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CITATION ANALYSIS OF PH.D. THESES SUBMITTED TO PANJAB UNIVERSITY, CHANDIGARH (INDIA) DURING 2002-2012

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CITATION ANALYSIS OF PH.D. THESES SUBMITTED TO PANJAB UNIVERSITY, CHANDIGARH (INDIA) DURING 2002-2012

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And

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Abstract:

University libraries are playing an important role to collect and organize the records of knowledge to support teaching and research programmes. Citation analysis is very helpful for Librarian to know researchers literature usage patterns, and helps to analyse the most useful journals to subscribe. In this paper, citation analysis is engaged in studying Ph.D. theses submitted to the Department of Economics, Panjab University Chandigarh, during the period (2002 – 2012) with a view to find out citation practice in the thesis. Citation analysis is a important component of bibliometric studies. The bibliometric studies help to assess research publications and help to produce information which can be used by information experts, decision makers, and experts. This research paper will be helpful tool for assessment of research works in Economics and demonstrate with facts and figures research publications in the field of Economics.

Keywords: Citation analysis, Economics, Ph.D. Theses, Panjab University, Chandigarh,

Department of Economics (Panjab University, Chandigarh)

As per Handbook of Information (2015), the Department of Economics was established in 1951 and has the honour of producing many well-known economists like Dr. Manmohan Singh (Prime Minister of India), Late Dr. G.K. Chadha (former member Prime Minister's Economic Advisory Council and former Vice-Chancellor, Jawaharlal Nehru University) and Dr.

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B S Minhas. Currently, the department offers five Years integrated programme in Economics (B.A. Hons.), M.A. and M.Phil courses as well as opportunities for doctoral research. The department has a total of seven full time faculty members. 90 research scholars have already been awarded the doctoral degree since the inception of the department and 80 research scholars are currently pursuing their research work for the award of doctoral degree. Thrust areas of research include Agricultural Economics, International Economics, Money and Banking, etc.

Review of Literature

Sasikala and Raju (2008) in their paper entitled ‘Information use pattern in Economics’ analyzed 24,699 citations from 192 doctoral theses awarded by Andhra University during 1950-2002. The findings of their study revealed that majority of the citations were from books (38%), followed by journals (35%). The subject distribution of doctoral theses revealed that more than half of the theses submitted were on ‘Industrial Economics’, followed by ‘Labor Economics’. Their study also found that works of single authorship were predominant and half-life of literature in Economics was found to be 14½ years. **Burman and Sheela (2011)** in their paper entitled ‘Citation analysis of dissertations of Law submitted to University of Delhi’ analyzed 3,052 citations from 33 LL.M (Master of Law) dissertations and found that 25.52% citations were from journal articles, followed by 22.21% citations from books. They observed that single authorship was more predominant (79.84%) in comparison to multiple authors. Majority of the cited journals were published from USA (41%), followed by India (37.41%) and UK (12.23%). 69.78% periodicals cited were from the field of Law, followed by Science and Technology (10.79%), Social Sciences (9.35%), Economics (7.9%) and Education (2.15%). 31.45 % papers were cited within five years of their publication and half-life of periodicals in the field of Law was found to be 11 years. **Trayambakrao and Sonwane (2012)** in their paper entitled ‘Citation analysis of Ph.D. theses on Economics submitted to Dr. Babasaheb Ambedkar Marathwada University’ analysed that most cited documents were books (57.86%) and remaining 42.14% citations were from reports, journals, government publications, theses and others. The chronological distribution of citations shows that maximum number of citations (33.97%) was to publications published during 1999-2008. The authorship pattern of citations indicates that the

single author citations were more in number (72.81%) than others. The language wise distribution of citations show that 1505 documents (52.33%) cited were in English language. The geographical distribution shows that Indian literature was mostly cited by the researchers (68.57%). The ranking of web citations show that only 26 citations (0.90%) were web citations and remaining 2850 citations (99.10%) were print citations. Hence, their study revealed that the printed resources were mostly preferred by the researchers than the web-citations.

Statement of the Problem

Citation analyses helps in formulating the need-based collection building policy and also help to provide authentic data to inform the librarians, information Manager, Information Officers, Documentation officer to make thoughtful decisions in the documents' selection. It helps the Librarians in evaluating the existing library collection and help to take decision which collection, specially the journals, is to be kept or discarded from the library and eventually helps in making decisions for the collection development policy. In view of the above, the present study was designed to investigate the citation analysis of Doctoral dissertation submitted in the field of Economics, at Panjab University, Chandigarh in order to find out the ranking of the cited journals, half life of journals and books, authorship pattern, their geographical and chronological distribution, etc. It will help the librarians to budget their resources depending on the usage of their collection.

Objectives of the study:

The objectives of the present study included:

1. To observe the nature of authorship pattern in the field of Economics.
2. To examine the half-life of books and journals in the discipline of Economics.
3. To observe the chronological distribution of citations in Economics discipline.
4. To determine the national and international coverage of citations in Economics discipline.
5. To study the distribution of citations of different information sources and their formats.
6. To determine the ranking of most cited journals in Doctoral theses in the field of Economics.

7. To assess the availability of the highly cited journals in Panjab University, Chandigarh.

Research questions

The present study sought answers to the following questions:

1. What is the trend of authorship pattern in the Economics disciplines?
2. What is the half-life of literature used in the discipline of Economics?
3. What is the average age of cited material in the Ph.D. theses submitted in Economics at Panjab University?
4. Which are the top cited journals in the field of Economics at Panjab University?
5. Which type of reading material is preferred by the Economics researchers at Panjab University?
6. What are the most cited items in the Doctoral theses submitted in the field of Economics at Panjab University?
7. What is the average number of citations per thesis submitted in Economics at Panjab University?

Research Methodology

As per the objectives of the study, various research methods were explored. For this research paper, data was collected from 32 Ph.D. theses submitted during 2002-2012 in the department of Economics at Panjab University (Chandigarh). Firstly, researcher selected the theses (i.e., the source document) from which the data was collected. Citation/Bibliography of each thesis was recorded in MS-Excel and used wherever appropriate to analyse the data. The collected data was based on the objectives of ranked list of journals, authorship pattern of books and journals, chronological pattern of cited sources, geographical pattern of cited sources, etc.

Data Analysis Techniques

The data was analysed by using the appropriate methods and bibliometric laws. The simple counting citation methods and Bradford's Law was applied to find out the core journals in the field of Economics.

Data Analysis and Interpretations

As shown in table 4.1, a total of 32 Ph.D. theses were submitted in the Department of Economics during 2002-2012, in which 6229 sources were cited by the researchers. The following section analyses the citations of such theses on the basis of various dimensions like year of submission, form of cited documents, authorship pattern, etc.

Year-wise submission of Ph.D. theses

Table 1 shows the year wise submission of Ph.D. theses in the Department of Economics at Panjab University (Chandigarh) during 2002- 2012.

Year of submission	No. of Ph.D. theses submitted	%
2002	3	9.38
2003	3	9.38
2004	4	12.50
2005	1	3.13
2006	1	3.13
2007	6	18.75
2008	3	9.38
2009	3	9.38
2010	3	9.38
2011	3	9.38
2012	2	6.25
Total	32	100

Table 1: Year-wise submission of Ph.D. theses submitted in the Department of Economics

Table 1 indicates that the highest number of theses were submitted in 2007 (6, 18.75%), where as the least number of theses (1, 3.12%) were submitted in 2005 and 2006.

Form of cited documents

Table 2 and figure 1 below represent the number of citations pertaining to different types of publications like journals, books, research reports, theses/dissertations, conference proceedings, manuscripts, etc.

Sr. no.	Form of cited documents	Count	Cumulative count	%	Cumulative %
1	Books	2163	2163	34.72	34.72
2	Journals	2047	4210	32.86	67.58
3	Manuscripts	589	4799	9.46	77.04
4	Reports	315	5114	5.06	82.10
5	Websites/Internet sources	261	5375	4.19	86.29
6	Government documents	257	5632	4.13	90.41
7	Theses/Dissertations	181	5813	2.91	93.32
8	Newspapers	149	5962	2.39	95.71
9	Survey reports	137	6099	2.20	97.91
10	Conference proceedings	95	6194	1.53	99.43
11	Unidentified sources	35	6229	0.56	100

Table 2: Form of cited documents in the Ph.D.theses in Economics

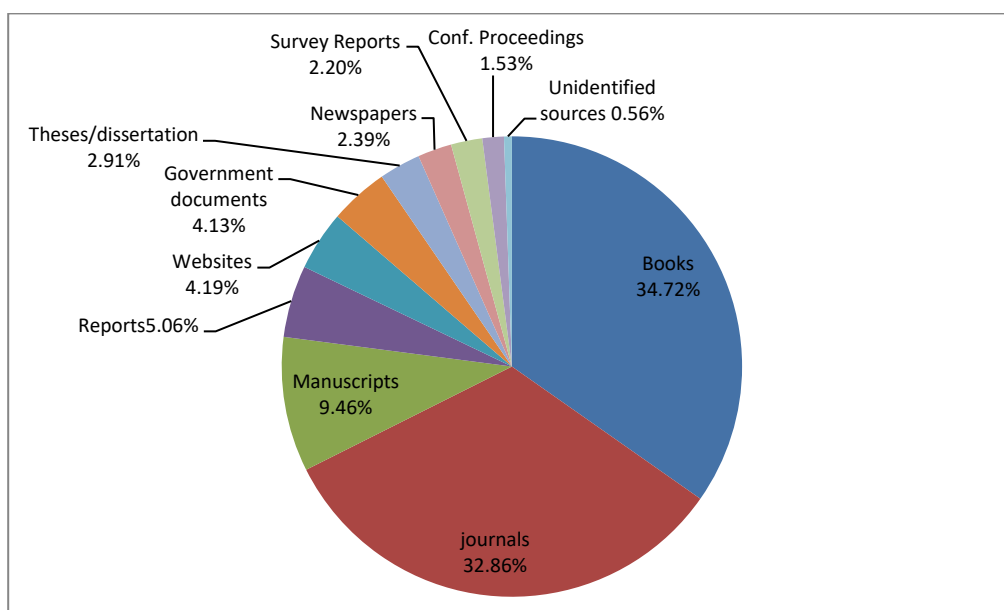


Figure 1: Form of cited documents in Economics

Table 2 and figure 1 indicate that out of 6229 citations cited in the Ph.D. theses submitted in the Department of Economics, books comprised the highest citations (2163, 34.72%), followed by journals' citations (2047, 32.86%), manuscripts (589, 9.46%), reports (315, 5.06%),

websites/Internet sources (261, 4.19%), government documents (257, 4.13%), theses and dissertations (181, 2.91%), newspapers (149, 2.39%), survey reports (137, 2.20%) and conference proceedings (95, 1.53%). Some of the sources could not be classified under any of the above categories as it could not be ascertained with surety whether they belonged to journals, books, newspapers, government documents, etc. Hence, they were grouped under the category of ‘unidentified sources’. Since books and journals together accounted for 67.58% citations, authorship pattern, half-life, etc. were calculated for such documents only.

Authorship pattern in citations

The study of authorship pattern and productivity is an important activity in the field of citation analysis. The authorship pattern in the present study was categorized into four groups: single author, two authors, three authors and more than three authors. Table 3 below shows the authorship pattern of citations:

Authorship Pattern	Books				Journals					
	Citations	Cumulative citations	%	Cumulative %	Citations	Cumulative citations	%	Cumulative %	Total citations	% of total citations
Single	1754	1754	81.09	81.09	1317	1317	64.34	64.34	3071	72.95
Two	325	2079	15.03	96.12	547	1864	26.72	91.06	872	20.71
Three	70	2149	3.24	99.35	151	2015	7.38	98.44	221	5.25
More than three	14	2163	0.65	100.00	32	2047	1.56	100.00	46	1.09
Total	2163	--	100.00	--	2047	--	100.00	--	4210	100

Table 3: Authorship pattern of citations in Economics

A total of 4210 citations to books and journals were analysed to ascertain the authorship pattern in the Ph.D. theses submitted in the Department of Economics, Panjab University (Chandigarh) during the study period. Table 3 depicts the authorship pattern of the cited books

and journals. Out of the total citations, books accounted for 2163 citations (51.38%), while journals accounted for 2047 citations (48.62%). It is clear from the above table that citations to single authorship was higher in books (1754, 81.09%) as well as in journals (1317, 64.34%). Two authors accounted for 325 citations (15.03%) to books and 547 citations (26.72%) to journals, followed by three authors with 70 citations (3.24%) to books and 151 citations (7.38%) to journals. Citations to more than three authors were the least in books (14, 0.65%) and journals (32, 1.56%).

In order to find out the degree of research collaboration, a formula proposed by Subramanyam (1983) was applied to the data. The degree of collaboration of books was calculated as 0.19 (Appendix 1-a) and the degree of collaboration of authors in cited journal articles were calculated as 0.36 (Appendix 1-b). Collaborative index, which is the number of authors per paper, was calculated using the formula given by Lawani (1986). Collaborative Index for books was calculated as 1.24 (Appendix 1-c) and Collaborative Index for journals was calculated as 1.47 (Appendix 1-d). Collaborative coefficient was calculated as per the formula given by Ajiferuke (1983). Collaborative Coefficient of authors of books was calculated as 0.10 (Appendix 1-e) and collaborative coefficient of authors of journal articles was calculated as 0.19 (Appendix 1-f).

Obsolescence of cited literature

‘Half-life’ or ‘Obsolescence rate’ of the documents can be calculated by analyzing the age of the cited documents. Studies of obsolescence of literature commonly assess the decline in the use of documents over time. It helps the librarians in weeding out old documents from the library.

Obsolescence of cited journals

Table 4 shows the obsolescence of journals as cited in 32 Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh) during 2002-2012:

Age in years	No. of Citations	Cumulative Citations	%	Cumulative %
1	10	10	0.49	0.49
2	11	21	0.54	1.03

3	7	28	0.34	1.37
4	16	44	0.78	2.15
5	29	73	1.42	3.57
6	31	104	1.51	5.08
7	37	141	1.81	6.89
8	78	219	3.81	10.70
9	76	295	3.71	14.41
10	75	370	3.66	18.08
11	99	469	4.84	22.91
12	61	530	2.98	25.89
13	60	590	2.93	28.82
14	78	668	3.81	32.63
15	68	736	3.32	35.96
16	49	785	2.39	38.35
17	62	847	3.03	41.38
18	59	906	2.88	44.26
19	50	956	2.44	46.70
20	75	1031	3.66	50.37
21	70	1101	3.42	53.79
22	71	1172	3.47	57.26
23	31	1203	1.51	58.77
24	28	1231	1.37	60.14
25	33	1264	1.61	61.75
26	36	1300	1.76	63.51
27	57	1357	2.78	66.29
28	48	1405	2.34	68.64
29	36	1441	1.76	70.40
30	40	1481	1.95	72.35
>30 <104	566	2047	27.65	100.00

Table 4:Half-life of journal articles cited in the Ph.D. theses submitted in the Department of Economics

Table 4 represents the number of citations and their respective ages. It indicates that 73 journal citations (3.57%) are just 5 years old, 370 citations (18.08%) are 10 years old and 736 citations (35.96%) are 15 years old. The maximum age of the citations was found to be 104 years. This shows that the researchers in the Department of Economics cite journal articles published even 100 years back. The table also shows that half-life of 50.37% journal citations are

just 20 years. A similar study carried out by Hirwade & Dankhade in the same field in 2002 also found that half-life of journal articles was 22 years. Figure 2 shows the half-life of journals for cumulative frequency of citations.

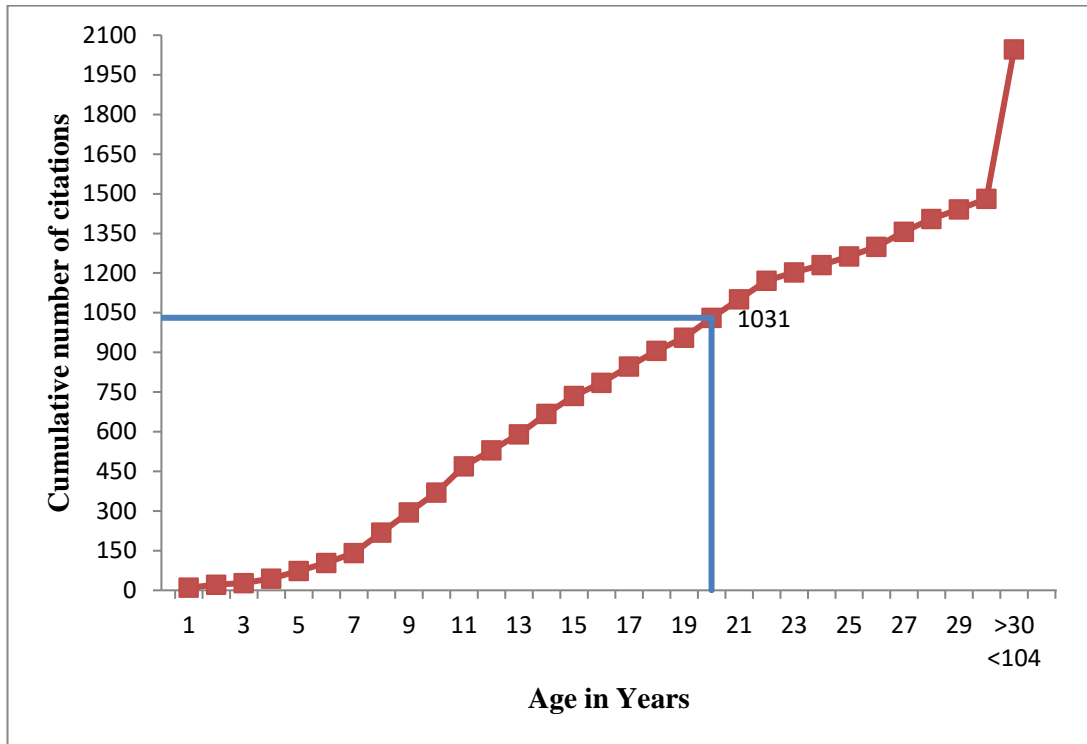


Figure 2: Bar graph showing half-life of journals for cumulative frequency of citations in Economics

Figure 2 above shows that the time taken to cite 2047 citations. It can be seen that the x-coordinate for 1031 cumulative citations (half of the total citations) is 20 years. Thus, 20 years was found to be the half-life of journals cited in the theses submitted in Department of Economics at Panjab University (Chandigarh).

Obsolescence of cited books

Table 5 shows the obsolescence of books as cited in 32 Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh) during 2002-2012.

Age in years	No. of citations	Cumulative citations	%	Cumulative %
1	6	6	0.28	0.28
2	13	19	0.60	0.88

3	18	37	0.83	1.71
4	53	90	2.45	4.16
5	52	142	2.40	6.57
6	51	193	2.36	8.93
7	64	257	2.96	11.88
8	59	316	2.73	14.61
9	55	371	2.54	17.15
10	66	437	3.05	20.21
11	106	543	4.90	25.11
12	62	605	2.87	27.97
13	66	671	3.05	31.02
14	54	725	2.50	33.52
15	75	800	3.47	36.99
16	61	861	2.82	39.81
17	58	919	2.68	42.49
18	33	952	1.53	44.02
19	43	995	1.99	46.00
20	36	1031	1.66	47.67
21	45	1076	2.08	49.75
22	25	1101	1.16	50.90
23	50	1151	2.31	53.22
24	41	1192	1.90	55.11
25	23	1215	1.06	56.17
26	32	1247	1.48	57.65
27	30	1277	1.39	59.04
28	29	1306	1.34	60.38
29	58	1364	2.68	63.06
30	30	1394	1.39	64.45
>30 < 104	769	2163	35.55	100.00

Table 5:Half-life of books cited in the Ph.D. theses submitted in the Department of Economics

Table 5 reveals that 142 citations to books (6.57%) are 5 years old, 193 citations (8.93%) are 6 years old and one fourth of the total book citations (25.11%) are 11 years old. More than half (50.90%) of the total citations are just 22 years which indicate that the half-life period of

citations to books is 22 years. The table also indicates that researchers in the discipline of Economics use books published 100 or more years back as well. Figure 3 shows the half-life of books for cumulative frequency of citations.

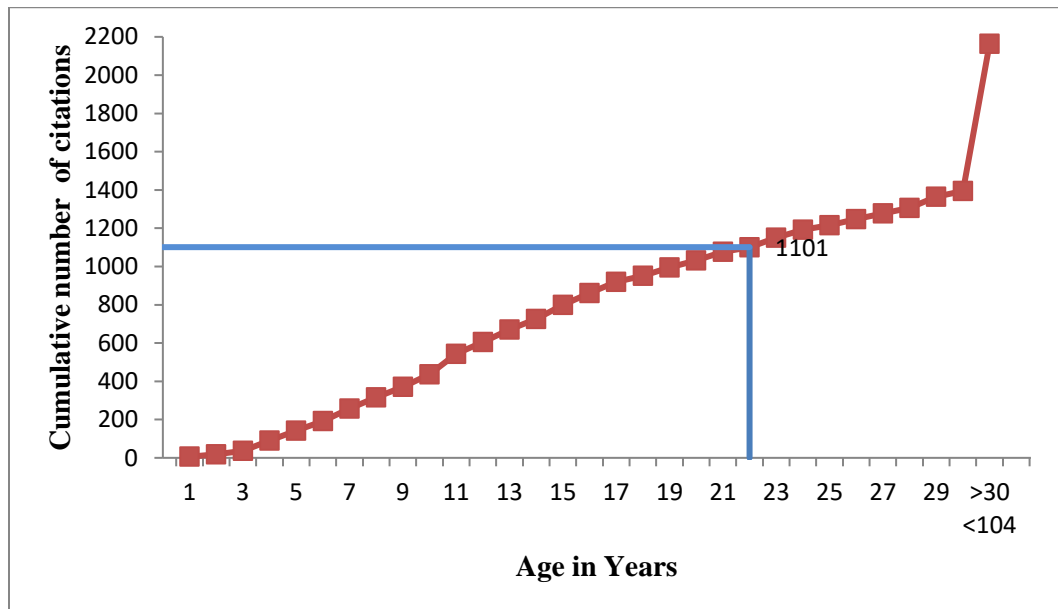


Figure 3: Bar graph showing half-life of books for cumulative frequency of citations in Economics

Figure 3 above shows that the time taken to cite 2163 citations was 104 years. It can be seen that the x-coordinate for the y-coordinate for 1101 cumulative citations (half of the total citations) is 22 years. Thus, 22 years was found to be the half-life of books cited in the Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh) during 2002-2012.

Chronological distribution of citations

Chronological distribution of citations in the Ph.D. theses in a particular field indicates whether the research carried out is up to date with the latest research taking place in that area or not. The citations analysed in the present study were distributed into groups of ten years each to know their chronological distribution.

Chronological distribution of citations to journals

Table 6 and figure 4 show the decade-wise distribution of journal citations used in the Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh).

Sr. no.	Period	Frequency of occurrence	Cumulative frequency	% of frequency	% of cumulative frequency
1	Before1925	5	5	0.24	0.24
2	1926-1935	11	16	0.54	0.78
3	1936-1945	48	64	2.34	3.12
4	1946-1955	90	154	4.40	7.52
5	1956-1965	135	289	6.59	14.11
6	1966-1975	187	476	9.14	23.25
7	1976-1985	271	747	13.24	36.49
8	1986-1995	515	1262	25.16	61.65
9	1996-2005	681	1943	33.27	94.92
10	2006-2012	104	2047	5.08	100

Table 6: Chronological distribution of citations to journals in Economics

The table 6 above clearly indicates that the highest number of journal citations belong to publications published during 1996-2005 (681, 33.27%), followed by 515 citations(25.16%)to journals that were to journals published during 1986-1995, 271 citations (13.24%) to journals published during 1976-1985, 187 citations(9.14%) to journals published during 1966-1975, 135 citations (6.59%)to journals published during 1956-1965, 90 citations (4.40%) to journals published during 1946-1955, 48 citations (2.34%) to journals published during 1936-1945, 11 citations (0.54%) to journals published during 1926-1935 and only 5citations (0.24%) to journals published before1925.

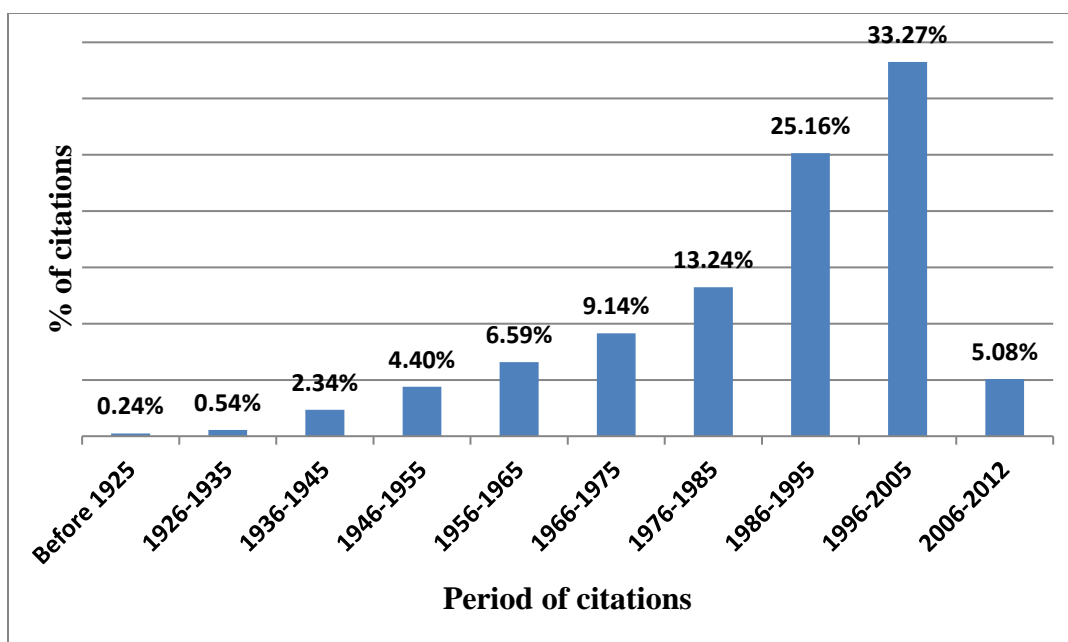


Figure 4: Chronological distribution of citations to journals in Economics

Figure 4 gives a pictorial representation of the chronological distribution of the citations to journal articles cited in the Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh). It shows that the highest citations were gained by the journal articles published during 1996-2005. The figure also shows that there has been a steady growth in citations till the time period of 1976-1985. After that, there has been a steep growth in the citations for the period 1986-1995 and 1996-2005. It can be also seen from the figure that there has been a steep decline in citations to journal articles from 1996-2005 to 2006-2012.

Chronological distribution of citations to books

Table 7 and figure 5 show the decade-wise distribution of citations to books used in the Ph.D. theses submitted in the Department of Economics, Panjab University (Chandigarh).

Sr. no.	Period	Frequency of occurrence	Cumulative frequency	% of frequency	% of Cumulative frequency
1	Before 1925	09	09	0.42	0.42

2	1926-1935	98	107	4.53	4.95
3	1936-1945	105	212	4.86	9.81
4	1946-1955	115	327	5.31	15.12
5	1956-1965	192	519	8.88	24
6	1966-1975	203	722	9.38	33.38
7	1976-1985	290	1012	13.40	46.78
8	1986-1995	480	1492	22.20	68.98
9	1996-2005	634	2126	29.31	98.29
10	2006-2012	37	2163	1.71	100

Table 7: Chronological distribution of citations to books in Economics

Table 7 above reveals that maximum number of citations belong to books published during 1996-2005 (634, 29.31%) and minimum citations belong to books published before 1925 (9, 0.42%). The data reflected in table also shows that books published during 1996-2005 have mostly been cited by the researchers in the discipline of Economics.

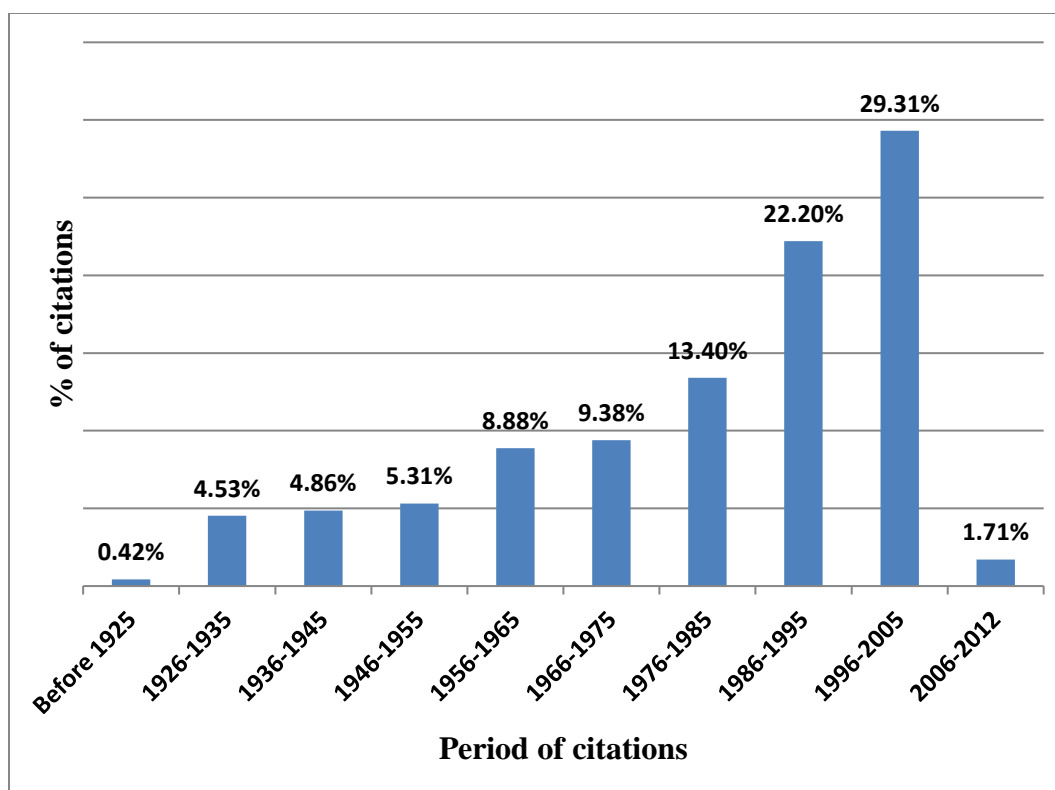


Figure 5: Chronological distribution of citations to books in Economics

Figure 5 above shows a pictorial representation of the chronological distribution of the citations to books cited in the Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh). It shows that there has been a steady growth in citations for the time period of 1976-1985. After that, there has been a steep growth in the citations for the period 1986-1995 and 1996-2005. It can be also seen from the figure that there has been a steep decline in citations to books from 1996-2005 to 2006-2012.

Geographical distribution of citations

Table 8 shows the geographical distribution of books and journals' citations used in the Ph.D. theses submitted in the Department of Economics at Panjab University (Chandigarh).

Country	Books				Journals			
	Counts	Cumulative counts	%	Cumulative %	Counts	Cumulative Counts	%	% of cumulative count

India	803	803	37.12	37.12	905	905	44.21	44.21
UK	557	1360	25.75	62.87	360	1265	17.59	61.80
USA	715	2075	33.06	95.93	687	1952	33.56	95.36
Pakistan	0	2075	0.00	95.93	6	1958	0.29	95.65
Canada	4	2079	0.18	96.11	18	1976	0.88	96.53
Australia	8	2087	0.37	96.48	5	1981	0.24	96.77
Bangladesh	0	2087	0.00	96.48	7	1988	0.34	97.12
France	22	2109	1.02	97.50	0	1988	0.00	97.12
Germany	18	2127	0.83	98.33	0	1988	0.00	97.12
Netherlands	16	2143	0.74	99.07	0	1988	0.00	97.12
Brazil	0	2143	0.00	99.07	4	1992	0.20	97.31
Japan	15	2158	0.69	99.76	13	2005	0.64	97.95
Mexico	0	2158	0.00	99.76	5	2010	0.24	98.19
New Zealand	0	2158	0.00	99.76	6	2016	0.29	98.48
South Africa	0	2158	0.00	99.76	28	2044	1.37	99.85
Russia	4	2162	0.18	99.95	0	2044	0.00	99.85
Singapore	0	2162	0.00	99.95	2	2046	0.10	99.95
Sweden	1	2163	0.05	100.00	1	2047	0.05	100.00

Table 8: Geographical distribution of citations in Economics

Table 8 shows the geographical distribution of citations cited in the Ph.D. theses submitted in the Department of Economics, Panjab University (Chandigarh). It reveals that majority of the citations to books (803, 37.12%) and journals (905, 44.21%) are Indian publications, followed by publications from UK (557, 25.75% for books and 360, 17.59% for journals) and USA (715, 33.06% for books and 687, 33.56% for journals). It is clear from the table that there are no citations of books published from Pakistan, Bangladesh, Brazil, Mexico, New Zealand, South Africa and Singapore, whereas journal citations do exist for such countries. Similarly, there are no citations to journal articles published from France, Germany, Netherlands and Russia, whereas book citations were seen from such countries.

Ranking of cited journals

To determine the core journals in the field of Economics, a rank frequency distribution of all cited journal articles was calculated. The ranking list is a practical tool to select the journals of maximum utility in relation to their coverage of literature in a particular subject

Sr. no.	Title	Citations	Cumulative citations	%	Cumulative %	Rank
1	Economic & Political Weekly	217	217	10.60	10.6	1
2	Economic Journal	96	313	4.69	15.29	2
3	American Economic Review	56	369	2.74	18.03	3
4	Indian Journal of Agricultural Economics	55	424	2.69	20.71	4
5	Journal of Industrial Economics	54	478	2.64	23.35	5
6	ArthaVijnana	52	530	2.54	25.89	6
7	European Economic Review	52	582	2.54	28.43	6
8	Journal of Economic Literature	47	629	2.30	30.73	7
9	Journal of Development Economics	39	668	1.91	32.63	8
10	Applied Economics	39	707	1.91	34.54	8
11	Asian Economic Review	37	744	1.81	36.34	9
12	Econometrica	29	773	1.42	37.76	10
13	Economic Development and Cultural Change	27	800	1.32	39.08	11
14	Economic Letters	24	824	1.17	40.25	12
15	Economic Records	24	848	1.17	41.43	12
16	Economica	24	872	1.17	42.60	12
17	Journal of International Economics	23	895	1.12	43.72	13
18	Indian Economic Review	23	918	1.12	44.85	13
19	International Economic Journal	20	938	0.98	45.82	14
20	International Economic Review	19	957	0.93	46.75	15
21	Journal of Development Studies	19	976	0.93	47.68	15
22	Journal of Economic Behaviour and Organisation	18	994	0.88	48.56	16
23	Journal of Economic Studies	17	1011	0.83	49.39	17
24	Journal of Environmental Economics and Management	17	1028	0.83	50.22	17
25	Punjab Past and Present	16	1044	0.78	51.00	18
26	Journal of International Trade and Economic Development	15	1059	0.73	51.73	19
27	Journal of Political Economy	13	1072	0.64	52.37	20
28	Journal of Rural Development	13	1085	0.64	53.00	20
29	Kurukshetra	12	1097	0.59	53.59	21
30	Mainstream	12	1109	0.59	54.18	21

Table 9: Ranked list of highly cited journals in Economics

For this purpose, the titles of the cited journals were recorded against each journal article in the work sheet. Ranking of the journals was prepared on the basis of the total citations received by each journal. The journals were ranked on the basis of the citations received by them and arranged in descending order. Table 9 shows the rank of journals and the percentage of citations they received.

Table 9 shows that out of a total of 353 journal cited in the theses submitted during the study period, 'Economic & Political Weekly' was the most highly cited periodical(217, 10.60%), followed by 'Economic Journal' (96, 4.69%), 'American Economic Review' (56, 2.74%), 'Indian Journal of Agricultural Economics' (55, 2.69%), 'Journal of Industrial Economics' (54, 2.64%), 'ArthaVijnana' (52, 2.54%), 'European Economic Review'(52, 2.54%), 'Journal of Economic Literature' (47, 2.3%), 'Journal of Development Economics' (39, 1.91%), 'Applied Economics' (39, 1.91%), 'Asian Economic Review' (37, 1.81%), 'Econometrica' (29, 1.42%), 'Economic Development and Cultural Change' (27, 1.32%), 'Economic Letters'(24, 1.17%), 'Economic Records' (24, 1.17%), 'Economica' (24, 1.17%), 'Journal of International Economics' (23, 1.12%), 'Indian Economic Review' (23, 1.12%), 'International Economic Journal' (20, 0.98%), 'International Economic Review', (19, 0.93%), 'Journal of Development Studies' (19, 0.93%), 'Journal of Economic Behaviour and Organization' (18, 0.88%), 'Journal of Economic Studies' (17, 0.83%) and 'Journal of Environmental Economics and Management' (17, 0.83%). It also indicates that the journals mentioned above cover 54.18% of the total citations and remaining 323journals accounted for rest of the citations (45.82%).A similar study carried out by Nasir & Devender Kumar in 2011 also found that journal entitled 'Economic & Political Weekly' got the rank first.

Application of Bradford's law to cited journals

Bradford's law of scattering is used to determine the core journals in any given field or domain. It states that "if scientific journals are arranged in order of decreasing productivity of articles on a given subject, these may be divided into a nucleus of journals more particularly devoted to the subject and several groups or zones containing the same number of articles as the

nucleus, when the number of journals in the nucleus and succeeding zones will be as 1: n: n²:..."(Bradford, 1934, 1938). Table 10 below indicates the verbal formulation of the Bradford's law of scattering as applied to the cited data in the theses submitted in the Department of Economics and considered in the present study:

Number of Zone	Number of Journals	Number of Citations	Bradford's constant (k)
Core zone	6	530	--
Zone 1	42	761	7.283
Zone 2	305	756	7.284
Total	353	2047	

Table 10: Dispersion of journals in Economics

Table 10 shows the distribution of journals into three zones. It is evident from the ratio (6:42:305) that the numbers of journals in the three zones are in geometric progression. Hence, it can be concluded that the dispersion of journals in the field of Economics satisfy the formulation of Bradford's law of scattering. The mathematical formulation was also applied to check the validity of the verbal formulation using the formula of Egghe (1986, 1990) where k was calculated as:

$k = (e^v \times Y_m)^{1/p}$, where:

^v Is Euler's number having the value 0.5772

e is Euler's number.

e^v is a constant with the value 1.781.

Y_m denotes the number of citations received by the most cited journal ($Y_m = 217$),

p is Bradford group or number of zones (i.e. p = 3) Hence,

$$k = (1.781 * 217)^{1/3}$$

$$k = 7.284$$

Using the value of k calculated above, Bradford groups (zones) were also calculated. The nucleus zone r_0 was calculated as: $r_0 = \frac{T(k-1)}{(k^p-1)}$

where, T represents the total number of journal in the study (i.e. 353). By applying the above formula, r_0 was calculated as:

$$r_0 = \frac{353 (7.284 - 1)}{(7.284^3 - 1)}$$

$$r_0 = \frac{2218.279}{385.4769}$$

$$= 5.75$$

With r_0 and k, different Bradford zones were calculated as below:

Nucleus zone $r_0 = r_0 * 1 =$

$$5.75 * 1 = 5.75$$

First zone

$$r_1 = r_0 * k = 5.75 * 7.284 = 41.88$$

Second zone

$$r_2 = r_0 * k^2 = 5.75 * 7.284^2 = 305.07$$

The above theoretical distribution of Bradford's law enabled the testing of the exact fit of Bradford's law to the data in the present study. Using this distribution, the number of citations for each Bradford's group were calculated as shown in table 10. The exact number of journals in each Bradford's group were calculated using the value of k and r_0 , r_1 and r_2 . By dividing r_2 by r_1 and r_1 by r_0 , the value of 7.283 and 7.284 respectively were calculated which is equivalent to the value of k as calculated using the formula of Egghe (1986. 1990). This shows that in the present study, the journals cited in the theses submitted in the Department of Economics are in accordance with the Bradford's distribution.

Findings of the Study

To study the citation analysis of Ph.D. theses in the field of Economics, 6229 citations from 32 Ph.D. theses submitted in the Department of Economics during 2001-2012 were analysed. The major findings of their analysis show:

- I. The highest numbers of theses in Economics were submitted in 2007 (18.75%).
- II. The researchers in the discipline of Economics use books and journals more than other form of documents for their research work. Book citations accounted for 34.72% and journal citations accounted for 32.86% citations.
- III. Citations to single authorship were dominant than joint authorship in both books (81.09%) and journals (64.34%).
- IV. The degree of collaboration of books was calculated as 0.19 and degree of collaboration of journals was calculated as 0.36.
- V. Collaborative index of books was calculated as 1.24 and collaborated index of journals was calculated as 1.47.
- VI. Collaborative coefficient for books was calculated as 0.10 and collaborated coefficient for journals was calculated as 0.19.
- VII. The half life period of journal citations was found to be 20 years and the half life period of book citations was found to be 22 years.
- VIII. Maximum number of citations to journals (33.27%) and books (29.31%) belong to publications published during 1996-2005.
- IX. Majority of citation to books (37.12%) and journals 44.21%) were of Indian origin, followed by U.K. and U.S.A.
- X. Out of 353 journals cited in the Ph.D. theses, Economic & Political Weekly was found to be the most cited journal.
- XI. The dispersion of journals in the field of Economics satisfies the formulation of Bradford's law of scattering.

Conclusion:

Citation analysis is very helpful tool to provide an insight into the information seeking behavior of library users and helps in determining the impact of scholarly work and planning for

library development collection policy. Citation analysis is useful for all type of libraries to understand their researcher's literature use patterns and to identify to most significant journals to subscribe. This research work will be helpful for the researchers of Economics to identifying the primary sources of information for progressive work of their ongoing research. Ranking lists of journals cited by the researchers in their doctoral theses of Panjab University, Chandigarh will also be more helpful to the Librarians in the selection and acquisition of the most important journals within their restricted budgets.

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Appendix 1

The degree of collaboration in research can be measured with the help of multi authored papers. The formula proposed by **K. Subramaniam (1983)** has been used. The formula is:

$$\text{The degree of collaboration } DC = \frac{Nm}{Nm + Ns}$$

DC= Degree of Collaboration

Nm= Degree of multiple authors

Ns= Number of Single authors

Collaborative Index

Collaborative index is the number of authors per paper as first given by **Lawani (1986)**. The following formula is used to calculate the collaborative index:

$$CI = \frac{(F_1 + 2F_2 + 3F_3 + 4F_4 + \dots + kF_k)}{N}$$

Where F_1 indicates single authored papers

F_2 indicates double authored papers

F_3 indicates three authored papers, likewise

N is the total number of papers in the discipline

Collaborative Coefficient

Collaborative coefficient given by **Ajiferuke (1983)**, as

$$CC = 1 - \frac{\left(F_1 + \frac{1}{2}F_2 + \frac{1}{3}F_3 + \frac{1}{4}F_4 + \dots + \frac{1}{k}F_k \right)}{N}$$

Where, F_1 indicates single authored papers

F_2 indicates double authored papers

F_3 indicates three authored papers, likewise

N is the total number of papers in the discipline

The degree of collaboration $DC = \frac{Nm}{Nm + Ns}$

DC= Degree of Collaboration

Nm= Degree of multiple authors

Ns= Number of Single authors

1. Degree of collaboration, collaborative index and collaborative coefficient in the discipline of Economics

1-a) Degree of Collaboration (Books)

Here, $Nm = 409$

$Ns = 1754$

$$C = \frac{409}{409 + 1754} = \mathbf{0.19}$$

Degree of Collaboration of Books was calculated = 0.19

1-b) Degree of Collaboration for Journals Authors

Here, $Nm = 730$

$Ns = 1317$

$$C = \frac{730}{730 + 1317} = 0.36$$

Degree of Collaboration of Journals was calculated = 0.36

Collaborative Index

Collaborative index is the number of authors per paper as first given by **Lawani (1986)**

. The following formula is used to calculate the collaborative index:

$$CI = \frac{(F_1 + 2F_2 + 3F_3 + 4F_4 + \dots + kF_k)}{N}$$

Where F_1 indicates single authored papers

F_2 indicates double authored papers

F_3 indicates three authored papers, likewise

N is the total number of papers in the discipline

1-c) Collaborative Index for Books

$$CI = \frac{(1754 + 2 \times 325 + 3 \times 70 + 5 \times 14)}{2163}$$

$$CI = 1.24$$

Collaborative Index for Books was calculated= 1.24

1 -d) Collaborative Index for Journals

$$CI = \frac{(F_1 + 2F_2 + 3F_3 + 4F_4 + \dots + kF_k)}{N}$$

$$CI = \frac{(1317 + 2 \times 547 + 3 \times 151 + 5 \times 32)}{2047}$$

$$CI = 1.47$$

Collaborative for Journals was calculated **1.47**

Collaborative Coefficient

Collaborative coefficient given by **Ajiferuke (1983)**, as

$$CC = 1 - \frac{\left(F_1 + \frac{1}{2}F_2 + \frac{1}{3}F_3 + \frac{1}{4}F_4 + \dots + \frac{1}{k}F_k \right)}{N}$$

Where, F_1 indicates single authored papers

F_2 indicates double authored papers

F_3 indicates three authored papers, likewise

N is the total number of papers in the discipline

1-e) Collaborative Coefficient (Books)

$$\text{Here, } CC = 1 - \frac{\left(1754 + \frac{1}{2}325 + \frac{1}{3}70 + \frac{1}{5}14 \right)}{2163}$$

$$1 - \frac{58279}{30} * \frac{1}{2163}$$

$$CC = 1 - \frac{58279}{64890}$$

$$CC=0.10$$

Collaborative Coefficient of Books Authors was calculated 0.101

1-f) Collaborative Coefficient of (Journals)

$$CC = 1 - \frac{\left(F_1 + \frac{1}{2}F_2 + \frac{1}{3}F_3 + \frac{1}{4}F_4 + \dots + \frac{1}{k}F_k \right)}{N}$$

$$\text{Here, } CC = 1 - \frac{\left(1317 + \frac{1}{2}547 + \frac{1}{3}151 + \frac{1}{5}32 \right)}{2047}$$

$$1 - \frac{49417}{30} * \frac{1}{2047}$$

$$CC = 1 - \frac{49417}{61410}$$

$$\mathbf{CC=0.19}$$