Citation analysis of dissertations submitted to the Department of Animal Science, University of Ibadan, Nigeria

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Citations in master’s degree dissertations submitted to the Department of Animal Science, University of Ibadan, Nigeria during the period 2000-2007 were analysed for finding possible relationships between citing, cited articles and authors. Frequency and percentage distributions (presented in charts, tables, and graphs) and measures of central tendency were used to analyse data. Findings showed that journals were the most utilized reference materials in the dissertations. Also, poultry nutrition works had the highest number of dissertations followed by agricultural biochemistry and nutrition. The lowest number of dissertations was from forage production and management and monogastric nutrition with just two dissertations each. The findings from this study could serve as a user study with implications for both collection development and user services design in libraries. Future studies could focus on ascertaining the implications of collection of reference materials to project and article referencing, instruction in classes and outreach.

Introduction
In his essay on citation analysis, King¹ pointed out that scientists are drowning in a flood of information overload. Remarkably, thousands of scientific studies are published on a daily basis. One method for tracking and evaluating research is citation analysis. Citation analysis works because scientists leave an unmistakable trail behind them as they report their work— a trail of footnotes. Today, a scientific publication is easily recognized by its footnotes, endnotes and references to other scientific articles or books². Contributions to scientific knowledge are often crystallized in the form of a scientific article. Such contributions may take the form of new facts, new hypotheses, new theories or theorems, new explanations or a new synthesis of existing facts³. In each case, a metamorphosis has taken place from an existing, say ‘old’ situation, to a ‘new’ one. The metamorphosis itself takes place in the head of the investigators with the help of scientific equipment and is usually invisible to outsiders, but scientific tradition requires that an author refer to earlier articles, which relate to the theme of his/her paper. The author must clarify his/her starting point. Identifying those predecessors whose concepts, methods, discoveries, etc. have inspired or were used in developing ‘the new things’ that reveal ‘the old things’. Viewed from another angle, the author acknowledges a group of inspirational articles written by earlier researchers by referring to them⁴.

Citation analysis reflects on citation practices⁵. Citation analysis is also seen as that which is used to determine competitive position of authors, to study the structure of literature, to manage a collection of journals, to define the structure of science and for scientists to identify useful journals among other things⁶. From an application point of view, citation analysis may be considered as a collaborative peer effort to analyze and promote the quality of scholarly publication and research⁷. Citation analyses study the patterns of citations in documents, an objective method for gathering data about information needs⁸. Williams and Fletcher⁹ explained citation analysis as a non-intrusive method of finding patterns in a specific population’s use of research materials. Meho¹⁰ has observed that citation analysis is actually a branch of information science in which researchers study the way articles in a scholarly field are accessed and referenced by others. It has been used for the purpose of scholarly analysis and evaluation in several fields of human endeavour. Johnson¹¹ pointed out that citation studies reveal much about scholarly communication and can be an effective tool to guide collection development in academic libraries.

It is against this background that in this study, citation analysis is employed in studying Masters’ dissertations submitted to the department of Animal Science, University of Ibadan, Nigeria (2000-2007) with a view to finding out citation practices in the dissertations.
The Department of Animal Science, University of Ibadan was founded in 1967 and is one of the seven departments under the Faculty of Agriculture and Forestry. In this study, the terms reference material and cited item are used interchangeably. The following research questions guided the study:

- Which citation formats are used mostly in the dissertations submitted to the department of animal science?
- Which are the most cited items in the dissertations and to what extent do citations apply to Bradford and Zipf laws?
- What is the age of cited items in the dissertations?
- What are the most frequently cited journals in animal science?
- What is the trend in the number of citations over the period 2000 – 2007?
- Which subject areas within animal science areas of specialization have the highest number of dissertations?
- To what extent do masters’ students in the department of animal science use journals from non-animal science disciplines?
- Are there changing/shifting foci of study area? If Yes, towards which area?
- To what extent do the dissertations contain journals from non-animal science disciplines?
- What is the impact of the internet on referencing in the dissertations over the years?
- How do citations patterns vary among animal science discipline?

**Previous studies**

A survey of the literature illustrates the breadth and potential application of conducting a citation analysis. Labonte carried out citation analysis to determine if the science-engineering library at the University of California at Santa Barbara (UCSB) is meeting the needs of an interdisciplinary group of 60 faculty members at the new California Nanosystems Institute. The study was aimed at developing a core list of journals and identifying journals

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**Table 1— Distribution of citations in the dissertations**

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<thead>
<tr>
<th>Materials referenced</th>
<th>Journals</th>
<th>Books</th>
<th>Conference papers</th>
<th>Web resources</th>
<th>Technical reports &amp; standards</th>
<th>Government documents</th>
<th>Theses &amp; dissertations</th>
<th>Miscellaneous</th>
<th>Total</th>
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<tr>
<td>Number of reference and %</td>
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<td>2694 (22%)</td>
<td>1025 (8%)</td>
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<td>451 (4%)</td>
<td>327 (3%)</td>
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**Table 2— Distribution of citations by year**

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that should be added to the collections in the sciences-engineering library at UCSB. Results from the study indicated that the library subscribed to 98 percent of the journals in which faculty members are publishing or citing frequently. The paper suggests that this information is useful to map the citation patterns of a new interdisciplinary field and can be used for future collection management decisions. Williams and Fletcher\(^1\) performed a citation analysis on materials used by graduate students in engineering (comprising the engineering discipline of aerospace, agricultural, electrical, chemical, civil, and computational engineering) at Mississippi State University. The essence of the citation research was to guide library collection development decisions. The case study found that journals (38%), conference papers (19%), and books (18%) are the most heavily used formats, with books aging more slowly than other formats. Core journals lists are developed by total citations and by number of citing authors. Variations among engineering disciplines were identified, including variations in format, age and subject classification of journals. The results of this study suggested three areas in need of future research. First, while journal ranking are usually based on total number of citations, ranking by number of citing authors may be useful for studies of masters’ dissertations and doctoral theses. Second, the Library of Congress Classification of journals cited indicates significant variation in subject classes cited among engineering disciplines.

The work by Spies\(^1\) reviewed fourteen “major” journals of exploration geophysics for “effectiveness”. This paper presented a basic tenet of citation analysis as follows: the references that an author cites are a roughly valid
indicator of influence, hence value, to his work. A measure of cost effectiveness was also incorporated into this study as subscription costs and citation rates were compared between commercial publications and those produced by professional societies. Uzun, Menard & Ozel\(^\text{15}\) studied the citation rates of 572 Turkish physics publications that appeared in the source journals listed in the Science Citation Index. This analysis was global in scope as is commonly the case with citation studies. They examined impact factor, immediacy index, citation frequency, and the nationality of the publishing house. The question which these normal parameters and scope raise for librarians was how relevant it was to the local collection for which they had a responsibility to build based upon the research and curriculum program ongoing at the institution.

Rousseau\(^\text{16}\) presented a citation distribution of mathematics journals, wherein it is proposed that a four-year impact factor would be more suited to mathematics than the more or less typical two-year impact factor used in Science Citation Index. Hurd\(^\text{17}\) categorized journals in a sample population according to the disciplines of Physics, Biology, Chemistry, and Engineering. The categorization was done according to the Ulrich’s subject classification. The article also specified the number of citations for the different formats of materials such as journals, monographs, conference proceedings, dissertation, unpublished and others which included government documents, handbooks, tables, technical reports and software. The total number of citations was 1931 taken from 57 articles. Journals formed the largest citations. Redman, Manakyan, and Tanner\(^\text{18}\) presented an analysis of the citation patterns and rankings for journals in real estate and related areas for the period 1990-1995. Journals were ranked based on the number of times they were cited in four base journals with adjustments for journal size and longevity. The results showed that Real Estate Economics is the most cited journal among real estate publications followed closely by the Journal of Real Estate Finance and Economics and the Journal of Real Estate Research. A temporal analysis revealed a shift in citations over the time period, away from the traditional economics and practitioner-oriented journals to the academic real estate journals. Chuang\(^\text{19}\) carried out a study using citation analysis to identify major themes and contribution to Health and Insurance literature during the period 1999-2003. Results showed that the most cited articles were published in 10 unique journals, only 6 of which were close to health care.

Muhammad and Khalid\(^\text{20}\) carried out a citation analysis of two core Pakistani economic journals. Selected volumes of the Pakistan Development Review (PDR) and the Pakistan Economic and Social Review (PESR) were analysed to find the citation patterns of their articles. Eight volumes of each journal were selected, two volumes representing a decade. The results reveal that the PDR has been the most cited journal. More than 50 per cent of the citations from both journals were single-authored. More than 50 per cent of the citations were from non-journal sources, mainly books. Although citations from online sources were seen, it was a negligible number. Georgas and Cullars\(^\text{21}\) made a citation study of the characteristics of the Linguistic literature of which citations were obtained from the Language and Linguistics Behavior Abstracts (LLBA) database. They specified the number and percentage of citations in terms of type of source cited such as monographs, articles in books, journal articles and theses. The result showed that the journals articles had the highest score in the cited and citing sources which were 73.3% and 42.8%. Wohlin\(^\text{22}\) analysed the most cited articles in software engineering journals. The article specified that citation

<table>
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<th>Age of oldest item (years)</th>
<th>50% of items less than (years)</th>
<th>80% of items less than (years)</th>
<th>10 years old or less (%)</th>
<th>5 years old or Less (%)</th>
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</thead>
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<tr>
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<td>79</td>
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<td>14</td>
<td>62</td>
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<td>Books</td>
<td>65</td>
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<td>Journals</td>
<td>79</td>
<td>9</td>
<td>17</td>
<td>61</td>
<td>59</td>
</tr>
</tbody>
</table>

Table 4 — Age of materials
and related work provided a crucial resource to research work. The author also conducted an analysis using the ISI Web of Science to identify the most cited software engineering journal articles published in 1999 with the objective being to identify and list articles that have influenced other than the most which was measured in the citation count. The articles were most cited by others. A list of 20 most cited articles was presented from his results.

**Data collection and analysis**

The research design adopted was a descriptive study. Two major sources of data used were dissertations submitted for master’s degree in the department of Animal Science, University of Ibadan, Nigeria covering the period 2000-2007 and the database of dissertations in the department. The sampling procedure for the study was purposive since data was being collected specifying a target period 2000-2007. This sample also represented the total population of the dissertations. In all, 126 masters’ dissertations were analysed.

Each dissertation was manually examined and citations were extracted from the references section of each of the dissertation. The method of data collection was document extraction through content analyses. Data extracted from the dissertations included year of publication (year of project submission), year of cited work, year of the oldest materials cited, number of citations, most cited year (mode of occurrence), title of project work, volume of project work, type of cited journal, journal type cited and years cited. The citations in each cited title were broken into eight categories namely: journals (serials other than monographic series and conference proceedings), books, conference papers, web resources and technical reports and standards (including government technical reports). Others were government documents (state, federal and foreign), theses and dissertations and miscellaneous material (patents, personal communications, product literature, software and software manuals, university extension documents, unpublished materials, and others).

The data extracted were entered into MS-Excel worksheet. Frequency distributions charts, graphs, and measures of central tendency like mean, mode and median were obtained using the MS-Excel.

**Results**

**Distribution of citations in the dissertations**

The citations in the dissertations totaled 12,374. The results were presented in Tables 1 & 2 and Figures 1 & 2. Table 1 showed the distribution of types of
reference materials cited in the dissertations as grouped or categorized in this study. Figures 1 and 2 show the total of all citations by year.

From the results presented in Table 1, it can be observed that citations to journals alone accounted for more than half of the total citations constituting 55%. This was followed by citations to books that were 22%. The descending order of other materials cited was as follows: conference papers (8%), miscellaneous (5%), government document (4%), theses and dissertations (3%), technical reports and standards (2%) and web resources (1%). There was an average of 98 citations per dissertation for the 126 available masters’ dissertations. Previous studies that have ranked reference materials corroborate that journals were the most cited reference material, with other citation formats having varying percentages in their rankings and they may vary widely. As shown in Figure 1, the highest number of citations for dissertations was recorded in 2003 followed by 2006 with the least recorded in the year 2007.

As presented in Figure 2, 2007 had the highest citations while 2000 recorded the least. The distribution of citations to the dissertations was unsymmetrical or skewed.

From Table 2, it can be observed that journals had highest values through all the years among the reference materials cited in the dissertations. The highest citation to journals was 1992 in 2003. However, web resources were the least cited.

**Distribution of citations by type of reference materials**

Cited reference materials were grouped into eight categories as follows: journals (serials other than monographic series and conference proceedings), books, conference papers, web resources, technical reports and standards (including government technical reports), government documents (state, federal and foreign), theses and dissertations, and miscellaneous documents (personal communications, product literature, software and software manuals, university extension documents, unpublished materials and others).

Analysis revealed that the highest overall citation to journals was recorded in the year 2003 with 632 citations followed by 474 citations in the year 2006 with the least being 54 citations in 2007. For that of conference papers, the highest overall citation was recorded in the year 2006 with 217 citations followed by 185 citations in year 2004. The least was 34 citations in 2007. Web resources recorded 52 citations as the highest overall citations in the year 2006 followed by 24 citations in year 2005. However zero citations were recorded in years 2000, 2001, and 2003. The highest citation to technical reports and standards varied from that of the web by three counts having a value of 49 citations in the year 2006 followed by 43 citations in year 2003. The least was one citation in 2007. Government documents had the highest overall citation in the year 2003 with 82 citations and closely followed by 76 citations occurring twice in years 2000 and 2001. The least was 9 citations in 2007. The uppermost overall citation to theses and dissertations was evidenced in the year 2006 with 59 citations followed by 57 citations in year 2004. The least was 7 citations in 2007. The topmost overall citations to miscellaneous documents were also indicated in the year 2006 with 177 citations followed by 104 citations in year 2003. The least was 21 citations occurring in years 2002 and 2007 (Table 3).

As displayed in Table 3, journals and books were the most cited materials over the years with journals being cited as the foremost cited reference materials all through the years 2000-2007. Conference materials, government documents, technical reports and standards and web resources also followed in this order with web resources being the least cited.

**Age of citations**

Age is the length of time a reference material has existed and it is usually measured in years. However in this study, percentages were used to describe reference materials (items) to make them more expressive in years. The results on the age of citations are presented in Table 4.

The oldest reference material in the dissertations was a 1921 serial material (journal) named Chemistry Abstract. Two earlier studies have found that majority of reference materials cited in the citation analysis studies they carried out were less than eight years old. In this study, 50% of all reference materials cited in the dissertations was less than eight years old and 80% within the last 14 years. Conference papers were the most recent materials with 72% published in the last 10 years. Journal was thus the oldest reference material cited. Therefore, conference
papers tended to be more current than books or journals. This is in agreement with Williams & Fletcher\textsuperscript{32} that noted that 76% of conference papers were also published in the last 10 years in their citation analysis study. Also, close to half of books were less than 5 years old (49%) while 55% of conference papers and 52% of journals fit that category.

**Journals citations distribution**

In all, eight-hundred and one journal titles were found in the dissertations. Table 5 shows the frequency of occurrence of journals cited in the field of animal science as found in the dissertations.

*Poultry Science Journal* (PSJ) was the most cited journal having a total of 926 citations. This was found in 78 dissertations. The probability of finding a dissertation that cited PSJ article is 0.6190 indicating high dissertation citations and the visibility of PSJ in the dissertations. The highest citation by any individual to PSJ was 36 and this occurred in 2004.

Citations to *Animal Feed, Science and Technology Journal* (AFSTJ) ranked as second on the list of most cited journals having 707 citations. This was found in 69 dissertations. The probability of finding a dissertation that cited AFSTJ is 0.5476. The highest citation by any individual to AFSTJ was 29 and this occurred in 2004.

*Journal of Nutrition* (JON) ranked third in the list of most cited journals having a total of 413 citations. This was found in 43 dissertations. The probability of finding a dissertation that cited JON article is 0.3412. The highest citation by any individual to JON is 20 and this occurred in 2003.

Among the top twenty journals used for analysis, the least cited journal were Tropical Animal Production Investigation and Livestock Production Science with 38 citations each, and International Journal of Goat and Sheep Research and Development in Animal and Veterinary Science with 37 citations each.

**Study areas in the dissertations**

The results of the analyses performed to find out the distribution of the dissertations in the sub-fields of animal science are presented in Table 6.

Table 6 shows that poultry nutrition is the subfield that is mostly researched between years 2000-2007 with 27 dissertations (21%). This was followed by agricultural biochemistry and nutrition with 25 dissertations (19.8%). The least researched subfields were forage production and management and monogastric nutrition that were the study areas of 2 dissertations each. Poultry nutrition peaked in 2000 with eleven masters’ dissertations focusing on the subfield.

**Citation pattern among animal science disciplines**

Journals were the most cited reference material for the different animal science disciplines between years 2000-2007. This was followed by books. Table 7 shows citations for the coverage period. It was only in forage production and management that books were most cited. Web resources were the least cited as it was not cited at all in any of the dissertations of forage production and management. However, it ranked sixth in the animal physiology subfield with 41 citations, being cited more than theses and dissertations (30 citations) and technical reports and standards (26 citations).

**Discussion**

**Citations formats**

The citation formats used in the dissertations include journals, books, conference papers, web resources, technical reports and standards (including government technical reports) and government documents (comprising state, federal and foreign government documents). Other citation formats used were theses and dissertations and miscellaneous reference materials (comprising patents, personal communication, product literature, software and software manuals, university extension documents, unpublished materials, and others). This classification of citation formats is in line with the formats that have been extensively used in various works on citation analysis. Among them were Williams & Fletcher\textsuperscript{33} who divided the reference materials (formats) of their citation study into eight groups. Actually, this study strongly builds on Williams and Fletcher’s citation analysis to relate it to the animal science discipline. Johnson\textsuperscript{34} and Gooden\textsuperscript{35} also carried out citation studies in which five groups were clearly identified. This study improved on and added to these groups since animal science as an agricultural discipline utilizes myriads of reference materials.

**Most cited items, Bradford and Zipf laws?**

The most cited items were journals which accounted for more than half of the total citations 6875 (55%). The
use of web resources was very low 1\%, (10 citations) in the dissertations. Other reference materials or citation formats apart from books and conference papers that ranked 2\textsuperscript{nd} and 3\textsuperscript{rd} were moderately used in the dissertations. Many citation analyses buttress the claim in this study that journals are the most used materials in any research field judging from the fact that they point to currency of research works\textsuperscript{36-48}. It is also in support of Johnson\textsuperscript{49} where journals ranked 1\textsuperscript{st} and books ranked 2\textsuperscript{nd} as well as that of studies like Dombrowski\textsuperscript{50}.

In addition, Bradford’s Law of Scatter\textsuperscript{51} also applies in this study with 12 journals accounting for half of the journal citations in the field of animal science. This kind of user-data implications should be considered in evaluating journals. Therefore, the Bradford’s zone of few journals accounting for many citations is confirmed by the findings from this study. In one of the early citation studies, Gross and Gross\textsuperscript{52} discovered that very few journals were cited frequently in the Journal of the American Chemical Society, while many journals were only cited once. Their findings concur with Zipf’s law, which states that while few items occur often, many items occur rarely\textsuperscript{53}.

**Age of the cited items**
The oldest cited item was a periodical. Fifty percent of all reference materials cited in the dissertations was less than eight years old. Conference materials were the most recent materials with 72\% dissertations published in the last 10 years. Eighty percent of books were less than 20 years. This supports Musser & Conkling’s\textsuperscript{54}.

<table>
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<th>2001</th>
<th>2002</th>
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recommendation that books should not be placed in storage as quickly as other citation formats because of a lasting referral to them. Johnson\textsuperscript{55} observed that age of cited works was much less diverse but in this study age of reference materials were much more diverse. This agrees with Williams & Fletcher\textsuperscript{56} that much diversity was experienced in ages of materials used in their study.

**Most frequently cited journals**
The most cited journals in the dissertations were *Poultry Science Journal* (926 citations) followed by *Animal Feed Science and Technology Journal* (707 citations), *Journal of Nutrition* (413 citations), and *Journal of Animal Science* (266 citations). The least cited journal titles include *Phytochemistry*, *Cancer* and *Milchwissenschaft* which were only cited once. The most frequently cited journals were actually agricultural journals which is in line with the facts that any research discipline tend to cite more from the journals that are from core areas of that discipline\textsuperscript{57-61}.

**Average number of citations per dissertation**
A total of 12,374 reference materials were cited in 126 dissertations. This gives an average of 98 citations per dissertation. This is in agreement with Gooden\textsuperscript{62} where citation analysis of the Ohio State University chemistry department had their number of citations ranging from a low of 24 to a high of 491 and averaged about 123 citations each. Therefore, the number of citations in this study is a good indicator of a relatively good citation pattern in terms of number of materials cited in the animal science bibliographies.

**Trend in number of citations**
The number of citations to journals in the dissertations tended to be highest for every year of the coverage period of this study. This is definitely responsible for journals being ranked as the topmost cited material while number of citations to web resources tended to be lowest for every year of the coverage period of this study. Values for citations were seen to be constantly changing for all reference materials experiencing lows and highs at different years. However, visible highs were glaring in journals, books and conference papers in the dissertations. Number of citations to web resources experienced highs in 2006 (52 citations). This study is in agreement with the studies of Aina\textsuperscript{63} and Williams & Fletcher\textsuperscript{64} where journals among all reference materials ranked highest throughout all the years of the coverage period of their citation analyses.

**Subject areas of specialization**
Poultry nutrition works had the highest number of occurrences (27 dissertations, 21%), followed by agricultural biochemistry and nutrition (25 dissertations, 19.8%). The areas of specialization with lowest number of dissertations were forage production and management and monogastric nutrition with two dissertations each. Williams & Fletcher\textsuperscript{66} pointed out that computational engineering had the highest number of dissertation submission. Also, the old areas, poultry science and animal biochemistry and nutrition in this study had the highest number of theses submission.

**Changing/shifting foci of study area**
In the dissertations, poultry nutrition is an area that is dwindling greatly having reached its peak in 2000. Also, studies in ruminant nutrition diminished as well with zero studies from year 2002 to 2007. Animal biochemistry and nutrition studies despite being ranked second in terms of dissertation submission dwindled experiencing visible highs and lows with zero dissertation work for year 2007. Animal physiology can be weakly considered to be the new focus of the masters students as the number of dissertations increased over time but gradually recorded just one study in 2007. Citation analysis for different fields have shown that there would always be changing or shifting focus of study area because of student discretion, faculty area of specialization, available dissertation supervisors and funding\textsuperscript{66-67}.

**Citations of works from non-animal science disciplines**
Animal science as an agricultural science discipline is an area that extensively makes use of a wide range of science journals ranging from medical sciences, life sciences, mathematics, engineering (especially agricultural engineering), food sciences, veterinary sciences and even social sciences. Close to 20% of the journals identified in this study were found to be core animal science journals. The remaining 80% ranged among the other sciences including few additions from other areas of study apart from the sciences. Thus, it can be said that animal science uses more journals that are not core animal science journals. However, this study reveals that the core animal science journals account for the bulk of the citations in the discipline’s bibliographies. This is in line with the work of Garfield\textsuperscript{68} where he clearly put forth that agricultural scientists use and cite the same frequently cited basic research journals used by all other research workers in life sciences. This was Garfield’s argument when he stated emphatically
that an agricultural citation index is embedded in science citation index. This study shows that about 80% of the total journals used in postgraduate studies in animal science are actually from the basic sciences.

Impact of the Internet

Although the Internet was least used in all the cited reference materials, nevertheless the use of web resources in animal science research as seen in the dissertations is on the rise. Though in the dissertations, internet sources were not cited in the first three years (2000-2003) it however greatly increased in the last 4 years especially achieving a peak of 52 cited references, although its utilization fell sharply to two cited items in 2007. This finding supports Aina’s⁵⁰observation that the web was the least source used. However, Williams & Fletcher⁷⁰had a contrary result in their study of master in engineering students. The web was ranked 4⁰behind journals, conference papers and books in eight-group classification of reference materials used in engineering. Web usage from various citation analyses carried out might simply indicate that its thorough utilization would be discipline independent and would also anchor on the promotion of information technologies especially the internet by institutions and governments.

Variations in citation patterns

In the dissertations, all animal science sub-disciplines cite journals extensively. However, animal nutrition and biochemistry cited journal reference materials from other disciplines. Animal production was ranked second in terms of dissertation submission but was rated eighth in citation to journals. Zero web citations were recorded for monogastric nutrition and forage production and Aina. These variations concurred with Williams & Fletcher⁷¹who indicated that different sub-fields of a discipline utilize varying degrees of reference materials pointing to their varying citation patterns and this might also be discipline specific.

Conclusions

Citation analysis should be used at institutional and governmental levels for the formulation of citation-based science policy for an all round development in science and agriculture. The findings from this study also show several important areas of reference materials as vital information sources in research for postgraduate students. This will no doubt help the University of Ibadan’s main library and other departmental libraries in their budget planning to judiciously use their shrinking budgets and funds to make far-reaching library-material collection decisions.

Although, several findings were pointed out in this study but a single research cannot be all-encompassing to point out the multifarious existing problems that call for urgent solutions. With this study carried out in a single university, it would be beneficial to replicate it in some of the other top ten universities with virile animal science departments in order to compare the results. This will help in answering questions like: Are the core materials similar? Are other sources mentioned in this study apart from the journal also beneficial to their research works? These answers could prove to be helpful to already established university libraries and new private universities seeking to establish animal science departments with implications for boosting existing and new collections.

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