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A CITATION ANALYSIS OF ENGINEERING  
LITERATURE CITED BY POST  
GRADUATE STUDENTS OF A.B.U ZARIA

BY

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ABSTRACTS

This study applied citation analysis to the literature of Engineering with the sole aim of determining the core of journals used by Post-graduate Engineering students of A.B.U., Zaria.

The sample of the study consists of sixty (60) theses representing 90% of the total number of theses produced between 1985 to 1990. The Bradford law was applied to give a core of the literature cited.

The study revealed a total of 2,270 citations with journals receiving the highest citation of 927 (40.4%) Six periodical titles were identified as core with a total of 203 (21.907.) citation. The study also revealed that the small core of journal emanate from one single body-American Society of Civil Engineers (ASCE). The study confirmed Waldhart-(1973) revelation that Engineers with academic affiliation cite a significantly higher proportion of journals while Engineers with, non-academic affiliation are more of technical report.

1.0 Introduction

The continuing growth in both Knowledge and subject literatures: and its effective utilisation have become matters of significant concern to contemporary society, especially librarians and information scientists, who have devoted much of their efforts to the study of the structure, communication patterns, and communication habits, of scholars in different subject fields with the view of identifying literatures of high utility of scholars and" to acquire and organised these literatures in such a way as to optimise their usefulness.

A more scientific techniques that is helpful not only in identifying the most useful literatures but also in understanding the structure of subject fields is citation analysis. It is the study of pattern of literature used in a given subject field for the purpose of identifying the core literature that researchers cite most in the course of their research work.

### 1.1 Conceptual Framework

Citation studies are based on the "reference tradition". Weinstock (1970) has explained that this tradition requires that when a reputable scientist or technologist publishes an article, he should refer to earlier articles which relate to his theme. These references are supposed to identify those earlier researches whose concepts, methods, apparatus, etc, inspired or were used by the author in developing his own article.

Brittian and Line (1973) have listed about five possible sources from which references or citations can be collected; Abstracting and Indexing journals; National or general bibliographies; selective or critical bibliographies; primary publication (used directly or by means of science citation Index); Review journals. Therefore for any analysis the choice of sources must depend largely on the aim of the analysis.

Counting citations in articles from primary publication is the method most frequently used for citation studies. It consists of counting the number of times a document is cited in footnotes, references or bibliographies appended to journal articles, books, or secondary journals (i.e abstracting and indexing services). When such citations data are collected for a number of cited documents, the next step is to arrange the cited documents in the decreasing order of frequency of citation. The documents cited the most number of times would be ranked first on the core list, the document receiving the lowest number of citations would be the last item on the list. Such a core list of documents, ranked by the frequency of citations and number of source, items contributed by each title, would provide a simple tool for identifying the significant publications in a subject. Thus citations are very important because they reflect the collective judgement of scientists about the materials they judge relevant to their own work.

Like many subject fields, the literary out put in Engineering has been on a steady increase especially in this age of rapid development of scientific and technological discoveries. In the fore-front of technological development in Nigeria is the Faculty of Engineering at Ahmadu Bello University, Zaria, the oldest in the country and West African sub-region. The faculty which started in 1955 became, in 1962, one of the foundation faculties of A.B.U. and award the

first Nigerian and specifically A.B.U. Engineering degrees in 1965.

Today, the faculty has undoubtedly produced several theses both at the undergraduate and post-graduate levels, as these are one of the requirements for the award of degrees. There is no doubt to the fact that these researchers relied considerably on the works of other scholars during the course of their theses preparation. An examination of the literature used in the production of postgraduate theses with the view of identifying the core literature is the aim of this study.

It is in view of the above that this study sets out to answer the following questions:

- i) What are the characteristic of the cited materials in term of formats?
- ii) Which of the formats is cited most?
- iii) How current are the materials cited?
- iv) What constitutes the core of cited journals in Engineering?

This study has the objective of applying citation analysis to the literature of Engineering with the sole aim of determining the core of journals used by postgraduate Engineering students of Ahmadu Bello University, Zaria.

### 1.2 Assumptions

It is assumed that the analysis of the literature cited by postgraduate students could aid library in planning acquisition policy.

### 1.3 Significance of the Study

The study will greatly assist libraries, especially those in the newly Established Federal Universities of Technology and Polytechnic, in making decision on what to acquire and what percentage of the total budget should be allocated to what material.

The study also reveals to Engineering libraries list of core journals which must belong to the library's collection and which constitute the minimal nucleus of periodicals circulating in the library plus the minimal nuclei of journals devoted to the subjects of most interest to the library's nucleus of users.

#### 1.4 Methodology

The population for this study consists of all the masters and Doctoral Dissertations produced by postgraduate students of Faculty of Engineering, Ahmadu Bello University, Zaria within the period of this study, i.e 1985 - 1990.

A sample of sixty (60) theses was drawn out. This number represents about 90% of the total number of theses which are actually deposited in Kashim Ibrahim Library. Therefore the study does not include those theses that were still with post-graduate school and those lost.

##### 1.4.1 Data Collection

The references found at the end of each thesis were examined. For each reference a bibliographic detail; such as the following were noted in an index card;

- i) Authors
- ii) Title of periodicals
- iii) Title of article or book
- iv) Year of publication

Data from books, proceedings, journals, etc were also collected and used in supporting some of the findings.

##### 1.4.2 DATA ANALYSIS

Following the collection of data on the index cards, the cards were manually sorted and resorted to obtain the following informations:

- i) Forms of publication cited
- ii) Periodicals cited and the core of it
- iii) Age of the cited.

#### 1.5 FINDINGS AND DISCUSSION

##### 1.5.1 Bibliographic format of the citations.

The study revealed a total of 2,270 citations from sixty post-graduate theses in five years. Table I shows two additional formats which Engineers cite that are not usually cited by scientists. These are Technical report and standards/patents/manual.

Technical References to Trade Journals and Monographs  
**TABLE 1: DISTRIBUTION OF BIBLIOGRAPHIC FORMAT OF THE CITATIONS**

<u>FORMATS</u>	<u>Frequently of Citation</u>	<u>Percentages of Citation</u>
Journals	927	40.84
Books	319	27.27
Tech. Reports/Tech.Papers	182	8.02
Proceedings	157	6.92
Seminars/Conferences/ Synopsis	110	4.85
Standards/Patents/Manuals	81	3.57
Bulletin/Records	80	3.52
Dissertations/Theses	60	2.64
Magazines/Newspapers	24	1.05
Reviews	10	0.44
Others (Historical notes, official gazette, etc)	20	0.88
<b>Total</b>	<b>2,270</b>	<b>100.00</b>

Since Engineers of Technologists exhibit almost similar behaviour with scientists in terms of seeking and exchange of information, it is no surprise that journals received the highest citation of 927 accounting for 40.84%. Technical report is an important means used by Engineers in communicating the result of their research and development activities; this fact is confirmed from the third position taken by it in the table. It received a total of 182 (8.02%) citations. This figure is considered low and the low figure may be attributed to the fact that the Engineers under the study are research Engineers who are involve with theoretical information and the concepts of pure science. This group uses journals more frequently as against technical report used by the design Engineers who work in factories and industries and applies existing materials devices and systems to particular situations.

It is interesting to note that the above result is in general agreement with Ullrich's (1973) revelation that engineers with academic affiliations cited a significantly higher proportion of scientific references to society proceedings and transactions, research and developmental journals, monographs, and conference proceedings and symposia, while engineers with non-academic affiliation cited a significantly higher proportion of technical references to trade journals and monographs.

#### 1.5.2 Identification of Periodical cited and the determination of the core journals.

The study identified a total of 234 periodical titles cited by postgraduate Engineering students. The periodicals were published by associations, research institutes and industries related both to Engineering and non Engineering fields and are from different geographical locations the world over.

However, it is discovered that many, estimated at about 40% of the total periodical titles are published in America with a single society - American society of civil Engineers - contributing about ten titles covering many areas of civil Engineering. The study also revealed that 12(5.13%) periodical titles published in Nigeria were cited with journal of Nigerian Institute of Surveyors. The Nigeria Engineer and Nigerian Journal of Engineering and Technology recording the highest citation of 3 each.

The above revelation has serious implication to both individual Engineer and the librarian. To the individual engineer, this will inform him that american journal forms the most valuable and productive journals in Engineering since 80% of them are cited five times and above. To the librarian this will suggest to him that while he can acquire all the 12 periodical titles published in Nigeria, when acquiring foreign Engineering journals about 40% should be acquired from America.

One statistical method that is consistent in determining core journals is the Bradford ZIPF bibliography. Figure 1 represent the Bradford-ZIPF bibliography for the cited journals and it is drawn from the data.

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In Table II  
DISTRIBUTION OF CITATIONS AMONG JOURNALS

No. of Title	Frequency of citation Per title	Cumul- tive of Title	A & B	Cumula- tive of Citation (A & B)	Cumula- tive per centage of Title	Log of cumula- tive of Title
"	B	C	D	E	F	G
1	48	1	48	48	5.18	0.0000
1	36	2	36	84	9.06	0.3010
1	32	3	32	116	12.57	0.4771
1	30	4	30	146	15.95	0.6021
1	29	5	29	175	18.88	0.6990
1	28	6	28	203	21.90	0.7782
1	27	7	27	230	24.81	0.8451
4	23	11	92	322	34.73	1.0414
1	22	12	22	344	37.11	1.0792
2	19	14	38	382	41.21	1.1461
2	18	16	36	418	45.09	1.2041
2	16	18	32	450	48.54	1.2553
1	14	19	14	404	50.05	1.2788
1	11	20	11	475	51.24	1.3010
3	10	23	30	505	54.48	1.3617
4	9	27	36	541	58.36	1.4314
3	8	30	24	565	60.95	1.4771
4	7	34	28	593	63.97	1.5315
3	6	37	18	611	65.91	1.5682
4	5	41	20	631	68.07	1.6128
10	4	51	40	671	72.38	1.7076
17	3	68	51	722	77.89	1.8325
39	2	107	78	800	86.30	2.0294
127	1	234	127	927	100.00	2.3692

Brookes (1969) noted that the point where the initial curvature ends and where the linear portion of the graph takes off is the demarcation of the core. As illustrated in the graph above, the point of intersection is exactly on 203 cumulative titles and this represent only six periodical titles. Hence, these six periodical titles are the core.

While as 234 titles produced a total of 927 citations, only six titles constitute the core with a total of 203 (21.90%) citation. Journal of American Society of Civil Engineers received the highest citation of 48; followed by journal of water pollution control with 36 citations. Journal of Hydraulic engineering received 32 citation; while journal of structure received 30 citations, journal of irrigation and drainage received 29 citations. The core journal that received the lowest citation is journal of American water works Association with 28 citations.

It is interesting to note that, the small core of journals emanate from one single body. They are all from the different divisions of American Society of Civil Engineers. An important implication of this revelation to acquisition librarian is the fact that the study shows where the bulk of the periodical is being produced and concentration on those publishers' lists should be made when new purchases are being considered.

### 1.5.3 AGE OF THE CITED MATERIALS

Studies in citation analysis are increasingly concerned with age as a characteristic of cited literature. It has been confirmed by many scholars that papers in the sciences tend to emphasize current sources in their citation while as humanistic subjects tend to emphasize retrospective sources. The aim of this study is to find out where Engineering subjects lay their emphases.

The study revealed that the oldest cited article was in 1819. There were a total of 256 (27.62%) cited articles published before 1960. The analysis of the percentage of citations made to the last ten years revealed a total of 17.37% while the average age of all reference is 13.6 years.

From the foregoing, one can draw the conclusion that post graduate students of faculty of Engineering, Ahmadu Bello University, Zaria use both recent and old materials. However, they averagely use materials published within the last fourteen years.

### 1.6 CONCLUSION

The study concludes that Engineers or Technologists, especially those with academic affiliation exhibit similar behaviour with scientist by citing more (40.83%) journals than other type of materials. This goes to confirmed - Waldharts (1973) revelation that Engineers with academic affiliation

cite a significantly higher proportion of scientific references to society proceedings and transaction, research and developmental journals, monographs, and conference proceedings and symposia than Engineers with non-academic affiliation who cite a significantly higher proportion of technical references to trade journals and monographs.

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REFERENCES

- Weinstock, M. (1970) Citation Indexes in Encyclopedia of Library and Information Science, 5.
- Britain, M. J. and Line, M. B. (1973) "Documentation Notes; sources of citation and references for analysis purpose: a comparative assessment". Journal of Documentation; 29: 73 - 80.
- Waldhart, T. J. (1973) The relationship between the citation of Scientific Literature and the Institutional affiliation of Engineers. Ph.D Thesis, Indians University 104p. In Dissertation abstracts International, 33: P. 6381-A
- Brookes, B. C. (1969) "Bradford's Law and the bibliography of science". Nature 224: 953 - 956.
- Waldhart, Op. Cit. P. 6381 - A.