

Full Length Research

Analysis of cited information sources in Nigerian agricultural research with emphasis on animal health and production

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The purpose of this paper is to investigate through citation analysis, the types of information resources Nigerian agricultural science researchers (with particular reference to animal health and production) use in their scholarly communication process. The design of the study is a citation analysis approach. Two main line journals in animal health and production namely; Nigerian Journal of Animal Production and Nigerian Veterinary Journal were used for this study. All the volumes of these journals for a period of seven years were used for the study. References in these journals were harvested and used for the analysis. There were a total of 8328 citations harvested from the journals out of which 58% of them are journal citations and books and monographs accounted for 24%. The findings also reveal that more than 31% of the cited sources were published between 1991 and 2000 while 25.9% were published from 1981 to 1990. Materials of 2001 to date constituted 20.2%. There is also a very low citation to electronic sources which would have provided citations to more current materials. Similarly, authorship pattern reveals that multiple authors dominate the cited sources. About 21 journals were identified as the most frequently cited journals while most frequently researched animal is poultry. The age of the cited sources suggests that the researchers lack access to current research and therefore has a lot of policy implications to Nigerian university libraries in terms of subscribing to current journals in the libraries with emphasis on the identified frequently cited journals. This is a fundamental study with interest in identifying the sources of information for Nigerian researchers interested in animal health and production, the volume of research in the area, authorship pattern and the most consulted journals in the area.

Key words: Citation analysis, bibliometrics, journals, scholarly communication, agricultural information, animal health, animal production.

INTRODUCTION

Agriculture has over the years remained very critical in the economic development of many developing countries. Owing to this, agricultural research has always taken a central position in the research agenda of many countries including Nigeria. Agricultural research in Nigeria is even more critical now with the present global food crisis which is affecting many countries of the world. Although Nigeria depends heavily on the oil industry for its budgetary

revenues, Nigeria is predominantly still an agrarian society. Approximately, 70% of the population engages in agricultural production at a subsistence level. Encyclopedia of the Nations (2009) maintains that agriculture provides 41% of Nigeria's total gross domestic product (GDP) for some years now. This percentage represents a decrease of 24.7% from its contribution of 65.7% to the GDP in 1957. The decrease may likely continue because in most cases economic development decreases the relative size of the agricultural sector. If this decrease has to be addressed there should be intensification of agricultural research in the country.

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Although agricultural activities in Nigeria have been concentrated on crop production, a significant portion of the agricultural sector in Nigeria involves cattle herding, fishing, poultry, goat and rabbit keeping among other forms of animal husbandry which contributed more than 2% to the GDP in the 1980s. According to the UN Food and Agriculture Organization, estimate cited in Encyclopedia of the Nation (2009), there were 12.2 million cattle, 13.2 million sheep, 26.0 million goats, 1.3 million pigs, 700,000 donkeys, 250,000 horses, and 18,000 camels, mostly in northern Nigeria and owned mostly by rural dwellers rather than by commercial companies.

Fisheries output ranged from 600,000 to 700,000 tons annually in the 1970s. Estimates indicate that the output had fallen to 120,000 tons of fish per year by 1990. This was partly due to environmental degradation and water pollution from Niger Delta areas of the country. The reduction in agricultural outputs in the country has continued with high dependence in the oil sector. The continuous decline in agricultural productivity particularly in animal production in many African countries has made Forum of Agricultural Research in Africa (FARA) to encourage more research in agriculture. According to FARA (2007) access to information has been a major constraint to research in agriculture in many developing countries. Access to information is very critical since research is needed to take a look at agricultural capacity building at all levels with a view to recommending how agricultural teaching and training can be revitalized and made contextually appropriate for the world of work and make agriculture once again a career of choice. Now that agricultural research is increasingly becoming knowledge based, access to information is becoming more pivotal to increased food production. At the end of March 1999, the Global Forum on Agricultural Research (GFAR) organized with the support of FAO and the World Bank a consultation on: "information initiatives in agricultural research: enhancing global cooperation".

The main conclusion of the consultation was to establish an enabling global framework for agricultural research information for development as a first step towards a "global knowledge system in agricultural research for development". The participants also recognized the key role the Regional and Sub-Regional fora have to play in assessing the information needs of the different categories of end-users at the local, national and regional levels. In Nigeria, agricultural research has over the years suffered the same problem of lack of adequate information like so many other research areas in the country. The focus of this paper is therefore to examine information sources Nigeria agriculturists particularly those who have their research interest in animal health and production consult in carrying out their research and the volume of research in animal health and production. The specific objectives of the paper are to:

i) Find out the sources of information for Nigerian

researchers consult in the area of animal health and production.

ii) Examine the age of these information sources;

iii) Examine the authorship pattern among these researchers;

iv) Identify the most frequently cited journals in this area of research;

v) Identify the most researched area in animal health and production.

LITERATURE REVIEW

The application of citation analysis in bibliometric studies is not new in information science. This research method was made popular by Eugene Garfield who had characterized the basic nature of citation analysis as "a very general measure of contribution an individual makes to the growth of knowledge" (Garfield, 1979). Karison (1994) observed that citation analysis has been found to be useful in investigating the coverage of library acquisitions and for research evaluation. The objective of citation analysis is to scrutinize how researchers make references to earlier works they have read. It is believed that a work's influence to scholars is determined by the frequency of its citations in later works. As a result of this a number of investigators have employed citation analysis in the determination of research outputs of individuals, institutions and even geographical areas. In addition to this, it has been used to determine the information sources a particular group of researchers use, the volume of research in a field, the impact factors of journals and individual researchers among other things. In the field of agriculture, Omekwu and Atinmo (1998) conducted a citation analysis on patterns of agricultural communication research at the University of Ibadan.

In the study, bibliographic references of 37 theses purposefully selected were analyzed and authors of cited references were classified into two: Nigerian and non Nigerian authors. Journals cited were grouped into three: national, regional and international journals. The citation analysis indicated a very significant difference in the citation of national and non national authors. Non Nigerian authors were cited more than Nigerian authors. The study also reveals no significant difference between the citation of regional and international sources but a very significant difference when compared with the citation of national journal sources. A related work was done by Aina (1983) who applied citation studies to determine the characteristics of literature used by agriculturists in Nigeria. Source data was obtained from journals published in Nigeria that reported original articles with evidence of utilization of published sources. The journals were also representative of agriculture as a whole. The source journals contributed a total of 961 citations and findings revealed that serials titles

contributed 516 (53%), monograph contributed 427 (44%) while theses contributed 18 (1.8%). It was also discovered from the study that nearly half of the titles used by Agriculturists in Nigeria are published in United States and England. The two countries account for about 50% of the publications.

Another study by Dulle et al. (2004) analyzed the citation patterns of agricultural scientists in Tanzania using doctoral theses. The objectives of the study were to: assess researchers' access to information as reflected from citation analysis; establish a list of core agricultural journals for agricultural researchers in Tanzania using citation analysis and user opinions; and find out the extent to which the available information resources meet the research needs revealed by the study. A total of 295 M.Sc theses and 21 PhD theses submitted at Sokoine University of Agriculture from 1989 to 1999, and 309 conference proceeding articles published during the same period were analyzed. The result of the study revealed generally that agricultural scientists in the country had limited access to current journals. Several recommendations were made to alleviate the situation, with a focus on electronic journal provision supported by international organisations.

Similarly, Olatokun and Makinde (2009) conducted a citation analysis of doctoral works submitted to the Department of Animal Health University of Ibadan and found out that citations to journals accounted for more than half of the total citations and books contributed 18.08%, while web resources were the least cited material. Twenty top journals were identified with Journal of Animal Science leading the twenty journals. The study also revealed that about 80% of the cited sources are less than fifteen years old. Adewole (1987) used citation analysis to examine the ranking of journals for the purpose of acquisition of livestock journals in library. His findings revealed that Journal of Animal Science ranked first with 889 citations and identified 18 core journals with a total citation of 11,070 representing 32.3% of the total citations. Swanepoel (2008) also applied it to determine the nature and extent of information sources used by postgraduate students of health and biomedical sciences with special references to the use of humanities literature. His findings indicate that the students make use of limited information from humanities in preparing their theses despite their availability. In a related study, Gooden (2001) conducted citation analysis of dissertation accepted in the Department of Chemistry at the Ohio State University between 1996 and 2000 to determine material use. The 30 dissertations studied generated a total of 3,704 citations. The results showed that journal articles were cited more frequently than monographs.

Journal articles constitute 85.8% of the citations while 8.4% were monographs, dissertations, theses, conference proceedings, newspapers and annual reports constitutes 2.2% and miscellaneous publications are 3.6%. Herring (2002) conducted a study to investigate the

use of electronic resources in scholarly electronic journal through citation analysis. Scholarly electronic journals published in 1999 to 2000 were used for the study. The findings of the study show that more than half of the articles studied included electronic references and that 16% of the total references were to electronic resources. In the study, 345 (8%) of the electronic resources were to such unpublished or ephemeral resources and over one quarter (27%) of the electronic resources cited in the study were categorized as interdisciplinary or outside the discipline area of the journals or the author's affiliations. Tonta and Al (2006) did a citation analysis of 100 theses and dissertations of library and information science and discovered that 50% of the citations are from monographs, 42% from journals, 3% from dissertations, 3% from electronic publications and 2% from other sources. The findings also showed that more than half of the cited sources are in English language (55%), the rest mainly are in Turkish language. Rethlefsen (2007) analyzed citation of journal articles authored by Minnesota Department of Health staff. Journals were the most heavily cited format (63%).

Another study, Bhat and Kumar (2008) made an analysis of research articles from scholarly electronic journals published in 2000 to 2006. The study focused on the extent to which scholars are using web-based sources in scholarly electronic journals. Results of the study shows that 81.49% of articles published in selected 9 electronic journals during 2000 to 2006 have web references. Out of 25,730 references, 56.54% of references are print journal references and 43.52% of them are web references. Similarly, Javed and Shah (2008) study revealed that 49.52% citations pertained to journal articles and rest to other resource types. Jan (2009) also conducted a citation analysis of all the journal articles published in the Library Trends from 1994 to 2007. 593 articles were published in the journal during 14 years. Highest number (52) of articles was published in 2004. The Journal contained 15662 references for the study period of which 13783 are print-citations and 1879 are electronic-citations. Every issue published approximately 11 articles and each article has an average of 23.2 print-references and 3.1 electronic-citations. It was found that 44.51% print books are consulted by the authors and 0% e-books are accessed.

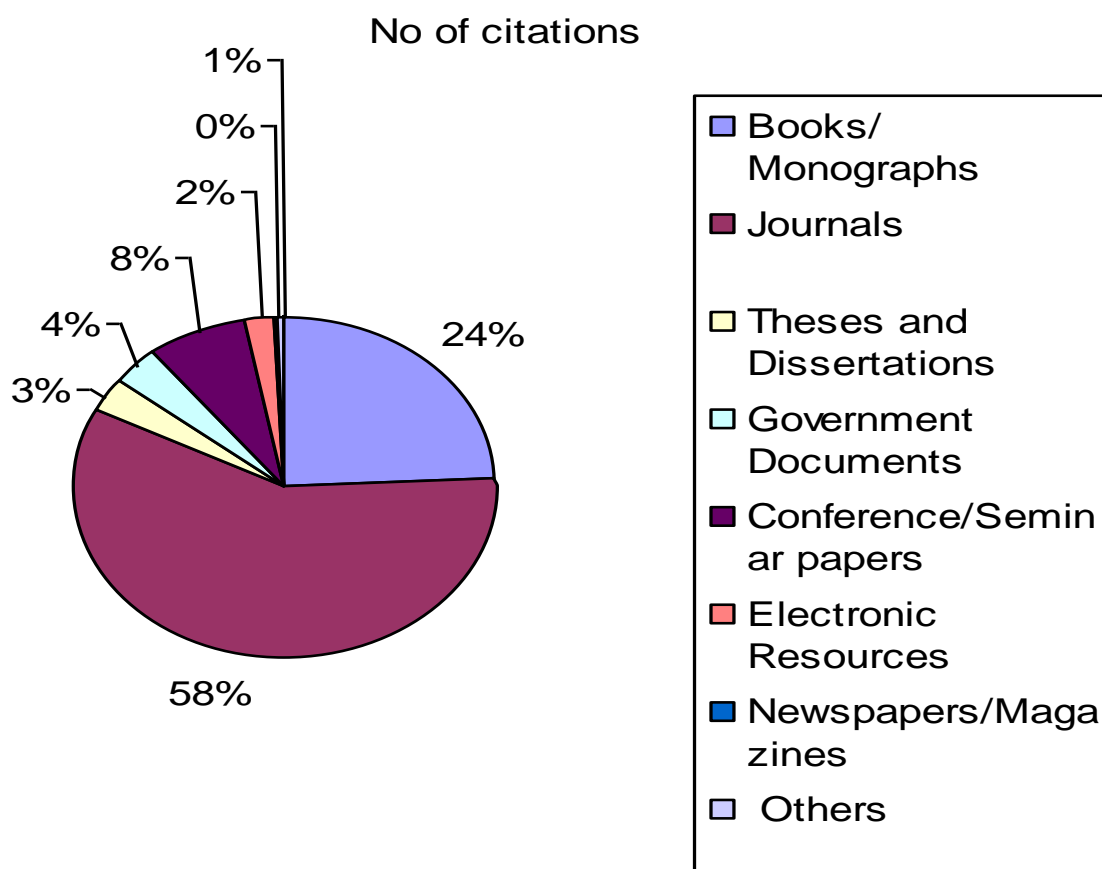
Authors have consulted 44.04% print-journals as against 11.82% electronic-journals. Figures shows that 88.14% other web references are used in the articles reference. Female contribution (52.34%) accounts more than male contribution (47.66%).

RESEARCH METHODS

The method adopted for this study is the use of citation analysis that is analysis of cited reference sources in the source journals. Two journals of agricultural science research with specific interest in animal health and production were used for the study.

Table 1. Type of cited information sources.

Cited sources	No. of citations	Percent (%)
Books/monographs	2036	24.4
Journals	4832	58
Theses and dissertations	272	3.3
Government documents	302	3.6
Conference/seminar papers	636	7.6
Electronic resources	192	2.3
Newspapers/magazines	4	0.05
Others	54	0.7
Total	8328	99.9

**Figure 1.** Type of cited sources.

The journals, Nigerian Journal of Animal Production and Nigerian Veterinary Journal were selected for the study because the former is a main line journal of The Nigerian Society for Animal Production and the latter is another main line journal of the Nigerian Veterinary Medical Association; both of them learned society interested in research in animal health and production. References to the articles published between 2003 and 2009 (seven years period) issues of these journals were manually counted and analyzed in line with the specific objectives of the study. Citations from the articles in the issues of the journals documented as references were analyzed

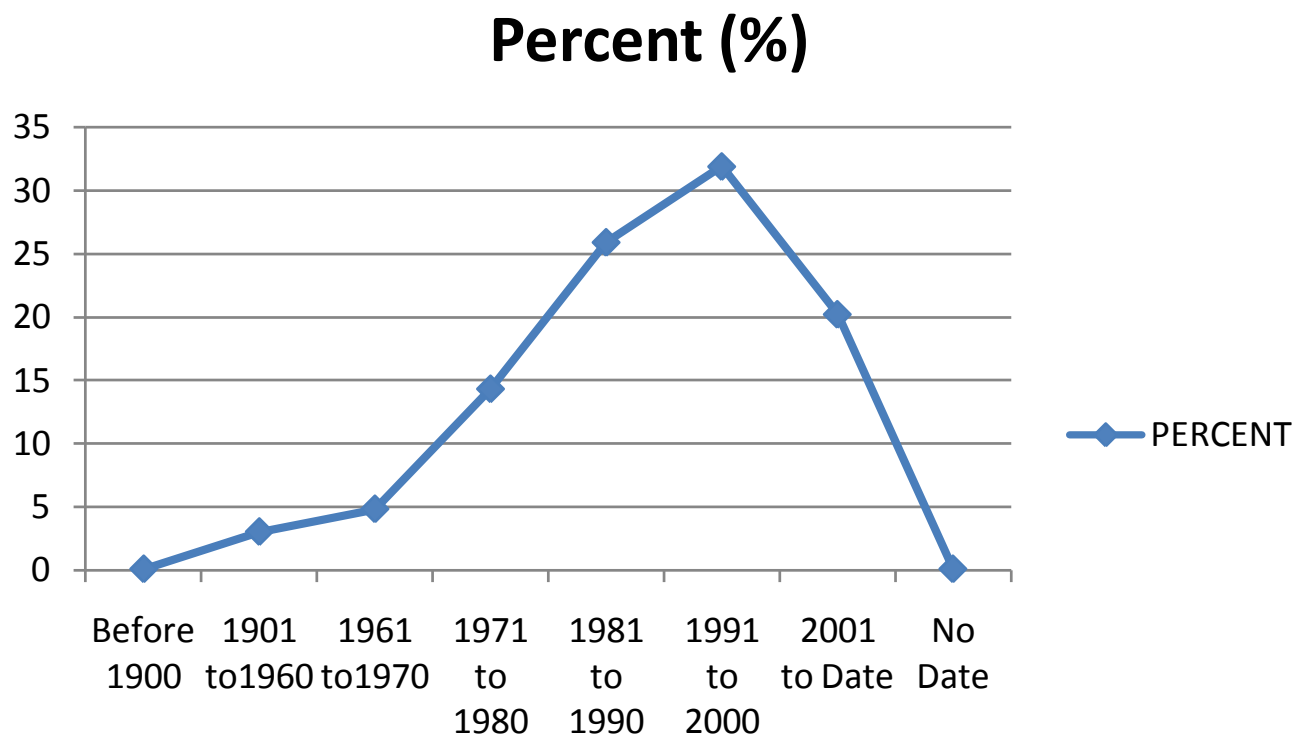
using manual counts. The volume of research in animal health and production was analyzed from the articles published in the journals (the source data). The data from the analysis were presented in tables and charts.

DATA PRESENTATION

Table 1 and Figure 1 reveals that journals are the most cited sources of information for Nigeria agricultural

Table 2. Timeliness of cited sources (N = 8328).

Age distribution	No	Percent (%)
Before 1900	4	0.05
1901 to 1960	244	3.0
1961 to 1970	398	4.8
1971 to 1980	1182	14.3
1981 to 1990	2136	25.9
1991 to 2000	2646	31.9
2001 to Date	1678	20.2
No date	4	0.05
Total	8328	100

**Figure 2.** Age distribution of cited sources.

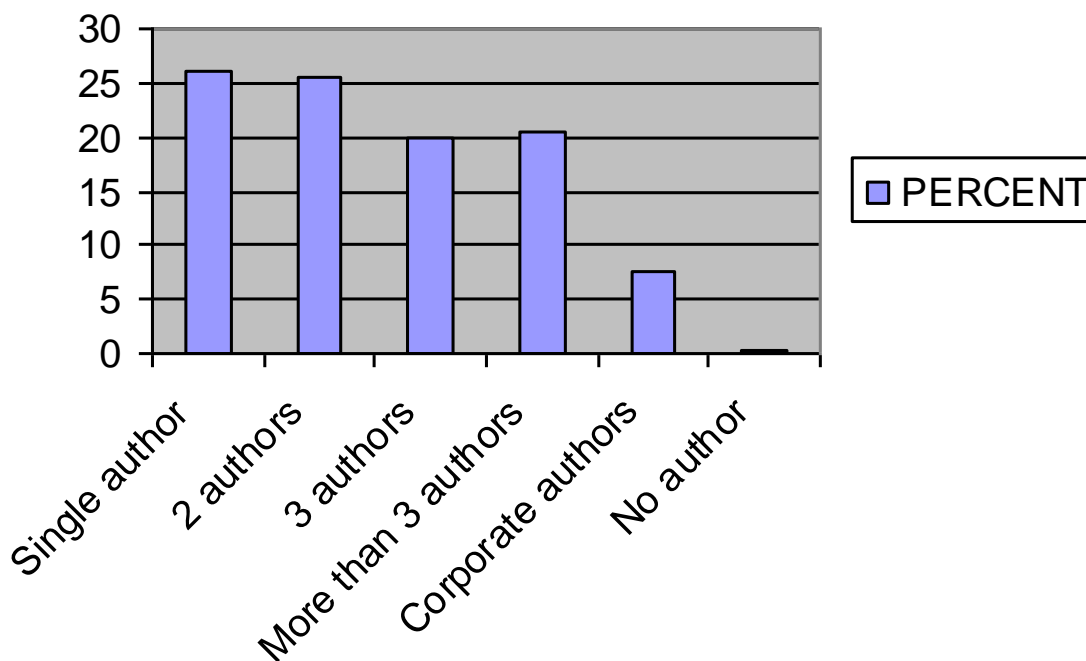
researchers followed by books and monographs. Journals account for 58% of the whole citations while books have 24.4% of the citations. Agricultural science researchers also cite conference and seminar papers. These account for 7.6% of the entire citation. However, this group of researchers rarely cites newspapers and magazine. Only two citations are from newspapers and magazine which is a mere 0.05% of the whole citations. Citation to electronic sources is very low among Nigerian agricultural science researchers for as can be seen from the result that electronic resources account for only 2.3% of the citations. The result also indicates that citations to government documents and theses and dissertations

account for 3.6 and 3.3% respectively. Table 2 and Figure 2 indicate that only two of the citations are works done before 1900. A great percent of the cited sources are works done from 1991 to 2000 which constitute 31.9% of the whole citations, followed by works done between 1981 and 1990 (25.9%). The third in the category are works done from 2001 to date which account for 20.2% of the whole citations while works done from 1971 to 1980 constituted 14.3% of the citations. Citations to works written between 1961 and 1970 accounted for 4.8% and that of 1901 and 1960 accounted for 3%. Table 3 and Figure 3 present the authorship pattern of animal health and production

Table 3. Authorship pattern (N = 8328).

Author	No	Percent (%)
Single author	2180	26.2
2 authors	2136	25.6
3 authors	1656	19.9
More than 3 authors	1702	20.4
Corporate authors	630	7.6
No author	24	0.3
Total	8328	100

Authorship pattern of cited sources

**Figure 3.** Authorship pattern of cited sources.

research in Nigeria.

From the table, it can be seen that single authorship constitutes 26.2% of the cited works while two authors has 25.6%. Citations to 3 authored works account for 19.9% of the cited works while citations to works written by more than three authors account for 20.4%. Works by corporate authors are cited 630 times or 7.6% while information sources without authors constitute 0.3% of the citations. Table 4 presents result of the most frequently cited journals in agricultural research in Nigeria. The result shows that two journals heavily cited by the researchers in animal health and production are Nigerian Journal of Animal Production and Poultry

Science. The former is cited 424 times while the later is cited 248 times. Other journals that are also heavily cited are Tropical Journal of Animal Science (162 times), Journal of Dairy Science (152 times), Animal Feed Science, (144 times). These are the top five journals; however there are other journals that have up to 80 citations. These are Journal of Food Science, (120 times), Journal of Nutrition, Nigerian Veterinary Journal, Tropical Veterinary and Veterinary Records. There are other ten journals that have up to twenty citations as can be seen in the table. These twenty-one journals all together accounted for 2243 or 46.6% of the journal citations. Table 5 and Figure 4 present the result of the

Table 4. The most frequently cited journals (N = 2253).

Journals	No. of citations	Percent of total journal citations (4832) (%)
Nigerian Journal of Animal Production	424	8.8
Poultry Science	248	5.1
Tropical Journal of Animal Science	162	3.4
Journal of Dairy Science	152	3.1
Animal Feed Science Technology	144	3.0
Journal of Food Science	120	2.5
Journal of Nutrition	112	2.3
Nigerian Veterinary Journal	90	1.9
Tropical Veterinary	84	1.7
Veterinary Records	84	1.7
Vom Journal of Veterinary Science	72	1.5
Journal of American Veterinary Association (JAVMA)	72	1.5
American Journal of Tropical Medical Hygiene	70	1.5
Tropical Animal Health Production	62	1.3
Avian Pathology	54	1.1
Tropical Medical Parasitology	54	1.1
Indian Veterinary Journal	54	1.1
British Poultry Journal	50	1.0
Bulletin of Animal Health and Production in Africa	50	1.0
British Veterinary Journal	50	1.0
Avian Disease	45	0.9
Total	2253	46.6

Table 5. Most frequently researched animal (N = 248).

Animals	No	Percent (%)
Poultry	90	36.3
Goats/sheep	34	13.7
Cattle	28	11.3
Rabbits	22	8.8
Dogs	16	6.4
Swine	8	3.2
Fishery	8	3.2
Rats	4	1.6
Horses	2	0.8
Monkeys	2	0.8
Snails	2	0.8
Grass cutters	2	0.8
General	30	12
Total	248	100

most frequently researched animal.

The revelation from this result is that poultry is the most researched animal within the period under study. Poultry was researched 90 times or 36.3% of the whole followed by goats/sheep which accounted for 13.7% of the number. Cattle, rabbits and dogs were researched 28, 22 and 16 times respectively. Rats were researched four times while horses, monkeys snails and grass cutters

have 2 each. Research on general issues about animal health and production is 30 representing 12% of the total.

DISCUSSION

The findings from this study have a lot of revelation and implication for agricultural research in Nigeria and equally

Most researched animals

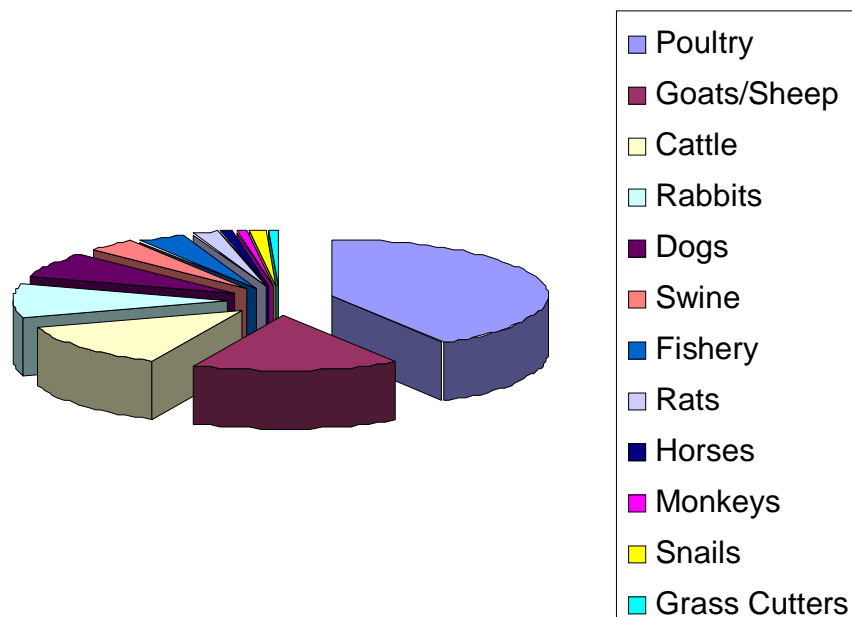


Figure 4. The most researched animal.

for librarianship. The findings show that agricultural science researchers rely heavily on journals. Journal citations accounted for nearly 60% of the entire citations. This is in line with Aina's 1983 study which equally found out that about 53% of citations in agricultural research are to journals. This means that not much has changed over the years. It is also noteworthy to observe that books and monographs are also significantly cited. This is quite unlike other core sciences where more than 80% of the citations are to journals as can be seen in Gooden's 2001 study. A worrisome development from the findings is the low citations to electronic sources. This gives a lot of concern particularly in the present information age where the Internet is playing a key role to research and development. This finding demonstrates very low use of the Internet among Nigerian agricultural researchers. This corroborates recent findings of Olatokun and Makinde (2009) who equally reported low use of electronic resources among Nigerian agricultural scientists. The reason for this may be low poor ICT infrastructure in Nigeria which has been reported in a number of studies and probably lack of internet search skills among the researchers coupled with low internet bandwidth in many developing countries Particularly Nigeria. When the age distribution of cited sources is considered a more glaring danger is noticed.

The greatest numbers of the citations are sources that are published from 1991 to 2000 which are more than ten years old. Closer observation will equally reveal that more than 70% of the cited sources are between ten and thirty years old for they are published from 1971 to 2000.

This is not adequate for a science based literature which gets obsolete within a short time. The publications that can be arguably current are those published from 2001 to date. They constitute only 20.2% of the whole citations. The implication of this finding is that agricultural science researchers in Nigeria lack current information resources in their libraries. The internet that would have provided current information is lowly used as can be seen from the findings. This finding differ to some extent with the findings of Olatokun and Makinde who revealed that up to 80% of the resources used by the researchers investigated were less than 15 years old. However, it corroborates the findings of Dulle et al. (2004) in their report that Tanzanian agricultural science researchers lack access to current information resources for their research. The difference on the age of materials between this present study and that of Olatokun and Makinde may be as a result of the source data used for the study. This is doctoral research tend to make use of more current information because of series of panel assessment it has to pass through. Authorship patterns indicate that agricultural researchers enjoy collaborative work like many other scientists. This is shown from the number of multiple authors in the citations. Although single authored citations are significant (26.2%), it is not comparable with multiple authors which when added together accounted for about 60% of the whole citations. It is interesting to note that citations to more than three authors are very significant (20.4%). This development is really encouraging because collaborative research is highly emphasized now.

Findings also revealed that the most frequently cited journal is Nigerian Journal of Animal Production which was cited 428 times. This probably is because it is published by Nigeria researchers with interest in animal production. This is followed by Poultry Science which was cited 248 times. It is interesting to note that this journal is published outside Nigeria and therefore one cannot argue that the reliance on it is based on mere availability. Its high citation seemingly is based on the quality and the research impact the journal command in global scholarly community. It is interesting to observe that the number of core journals identified in this study have similarity with those identified by Adewole (1987), Dulle et al. (2004) and Olatokun and Makinde (2009). While the present study identified twenty one core journals, Adewole identified eighteen and Dulle and others identified twenty core journals. A very important thing to note again is that Journal of Animal Science, Poultry Science and Nigerian Journal of Animal Production continue to feature prominently among the most cited journals. There are other 19 journals which have up to twenty citations in the present study. Surprisingly, majority of these journals are foreign based journals. One can safely conclude that Nigerian agricultural science researchers rely more on foreign based journals than local journals. These identified journals accounted for more than 46.6% of journal citations while others are scattered to other journals. The most researched animal is poultry, while the least researched are horses, monkeys, snails and grass cutters. One is surprised that so many researchers in animal health and production are concentrating on poultry. Probably farmers find poultry more lucrative to engage in more than other animals. Another reason might be that it is cheaper to conduct research on poultry more than some other animals.

In the present situation where food security is generating a lot of national and international concern, more research interest should be given to animals like snails, swine, fish goats and sheep.

CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it is glaring that research in agricultural science in Nigeria requires adequate and up-to-date information. The currency and adequacy of these information resources is doubtful. This therefore, requires intervention from librarians who are the major stake holders in information management and accessibility. This is even more demanding when it is evident that this group of researchers is not familiar with electronic information resources as we can see that their citation to electronic resources is low. This has serious policy implication on libraries in terms of library acquisition and the formats in which these materials have to be acquired. Nigerian libraries particularly university and research libraries that mandates to support research

in different areas, have major roles to play here in terms of provision of information and communication (ICT) infrastructure to propel research and development in agricultural related areas. The researchers on their own part need retraining and retooling on modern information seeking and handling skills.

Nigerian agricultural science researchers should be encouraged to train themselves on the use of ICT to enhance their research capacity. Librarians should help in identifying relevant web sites and open access data bases for agricultural research and communicate same to the researchers.

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