80	80	38	198
5	Federal University of Technology, Yola (FUTY)	Federal	NE	1981	77	57	42	176
6	Nnamdi Azikiwe University, Akwa (NAU)	Federal	SE	1992	35	63	44	142
7	University of Calabar (UNICAL)	Federal	SS	1975	92	65	63	220
8	University of Ibadan (UI)	Federal	SW	1948	47	41	62	150
9	University of Ilorin (UNILORIN)	Federal	NC	1975	69	26	57	152
10	University of Maiduguri (UNIMAD)	Federal	NE	1975	167	121	142	430
11	University of Nigeria, Nsukka (UNN)	Federal	SE	1960	47	41	41	129
12	University of Uyo, Akwa Ibom (UNIYO)	Federal	SS	1991	58	51	40	149
13	Abia State University, Uturu (ABSU)	State	SE	1981	82	46	114	242
14	Ambrose Ali University, Ekpoma (AAU)	State	SS	1980	126	185	155	466
15	Benue State University, Makurdi(BSU)	State	NC	1992	185	285	320	790
16	Delta State University, Abraka (DELSU)	State	SS	1992	143	144	198	485
17	Imo State University, Owerri (IMSU)	State	SE	1992	177	121	157	455
18	Kwara State University, Malete (KWASU)	State	NC	2009	68	32	65	165
19	Tai Solarin University of Education, Ijebu-Ode (TAUSED)	State	SW	2005	155	140	58	353
20	Umaru Musa Ya'adua University, Katsina (UMYU)	State	NW	2006	147	133	181	461
21	Adeleke University, Ede (AU)	Private	SW	2011	11	24	32	67
22	Benson Idahosa University, Benin City (BIU)	Private	SS	2002	5	3	5	13
23	Madonna University, Okija (MU)	Private	SE	1999	10	14	10	34
	Total				2507	2169	2439	7115

Source: *Librarians' Registration Council of Nigeria (LRCN), 2016 and Academic Planning Establishments of the Universities, 2016.*

(NB: NC – North-central, NE – North-east, NW – North-west, SE – South-east, SS – South-south,

SW – South-west)

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Customer Care Services at Moi University Library, Kenya

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Abstract

The study investigated the state of customer care services at Moi University (MU) Library in Kenya. Using a mixed method research approach, a sample of 672 respondents (students, academic staff, librarians) from three campuses of Moi University participated in the study. Document analysis was used to extract data from relevant staff training manuals. The study established that the information needs of primary customers of the MU Library were not sufficiently being met. It was further revealed that even though the library staff was friendly and helpful, their attitude was below the expectations of customers. The findings also revealed that the primary customers were aware of the existence of a customer care unit, which allows them to make suggestions for improvement of library products/services. This study concluded that the customer care unit of the MU Library has not sufficiently responded to its mandate and recommends that the MU Library management should develop a strategic approach to customer care so as to ensure efficiency and effectiveness.

Keywords: Quality Library Services; Customer Care Services; University Libraries.

Introduction

Customer care is a crucial element of business that allows customers to have direct contact with a business and ensure customer's needs are met, and in most cases exceeds expectations (Morgan, 2018). Customer care is a customer service that entails making every effort to satisfy customers and ensuring that the product or service has met customer expectations (Hossain 2015). According to Dlamini (2006), customer care is a customer service that comprises a series of activities designed to enhance the level of customer satisfaction – that is, raises the feeling that the product or service has met customer expectations. Satisfied customers often continue using the products and services and even end up promoting the use of the very products and services to others. According to Ouda (2015), customer care was not often a focal point in libraries because librarians work on the assumption that as long as they opened their services, no additional efforts were required. However, King (2018), observes that the immense technological upheaval which gives library customers a variety of options including Yahoo!, Google, the ever evolving Web 2.0 technologies and now the opportunities of the emerging Fourth Industrial Revolution, mean that to survive in the 21st Century, libraries need to relook at the issue of customer care. Harland, et al (2019) observe that one of the challenges facing academic libraries globally is diversity of information services and King (2018) suggests that academic libraries have to reinvent their customer relationships. The concept of 'customer care' has been applied in the private sector to ensure effective value-adding service delivery, and it is a high time that it is fully developed in the public sector and especially in academic libraries such as the Moi University Library (MU Library).

The MU Library was established in 1984 with a main library at the main campus and branch libraries to cater for users located in satellite campuses of the University. The library collectively serves approximately 30,000 customers/users across all the campuses, who mainly comprise academic staff, students, university management, administrative and general staff. But in addition, the MU Library extends its services to other higher educational institutions

including other universities, colleges, schools as well as other libraries and communities around the MU campuses. This study investigated the state of customer care at MU Library, guided by the following specific objectives to:

- determine the composition of Moi University primary customers;
- establish the quality and relevance of information products and services that are provided by Moi University Library;
- determine the extent to which the information needs of primary customers are being satisfied.
- Investigate the customer care practices of the Moi University Library.

Literature Review

A study by Hisle (2002) suggests that academic librarians have to shape and change their services in tandem with the research problems of their customers. This implies that for an academic library needs to satisfy its users by ensuring that they get the best customer care, underpinned by a relevant theoretical framework.

Customer Care Practices

To enhance customer care in a library, it is important to conduct surveys and audits through which to establish who the customers are; explore and segment customer needs; determine the products and services that best respond to customer needs; and identify and mitigate the challenges of customer care in the library. The building of relationships and provision of quality services includes such practices as identification of customers and their information needs as undergirds for service and product customisation that ultimately enhance satisfaction.

Library users are increasingly referred to as the 'customers' and marketing theory portrays customers as internal, external and corporate customers, and arranges them as potential target markets. Orayo (2018) notes that with the introduction of new technology and recessing economy competitive pressure, information availability, rising costs, and increasing awareness mandate that academic libraries become more user focused. This calls for a better understanding of

library users and their needs in order to provide the appropriate type and level of service. According to Kassim (2009), satisfying customer's information needs in academic libraries has always been the primary objective of libraries and librarians. Customer satisfaction, being the degree to which an organizations product or service performance matches the expectations of customers (Bernedt and Brink, 2008), implies that the academic library has to match the information needs of the customers with the products and services provided. Rowley (2000) advises that in order to respond effectively to the customer needs the academic library needs to segment their customers into groups and then create a profile of each group. Rowley (2002) elaborates that segmentation offers a better understanding of customers and their needs, a more effective targeting of resources and tailored marketing communication. Lamb (2019) observes that, all members of a market segment have common characteristics and advices that in order to respond effectively, the library should carefully match each customer segment to specific library services. Millsap (2011) emphasises the importance of achieving good customer care through offering good quality service.

Several studies observe that the quality of academic libraries is connected with services, product as well as staff, facilities, and space (Derfert-Wolf and Goski, 2005; Prakash and Mohanty, 2011; Patil and Sawant 2017). Hernon and Nitecki (2001) state that service quality definitions vary across the literature but are based on four underlying perspectives:

- Excellence, which is often externally defined;
- Value, which incorporates multiple attributes, including the perception of meeting or exceeding expectations and the benefit to the recipient;
- Conformance to specifications, facilitates precise measurement;
- Meeting or exceeding expectations.

Library science researchers interested in service quality have however focused mainly on the fourth definition. Hernon and Nitecki, (2001), for instance, propose "the Gaps Model of Service Quality" which focuses on the need to determine the gap between customers' expectations for a

particular service or for the library in general versus the customer perception about the actual library and its services. On the other hand, Hernon and Altaman (1998) argue that even though quality services are multidimensional, their two critical dimensions are content and context. Content refers to that which prompted the visit, usually a certain material or information or study space in the library, Context refers to the experience itself, which may include the ease or difficulty in navigating the system(s), interaction with staff and/or the comfort of the physical environment. Customers who visit the library be it physically or electronically experience both the content and context. Determining and improving the quality of these two dimensions through provision of ambiance and ergonomics is therefore as important a part of a commitment to customer care, as are the products and services.

Dempsey (2009) refers to the product as anything that can be offered by a library to satisfy customers/users need. According to Mathusudhan (2018) the concept of product is less well defined in the not-for-profit world. Library products are both tangible (books, journals, CD-ROMS, bibliographies, pathfinders, research reports, etc.) and intangible (databases, licensed online services, consortia programmes, etc.). Service, according to Hemandez (2010), is the how and the means by which a business satisfies its customer's needs. It consists of offering a fair "prices, products, clear information, efficiency within the business", and responding to enquiries, thanking customers and telling them to have a nice day. For full customer satisfaction, these products and services have to be mediated by qualified staff.

The quality, abilities and effectiveness of staff are an asset to the customer care (Orayo, 2018). Mclean-Conner (2006) opines that every employee who interacts with the customer can enhance or jeopardise the relationship that the academic library tries to build with customers and therefore staff must have appropriate skills to respond, efficiently and effectively, to customers. Weigand (1997) advises that a library should establish training initiatives for all staff who are expected to support the customer

care programme and such training should be continued for all staff throughout their work life.

This brief literature review underscores the fact that customer care is important in academic libraries. Even though the MU Library has a customer care unit, customer care functions have not been reviewed or documented. This is a serious omission given that this library is among the largest, best equipped and well-furnished university libraries in East Africa. Moreover, and particularly in Kenya, the idea of customer care has not received much attention as evidenced by the dearth of literature on the subject. This study, therefore aimed to open the way by investigating and documenting the status of customer care at the MU Library.

Research Methodology

This study used the mixed methods research approach by the triangulation of the quantitative and qualitative research methods. The target population comprised students, academic staff and the professional librarians of Moi University. Three campuses of Moi University (Main campus in Kesses; the Nairobi campus; College of Health Sciences campus) were purposively selected because they serve the highest numbers of users and were easily accessible. From a cumulative total population of the three campuses of 18,278 students and 820 academic staff, stratified random sampling was used to select 377 (2.1%) students, and 262 (32%) academic staff and all the 33 (100%) professional librarians.

Sampling

To arrive at the sample size(s), periodic samples were taken out of the population and paired and their mean calculated. From a total population of 19,131 from the three campuses. A sample size based on the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html.), which agrees with the calculations used by Krejcie and Morgan (1970) in their article "determining sample size for research activities". Thiswas used to derive the critical values based on the confidence limits. Tables 1 and 2 show the population and sample used for the study.

Table 1: Distribution of Population Study among the Three Campuses

S/N		Students	Lecturers	Library staff	Total population
1	Main campus (Kesses)	11,778	670	20	12,468
2	College of Health Science	2,000	150	8	2,158
3	Nairobi campus	4,500	175*	5	4,505*
		18,278	**820**	**33**	

*Note: *All lecturers who teach in Nairobi campus are the same as those who teach in the main campus. Therefore, the figure for Nairobi campus was counted once within the main and college of health services population.*

Table 2: Distribution of Total and Sampled Respondents among the Three Categories

S/N	Respondents	Total population	Sampled population
1.	Students	**18,278**	**377**
2.	Lecturers	**820**	**262**
3.	Library staff	**33**	**33**
Total			**672**

*Note: Because the population of library is small the whole population of 33 constitutes the sample. The sample size of this study is 672, which is 3.5% of the total population.

Data Collection

After obtaining necessary permissions, copies of the questionnaire were distributed to the students and academic staff, while an interview schedule was used to obtain information from professional librarians. Clear background information and instructions were provided which clarified the survey's purpose, assured anonymity/confidentiality (O'Leary, 2004). Participants were assured of the ethical guidelines (withdrawal, confidentiality and anonymity) and signed an informed consent form.

Findings and Discussion

Of the targeted 377 students, 262 academic staff and 33 library staff of Moi University, responses were obtained from 276 (82%) students, 150 (57%) academic staff and 20 (85%) library staff, giving an adequate overall response rate of 68%. In terms of gender (library staff excluded), male respondents 264 (62%) dominated as compared to the 162 (38%) female respondents. The majority of student respondents were undergraduates 215 (78%) and the least were doctoral candidates 5 (5%). Among academic staff 7% (10) professors, 13% (20) senior lecturers, 51% (76) lecturers, 20% (30) assistant lecturers and 9% (14) Graduate assistants and Tutorial fellows combined. A large number of the library staff were senior library assistants 15 (54%).

Data from the questionnaire were analysed using descriptive statistics and themes derived from research objectives. Themes were used to analyse qualitative data obtained from the interviews as well as documents. Information from these themes was then converted into percentages to give explanations.

The discussion combines the responses of all the three segments of respondents, thus triangulating the findings. In most cases, the responses of the library staff were used to corroborate or diverge from the views of the students and staff, the latter two categories being the clients of the former.

Moi University Library Primary Customers
Asked to indicate how they viewed themselves, students overwhelmingly considered themselves to be library customers by the large majority (90%) who positively indicated so. To a lesser extent, a considerable proportion (70%) of academic staff considered themselves as library customers. Library staff corroborated these views by positively indicating that academic staff and students were their primary concern when offering services. These views are in tandem with previous studies that sought to establish the core customers of academic libraries. According to Simmonds and Andaleeb (2001)Iand Schmidt (2006) the primary customers/users in academic libraries are the students and the academic staff. This has also been supported by the findings by Ademodi (2011) and Bamidele (2012) who indicated that the primary users/customers that academic library is trying to reach with its services are the students and the staff. Even though the question focused on primary customers, it was instructive to note from the responses of the library staff that the MU Library recognises its role as a beacon of information service provision in the rural setting and where the main campus is located and Eldoret town where the Moi Teaching and Referral Hospital is located, by providing services to all staff at the Teaching Hospital as well as the children under age 18 years from schools neighbouring the main campus at Kesses. Ademodi (2011) affirms that academic libraries sometimes extend their services to reach even the members of the public. This view is further supported by Wang and Shieh (2006) who corroborate that customers in any service organisation include both internal and external customers.

To further confirm their claim as primary customers, students' responses confirmed that they heavily relied on the MU Library, as compared to the "occasional use" of the library by academic staff, the latter possibly using the library for references, when checking new materials that they could refer students to or for research purposes. On the frequency of library use the study shows that 54% of students were regular library users while only 15% of academic staff used the library "regularly" as shown in Table 3.

Table 3: Library Use by Students and Academic Staff (N=426)

Library use	Students	Academic staff
Regularly	231(84%)	23(15.3%)
Sometimes	39(14%)	119(79.4%)
Never	6(2%)	8(5.3%)
Total	**276(100%)**	**150(100%)**

The finding shows that a large number of students were the more regular customers/users of the library while academic staff were somewhat irregular. This makes sense given that academic staffs often have other sources other than the library which provide similar services offered by the library, such as Internet, while students often depended fully on the university library due to inability to afford the expensive technological devices for accessing resources and learning materials online. Only few of Moi University students had the means to purchase such electronic devices. This therefore implies that customer care programme needs to ensure that the heavier reliance of students on the library is reflected in the provision of products and services, including the customer care programme that target students. It was instructive that 6 (2%) of the students and 8 (5%) of academic staff did not use the MU Library at all. The library should draw in, guide and support these potential primary customers.

Information Products and Services

The second objective was to establish the quality and relevance of information products and services that were provided by MU Library. Library staff indicated that the library generally provided:

- both print and electronic information resources 27 (96%).

- subscriptions to a wide range of e-books and e-journals 28 (100%).

- wireless access to the internet to provide access to its wide range of information resources 28 (100%).

- products/services in response to the suggestions of users mostly obtained via their feedback in surveys 20 (71%).

- fairly good quality services against available resources 26 (93%).

- their services are satisfactory 23 (82%).

To establish the quality and relevance of the information products and services from the perspective of primary customers, the study first sought to find out whether or not the primary customers were aware of the range of products and services, could identify which of the products and services that they use.

Awareness of Products/Services in the Library

A list of the major categories of products and services available in the MU Library was provided for the primary customers to indicate which ones they were aware of. By and large, 78% of students and 55% of academic staff were aware of the products and services listed. The extent of their awareness could not be ascertained because it would have necessitated a longer questionnaire but suffice it to state that some products were more popular with certain categories of users than others. For example, students ranked high in use of past examination papers, online/electronic databases, and reference sources, while on the other hand academic staff ranked high in the use of government publications, research reports, journals, online/electronic databases and conference proceedings. In terms of the preferred information services, the study revealed that short loan, lending services, photocopying services and access to the Internet, were the most popular information services. Services like audio visual services, printing services and interlibrary loans were lowly ranked (less than 50%) by most of the respondents.

Quality and Relevance of Products/Services in the Library

In terms of the quality of these products and services, all the librarians interviewed averred that set standards had to be met in the provision of the above-named products and services, mentioning the ISO 9001:2008 standard which clearly defines quality management system standards and also Commission for University Education (CUE) standards for libraries. The majority (82%) of the library staff felt that the library provided good quality and satisfactory products and services. Considering that the customers might not have been aware of such standards, the study investigated the quality and relevance through their needs satisfaction and their level of satisfaction with products and services.

Level of Satisfaction with Products/Services

The majority (73%) of the customers (students and staff) felt that the products/services met their information needs. This supports the views of the library staff who indicated that customers/users were satisfied with products/services offered by the library. The 114 (27%) who indicated dissatisfaction with the product/services in meeting their information needs provided explanations summarised as follows:

- One-day borrowing period of short loan materials was too short 90 (79%)

- Power fluctuations are too regular 100 (88%)

- The Internet was too slow most of the times 71 (62%)

- The information materials are very few 48 (42%)

- Most of the information materials are out dated 40 (35%)

- The library staffs are not cooperative 33 (29%)

Generally, library users were satisfied with products and services offered MU library. Library staff identified some contributing factors to their success as: through customers/users surveys which has been supported by Evans (2009) that survey is one of the data- gathering method that is most often used to ascertain customer needs, comments on the compliments register which were mostly positive, they solved most of their complaints, they provided wireless internet access, e-resources that had very current information, and the library also increased copies of popular titles every year. Other contributions to this list of services, was the fact that the customers could easily access the OPAC and that fact that library staff were very supportive and helpful most of the time. However, a few users identified shortcomings such as: insufficient quantities of information materials; outdated information materials, electric power fluctuations and the low internet bandwidth.

Customer Information Needs Satisfaction

As Kassim (2009) observes, satisfying customer information needs in academic libraries has always been the primary objective of libraries and librarians. The third objective sought to find out the extent to which the information needs of primary customers were met.

The responses depict that a majority of the students (77%) indicated that their information needs were well taken care of while a significant number (78%) of the academic staff felt that their needs were "fairly taken care of" but not necessarily "well taken care of" by the library as they should. Seventy-eight percent of library professionals on their part indicated that customers'/users' needs were "fairly taken care" as depicted in Figure 1. This corroborated the views of students and academic staff that satisfaction of information needs in the Moi University Library was average. Library staff in their responses further averred that the major causes of dissatisfaction for some of the customers were:

- Shortage of core texts 2 (40%);
- Slow Internet access 5 (100%);
- Constant power surges 5 (100%) and
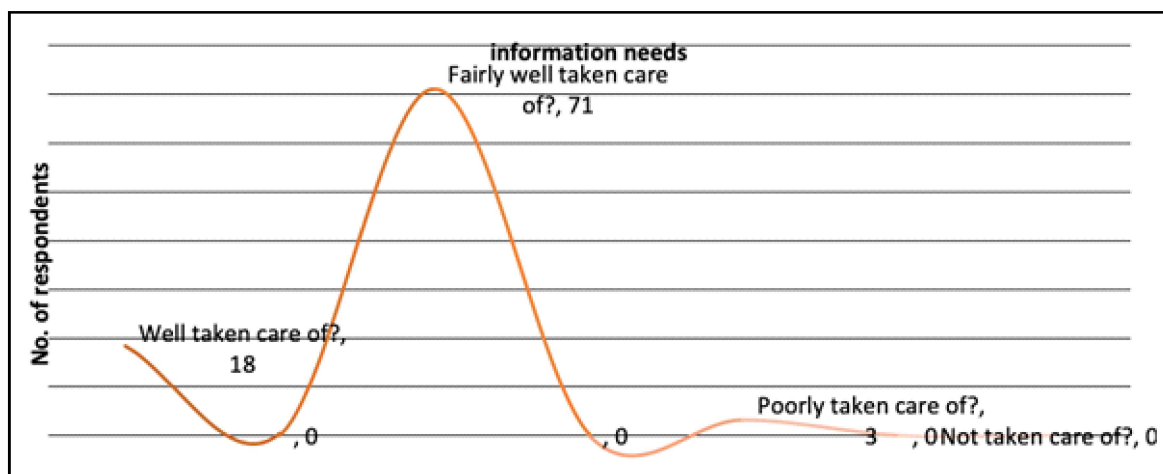- Out dated information materials 3 (60%).

Fig. 1: Satisfaction of Information needs

To further understand the extent to which their information needs were being met, the study explored the frequency that customer's get their needs met by the library.

The findings indicate that the information needs were met "most of the time" (73%) of the students and 64% of the academic staff) even though not always. This implies that the library has some shortcomings in addressing user information needs.

Customer Care Practices at Moi University Library

Most of the library staff 23 (82%) confirmed that the MU Library had a fully staffed customer care unit even though most 20 (71%) of them felt that there was inadequate support for the unit as the library lacks a clear policy that specifically addresses customer care to guide the unit. The study established that the unit provides orientation to new users, current awareness services, conduct occasional customer care survey and analysis of data, provide information on literacy skills to customers, address all customer enquiries, ensure circulation of information services, train users on the use of the Online Public Access Catalogue (OPAC), enforce rules and regulations of the library and provided Selective Dissemination of Information. The majority of the primary customers 351 (82%) were aware of a customer care unit. As for a customer care policy, 317 (74%) think that there is one. However, it was imperative that many of the primary customers had participated in activities labeled as customer care activities and assumed that such activities are a demonstration of an underlying policy.

Customer Care Activities

Library staff indicated that in addition to publicity and orientation activities, customer surveys were conducted three (86%) to four (14%) times in a year. Table 4 indicates the participation of primary customers in customer care activities.

Table 4: Customer Care Activities/Experiences (N=426)

Activity/experience	No. of Respondents
Discussion(s) on library customer care policy	98 (23%)
Using an electronic library card to borrow books	426 (100%)
Returning of borrowed books on time so that such books may be available to other fellow customers	420 (99%)
Being treated with respect and courtesy by library staff	400 (94%)
Avoiding smoking, eating and drinking in prohibited areas in the library so as to ensure a conducive atmosphere for both the other customers as well as the library materials.	426 (100%)
Feeling that the library provides services in a friendly and helpful manner	316 (74%)
Being able to read comfortably as the library provides a conducive reading environment	350 (82%)
Available information resources in the Library are appropriate for users' needs	307 (72%)
Publicity of Library services makes it possible to know the range of services	242 (57%)
Provided library services meets and exceeds customer expectations	155 (36%)
Participated in library customer care research	245 (58%)
Others (Please indicate)	0

Library Staff

The manner in which staff dispense their duties often goes a long way to build customer confidence and customer satisfaction. Their efficient handling of queries, helpfulness, friendliness and attitude while dispensing their duties go a long way in reinforcing customer confidence and satisfaction. Respondents were asked to rate these attributes, i.e. efficiency, helpfulness and attitude of the library staff in making available the information requested.

(a) Efficiency of library staff in delivering services was rated by most respondents as "fair" by both students (82%), and academic staff (61%). These findings suggest that MU Library staff may have had some of the requisite skills as observed by Mclean-Conner (2006) that every employee who interacts with customers in any way must have appropriate skills to respond, efficiently and effectively to customer needs.

(b) Friendliness and helpfulness of library staff are important factors in customer care, which have to do with the way in which staff manage customer requests and level of assistance they provide to customers.

The findings revealed that a large majority of students (80%) and of academic staff (78%) found the library staff to be both friendly and helpful.

(c) Attitude: The general attitude of library staff is an important contributor to customer care. The majority of students (82%) and academic staff (76%) rated the attitude of MU Library staff as merely "fair" if not "not good." Thus staff attitude was found wanting even though their friendliness and helpfulness were found to be generally positive. Contrarily, the library professional interviewed rated staff attitude as

being positive or good. Walter (1994) and Weingand (1979) opined that good customer care 'wears many faces'; friendly staff, accurate information, good behavior from staff, convenient service and speedy response.

Customer Satisfaction

To fully satisfy library customers is normally difficult. Kiran (2010) in his study on service quality and customer satisfaction in academic libraries in a Malaysian university advises that a customer who is satisfied by library services several times, is likely to perceive the service as quality hence the need to focus on satisfying customers in every encounter. In order to rate whether this was the case with MU Library, the purpose being to assess the satisfaction of library users towards the services and products that the library offered, the study focused on the customers' satisfaction with the helpfulness of staff, friendliness, library staff availability, usefulness of information, library opening hours, up-to-datedness of information material, ease of finding information materials, products/services provided by the library in meeting their needs, speed of downloading of information, the range of services offered, speed of response to initial inquiry, and overall customer care. As depicted in Table 5, all these factors were rated as good by most of the respondents, with most of them being over 50% rate of satisfaction.

Table 5: Satisfaction Levels of Respondents (N=426)

Level of satisfaction	Rating			
	Excellent	**Good**	**Fair**	**Poor**
Overall customer care	50 (12%)	300 (70%)	49 (12%)	27 (6%)
Helpfulness of staff	55 (13%)	285 (76%)	62 (15%)	24 (6%)
Friendliness of staff	70 (16%)	305 (72%)	40 (9%)	11 (3%)
Library catalogue	323 (76%)	90 (21%)	13 (3%)	0
Staff availability	101 (24%)	280 (66%)	35 (8%)	10 (2%)
Usefulness of information available	80 (19%)	250 (57%)	50 (12%)	46 (11%)
Library opening hours	350 (82%)	50 (12%)	26 (6%)	0
Up to date ness of information materials	80 (19%)	100 (23%)	216 (51%)	30 (7%)
Speed of downloading information	100 (23%)	117 (27%)	180 (42%)	9 (7%)
Range of services offered	98 (23%)	205 (48%)	93 (22%)	30 (7%)
Speed of response to your initial enquiry	80 (19%)	178 (48%)	108 (25%)	60 (14%)
Ease of finding the information materials	89 (21%)	213 (50%)	73 (17%)	51 (12%)

The Library staff indicated that their customers were satisfied with their services supported by e following reasons:

- 'Customer surveys revealed that they were satisfied' 23 (100%);
- 'Comments on the compliments register were positive' 18 (78%);
- 'The library has always strived to solve most of their complaints' 18 (78%);
- 'The library provides wireless internet access and the library is well packed' 23 (100%);
- 'We are providing e-resources that have very current information' 20 (87%);
- 'We increase copies of popular titles every year' 15 (65%)
- 'Our OPAC is web-based' 22 (96%);
- 'Our staffs are very supportive and helpful to users' 16 (70%) and
- 'We have long opening hours including weekends' 23 (100%).

Nevertheless, the MU Library seems to fall short of what has been discussed by Jobber and Lancaster (2003) that customer care has to ensure that both the products/services and the aftercare associated with serving customer's needs, meet, and in most cases exceed expectations of the customers. There is decidedly no evidence of exceeding expectations at the MU Library and therefore a need to improve on the customer care programme, especially the part that focuses on customers'/users' information needs satisfaction.

Conclusions and Recommendations

The MU Library cares about customer satisfaction with information services/products as evidenced in the existence of a customer care unit. However, the study could not conclusively establish whether or not the MU Library had a customer care policy in place. The customer care unit focuses on creating awareness on the information products and services for their customers/users; publicity and display/ exhibitions of all new information materials; library orientation and notices directed at new members; infusion in other value providing services such as library web pages, library guide and Selective Dissemination of Information (SDI), all of which contribute positively to customer care. Regular customer studies are conducted, through which the views of customers are obtained. Additionally, the MU Library staff are both friendly and helpful, which is important for customer service provision. However, it was revealed that the information needs of majority of the primary customers/users were not sufficiently met, in spite of the availability of good quality products and services available. Moreover, the overall rating of library staff's attitude when serving their customers was found to be below expectations of the customers, a shortcoming that needs to be remedied. It was also evident that the customer care programme, though present, was not significantly visible or effective.

Based on the premise that a library needs to enhance its response to the information needs of their customers in order to meet and even exceed expectations, this study recommends that the MU Library management should develop a strategic approach to customer care services so as to ensure efficiency and effectiveness. Firstly, a customer care policy needs to be decisively and clearly in place, supported by sufficient resources, especially funding and capacity, if the customer care unit is to be effective. An improvement of the products and services after thoroughly identifying the needs of the different segments of customers is imperative. Among these it is important that the Moi University Library adopts the use of social media for communicating and updating users on new services and products. The customer care programme should also support library staff by fine-tuning their skills and ability. As Colón-Aguirre (2017) suggests, "service learning as a sensible approach to help bridge this gap between education and practice" thus enabling staff, not only to provide accurate information and provide speedy responses but also to exhibit a positive attitude and respond effectively and efficiently to the diverse and changing needs of the library customer.

References

Ademodi, O. (2011). Reference Services in Academic Libraries. Available From Http://Unllib.Unl.Edu/Lpp [Accessed: 11 June 2018]

Adeniran, P. (2011). *Us*er Satisfaction with Academic Libraries Services: Academic Staff and Students' Perspectives. *International Journal of Library and Information Science*, 3(10), 209-216. Available From: Http://Www.Academicjournals.Org/Ijlis.Htm [Accessed: 11 June 2011].

Bamidele, I. A. (2012). A Comparative Study of Faculty Members' Expectation of Academic Library Services in Three Universities in Ogun State, Nigeria. *Canadian Social Sciences*, 8 (4), 202-210.

Bernedt, A and Brink, A. (2008). Customer Relationship Management and Customer Service. Lansdowne, SA: Juta.

CIVIC Technologies. (2009). *Using Market Segmentation for Better Customer Service and More Effective Strategic Planning*. Available Form: *H*ttp://Adcontent.Reed business.Com/Saralinks/Business decision20 whitepaper20110909520. Final.Pdf [Accessed: 23 October 2011].

Colon-Anguirre, M. (2017). Service Learning for Improvement of Customer Service Education in LIS. *Education for Information*, 33 (3), 1-5

Daneshgar, F. and Parirokh, M. (2012). An Integrated Customer Knowledge Management Framework for Academic Libraries. *Library Quarterly*, 82: 7-28.

Derfert-Wolf, L. and Goski. (2005). Quality of Academic Libraries – Funding Bodies, Librarians and Users' Perspective. *World Library and Information Congress.71th IFLA General Conference and Council. Libraries – A Voyage of Discovery.* August 14 – 18 2005, Oslo Norway.

Dempsey, K. (2009). The Accidental Library Marketer. Medford, New Jersey: Information Today, Inc.

Dlamini, P. N. (2006). Customer Care Services and Strategies in Academic Libraries in Tertiary Institution in Kwazulu-Natal: Preliminary Findings. *A Paper Presented at the 6th LIASA Conference Student Interest Group Symposium, Polokwane,* 26 September to 1 October 2004.

Ekel, H., Orji D. I. and Okorie, A. C. (2010). Quickies for the 21st Century Librarian. Available From Https://Www.Researchgate.Net/Publication/282506805_Quickies_for_the_21st_Century_Librarian [Accessed: 11 February 2020].

Esri, J. B. (2010). Targeting Local Library Patrons. Available at: Http://Www.Esri.Com/News/Arcuser/0110/Tapestry.Htm. [Accessed: 4 January 2013].

Evans, G. E. and Carter, T. L. 2009. *Introduction to Library Public Services*. 7th Ed. London: Libraries Unlimited.

Gronroos, C. (2007). *Service Management and Marketing*, 3rd Ed. West Sussex: John Wiley And Sons

Harland, F., Stewart, G. and Bruce, C. (2019). Leading the Academic Library in Strategic Engagement with Stakeholders: A Constructivist Grounded Theory. *College and Research Libraries*, 80 (3) 319-339.

Hemandez, C. (2010). Thesis on Customer Service and Consumer Protection at Richer Sounds. (Blog) Available From:Http://Writing4students. Blogspot. Com/2010/05/Thesis-On-Customer service.Html. [Accessed: 23October 2011].

Hernon, P. and Altman, E. (1998). *Assessing Service Quality: Satisfying the Expectations of Library Customers.* Chicago: American Library Association.

Hernon, P. and Nitecki, D. (2001). Service Quality: A Concept not fully Explored. *Library Trends*, 49 (4), 687-708.

Hisle, W. L. (2002). Top Issues Facing Academic Libraries. *A Report of the Focus on the Future Task Force Association of Libraries And Research* Libraries*, 63(10). Available From: Http://Www.Ala.Org/Ala/Mgrps/Divs/Acrl/

Publications/Crlnews/2002/Nov/Topissues facing.Cfm [Accessed: 23 October 2012].129

Holley, RP (2020). Academic Library Users are not "Customers": A Response to Steven Bell. Library Administration, 60 (1):88-96.

Hossain, M. J. and Munshib, M. N. (2015). Customer Service Performance of a Public University Library in Bangladesh. *Annals of Library And Information Studies* 62 (1), 115-125.

Indossoi, S. (2010). Customer Care: Looking Forward to Improve Customer Care Services. *The New Times Rwanda, [Online]* 3 November, Issue 1443. Available: Http://Www.New times. Co.Rw/Index.Php?Issue=14131and article= 2552 andweek=01 [Accessed: 23 October 2012].

Jobber, D. And Lancaster, G. (2003). *Selling and Sales Management.* London: Prentice Hall.

Kassim, N. A. (2009). Evaluating Users' Satisfaction on Academic Library Performance. *Malaysia Journal of Library And Information Science,* 14 (2), 101-115.

Kaur, K. And Singh, D. 2010. Customer Service for Academic Library Users on the Web. *The Electronic Library* 29 (6) 737-750.

Keefe, LM. 2004. What is the Meaning of Marketing? Marketing News, 38 (15), 17-18.

King, D.L. (2018), "How to Stay on Top of Emerging Technology Trends for Libraries", Library Technology Reports, 54 (2), 1-35. Available at: Https://Journals.Ala.Org/Index.Php/Ltr/Issue/ Viewissue/673/435 (Accessed July 20, 2018).

Kiran, K. (2010). Service Quality and Customer Satisfaction: Perspectives from a Malaysia *University. Library Review*, 59 (4), 261-273.

Krejcie, R. V. and Morgan, D. W. (1970). Determining Sample Size Research Activities. Education and Psychology Measurements, 5 (30), 607-610.

Kwaghgba, D. N., Chorun, M. T. and Goshie, R. W. (2015). Assessment of Customer Satisfaction with Products and Services of Academic Libraries in Zaria Metropolis. International *Journal of Academic Libraries and Information Science,*3(9), 236-246

Lamb, A. (2019). Marketing for Libraries: Market Segmentation. Available from Https://Www. Eduscapes.Com/Marketing/4.Htm#B. [Accessed: 16 February 2020]

Madhusudhan, M. (2008) ."Marketing of Library and Information Services and Products in University Libraries: A Case Study of Goa University Library". *Library Philosophy And Practice* (E-Journal). 175. Https://Digitalcommons.Unl.Edu/ Libphilprac/175

Mclean-Conner, P. (2006). Customer Service: Utility Style. Oklahoma, USA: Penny Well Corporation.

Men, J. M. And Israel, A. A. (2017). "The Role of Academic Libraries in the Accreditation of Undergraduate: A Case Study of Federal University of Technology Minna, Niger State. *Library Philosophy And Practice* (E-Journal). 1529.Http://Digitalcommons.Unl.Edu/Lib philprac/1529

Miller, K. (2008). Service Quality In Academic Libraries: Analysis of Libqual+Â„¢ Scores and Institutional Characteristics. Http://Stars. Library. Ucf.Edu/Etd/3570 [Accessed: 15 February 2020].

Millsap, G. (2011). Using Market Segmentation to Provide Better Public Library Services. *Marketing Library Services,* 25 (3), 4.

Morgan, B. (2018). Customer Experience Vs. Customer Service Vs. Customer Care. Available from Https://Www.Forbes.Com/Sites/Blak emorgan/2018/03/05/Customer-Experience-Vs-Customer-Service-Vs-Customer-Care/#4acba 3174167 [Accessed: 16 February 2020]

O'Leary, Z. (2004). The Essential Guide to Doing Research. London: Sage.

Orayo, J, Maina, J, Wasike, J. M. and Ratanya, F. C. (2019). Customer Care Practices at the University of Nairobi (UON), Jomo Kenyatta Memorial Library (JKML), Kenya. Library Management, 40 (3/4), 142-154. Available At Https://Doi.Org/10.1108/LM-05-2018-0038 [Accessed: 15 February 2020].

Ouda, P. (2015) . Customer Care in Public University Libraries in Kenya: Case Study of the Moi University Library. Available from Http://

Uir.Unisa.Ac.Za/Bitstream/Handle/10500/18891/Dissertation Ouda_Pa.Pdf?_Sequence=1andisallowed=Y [Accessed: 16 February 2020].

Patil, S and Sawant, S. (2017) . *Service Quality Expectations of Academic Library Users*. In National Conference on Enhancing the Role of the Library in Teaching and Learning, Pune, 24-25 January 2017. [Conference Paper]

Prakash, A. and Mohanty, R. P. (2012). Understanding Service Quality Production Planning and Control, 24 (12)1-1 Available From Https://Www.Researchgate.Net/Publication/254305500_Understanding_Service_Quality [Accessed: 16 February 2020]

Rahman, M. R. And Safeena, P. K. (2016) *Customer Needs and Customer Satisfaction.* Available from Http://Eprints.Cmfri.Org.In/Id/Eprint/108

Rowley, J. (2000) . From Users to Customers? *OCLC Systems and Services, 16*(4), 157-167. Available From: Www.Emeraldinsight.Com/Journals.Html [Accessed: 15 June 2011].

Sahu, A. K. (2007). Measuring Service Quality in an Academic Library: An Indian Case Study. *Library Review*, 56 (3), 234-243

Schmidt, J. (2006). *Marketing Library and Information Services in Australian Academic Libraries*. Available From: Http://Www.Library.Uq.Edu.Au/Papers/Paperarchives/Marketing_Library_And_Info_ Services.Pdf [Accessed: 16 May 2013].

Simmonds, P. L. and Andaleeb, S. S. (2001). Usage of Academic Libraries: The Role of Service Quality, Resources, and User Characteristics. *Library Trends*, 49 (4), 626 – 634. Available From: Http://Www.Ideals.Illinois.Edu/Bitstream /Handle/2142/8368/Librarytrend Sv49i4f_Opt.Pdf?Sequence=1. [Accessed: 15 February 2012].

Talley, M and Xelroth, J. (2001).Talking about Customer Services. *Information Outlook*, 5(12), 1-7. Available From: Http://Wwwsla.Org/Content/Shop/Infation/Infoonline/2001/Htm. [Accessed: 11June 2011].

Verma, M. K. (2018). Use and Satisfaction with Library Resources and Services by Teachers and Students in Colleges of Lunglei District: An Evaluative Study. Http://Mzuir.Inflibnet.Ac.In/Bitstream/123456789/489/1/Lalrokhawma%20 (LIS).Pdf [Accessed: 16 February 2020].

Walter, S. (1994). *Customer Service: How-to- Do-It Manual For Librarians*. New York: Neal-Schuman Publishers.

Wand, P. (2005). *The Academic Library 2010: A Vision Report of Symposium 2010*. Washington: American University Libraries.

Wang, I. M. And Shieh, C. J. (2006). The Relationship Between Services Quality and Customer Satisfaction: The Example of CJCU Library Available From: Https://Www. Researchgate. Net/Publication/237561091_The_Relationship_Between_Service_Quality_And_Customer_Satisfaction_The_Example_of_CJCU_Library [Accessed: 11June 2019]

Weingand, D. E. (1997). *Customer Service Excellent: A Concise Guide for Librarian.* Chicago: American Library Association.

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