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1-10-2014

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Gohain, Anjan and Saikia, Dr. Mukesh, "CITATION ANALYSIS OF PH.D THESES SUBMITTED TO THE DEPARTMENT OF CHEMICAL SCIENCES, TEZPUR UNIVERSITY, ASSAM" (2014). *Library Philosophy and Practice (e-journal)*. Paper 1066.
http://digitalcommons.unl.edu/libphilprac/1066

CITATION ANALYSIS OF PH.D THESES SUBMITTED TO THE DEPARTMENT OF CHEMICAL SCIENCES, TEZPUR UNIVERSITY, ASSAM

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ABSTRACT:

The present study is based on 10983 citations, appended in the 30 PhD theses of chemical sciences submitted to Tezpur University, Assam for the award of doctoral degree during the period 2008-2012. The main purpose of this study was to investigate authorship pattern of the citations, type and form of literature cited, and compiled a rank list of core journals in chemical sciences. The study revealed that journals were the most preferred sources of information used by the researchers in the field of chemical sciences accounting for 78.83% of total citations, followed by books with 15.57 % citations. The Journal of Journal of American Chemical Society has ranked the first with 617 citations accounting for 7.13% of the total journal citations. Journal of Molecular Catalysis a: Chemical 6.57% occupies the second rank getting 569 citations, followed by Macromolecules 6.27% with 543 citations. Authorship pattern for journal citations shows that most of the citations were contributed by more three authors that mean the collaborative research is prevailing in chemical sciences. The findings of the study revealed that out of the total number of 8658 journal citation, 39.89% are by more than three authors, followed by two authors with 22.28 %.

Keywords: Citation Analysis; Bibliometric Study, Authorship Pattern; Journals Ranking; Bibliographic Form; Ph.D. Theses; Tezpur University; Chemical Sciences.

1. INTRODUCTION:

Citation analysis is the analysis of the citation or bibliographical reference that is appended with the research communication. It studied citations in scholarly works to establish links to other works or other researchers by counting the citations appended at the end of each scientific article. The citations normally provide the bibliographic data about the used documents. Citation analysis is useful for understanding subject relationships, authorship pattern, impact, publication trends, and bring out useful information like the relative use of different kinds of documents such as books, periodicals, e-resources, reports, Ph.d thesis, conferences, standards, patents etc. which can be better utilized for bibliometric studies in many respects. Citations analysis is one of the popular methods employed in recent years to identify the core references in a subject. With citation analysis one can evaluate and interpret citations received by

articles, authors, institutions, and other indications of scientific activity. Thus it helps to identify the quality of the information sources.

The Tezpur University was established in 1994. The Department of Chemical Sciences was started in the year 1997. In the beginning it offered M. Sc. course in Polymer Science. From July 2006 the Department has been offering M. Sc. program in Applied Chemistry with specialization in Catalysis, Medicinal Chemistry and Polymer Chemistry. Presently the Department is offering 5-year Integrated M. Sc. in Chemistry, M. Sc. in Chemical Sciences and M. Tech. in Polymer Science and Technology. The Department has also been offering Ph. D. programs in the broad areas of Chemistry such as Organic Chemistry, Inorganic Chemistry, Bio–inorganic Chemistry, Surfactants, Water Treatments, Polymer Chemistry, Theoretical and Computational Chemistry, Catalysis and Nan particles.

2. OBJECTIVES OF THE STUDY:

- To identify the most cited sources of information consulted by the researchers in chemical sciences.
- To identify the authorship pattern and degree of collaboration in chemical sciences research.
- To identify average number of references cited per theses.
- To determine the year wise distribution of theses submitted in the department. of chemical sciences
- To determine the most frequently cited journals in chemical sciences.
- To prepare a rank list of core journals of chemical sciences in order of their frequency of citation.

3. LITERATURE REVIEW:

Banateppanvar, K, Biradar, B. S and Kannappanavar, B.U (2013)[1] studied doctoral theses of botany, submitted to the Kuvempu University during the years 2000-2006. Findings revealed that journals were the most preferred sources of information used by the researchers in the field of botany, accounting for 74.77 % citations. Authors found that major citations come from journal literature. Authorship pattern for journal citations shows that most of the citations were contributed by multi authors. Gupta, J. & Khare, V. P. (2013)[2] studied research performance monitoring the researchers of Dr. Harisingh Gour University, Sagar using citation analysis. Findings revealed that the most of the cited sources were journals. Authors found that most of the contributions of journals were from USA, and the most cited journals are IASLIC Bulletin with11.89% citation, followed by ILA Bulletin with 9.35% citation occupies the second rank. Singh, K.P and Bebi (2013)[3]studied citation analysis of PhD theses submitted in the department of sociology of the University of Delhi during 1995-2010. The study was based on the 5766 citations taken out from 25 PhD theses of sociology. Authors found that highest number of citations was single authored 83.94 %, and 67.23 % citations were from books and only 22.20 % citations were from journals. The country-wise scattering of citations revealed that 2536 (45.52 %) citations were from India, followed by USA and UK. Goyal, V., Gupta, G.K. and Kumar, A. (2013)[4] studied authorship trends and

collaborative research in the field of chemical sciences based on the data collected from Indian Journal of chemistry section-B (IJCB) published during the 2002-2011. Findings revealed that multi authored articles 97.24% prevail the single authored articles 2.75%. The degree of collaboration in the field of chemical sciences is 0.97 and average number of authors per paper varies from 3.21-3.78. Banateppanvar1, K and others (2013)[5] studied the materials cited in doctoral theses of the Zoology, submitted to the Kuvempu University, India during the year 2002 to 2006. Findings revealed that journals were the most preferred sources of information used by the researchers in the field of Zoology accounting for 74.47% of total citations followed by books and monographs 18.02% citations. Citations from conference proceedings, theses, reports, patents and news papers were also found. It is also observed that researchers were taken advantage of internet resources. The Journal of Mutation Research occupied first rank with 94 citations accounting for 5.71% of the total journal citations. It is observed that major citation from journal literature and maximum numbers of cited materials were contributed by multi authors and degree of collaboration is 0.71. Banateppanvar, K., Biradar, B.S. and Kannappanavar, B.U. (2013)[6] studied citation analysis of doctoral theses in biotechnology submitted to Kuvempu University, Karnataka. Authors found that journals were the most preferred sources of information used by the researchers in the field of biotechnology accounting for 79.72% of total citations. Citations from books, proceedings, theses, reports and patents are also found. Plant cell tissue & org .cult (Netherlands) has ranked the first with 121 citations accounting for 4.16% of the total journal citations. Further, Bradford's Law of Scattering was applied. It is observed that major citation from journal literature, besides that study examined the authorship pattern more cited materials were contributed by multi authors and degree of collaboration is 0.85. Zafrunnisha, N. (2012)[7] examined 9,162 citations, appended in the 77 doctoral theses of sociology submitted to Sri Venkateswara University, Tirupati and Osmania University, Hyderabad for the award of doctoral degree during the period 1974-2005.Author investigated the distribution of authorship pattern, bibliographic form, core journals, country, language, subject wise distribution of journal citations and core periodicals. Author found that sociology researchers in both the universities referred mostly book source rather than other sources. Most of the publications cited by the sociology researchers were published by developed countries and all the citations were published in English language only. Kumar, K and Reddy, T.R (2012)[8] studied citations in master's degree dissertations submitted to the department of library and information science, Sri Venkateswara University, Tirupathi during the period 2000 – 2007. Findings showed that journals were the most utilized reference materials in the dissertations. Trayambakrao, K.D and Sonwane, S (2012)[9] studied 2876 citations appended in 34 theses of Economics submitted to Dr. Babasaheb Ambedkar Marathwada University the year 2000-2010. Authors carried out this study to find the types of cited document, the chronological distribution of cited documents, the authorship pattern of cited document, the rank list of cited journals-books, the language wise distribution, geographical distribution of cited documents, the rank list of cited web – sources and the cited authors. Haldua, H; Arya C and Kaushik, A. (2012)[10] studied citation analysis of dissertations in molecular biology and biotechnology submitted by the doctoral students of the molecular biology and biotechnology sciences at the G. B. Pant University of Agriculture and Technology, Pantnagar, India. Authors aim to assist the library collection development in order to fulfill the needs of scientists and research

scholars. The findings of the study showed that citation analysis is a valid, reliable and practical method to provide reasonably accurate information on the use of molecular biology and biotechnology literature by doctoral students. Publishing research in high-quality journals is an integral part of academic life. Therefore, researchers often refer to journal rankings when making decisions to submit and publish their research findings. Mishra, D.K Gawde, M and Solanki, MS (2012)[11] attempted to know the citation pattern of research scholars of English by using bibliometrics techniques. . Elango, B. and Rajendran, P. (2012)[12] examined the authorship trend and collaboration pattern in marine sciences literature. Findings revealed that the co-authored papers were dominated in the field of marine sciences. Hussain ,A and Swain, D. K (2011)[13] studied the top papers of computer science as reflected in Science Direct to find out authorship pattern, ranking of authors, ranking of country productivity, ranking of journals, and highly cited papers of computer science. Authors found that out of 495 top papers; three-authored articles are little ahead than two authored articles followed by four-authored articles and in respect of country wise productivity USA is at the top followed by UK, Taiwan, Chaina, and Canada. Finding also revealed that European Journal of Operational Research occupies the top position followed by Computers in Human Behavior, and Pattern Recognition. Shafi, S. M and Gazi,W.(2005)[14] studied of one hundred doctoral dissertations submitted to Kashmir University during the period 1980-2000 in the field of natural sciences. Authors found that the number of citations given in support of literature review is not adequate which does not exceed 50-100 citations in 32 %theses. The highest citations are from journals followed by seminar proceedings. The half life of journal citations is 37 years. It shows non use of adequate literature in the respective fields. The maximum number of journal use pertain to 1982-91 and 1972-76 which is, on the other hand, significant indicator for the use of recent journals subscribed by the institutions Nasir,J and Kumar,D(2010)[15] studied 4,875 citations in the doctoral dissertations submitted between 1990-2010 in the department of economics, Aligarh Muslim University, Aligarh, India to ascertain the authorship patterns, distribution of literature by format, language, country and decade, and ranking of journals by citation frequency,. Findings revealed that books were the most dominant form in which information is communicated in economics. The dominant language of the literature cited is English and the single authorship prevails in the citations.

4. METHODOLOGY:

Keeping in view the objective of the present study necessary data has been collected from 30 doctoral theses submitted in the department of chemical sciences of Tezpur University, Assam, India from 2008-2012. The bibliographical references which were used by the researchers for completing the theses at the end of each chapter and end of the doctoral theses were taken as the source of data for the study. For this purpose each book, journals, patent, web resources, standards/technical reports PhD these, and seminar/conference proceedings etc. were taken for analysis. The collected data was classified, tabulated, presented, analyzed and interpreted with the help of tables. The study presents analysis of several parameters like authorship pattern, forms of literature, and finally a list of core journals was compiled and prepared on the basis of highly cited articles of the journals in chemical sciences.

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Findings and analysis:

Table 1: Year-wise Distribution of theses

Sl.No	Year	Number of theses	Percentage
1	2008	3	10.00
2	2009	5	16.67
3	2010	8	26.67
4	2011	7	23.33
5	2012	7	23.33
		30	100

Table 1 shows the year-wise distribution of theses submitted to the department of chemical sciences, Tezpur University. A maximum number of 26.67 %(08) theses were submitted in the year 2010. 23.33 %(07) theses submitted in the year 2011 and 2012, followed by 16.67 % (5) in 2009, and 10.00% (3) theses in the 2008. It is observed in the table that the highest number of PhD degrees (08) was awarded in chemical sciences by Tezpur University during the year 2010.

Table 2: Average number of citations per theses

Sl.No	Year	Total number of thesis	Total no of citations	Average citation per thesis
1	2008	3	1276	425.33
2	2009	5	1788	357.60
3	2010	8	2455	306.88
4	2011	7	2534	362.00
5	2012	7	2930	418.57
		30	**10983**	**366.10**

Table 2 revealed the data regarding the average number of citations per theses. It is observed from the study that on an average 366.10 citations were cited per theses by the chemical science research scholars. The highest number of citations per theses 425.33 was found in the year 2008 and the lowest average number of citations 306.88 was found in the year 2010.

Table 3. Authorship pattern of journal citations in chemistry

Sl.No	Authors	Total no. of citations	Percentage of citation
1	Single Author	1399	16.16
2	Two	1929	22.28
3	Three	1876	21.67

4	Multiple authors papers	3454	39.89
	Total	**8658**	**100**

Table 3 shows the authorship pattern of journal citations .It revealed that out of 8658 journal citation ,39.89%(3454) were by more than three authors, followed by two authors 22.28 %(1929),three authors 21.67%(1876) and single author covers only 16.16% (1399). It is observed that majority of the cited documents were by multiple authors papers that means the collaborative research is prevailing in chemical sciences.

Table 4: Distribution of citations according to bibliographic format

Sl.No	Bibliographic format	Total No. of Citations	Cumulative citations	Percentage of Citation	Cumulative percentage
1	Journals	8658	8658	78.83	78.83
2	Books	1710	10368	15.57	94.40
3	Seminar//Conference Proceedings	191	10559	1.74	96.14
4	Ph.D .Theses	18	10577	0.16	96.30
5	Patent /Standards/Technical Reports	241	10818	2.20	98.50
6	Web Resources	165	**10983**	1.50	**100**
	Total	**10983**		**100**	

Table 4 shows the distribution of citations by bibliographic format in the field of chemical sciences. It is observed from the table that the journal contributes the highest number of citations accounting for 78.83% (8658) of the total citations. This revealed that journals are the most preferred sources of information used by the researchers in the field of chemical sciences .Books were the second most cited source accounting for 15.57% (1710) of the total citations. The next preferred source of information for chemical science research scholars is the Patent /Standards/Technical Reports which is 2.20 % (241), followed by seminar/conference proceedings 1.74% (191), 1.05% (165) Web resources and Ph.D .Theses 0.16% (18) citation. It is found that journals and books are widely used format by the researcher of university when compared to other sources of information.

Table 5: Rank list of core journals in chemical sciences

SL.No	Name of the journal	No. of citation	Cumulative citations	Percentage	Cumulative percentage	Rank
1	Journal of American Chemical Society	617	617	7.13	7.13	1
2	Journal of Molecular Catalysis A: Chemical	569	1186	6.57	13.7	2
3	Macromolecules	543	1729	6.27	19.97	3

4	Chemical Reviews	477	2206	5.51	25.48	4
5	Tetrahedron Letters	456	2662	5.27	30.75	5
6	Inorganic chemistry	442	3104	5.11	35.86	6
7	Journal of Polymer Science Part A: Polymer Chemistry	369	3473	4.26	40.12	7
8	Journal of Organic Chemistry	353	3826	4.08	44.2	8
9	Journal of Applied Polymer Science	248	4074	2.86	47.06	9
10	Angewandte Chemie International Edition	246	4320	2.84	49.9	10
11	Tetrahedron	237	4557	2.74	52.64	11
12	Polymer	231	4788	2.67	55.31	12
13	Coordination Chemistry Reviews	228	5016	2.63	57.94	13
14	Journal of Supercritical Fluids	219	5235	2.53	60.47	14
15	Inorganica Chimica Acta	211	5446	2.44	62.91	15
16	Polyhedron	182	5628	2.1	65.01	16
17	Molecular and Cellular Biochemistry:	152	5780	1.76	66.77	17
18	Industrial & Engineering Chemistry Research	151	5931	1.74	68.51	18
19	Applied Catalysis A	144	6075	1.66	70.17	19
20	Reactive and Functional Polymers	142	6217	1.64	71.81	20
21	Chemical Communications,	107	6324	1.24	73.05	21
22	Organometallics ,	99	6423	1.14	74.19	22
23	Catalysis Communications	91	6514	1.05	75.24	23
24	Accounts of Chemical Research	89	6603	1.03	76.27	24
25	Green chemistry	77	6680	0.89	77.16	25
26	European Polymer Journal	73	6753	0.84	78	26
27	Pure and Applied Chemistry	73	6826	0.84	7 8.84	26
28	Dalton Transactions	69	6895	0.81	79.65	27
29	Journal of Catalysis	65	6960	0.75	80.4	28
30	Journal of Chemical Society, Dalton Transactions	59	7019	0.68	81.08	29

31	Langmuir	56	7075	0.65	81.73	30
32	Journal of Organometallic Chemistry	53	7128	0.61	82.34	31
33	Macromolecular Rapid Communications	50	7178	0.58	82.92	32
34	Journal of Polymer Research	49	7227	0.57	83.49	33
35	Journal of Biological Chemistry	47	7274	0.55	84.04	34
36	Journal of Inorganic Biochemistry	45	7319	0.52	84.56	35
37	Journal of Medicinal Chemistry	44	7363	0.51	85.07	36
38	Journal of Physical Chemistry A	42	7405	0.49	85.56	37
39	Macromolecular Symposia	41	7446	0.47	86.03	38
40	Advances in Polymer Science	39	7485	0.45	86.48	39
41	Chemistry - A European Journal	38	7523	0.44	86.92	40
42	Journal of Chemical Society, Perkin Transactions	36	7559	0.42	87.34	41
43	Journal of Physical Chemistry B	35	7594	0.41	87.75	42
44	Organic Letters	33	7627	0.38	88.13	43
45	Macromolecular Chemistry.	32	7659	0.37	88.5	44
46	Reactive Polymers	31	7690	0.36	88.86	45
47	Journal of Controlled Release	29	7719	0.33	89.19	46
48	Biochemistry	29	7748	0.33	89.52	46
49	Powder Technology	28	7776	0.32	89.84	47
50	Synlett	26	7802	0.3	90.14	48
51	Journal of Chemical Physics	24	7826	0.28	90.42	49
52	Biological Trace Element Research	22	7848	0.25	90.67	50
53	Bioorganic & Medicinal Chemistry Letters	22	7870	0.25	90.92	50
54	Macromolecular Chemistry and Physics	21	7891	0.24	91.16	51
55	Science	20	7911	0.23	91.39	52
56	Chemical & pharmaceutical bulletin	20	7931	0.23	91.62	52
57	Catalysis Today	19	7950	0.22	91.84	53

58	Chemistry of Materials	18	7968	0.21	92.05	54
59	Current Opinion in Solid State & Materials Science	16	7984	0.18	92.23	55
60	Journal of Chemical Society D: Chemical Communications(London)	15	7999	0.17	92.4	56
61	Journal of Colloid and Interface Science	15	8014	0.17	92.57	56
62	Journal of Materials Chemistry	14	8028	0.16	92.73	57
63	Journal of Trace Elements in Medicine and Biology	14	8042	0.16	92.89	57
64	Materials Chemistry and Physics	13	8055	0.15	93.04	58
65	Progress in Polymer Science	12	8067	0.14	93.18	59
66	Archives of Biochemistry and Biophysics	11	8078	0.13	93.31	60
67	Catalysis Letters	10	8088	0.12	93.43	61
68	Chemical Society Reviews	10	8098	0.12	93.55	61
69	Inorganic Chemistry Communications	10	8108	0.12	93.67	61
70	Journal of Scientific and Industrial Research	9	8117	0.1	93.77	62
71	New Journal of Chemistry	9	8126	0.1	93.87	62
72	Process Safety and Environmental Protection...	9	8135	0.1	93.97	62
73	Synthetic Communications	9	8144	0.1	94.07	62
74	Nature	8	8152	0.09	94.16	63
75	SYNTHESIS	8	8160	0.09	94.25	63
76	Advanced Materials	8	8168	0.09	94.34	63
77	Chemtech	8	8176	0.09	94.43	63
78	Chinese Chemical Letters	8	8184	0.09	94.52	63
79	Colloids and Surfaces A: Physicochemical and Engineering	8	8192	0.09	94.61	63
80	Composites Science and Technology	8	8200	0.09	94.7	63
81	ENERGY FUELS.	8	8208	0.09	94.79	63
82	Fuels	7	8215	0.08	94.87	64

83	Journal of Chemical Society, Chemical Communications	7	8222	0.08	94.95	64
84	Journal of Chromatography	7	8229	0.08	95.03	64
85	Journal of Enzyme Inhibition and Medicinal Chemistry.	7	8236	0.08	95.11	64
86	Natural Product Reports	7	8243	0.08	95.19	64
87	Polymer Degradation and Stability	6	8249	0.07	95.26	65
88	RSC Advances	5	8254	0.06	95.32	66
89	Talanta	5	8259	0.06	95.38	67
90	Chemical Science	4	8263	0.05	95.43	68
91	Journal for Nanoscience and Nanotechnology (JNN)	4	8267	0.05	95.48	69
92	Journal of Macromolecular Science, Part A. Pure and Applied Chemistry	4	8271	0.05	95.53	70
93	45 Journals with 3 Citations each	135	8406	1.56	97.09	71
94	52 Journals with 2 Citations each	104	8510	1.2	98.29	72
95	148 Journals with 1 Citations each	148	**8658**	1.71	**100**	73
		8658		**100**		

Table 5 shows that total 337 journals with 8658 citations arranged in the order of decreasing number of their rank. The journal with the highest number of citations occupies the highest rank and thus found most important journal in the field of chemical sciences, while the least important titles are placed at the bottom of Table 5. *Journal of American Chemical Society* occupies the first rank as the most preferred journal having been cited 617 times. *Journal of Molecular Catalysis a: Chemical* 6.57% occupies the second rank getting 569 citations, followed by *Macromolecule*s *6.27% with 543 citation and Chemical Reviews* 5.51 % with 477citations occupied fourth rank. The first ten journals in the ranking list together account for 49.90 % of the total citations. Table 5 also shows that the first 50 Journals out of 337 total ranked journal covers 90.14 % of citations, while the remaining 287 journals together account for 9.86 per cent of citations

FINDINGS

In the present study 10983 citations were analyzed from 30 PhD theses in chemical sciences. On the basis of the above study the following conclusions are drawn:

- It is observed in the study that the highest number of Ph.D degrees (08) was awarded in chemical sciences by Tezpur University during the year 2010.

- It is observed from the study that on an average 366.10 citations were cited per thesis by the chemical science research scholars. Further, highest number of citations per thesis is 425.33 was found in the year 2008 and the lowest average number of citations 306.88 was found in the year 2010.
- Findings revealed that out of the total number of 8658 journal citation ,39.89%(3454) were by more than three authors, followed by two authors 22.28% (1929) and single author covers only 16.16%(1399) .
- Authorship pattern for journal citations shows that most of the citations were contributed by more three authors that proved the fact that chemical sciences research is collaborative in all aspects.
- The analysis of citations according to the bibliographic forms revealed that the journal contributes the highest number of citations accounting for 78.83 %(8658) of the total citations. This revealed that journals were the most preferred sources of information used by the researchers in the field of chemical sciences, which shows not only their importance in communicating scholarly literature but also dependency of researchers on journals for their research work. Books were the second most cited source accounting for 15.57 %(1710) of the total citations. The next preferred source of information for chemical science research scholars were the patent /standards/technical reports which were 2.20% (241) followed by seminar/conference proceedings 1.74%(191).
- It is found that journals and books were widely used format by the chemical sciences researcher of university.
- The rank list of journals in the field of chemical science revealed that journal citations cited by researchers were scattered among 337 journals. *Journal of American Chemical Society* occupies the first rank as the most preferred journal having been cited 617 times. *Journal of Molecular Catalysis a: Chemical* 6.57% occupies the second rank getting 569 citations, followed by *Macromolecule*s *6.27% with 543 citation and Chemical Reviews* 5.51 % with 477 citations.
- The first ten journals in the ranking list together account for 20.53 % of the total citations. However, table shows that first 50 Journals accounted for nearly 73.57% of citations. While the remaining 287 journals together account for 9.86 per cent of citations.

CONCLUSION

Citation analysis in any research activities has become one of the popular methods to study subject relationships, authorship pattern, impact, publication trends, and to identify core journal in a particular subject field or for a particular scientific community. It is evident from the citations that Ph.D research scholars of the department of chemical sciences, Tezpur University consulted enormous literature while preparing their dissertations. This study revealed that journals are the most preferred sources of information used by the researchers in the field of chemical sciences..*Journal of American Chemical Society* occupies the first rank as the most preferred journal having been cited 617 times. *Journal of Molecular Catalysis a: Chemical* 6.57% occupies the second rank getting 569 citations, followed by *Macromolecule*s *6.27% with 543* citations.

First 50 Journals out of 337 total ranked journal covers 90.14 % of citations, while the remaining 287 journals together account for 9.86 per cent of citations. This rank list of journals is very useful in the acquisition of periodicals in the library and could also help in evaluating the importance of journals. It helps librarians and researchers to select the journals of greater importance in a particular subject area. This kind of studies will also be helpful to recognize researcher's information needs and requirements and can serve as feedback to the librarians in the selection and acquisition of most useful journals within the budget constraints.

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