

Library Review

Creating a core journal collection for agricultural research in Tanzania: citation analysis and user opinion techniques

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Keywords

Materials management, Journals, Quality, Tanzania

Abstract

The major objective of this study was to analyse the citation patterns of agricultural scientists in Tanzania. The specific objectives 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. The study involved the analysis of 295 MSc theses and 21 PhD theses submitted at Sokoine University of Agriculture between 1989-1999, and 309 conference proceeding articles published during the same period. It is concluded that generally agricultural scientists in the country had limited access to current journals. A number of options are recommended to alleviate the situation, with a focus on electronic journal provision supported by international organisations.

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Introduction

Information is an important input for the success of any research system. Lack of information restricts researchers, lowers their confidence, their professional standing and their value to the research system (Tanzania Department of Research and Training, 1991). Books, research reports, theses, conference proceedings and scientific journals are among the major sources of information for researchers. For scholars, journals are the most dependable source of information (Aina and Mabawonku, 1997; Edwards, 1999).

Academic libraries face a serious budgetary problem in the development of library collections because of the rising cost and the increasing number of new journals. According to Bennion, as cited by Edwards (1999), "For over 20 years, prices have increased faster than inflation and have risen 15-30 percent annually since the mid-1980s". It has also been pointed out that since 1665, "Scientific journals have doubled in number every 15 years" (Sylvia and Lasher, 1995). This combination of circumstances makes it increasingly challenging for academic libraries to meet the information needs of their clients. Aggravated by poverty, academic libraries in developing countries face an even more difficult situation than their counterparts in the developed world.

Citation analysis is one methodology adopted by libraries in evaluating their collections, as well as a tool for building an effective journal collection (Aina and Mabawonku, 1997; Asundi and Kabin, 1996). A number of scholars have written on citation analysis. Olysen (1994) reports on a five-year project to identify the most vital or core literature of the agricultural sciences, covering developed as well as developing countries. In this study, citation analysis and bibliometric techniques were used to identify the most valuable literature for instruction and research at university level. Another study by Asundi and Kabin (1996) identified a list of core Indian periodicals in horticulture by analysing citations from 257 doctoral and masters degree dissertations at the University of Agricultural Sciences Bangalore during the period 1980-1989. The study concluded that a heavy concentration of large numbers of citations in a few periodicals means

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that librarians can have a large percentage of relevant literature in the field by subscribing to relatively fewer periodicals. In a similar study, Izah (1996) reports findings from a citation analysis of articles published from 1981 to 1982 in 15 issues of the *Nigerian Journal of Agriculture Extension*. He accordingly recommends results from the study to aid the collection development of agricultural extension libraries. Furthermore, Awogbami (1995) reported results of a project to determine the level of provision of sources of information on agricultural biology in the faculty of agriculture, Ibadan University. Conclusions from that study indicated that the library holdings were inadequate to meet the information needs of its clients. It is noted from the above observations that citation analysis studies have been done widely at both international and national levels. Citation analysis studies based at a national or institutional level are considered to be more effective in comparison to those based at an international or regional level, as the former take into consideration local information needs. Although a number of citation studies have been done in Africa, no similar study is documented in Tanzania as far as agricultural information is concerned.

The major objective of this study was to analyse the citation patterns of agricultural scientists in Tanzania. The specific objectives 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.

Used within the context of this study, citation analysis involved examining lists of references that accompany an article/publication in terms of certain patterns – namely: literature age, document types and the number of times an item is cited.

Methodology

First, the bibliographic citations in local publications (MSc and PhD theses submitted at Sokoine University of Agriculture and locally published conference proceedings) during 1989 – 1999 were collected. The breakdown of the publications analysed is as follows: 295 MSc theses; 21 PhD theses and 309 conference proceedings articles covering the fields of agriculture, forestry and veterinary medicine. The articles were selected through systematic random

sampling. Counts in terms of number of citations of books, proceedings articles, theses, journal articles and others were recorded. The journal title as well as publication date were recorded for each journal citation. The average literature age was also calculated.

Second, a questionnaire was designed to solicit from users a list of the ten journals they considered most useful for their disciplines. This information was gathered from 244 agricultural scientists at 16 research institutions throughout the country.

Journals were ranked based on number of citations and scores from user opinions. If the journal title was uncertain, it was verified using sources such as Ulrich's and a reputable library's journal collection index. By comparing these results with the currently available representative journal subscriptions, the capability of agricultural libraries in meeting user needs in the country was determined.

Results and discussion

Citation pattern

The citation pattern was determined with respect to types of documents cited, average number of citations and literature age. Agricultural researchers reported use of a variety of types of publication formats. As noted from Table I, on average, PhD theses had the highest number of citations as compared to MSc theses and conference proceedings. The total number of references cited in all 625 documents was 33,922, making an average of 54.3 per document analysed. Across the publications analysed, journals were more highly consulted (44.3 percent of total citations) compared to other sources of literature (books – 25.1 percent; proceedings – 10.3 percent; theses – 4.2 percent; reports – 5.7 percent and other sources – 10.4 percent). These findings are consistent with other studies, indicating that journals form the major part of the literature consulted in the publications of broadly science-based researchers.

For example, Aina and Mabawonku (1997) found that in the publications of information professionals, journals constituted 41.4 percent of the items cited, followed by books, 24.9 percent. Similarly, Edwards (1999) reported an overall journal citation rate of 72.8 percent and 15.4 percent for books (monographs) in his study of polymer science theses and dissertations. These results support the need for libraries to allocate a significant percentage of their budgets to journal subscriptions if they are to support scientific research activities successfully.

Table I Citation counts for different publications

Publication type	Citations						Total
	Theses	Books	Proceedings	Reports	Journals	Others	
MSc thesis (n = 295)	1,123	6,726	2,634	1,335	11,330	2,707	25,855
PhD thesis (n = 21)	90	555	323	148	2,007	287	3,410
Proceedings articles (n = 309)	221	1,240	526	436	1,704	530	4,657
Total	1,434	8,521	3,483	1,919	15,041	3,524	33,922
(%)	(4.2)	(25.1)	(10.3)	(5.7)	(44.3)	(10.4)	

In order to ascertain the currency of publications used for research, the difference in years between when a publication was published and when it was cited (used for consultation) was calculated for each journal citation. The overall average literature age based on 15,041 journal citations was 22.2 years. Aina and Mabawonku (1997), in their study on literature of the information profession in anglophone Africa, reported that majority of the publications used for research were published within ten years of publication. A similar study by Snyder and Bonzi (1998) reports the age of the cited publications among disciplines as follows: all disciplines (13 years); Asian studies (19.1 years); art (16.8 years); chemistry (11.1 years); geology (13.3 years); economics (8.8 years), and sociology (10.9 years).

The average literature age as revealed by this study is on the high side as compared to other studies. There are parallels in this finding with evidence of limited access to current literature noted by other researchers in Tanzania. Results previously reported by Dulle *et al.* (2001) show that a large proportion of the researchers (86.1 percent of 230 respondents) faced a variety of problems in accessing scientific literature. From that study, first, lack of comprehensive journal collections was ranked high, and second, outdated library materials.

Apart from those two major problems researchers reported in accessing scientific literature, other explanations are possible. Arguably, the subscribed journals may not have formed a true core collection due to lack of proper journal subscription criteria. For example, journal subscriptions selected purely on faculty staff opinions might not be the most appropriate.

However, information literacy among library users and the availability of library services such as current awareness services and selective dissemination of information may also affect utilization or underutilization of library facilities. From 1989 to 1999 the Sokoine National Agricultural Library (SNAL) on average subscribed to 184 current journal titles yearly through government subventions and donor funds (except for 1993-1996 when there were no journal

subscriptions). The fact that most of the documents analysed in this study cited older literature than the norm, but were authored by individuals who for the most part did have access to up-to-date collections at SNAL, suggests that probably the available resources were not used optimally. The causes may have been low levels of information literacy among library users or factors related to the services offered by the library during that time.

While information literate library users stand a better chance of utilizing library facilities more effectively, library services such as current awareness services and selective dissemination of information services also play an important role. The need for current awareness services as well as comprehensive user education from our libraries cannot be over emphasized in order to facilitate effective use of existing library resources.

However, it is worth noting that at this period the Sokoine National Agricultural Library advertised quite energetically over the local area network, and on notice boards across the university. In spite of this, statistics on the use of online journals provided by the International Network for the Availability of Scientific Publications, INASP (www.inasp.org.uk/), also revealed low use. Session usage report at SNAL for EBSCO hosted journals during March 2002 indicated that there were 11 logins, and of these not a single full text article was downloaded from the site. This compares with 15 logins and 98 full article downloads for the Institute of Finance Management in Dar es Salaam, and 186 logins and 556 full article downloads from the University of Dar es Salaam.

Rank of journals according to usage and user opinions

In an attempt to establish a list of core agricultural journals for agricultural scientists in the country, two approaches were adopted.

- (1) *Using citation scores.* Journals were ranked by citation counts and those with high citation counts were considered to be of high use and thus ranked accordingly.

- (2) *Using user opinion.* Journals ranked according to user opinions and those with high score were ranked at the top.

Scores obtained from (1) and (2) were merged, thus creating a single list of 650 journal titles. The Appendix provides just the 100 top ranked journal titles. One observation from these results is that a journal ranked high from citations counts is not necessarily ranked equally in user opinions. This observation suggests that a combination of the two methods can be useful if one is to come up with an objective collection management policy. Sharing this view, DeLooze *et al.* (1996) emphasized the combination of user opinions and citation analysis for building a good journal collection. Edwards (1999) further supports the need to consider citation analysis in combination with other quantitative measures in order to develop a more comprehensive picture of users' research needs. And given that, as indicated above, the citation pattern at Sokoine University of Agriculture may have been idiosyncratic, it was important to integrate broader opinions about journal use into the survey as a counterbalance.

If we ignore journals with fewer than ten counts (user opinions and citation counts combined), we obtain another list, this time of 368 journal titles. The cut off point of ten counts is taken for convenience, otherwise the list would be too long and experience has shown that no single library in the country has been able to subscribe to over 400 journal titles a year. Given that this list takes into consideration both citation counts and user opinions, it can be taken to represent a comprehensive journal collection fit to meet the needs of agricultural researchers in the country.

To establish the extent to which our collections at Sokoine National Agricultural Library meet the research needs revealed by the study, a check was made on the occurrence of the listed journal titles in The Essential Electronic Agricultural Library (TEEAL – with over 140 full text journals in CD-ROM format), EBSCO Host, Blackwell or IDEAL Library. At the time of finalising this study, SNAL – considered to be a major, relatively well-resourced library in terms of prevailing national standards – had no journal subscriptions, other than those available via the above facilities. In fact, a number of developing countries, including Tanzania, gain access to electronic journals from EBSCO Host, Blackwells and IDEAL library by means of support from the International Network for the Availability of Scientific Publications (INASP). Thus, it was useful to see to what extent these electronic sources met researchers' needs.

Out of 368 journal titles, 195 (59.9 percent) titles were available either in TEEAL, EBSCO Host, Blackwell or IDEAL Library. Interestingly,

for the first 100 titles, 71 (71 percent) titles were found in the above sources. The question we should then ask ourselves is, can our libraries meet researchers' information needs in the absence of donor support?

Based on experience over the years, no single agricultural library in our country can manage otherwise. The dwindling budgets facing most of our libraries suggest the need for such libraries to use their funds more wisely. Using the limited funds made available to our libraries through government subventions and other income generated internally, the libraries should strive to buy the TEEAL system first (it is relatively cheap – one update with more than 140 full text journals costs \$5,000 per year) and opt for purchase of periodical articles through document delivery rather than journal subscriptions, in anticipation of need. Document delivery is of particular importance to supplement the TEEAL system, which does not cover comprehensively other disciplines such as veterinary medicine and forestry. This way seems more practical in view of limited budgets, although other important factors such as response time in receiving the articles, convenience to the user, and the value of being able to browse a collection to find information need to be considered.

Conclusions and recommendations

Conclusions

Effective access to information is an essential requirement for the success of any research system. Although journals form the major part of the literature consulted by researchers, rising journal prices and the increasing number of journals published are making it more difficult for libraries to provide researchers with all the information they need.

Citation analysis is a useful tool for evaluating the use of libraries' collections. Beyond this – as demonstrated in this study – it can also be used to assess researchers' access to information. Citation analysis combined with user opinions has been shown to be useful in determining a core list of journals critical to agricultural researchers in Tanzania. Based on currently available information resources such as The Essential Electronic Agricultural Library (TEEAL) available in various zonal agricultural research centres in the country, and other electronic journals provided by EBSCO Host, Blackwell and IDEAL Library through INASP it is concluded that most of agricultural researchers' information needs can be met country-wide.

Recommendations

Strengthen resource sharing

The study revealed that it was difficult for researchers from one research station to get access to information resources of another center. This implied non-existence or weak resource sharing among agricultural libraries within the country. Hence, there is a need for the establishment of a document delivery mechanism (resource sharing) among agricultural libraries in the country. With a good resource sharing mechanism, holdings of one library should be equally available to other centers. Current developments in information technology have made it easier for resource sharing by bridging the distance barrier. For example, a researcher from a distant research station can request information from any library and the requested information can be sent to the requester. The Question and Answer Service (QAS) jointly run by the Sokoine National Agricultural Library and Information and Documentation unit of the Division of Research and Development (DRD) supported by the Technical Centre for Agricultural and Rural Cooperation (CTA) is a good start for resource sharing. The service in question provides information (bibliographic references, full text documents, and the like) on demand from different categories of users regardless of their locality. This service should be integrated within other library services so that it is continued beyond CTA's support.

User education/information literacy skills

Sometimes researchers' access to information is constrained by inadequate skills in the effective use of available resources. As a result of the growing information industry, coupled by developments in information technology, it has been difficult for many researchers and other users to cope with such changes. Too much information, both relevant and irrelevant, is made available to the user, especially from the Internet. Obtaining useful information depends on users' ability to exploit available information retrieval systems, since otherwise, the quality of information retrieved deteriorates. Too often the introduction of information technology has taken for granted the knowledge levels of the end users. It is thus important for libraries and other information providers to organize tailor-made training programmes for their active or potential users so that they utilise available information resources effectively. A strategy of incorporating information literacy skills at both undergraduate and postgraduate training will nurture a generation of information literate professionals.

Marketing of information services

It is beyond doubt that some information resources remain unused simply because they are unknown to users. There is thus a need for library and information centers to actively market their services. Introduction or strengthening of current awareness services (CAS) and selective dissemination of information services (SDI) is important for effective use of the available resources. Rather than confining such services to one institution, inter-institutional CAS/SDI is necessary to promote outreach to a wider pool of beneficiaries. This is especially useful for promoting resource-sharing successfully. By knowing what is available from a certain institution, researchers and other users can request information from other, more remote libraries and information centers.

Funding for information services

The majority of library and information centers depend on external donors for acquisition of their information resources. As a result of the absence of such donors, agricultural information services to the research community have suffered. Though part of the blame goes to the government, parent institutions also play their part for not allocating a fair proportion of government subventions to libraries as compared to other units within the institutions. It is thus recommended that government and parent institutions take more responsibility for funding library and information centers, rather than leaving this obligation to external donors.

It is equally important for users of information services to contribute to resourcing information services directly or indirectly. Examples would include direct payment for some of the services such as article orders through document delivery services. Alternatively, indirect payments would be possible by including a component for strengthening institutional information services in research project bids. It should be mandatory, for example, for institutions to have a policy requiring every research project to be charged a certain percentage for library acquisitions.

Journal subscriptions

The study devised a list of 368 core journals, the top 100 of which are shown in the Appendix. This core collection is recommended for use by all agricultural libraries and information centers in the country as a way of objectively selecting journal subscriptions. Since TEEAL has a number of journals in this list, it is recommended that libraries consider acquiring it and its updates, while reserving subscription access for those journals not available in the resource in question. Journals outside the core list should only be

considered for subscription on departmental rather than individual recommendations. Due to the high costs involved in journal subscriptions, libraries should consider setting aside funds for articles ordered through document delivery. For the least used journals it is economical to purchase articles through document delivery rather than subscribing to such journals in anticipation of need.

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Appendix

Table A1 A list of the top 100 core Tanzanian agricultural journals

S/N	Journal title	Citations	Opinion	Rank	Remarks
1	<i>Journal of Dairy Science</i>	474	17	491	T;E
2	<i>Journal of Animal Science</i>	444	27	471	T;E
3	<i>Soil Science Society of America Journal</i>	406	18	424	T;E
4	<i>East African Agricultural and Forestry Journal</i>	262	91	353	E
5	<i>Plant and Soil</i>	222	28	250	T;E
6	<i>Soil Science</i>	241	3	244	E
7	<i>Agronomy Journal</i>	206	37	243	T;E
8	<i>Poultry Science</i>	227	4	231	E
9	<i>Agroforestry Systems</i>	208	22	230	T;E
10	<i>Journal of Agricultural Science</i>	214	6	220	E
11	<i>Animal Production</i>	206	12	218	
12	<i>Animal Feed Science and Technology</i>	186	7	193	T;E
13	<i>Veterinary Record</i>	182	3	185	
14	<i>Australian Journal of Agricultural Research</i>	144	26	170	T;E
15	<i>Forest Ecology and Management</i>	108	57	165	T;E
16	<i>Bulletin of Animal Health and Production in Africa</i>	137	13	150	
17	<i>Journal of Soil Science</i>	117	23	140	
18	<i>World Animal Review</i>	127	2	129	T
19	<i>British Veterinary Journal</i>	111	11	122	
20	<i>American Journal of Veterinary Research</i>	81	34	115	E
21	<i>Small Ruminant Research</i>	105	9	114	E
22	<i>Advances in Agronomy</i>	85	26	111	
23	<i>American Society of Agricultural Engineers Transactions</i>	93	10	103	T
24	<i>Indian Journal of Animal Sciences</i>	103	0	103	
25	<i>Indian Society of Soil Science Journal</i>	102	1	103	T
26	<i>Tropical Animal Health and Production</i>	87	16	103	T;E
27	<i>Soil and Tillage Research</i>	79	23	102	T;E
28	<i>Crop Science</i>	58	40	98	T;E
29	<i>Animal Breeding Abstracts</i>	92	5	97	
30	<i>Nutrition Abstracts and Reviews</i>	88	8	96	
31	<i>Phytopathology</i>	76	18	94	E
32	<i>Tropical Animal Production</i>	82	12	94	
33	<i>American Veterinary Medical Association Journal</i>	91	2	93	
34	<i>Journal of the Science of Food and Agriculture</i>	80	12	92	E
35	<i>British Journal of Nutrition</i>	79	10	89	E
36	<i>Journal of Soil and Water Conservation</i>	59	28	87	T
37	<i>Forest science</i>	73	12	85	E
38	<i>Australian Journal of Experimental Agriculture</i>	74	10	84	T;E
39	<i>Communications in Soil Science and Plant Analysis</i>	78	4	82	E
40	<i>Nature</i>	76	6	82	E
41	<i>Soil Biology and Biochemistry</i>	67	15	82	E
42	<i>Veterinary Parasitology</i>	81	1	82	E
43	<i>Agricultural and Forest Meteorology</i>	70	10	80	E
44	<i>Tropical Agriculture</i>	68	12	80	
45	<i>Experimental Agriculture</i>	62	17	79	E
46	<i>Research in Veterinary Science</i>	72	5	77	E;I
47	<i>Australian Journal of Soil Research</i>	53	20	73	T;E
48	<i>American Journal of Agricultural Economics</i>	47	18	65	T;E
49	<i>Canadian Journal of Animal Science</i>	55	9	64	
50	<i>Canadian Journal of Forest Research</i>	31	33	64	T;E
51	<i>Acta Agriculturae Scandinavica</i>	62	1	63	E
52	<i>Australian Veterinary Journal</i>	62	0	62	
53	<i>Science</i>	56	4	60	E
54	<i>Field Crops Research</i>	16	43	59	E

(continued)

Table A1

S/N	Journal title	Citations	Opinion	Rank	Remarks
55	<i>Journal of Dairy Research</i>	59	0	59	E
56	<i>Theriogenology</i>	47	11	58	E
57	<i>Indian Journal of Dairy Science</i>	56	1	57	
58	<i>Journal of Agricultural and Food Chemistry</i>	54	2	56	T
59	<i>Parasitology</i>	55	1	56	E
60	<i>Tropical Agriculture (Trinidad)</i>	38	18	56	
61	<i>World Development</i>	38	18	56	E
62	<i>Indian Veterinary Journal</i>	53	2	55	T
63	<i>Canadian Journal of Soil Science</i>	43	10	53	E
64	<i>Plant Disease</i>	36	17	53	E
65	<i>Livestock Production Science</i>	32	20	52	T;E
66	<i>World Review of Animal Production</i>	42	8	50	
67	<i>Ambio</i>	16	33	49	
68	<i>British Poultry Science</i>	46	3	49	
69	<i>Commonwealth Forestry Review</i>	35	14	49	T
70	<i>Geoderma</i>	34	15	49	T;E
71	<i>Soil Science and Plant Nutrition</i>	30	19	49	T
72	<i>Tanzania Veterinary Journal</i>	43	6	49	
73	<i>British Grassland Society Journal</i>	47	1	48	
74	<i>Fertilizer Research</i>	38	10	48	
75	<i>Indian Forester</i>	45	3	48	
76	<i>Journal of Forestry</i>	45	3	48	E
77	<i>Journal of Nutrition</i>	47	1	48	E
78	<i>Tropical Grasslands</i>	44	4	48	T
79	<i>Journal of Biological Chemistry</i>	17	30	47	E
80	<i>Weed Science</i>	42	5	47	T
81	<i>Journal of Farming Systems Research and Extension</i>	6	40	46	
82	<i>Norwegian Journal of Agricultural Science</i>	29	17	46	
83	<i>Journal of Reproduction and Fertility</i>	33	12	45	T;E
84	<i>Acta Tropica</i>	41	3	44	E
85	<i>Avian Diseases</i>	33	10	43	T
86	<i>Unasylva</i>	40	3	43	T
87	<i>Agriculture, Ecosystems and Environment</i>	13	29	42	T;E
88	<i>Journal of Hydrology</i>	32	10	42	T;E
89	<i>Journal of Economic Entomology</i>	31	8	39	E
90	<i>Netherlands Journal of Agricultural Science</i>	31	8	39	T
91	<i>Tanzania Science Journal</i>	5	34	39	
92	<i>Journal of Ecology</i>	37	1	38	E;B
93	<i>Journal of Environmental Quality</i>	31	7	38	T;E
94	<i>Journal of Immunology</i>	36	2	38	E
95	<i>Journal of Environmental Management</i>	5	32	37	T;E
96	<i>Water Resources Research</i>	35	2	37	
97	<i>Zimbabwe Journal of Agricultural Research: SADC Journal</i>	15	22	37	
98	<i>Indian Journal of Agricultural Sciences</i>	34	2	36	
99	<i>Journal of Agronomy and Crop Science</i>	9	27	36	E;B
100	<i>Immunology</i>	35	0	35	E

Note: T = TEEAL; E = EBSCO; B = Blackwells; I = Idealibrary

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