Citations in Engineering Doctoral Dissertations: An Obsolescence Study

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ABSTRACT

Impact of library holdings in terms of physical access of doctoral studies in six general universities of Karnataka (Bangalore University, University of Mysore, Mangalore University, Karnatak University, Gulbarga University and Kuvempu University) have been studied based on citation appended to the PhD dissertations in engineering and technology. It's evident that some materials in libraries become outdated as time progresses. This can be referred to as 'obsolescence'. Obsolescence studies are one of the foremost areas of citations, bibliometrics, scientometrics, and infometrics. Citation analysis has usually been generally study the obsolescence of materials, the existence of a core of heavily used sources, and so the sort of the foremost used materials. The problem most often studied in this fashion is that the obsolescence rate of the literature in many subjects of engineering. The study was done to grasp regarding the obsolescence of engineering literature cited in 137 doctoral dissertations of engineering and technology awarded during 1961 to 2008. The study reveals that, the overall of 7467 citations of periodical articles and 2014 book citations are scattered primarily among fifteen subjects. However, citations were derived from early 1990 to after 2001, 86 % of books cited by engineers and technologists in their PhD theses were of 9-39 years recent associated an outsized share of the journal citations (68.58 %) utilised by the researchers was published 20 years back or weres older than the recent ones. It together shows that extra journals literature cited during 1971-2000 equally in books literature cited at intervals of 1961-1990.

Keywords: Obsolescence, citations, bibliometrics, scientometrics, doctoral dissertations, engineering literature

1. INTRODUCTION

The scientific discoveries and inventions are of importance to mankind, if consumers are ready to utilise the obtainable information effectively and significantly. It is so necessary that information is created obtainable for effective utilisation at any levels, so as to profit the society. In view of the information explosion and it results in quantitative and qualitative studies of literature (often branded as bibliometrics, informetrics librametrics and scientometrics) to review and perceive the phenomena of literature, i.e., growth, impact, obsolescence, collaboration etc are typically known as measuring tools. Though technology has given many new gadgets, it becomes mandatory on the part of the professionals to grasp as what to accumulate and the way to produce the needed information to the users particularly in engineering field with least price and at a faster rate[1].

The use of information of a specific discipline or a document reaches a most when an exact period of your time right from its date of publication, and thenceforth, its use gradually declines. This sort of relationship is usually expressed by the term 'obsolescence'. Some documents, on the other hand, continue to see high levels of recognition long when their publication and they become 'Citation Classics'[2]. Obsolescence of literature helps the librarians to keep up the need-based collection of literature. There are many obsolescence studies accessible in the literature as well as several studies have been revealed in Indian journals on doctoral dissertations. However, there are not any studies carried out so far on obsolescence analysis of doctoral dissertations in engineering and technology awarded by the six universities of Karnataka. Thus an attempt has made to understand the journal and books obsolescence

analysis of 137 doctoral dissertations of engineering and technology discipline.

2. REVIEW OF RELATED STUDIES

Citation analysis (reference counting) has generally been used to study the obsolescence of materials. Vimala & Reddy[3] examined the obsolescence of literature in Zoology by citation analysis of 128 doctoral theses in Zoology. Study reveals that the citation frequency follows a negative exponential pattern. Half-life of literature is found to be 13 years for journal citations and 13.27 years for book citations. Another study carried out by Biradar & Kumar[4] examined the obsolescence of literature, annual aging factor, and mean life and utility factor of periodicals in the field of Chemistry. This study based on references appended to the articles published in *Indian Journal of Chemical Technology* during the year 1994, 1997 and 1999. Obsolescence of literature was studied and half-life of literature was found to be 11.8 years. Study also applied Brooke's formula for identifying annual aging factor and the average value was found to be 0.9754 and mean life and utility factor were calculated and found to be 16.1958 and 40.65 respectively. The growth of literature and their obsolescence are usually treated together, because they represent the initial and finial stages of the information cycle.

Whereas Tonta & Umut[5] analysed the bibliometric features of 100 theses and dissertations completed at the Department of Librarianship of Hacettepe University between 1974 and 2002. No correlation was found between the frequency of citations of the most frequently cited journals and their impact factors. Pillai[6] attempted to examine the obsolescence of literature in Physics by citation analysis and reviewed various studies already done in the field and outlined the results. Gunjal & Sangam[7] examined the obsolescence of literature and aforesaid factors in the field of Chemistry based on references appended to the articles published in selected Chemistry periodicals and doctoral theses during 1975–1995. Study reveals that the obsolescence factors such as annual ageing, half-life, mean-life, utility factor for the doctoral theses and the cited journal articles varies from one branch to another in chemistry. Hence these findings have implications in the formulation of policies relating to the planning and organisation and weeding of materials, binding of books and journals, retrospective searching of literature in libraries. Hui[8] carried out study on information aging into three parts: document and information aging, knowledge aging and web information aging, and given each part a specific discussion so as to show the state of information aging study in their country. So far no study has been carried out on the six universities of Karnataka, and this was the rationale of this study and accordingly the following scope and objectives have been lined up.

3. SCOPE OF THE STUDY

The present study attempts to discover the obsolescence rate of engineering literature cited within the scholarly persons' theses awarded in six universities specifically Bangalore University, University of Mysore, Mangalore University, Karnatak University, Gulbarga University and Kuvempu University, all above six universities are located in several geographical locations of Karnataka state. Further, this study focuses on the citations included in scholarly person's theses awarded in ten disciplines of engineering and technology has been covered for the study and elite through systematic sampling methodology. Category wise distribution of the cited items viz. journals, books & monographs, conference proceedings citations and others have been studied. Category wise percentile distribution and availableness of cited items have been calculated. However, this study limits to journals and books obsolescence study, further suggestive approach to re-engineering of assortment development policy of the university libraries have been lined up based on the findings.

4. OBJECTIVES

The objectives of the study are to:

(a) Study the distribution of PhD theses

(b) Take a look at the exponentiality of citation frequency

(c) Study the chronological distribution of journal and book citations, and

(d) Confirm obsolescence and half-life of engineering journal and book citations.

5. METHODOLOGY

This article relies on part of the scholar studies at University of Mysore, Mysore. The study confined to the branches of engineering and technology. Nearly 275 theses were submitted to these six universities throughout the period of 1961-2008. An attempt has been created to collect as many as theses from the six universities for this study. The data for the study has been obtained from 137 theses in the field of engineering and technology submitted by the research students. With this data in hand, there are 7467 citations of periodical articles and 2014 citations of books are scattered primarily among fifteen subjects. The details of the citations appended in each thesis is recorded by exploitation computers with the assistance of pre-designed surpass sheet. Some renowned statistical and bibliometric guidelines are applied for the study. The structure of the topic, its growth, distribution of documents, etc., has been examined in line of the objectives of the study. Finally, data interpretation and findings were recorded with conclusion.

6. DATA ANALYSIS

6.1 University-wise Distribution of PhD Theses

An attempt has been made to gather the chronological distribution of PhD theses for the study. The details of the PhD theses collected data for the study are conferred with in Table 1.

Table 1 reveals that, out of 137 PhD theses collected for the study, a majority 63 (45.98 %) were from Bangalore University, 30 (21.89 %) from University of Mysore, 20 (14.59 %) from Mangalore University, 12 (8.75 %) from Karnatak University, 7 (5.10%) from Gulbarga University , and 5 (3.65 %) from Kuvempu University. It can even be determined that more than 67 % of the theses were from Bangalore University and University of Mysore. Since Bangalore University is oldest University and it has University Visvesvaraya College of Engineering as its constituent college, several research registrations were done and degrees were awarded. Gulbarga and Kuvempu Universities being relatively new universities, less number of PhDs were awarded in Engineering and Technology. It is also determined that although Karnatak University is older than Mangalore University, it has produced only 12 PhDs.

6.2 Discipline-wise Distribution of PhD Theses

The details of the discipline-wise distribution of PhD theses data has been collected and analysed. It reveals that 53 (38.7 %) theses were in Civil Engineering, 38 (27.74 %) in Mechanical Engineering, 19 (13.87 %) in Electrical Engineering, 7 (5.1 %) each in Computer Science and Applied Electronics, 5 (3.64 %) in Chemical Engineering, 4 (2.92 %) in Electronics, 2 (1.45 %) in Aerospace Engineering, and remaning each one in Biotechnology and Mining with 0.73 %.

6.3 Subject-wise Citation of Journal Articles and Books

The subject wise distribution of journal articles and books cited in theses reveals that majority of citations belong to five major subjects i.e., Civil Engineering, Mechanical Engineering, Electrical and Electronics Engineering, Computer Science Engineering and Electronics & Communication Engineering. The subject wise distribution of journals articles and books cited in engineering & technology PhD theses were presented in Table 2.

It is determined from Table 2, that sizable amount of references were from journals (7467) followed by books (2014), also all the references were scattered into primarily among 15 subjects. But nearly 89 % of journals and 86 % of books were connected in five major subject fields as majority of PhD theses under citation study associated with these subjects. Among these five subjects highest

Table 1. University-wise distribution of PhD theses

S. No.	Years	Bangalore University	University of Mysore	Mangalore University	Karnatak University	Gulbarga University	Kuvempu University	PhDs awarded (%)
1.	1961-1970	-	5	-	2	-	-	7 (5.10 %)
2.	1971-1980	3	4	-	1	-	-	8 (5.84 %)
3.	1981-1990	9	4	2	5	2	-	22 (16.06 %)
4.	1991-2000	32	12	14	3	-	-	61 (44.53 %)
5.	2001-2008	19	5	4	1	5	5	39 (28.47 %)
Total		**63**	**30**	**20**	**12**	**7**	**5**	**137 (100 %)**
Percentage		**45.99**	**21.90**	**14.60**	**8.76**	**5.10**	**3.65**	**100 %**

Table 2. Subject-wise citations of journal articles and books

S. No.	Time span	Journals No. of citations (%)	Books No. of citations (%)
2.	Electrical Engineering	1722 (23.06 %)	172 (8.54 %)
3.	Mechanical Engineering	1404 (18.8 %)	502 (24.92 %)
4.	Electronics & Communication	849 (11.37 %)	175 (8.69 %)
5.	Computer Science Engineering	644 (8.62 %)	422 (20.95 %)
6.	Mining/Earth Science/ Geology	126 (1.69 %)	20 (0.99 %)
7.	Mathematics	119 (1.59 %)	56 (2.78 %)
8.	Physics	108 (1.45 %)	37 (1.84 %)
9.	Biotechnology	94 (1.26 %)	3 (0.15 %)
10.	Chemical Engineering & Chemistry	86 (1.15 %)	109 (5.41 %)
11.	Aerospace	63 (0.84 %)	4 (0.2 %)
12.	Management	58 (0.78 %)	13 (0.65 %)
13.	Medicine	41 (0.55 %)	18 (0.89 %)
14.	Biomedical Engineering	38 (0.51 %)	8 (0.4 %)
15.	Bioscience	25 (0.33 %)	12 (0.6 %)
16.	Others	72 (0.97 %)	6 (0.3 %)
Total		**7467 (100 %)**	**2014 (100 %)**

variety journal citations severally 27.03 % are on Civil Engineering, followed by citations on Electrical Engineering (23.06 %), Mechanical Engineering (18.8 %), Electronics (11.37 %) and Computer Science & Engineering (8.62 %). Whereas compared to books citations 24.92 % were on Mechanical Engineering followed by Civil Engineering (22.69 %) citations, Computer Science & Engineering (20.95 %), Electronics and Communication Engineering (8.69 %) and Electrical Engineering (8.54 %). Citations on Mining/ Earth Science/Geology, Physics, Biotechnology, Chemical Engineering and Chemistry, Aerospace, Management, Medicine, Biomedical Engineering, and Bioscience were small in variety and that they all together represent 14.21 % of total number of books citations compared to 10.15 % of journals citations. Since mechanical and civil disciplines are really oldest disciplines among the alternative disciplines this could be the reason for plenty of productivity has been seen at intervals the engineering analysis literature.

6.4 Chronological Distribution of Journal and Book Citations

The chronological distributions of journal and book citations are given in Table 3. The citations from the journals and books are divided into 12 periods having periodicity of ten year each. The citations before 1990 are enclosed within the cluster up to 1900 and also the journal and book citations are after 2001 enclosed 2001+ groups.

It is evident from Table 3 that, the engineers and technologists of the University of Karnataka prefer most of the citations of 1981-1990 (26.77 %), 1991-2000 (23.72 %) and 1971-1980 (20.72 %) periods. It shows that the literature cited by engineers and technologists in their PhD theses cite 71.21 % of

Table 3. Chronological distribution of journal and book citations

S. No.	Years	Journals	Books
		No. of citations (%)	No. of citations (%)
1.	Up to 1900	21 (0.28 %)	6 (0.30 %)
2.	1901-1910	27 (0.36 %)	7 (0.35 %)
3.	1911-1920	32 (0.43 %)	8 (0.40 %)
4.	1921-1930	72 (0.96 %)	16 (0.79 %)
5.	1931-1940	113 (1.51 %)	25 (1.24 %)
6.	1941-1950	225 (3.01 %)	109 (5.41 %)
7.	1951-1960	577 (7.73 %)	211 (10.48 %)
8.	1961-1970	996 (13.34 %)	422 (20.95 %)
9.	1971-1980	1547 (20.72 %)	442 (21.95 %)
10.	1981-1990	1999 (26.77 %)	541 (26.86 %)
11.	1991-2000	1771 (23.72 %)	209 (10.38 %)
12.	2001+	87 (1.17 %)	18 (0.89 %)
Total		7467 (100 %)	2014 (100 %)

journals that are within the period of 1971-2000. Relatively it conjointly discovered from the table 3 that almost 70 percent of the books cited by the scholars were from 1961 to 1900. Books concerning precedent days are least cited and up-to-date books also are less cited.

As time goes on, the information content of the journals and books that were once relevant and of universal application, becomes obsolete. The thought content of the journals and books of old editions has been well-tried to be either wrong or change of approach to several scientific and technical issues. The reasons for changes within the use of literature content could also be invalid or valid however incorporated in later work or outdated by later work.

6.5 Frequency of Journal and Book Citations and their Obsolescence

Obsolescence and age studies of literature are quite common in citation analysis and it involves the decline in use of documents or citation received by documents over a period of time. Table 4 represents the obsolescence of journals and books cited within the engineering and technology doctoral dissertations. A complete of 7467 journal and 2014 book citations were classified into 11 time zones, each having the time length of 10 years.

Table 4. Obselencece of journal and book citations

S. No.	Time Span	Journals	Books
		No. of citations (%)	No. of citations (%)
1.	0-9	989 (13.24 %)	369 (18.31 %)
2.	10-19	2154 (28.85 %)	528 (26.21 %)
3.	20-29	1670 (22.37 %)	496 (24.63 %)
4.	30-39	1296 (17.36 %)	345 (17.13 %)
5.	40-49	673 (9.00 %)	154 (7.65 %)
6.	50-59	348 (4.66 %)	64 (3.18 %)
7.	60-69	148 (1.98 %)	26 (1.29 %)
8.	70-79	82 (1.10 %)	14 (0.70 %)
9.	80-89	39 (0.52 %)	12 (0.60 %)
10.	90-99	37 (0.50 %)	4 (0.20 %)
11.	100+	31 (0.42 %)	2 (0.10 %)
Total		7467 (100 %)	2014 (100 %)

Table 4 reveals that, the engineers and technologists of the universities of Karnataka cite a lot of journals with time span of 10-19 years (28.85 %) equally a lot of books cited (26.21 %), followed by 20-29 years 24.63 % of books against of 22.37 % of journals citations. Whereas, during 30-39 years 17.36 % of journals and 18.31 % of books in 0-9 years. That is, an oversized proportion of the journal citations (68.58 %) employed by the researchers were published twenty years back or were older than the recent ones. The researchers' mostly cite

recent journals in their PhD theses. The analysis shows that there were lots of probabilities for a book to induce citations that was published in the last 20-29 years. The results conjointly indicate that the engineers and technologists prefer to cite current/recent books in their theses.

The half-life period of journals and books cited by the research students were calculated (median year) as 59 years and therefore the mean year of journal and book citations are 49.45.

7. FINDINGS AND CONCLUSIONS

Obsolescence studies are one of the main areas of citations, bibliometrics, scientometrics and infometrics. Citation analysis (reference counting) has typically been used to study the obsolescence of materials, the existence of a core of heavily used sources, and also the style of the foremost used materials. The issue most frequently studied in this manner is to knoe the obsolescence rate of the literature in several disciplines of information. Obsolescence and age studies of literature are quite common in citation analysis and it involves the decline in use of documents or citation received by documents over a period of time. It has been a priority for librarians these days owing to the increasing costs similarly as increasing range of resource (print and on-line journals and books). The studies of the obsolescence of literature facilitate the active library professionals and knowledge scientists to decide that, which document is to be too kept and which is to be discarded, so as to keep up the need-based assortment within the libraries. More the study reveals that, 71.6 % of total citations relate to 37 years old publications. This proves that researchers in engineering and technology are heavily addicted to emergent literature. It's additionally determined that regarding 27.83 % of the cited references were printed before 1970. The entire (7467) periodical articles and (2014) books citations were scattered primarily among every 15 subjects. But the literature cited by engineers and technologists in their PhD theses cite 71.21 % of journals that are within the period of 1971-2000. Giant share of the journal citations (68.58 %) used by the researchers was printed twenty years earlier or is older than the recent ones.

The researcher is most popular to cite old journals in their theses. Further study reveals that nearly 69.76 % of the books cited by the research students are of the period starting from 1961 to 1999. Books touching on earlier period are least cited and recent books are less cited. Majority of (26.86 %) citations are of the period of 1981-90. The results indicate that the engineers and technologists favor to cite current similarly as old books (86 % take advantage of books cited during 9-39 years) in their PhD theses.

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