

RESEARCH TRENDS IN ECONOMIC DOCTORAL THESIS: A BIBLIOMETRIC ASSESSMENT OF COLLABORATION, CITATION AGEING, AND CORE JOURNALS

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ABSTRACT: This paper aims to investigate various forms of cited sources, authorship and collaborative nature, the obsolescence of literature, and the identification of core journals in doctoral theses in Economics awarded by Manipur University during 1985-2018. During the period, a total of 103 theses have been awarded. Only 94 of them were included in the present study; however, the remaining 9 were excluded because they have some technical issues with the textual parts. A total of 13485 citations were extracted from 94 theses and included in the analysis using bibliometric techniques. The study examines authorship patterns to understand shifting trends in collaboration, measures citation half-life to assess the obsolescence of literature, and applies Bradford's Law to identify the core journals in economics. The findings of the study observe the presence of more single authored literature than that of the multi-authored literature; however, it reveals a gradual shift from single-authorship to collaborative research with the highest degree of collaboration values of books and journal articles, 0.28 and 0.40 respectively, moderate obsolescence of literature with a citation half-life of 27.8563 years (27 years, 10 months and 8 days). It identifies 7 core journals, preferred by many scholars and with the greatest Concentration of literature. The study's findings enrich collection development management and support scholarly communities.

KEYWORDS: Obsolescence, Bradford's Law, Scholarly Communication, Institutional Research Output, Citation Half-Life.

I. INTRODUCTION:

The applications of bibliometric studies as an indispensable tool for analysing scholarly communication and research trends have emerged as an important area in the dissemination of information across most knowledge domains. The present study is confined to the field of economic research outputs of Manipur University. The main reason for choosing the discipline in this study is that, despite its rich research output since its inception in 1972, no study of similar patterns has been conducted. This study covers the following four major aspects:

- A. Forms of Cited Sources
- B. Authorship and Collaborative Nature
- C. Obsolescence of cited literature
- D. Identification of core journals

to enable visibility into the scholarly communication practices followed by the University's economic research scholars.

II. OBJECTIVES OF THE STUDY:

The present study aims to:

1. Classify the forms of cited sources used by economic scholars in their theses.
2. Examine the authorship pattern and collaboration trends in economics theses.
3. Analyse the obsolescence of cited literature using citation half-life.
4. Identify the core journals using Bradford's Law of Scattering.

III. SCOPE AND LIMITATIONS:

This study includes theses awarded between 1985 and 2018 in the Department of Economics of Manipur University. The analysis considers only 94 out of 103 awarded doctoral theses. The remaining 9 theses have not been considered because they have some technical issues with the textual parts. It covers. It extracts only the citations available in the reference or bibliography within the theses. The main reason for choosing this subject is the balanced use of journal articles and other document formats, which enables a deeper, more accurate analysis, including the practical applicability of Bradford's Law. However, some other social science disciplines heavily rely on books, reports or qualitative sources, which makes the analysis difficult. Beyond that, the study's findings may not apply to other disciplines within the school of social sciences due to differences in research practices, citation behaviour, and publication patterns.

IV. LITERATURE REVIEW:

Various literature on bibliometric studies in the past related to forms of cited sources, bibliometric indicators for measuring collaboration trends including authorship pattern, age range of citations and journal concentration across disciplines have been examined. However, limited studies have focused on doctoral theses in regional universities, highlighting the significance of the present research. Contemporary pioneers like Subramanyam (1983), who introduced the Degree of Collaboration, followed by subsequent refinements such as the Collaboration Index (Lawani, 1980), and the Collaboration Coefficient (Ajiferuke et al., 1988), in the context of Research collaboration assessment, studied and established mathematical formulas to highlight the shift from single-authored to multi-authored research in most disciplines.

Bozeman et al. (2013) studied factors that influence and encourage collaboration among university researchers through motivation and impact assessment. Similarly, Katz and Martin (1997) highlighted that people collaborate at the most basic level, not institutions. Their study identified collaboration as a research-driven activity influenced by cost, communication technologies, specialisation, and interdisciplinary needs. Lee and Bozeman (2005) further noted that modern scientific research has become more interdisciplinary, complex, and costly, encouraging scientists to engage in collaborative research, which has become a fundamental requirement of funding agencies. The earlier works of Price (1963) and Price & Beaver (1966) elaborated on the rising trend in multi-authored publications, while Lawani (1986) explained the possibility of a relationship between collaboration and research impact. Supporting this, Melin & Persson (1996) and Subramanyam (1983) explained collaboration as a mechanism for sharing expertise, data and resources.

Increasing collaborative trends are also found concentrated in the empirical studies. In the studies of Senger (2014) and Thanuskodi (2012), multi-authored publications are found to dominate, while other studies by Singh and Bebi (2013) highlighted disciplinary variation in authorship patterns.

Regarding the use of various document forms and citation behaviour, Sashikala and Raju (2008) reported in their study that books and journal articles dominate citations in economic theses, with a half-life of 14.5 years. In the same vein, Tonta and AI (2006) reported higher citation rates for monographs than for journals and identified a half-life of around 9 years. Thanuskodi (2012) reported the presence of various document types and the distribution of authorship across disciplines.

Concerning studies on finding core journals, Bradford (1934, 1948) developed the concept of article scattering across journals to identify them. Meanwhile, studies such as Zingkhai and Meera (2022) examined the applicability of Bradford's Law and alternative models, such as the Leimkuhler models, to assess varying levels of suitability across datasets. In some studies, as reported by Sevukan and Sharma (2008), Bradford's Law did not always fit empirical data, underscoring the need for context-specific validation.

From the above review, it is evident that some research gaps are observed and reported such as lack of localised studies like studies focusing on economic theses of Manipur University; limited addressing on rich citation data of doctoral theses; restricting presence of all indicators in a study, however studies often found single bibliometric aspect (authorship, citation or obsolescence); presence of various document forms and varied authorship patterns suggested the need for discipline specific analysis; and Bradford's Law and measuring obsolescence using citation half-life have not been adequately tested in the local context of economic research.

V. NEED OF THE STUDY:

The study aims to address the identified research gaps mentioned above. It explains bibliometric aspects of various cited sources, authorship and collaborative trends, measures obsolescence of literature by analysing citation half-life values, and identifies core journals of a discipline. To address the lack of localised research, doctoral theses in Economics from Manipur University were selected for the study. It also contributes to understanding scholars' citation behaviour in a discipline-specific manner. Moreover, it tests the validity of Bradford's Law and calculates the citation half-life in a new empirical context. The findings of the study will be useful for library collection development, research evaluation and policy formulation within the University.



VI. METHODOLOGY:

The methodology of the study includes data collection, extraction of citations, certain data analysis techniques:

- A. **Data Collection:** The references or bibliographies appended at the end of 94 PhD theses were manually extracted and compiled into a dataset consisting of 13485 citations shown in the table given below:

TABLE I NUMBER OF THESES, CITATIONS EXTRACTED IN YEAR-WISE

Sl. No.	Year	No. of Scholars	Total Citations
1	1985	1	121
2	1987	1	95
3	1988	3	683
4	1989	1	100
5	1990	3	337
6	1992	2	301
7	1993	1	159
8	1994	2	512
9	1995	1	167
10	1996	2	244
11	1997	2	285
12	1998	2	132
13	1999	2	189
14	2000	3	512
15	2001	3	307
16	2002	1	96
17	2003	4	458
18	2004	4	808
19	2005	2	164
20	2006	2	309
21	2007	4	416
22	2008	5	918
23	2009	6	597
24	2010	2	260
25	2011	3	409
26	2012	5	689
27	2013	6	899
28	2014	6	927
29	2015	5	962
30	2016	4	591
31	2017	4	663
32	2018	2	175
		94	13485

- B. **Data Analysis Techniques:** -The analysis included the following data analysis techniques:

1) **Authorship Structure:** The organised citations were classified as multiple authorship of the cited literature.

2) **Collaboration Trends:** The values of the Degree of Collaboration (DC), Collaborative Index (CI), and Collaboration Coefficient (CC) were calculated using the respective formula to understand the collaborative nature of the cited literature.

2.1) **Degree of Collaboration (DC):** Degree of Collaboration (DC) formulated by Subramanyam K (1983) is used to measure the proportion of multi-authored papers out of the total published works within a given dataset

$$DC = \frac{N_m}{N_m + N_s} \quad \text{Where,}$$

N_m = Number of Multi-author papers, N_s = Number of Single-author papers.

Interpretations: It is assumed that if the value of DC=0, it means all publications are single-authored papers. Then, if DC=1, it means all publications are multi-authored. If the value of DC ranges from 0 to 1, a higher value of DC implies a greater tendency toward collaboration in research. However, this value does not distinguish the size of collaborative groups.

2.2) **Collaborative Index (CI):** Collaboration Index (CI) was formulated by Lawani M in 1980, which is used to compute the mean number of authors per paper of scholarly content, focusing more on the intensity of the collaboration within a specific time period.

$$CI = \frac{\sum_{j=1}^A (j * f_j)}{N} \quad \text{Where,}$$

j = the number of authors on a paper.

f_j = the number of papers with 'j' authors.

N = the total number of papers published.

\sum = (sigma) indicates the summation of all papers, from the minimum number of authors to the maximum.

Interpretations: It is assumed that when the value of CI is greater than or equal to 1(one), it gives a useful sense of the scale of collaboration (more authors per paper on average). This value gives a mean value rather than a proportion.

2.3) **Collaborative Coefficient (CC):** Collaboration Coefficient (CC) was formulated by Ajiferuke in 1988, which is applicable to measure the degree of collaboration in research, often applied to authorship patterns in scientific publications

$$CC = 1 - \sum [(1/j) * (f_j)] / N$$

Where, j = the number of authors on a paper.

f_j = the number of papers with 'j' authors.

N = the total number of papers published.

\sum = all possible values of j (number of authors), up to the maximum number of authors found in a single paper.

Interpretations: It is assumed that when the value of CC=0, all the papers are single-authored papers. If the value of CC is closer to 1, the dataset indicates a higher likelihood of co-authored papers, reflecting greater collaborative intensity within the research community. The value of CC lies in addressing the limitations of other measures, such as the Collaboration Index (CI) and the Degree of Collaboration (DC), by providing a more nuanced measure of collaboration. The CC values range from 0 to 1. The value of



CC does not reach to 1 unless there are infinite authors. The value of cc does not reach to 1 unless infinite authors.

3) **Obsolescence of Literature:** The obsolescence of literature from the age distribution of the cited literature was determined using Citation half-life.

Citation Half-Life (Median Age)

$$= L + \frac{\left(\frac{N-C}{2}\right)}{f} \times h \text{ where,}$$

L= Lower limit of frequency distribution

N= Total no. of citations

h= height of the frequency class

C=Cummulative citations

f= frequency where 50% of cum. citations falls.

4) **Bradford's Law of Scattering:** Cited journal articles distributed across the journals were identified using Bradford's Law to identify the core journals.

Firstly, Bradford's Law of Scattering gives 1: n: n² where n is Bradford's Multiplier. The data of the cumulative citations were computed and divided into three Bradford zones, each containing approximately equal number of citations.

Secondly,

$$\text{Error\%} = \frac{\text{Tot. Cal. Value of Journals} - \text{Tot. Given Value of Journals}}{\text{Tot. Given Value of Journals}} \times 100$$

Error (%) is calculated to test the validity of data in the respective Bradford's Zones.

Thirdly, Modified Leimkuhler's Model, introduced by Egghe, L (1990) is applied.

$k = (e_\gamma \times Y_m)^{1/p}$ Where,

$e_\gamma = 1.781$ (Euler's constant; sometimes represented as e^γ in texts)

Y_m = number of articles (or citations) in the **most productive source** (the journal with the most articles in the dataset)

p is the **number of Bradford zones** (groups that contain a similar number of articles) = 3

This value is the new Bradford's Multiplier, which plays an important role in determining new Bradford's Zones.

Fourthly, the following formula is derived from Bradford's Law of Scattering to determine the core journals:

$$r_o = \frac{T(k-1)}{(k^p-1)} \text{ where,}$$

T = Total Number of Journals,

p= Number of Bradford's Zones, and

k= New Bradford's Multiplier

Lastly, the New Bradford's Zones are obtained with the formula given below:

$$r_o: r1 = r_o * k; r2 = r_o * k^2 \text{ Where,}$$

r_o = a proportional distribution of citations or relationship among the three successive levels of Bradford's Zones.

k = the new Bradford's Multiplier.

It is concluded that the first zone of Bradford's Law constitutes the core journals of the disciplines under study.

VII. DATA ANALYSIS, RESULTS AND INTERPRETATIONS:

A. Forms of Cited Sources:

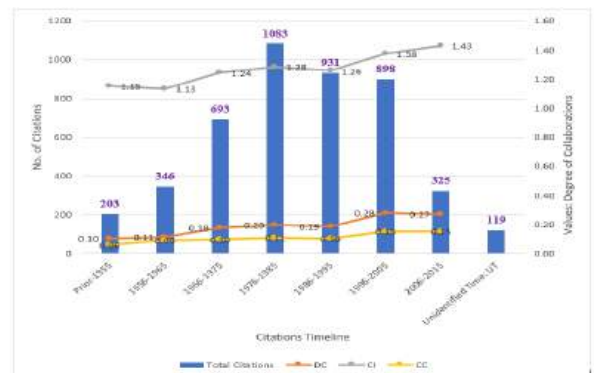
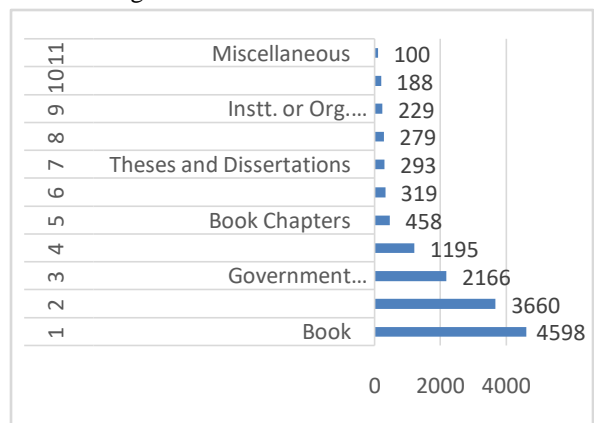
The analysis shows that various forms of cited sources are available in the theses and they are classified under certain broader terms. For the convenience of classifying cited sources other than books and journal articles, some broader terminology was employed to merge similar sources, such as: Web Resources; Book Chapters; Reports; Conference Publications; Government Publications; Other Periodical Publications; Theses and Dissertations; Instt. or Org. Publications, Miscellaneous. There are 11 forms of cited sources, and their frequencies are presented in the following table and figure.

TABLE II VARIOUS FORMS OF CITED SOURCES IN THE ECONOMICS PHD THESES

Sl. No.	Types of Cites Sources	No. of Citations	No. of Citations (%)	Cum. No. of Citations	Cum. No. of Citations (%)
1	Books	4598	34.10	4598	34.10
2	Journal Articles	3660	27.14	8258	61.24
3	Government Publications	2166	16.06	10424	77.30
4	Reports	1195	8.86	11619	86.16
5	Book Chapters	458	3.40	12077	89.56
6	Conference Publications	319	2.37	12396	91.92
7	Theses and Dissertations	293	2.17	12689	94.10
8	Other Periodical Publications	279	2.07	12968	96.17
9	Instt. or Org. Publications	229	1.70	13197	97.86
10	Web Resources	188	1.39	13385	99.26
11	Miscellaneous	100	0.74	13485	100.00

Fig.1 Various Forms of Cited Sources in the Economics Ph.D. Theses

Table II and Fig. 1 demonstrate that out of 13485 cited sources



compiled from 94 awarded Economics Ph.D. Theses, Books comprised the highest citations (4598, 34.10%); followed by Journal Articles (3660, 27.14%); Government Publications (2166, 16.06%); Report (1195, 8.86%); Book Chapters (458,3.40%); Conference Publications (319, 2.37%); Theses and Dissertations (293, 2.17%); Other Periodical Publications (279, 2.07%); Instt. or Org. Publications (229, 1.70%); Web Resources (188, 1.39%); and Miscellaneous (100, 0.74%)

B. Authorship Pattern and Research Collaboration Analysis:

The analysis of the main economic sources cited in the dataset revealed that single-authored citations dominate in overall citations. The nature of authorship of the cited sources was classified into two types: single-authors and multiple-authors. The analysis identified the authorship of overall citations and accounted for both book and journal citations, as the combination accounted for more than 61.24%. Therefore, the authorship of overall citations, books and journal article citations is shown as:

- 1) Of 13485 citations, 10334 citations are single-authored, and the remaining citations are placed under multi-authored sources.
- 2) In book citations, 3656 out of 4598 cited sources are single-authored, and the remaining citations are placed under multi-authored sources.
- 3) In journal articles, 2612 out of 3660 cited sources are single-authored, and the remaining citations are placed under multi-authored sources.

To assess collaboration trends, indicators used to measure collaboration, including the degree of collaboration (DC), the collaboration index (CI), and the collaboration coefficient (CC) for books and journal articles, were calculated separately.

The study analyses the distribution of 8258 citations (books: 4598; and journals: 3660), accounting for 61.24% of the total citations reflected in the Economics PhD theses. The chronological distribution of citations is grouped into decade-wise zones. All these citations are fitted into seven decade-wise zones for both books and journals. It is shown that the decade-wise zone classification is based on the most recent citations and fitted accordingly.

4) Authorship and Collaboration Pattern in Citations: Books

TABLE III AUTHORSHIP PATTERN AND COLLABORATION TRENDS IN CITATIONS (BOOKS)

Timeline	Authorship Collaboration for Research through Books Economics														
	Total Citations	Single Author	Multi-Author Citations							Nm	Ns+Nm	Unidentified Authors: UA	DC	CI	CC
			2	3	4	5	6	9	11						
Prior-1955	203	182	16	2	1	2				21	203	0.10	1.15	0.06	
1956-1965	346	307	34	4		1				39	346	0.11	1.13	0.09	
1966-1975	683	570	99	14	4	5			1	123	693	0.18	1.24	0.10	
1976-1985	1083	870	166	18	12	16	1			213	1083	0.20	1.28	0.11	
1986-1995	931	757	139	19	1	15				174	931	0.19	1.26	0.10	
1996-2005	898	647	196	34	4	15				249	896	0.28	1.38	0.15	
2006-2015	325	238	60	16	1	8	1	1		87	325	0.27	1.43	0.15	
Unidentified Time: UT	119	85	21	4	1					25	111	8			
	4598									932	4588	10			

Fig. 2 Authorship Patterns and Collaboration Trends in Citations (Books) TABLE III and Fig. 2 show that the period prior to 1955 had the lowest degree of collaboration (DC) value, 0.10, indicating that only single-authored publications were used. The extremely low collaborative coefficient (CC) of 0.06 indicates a zero collaborative research environment. During this period, scholarly publications were characterised by isolated research efforts with no collaboration. The collaborative index (CI) value of 1.15 indicates minimal author involvement per publication were shown during the year 1956-1965.

On the other hand, the period from 1996 to 2005 represents the most collaborative phase in all three indicators. The highest DC value of 0.28 signifies a substantial increase in multi-authored publications, CC value of 0.06 confirms a holistic, intensive collaboration and marks a shift from individual to team-based research. This period signifies an inclination towards intensive collaboration. However, the highest CI Value of 1.43 during the year 2006-2015 indicates a rise in the average number of authors per publication.

5) Authorship and Collaboration Pattern in Citations: Journals

TABLE IV AUTHORSHIP PATTERN AND COLLABORATION TRENDS IN CITATIONS (JOURNALS)

Timeline	Total Citations	Single Author	Multi-Author Citations										Nm	Ns+Nm	Unidentified Authors: UA	DC	CI	CC
			1	2	3	4	5	6	7	9	10	18						
Prior-1955	52	46	1	3	4	1	1						5	51	1	0.10	1.27	0.06
1956-1965	154	132	17	4	1								22	154		0.14	1.19	0.08
1966-1975	372	288	69	5	1	6							81	369	3	0.22	1.29	0.12
1976-1985	690	535	110	16	2	22		1					151	686	4	0.22	1.36	0.12
1986-1995	984	729	191	33	9	13	1						247	976	8	0.25	1.35	0.14
1996-2005	921	601	213	63	14	18	3	2					313	914	7	0.34	1.53	0.19
2006-2015	452	269	114	38	12	7	4	1	1	1	1		179	448	4	0.40	1.70	0.23
Unidentified Time: UT	35	12	1										1	13	22			
	3660												999	3611	49			

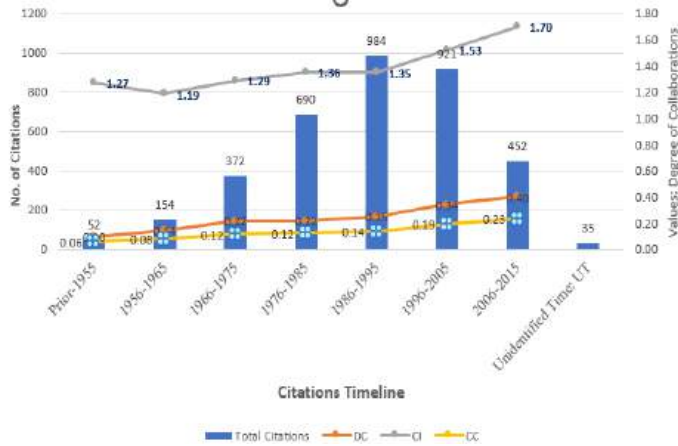
Authorship Patterns and Collaboration Trends in Citations (Journals)

Table IV and Fig.3 shown above, display the values of all three collaborative indicators, indicating a substantial increase in collaborative research across successive decades. The lowest co-authorship and zero collaboration characterised during the period Prior-1955, with DC and CC values of 0.10 and 0.06,

Table IV and Fig.3 shown above, display the values of all



respectively, However, for low CI value 1.19 falls during the year 1956-1965. In contrast to the above, collaborative measure



values for DC, CI, and CC reached their peak during the period 2006-2015 at 0.40, 0.23, and 1.70 respectively, marking a shift from individualistic research to more collaborative, team-based research.

C. Obsolescence of Literature in Economics doctoral theses:

The ageing of the literature cited in Economics PhD Theses were examined for the dataset of 13485 citations. It is noted that 11106 of 13485 citations have publication years and are included in the obsolescence analysis. The remaining citations (2279) with no publication years are excluded from the study.

Some facts of the dataset:

- Citations are counted as zero if unavailable during the study period, in descending order.
- Citations with the latest publication year: 2018
- Citations with the oldest publication year: 1776
- Age range of the citations: 136 years

1) Calculation of Citation Half-Life:

The publication years of the citations are arranged in descending order from 2018 (Appendix A), and the age range is grouped into 14-decade-wise. The cumulative frequency and its percentage are calculated and shown below:

TABLE V OVERALL CITATIONS IN GROUPED AGE RANGE

Sl. No.	Age Range	No. of Citations	Cum. Citations	Cum. Citations (%)
1	0-9	1115	1115	10.04
2	10-19	2514	3629	32.68
3	20-29	2449	6078	54.73
4	30-39	2496	8574	77.20
5	40-49	1430	10004	90.08
6	50-59	695	10699	96.34
7	60-69	188	10887	98.03
8	70-79	74	10961	98.69
9	80-89	44	11005	99.09
10	90-99	28	11033	99.34
11	100-109	25	11058	99.57
12	110-119	17	11075	99.72
13	120-129	23	11098	99.93
14	130+	8	11106	100

Table V helps to determine the citation half-life of 11106 citations, the statistical formula for calculating the median is found applicable to find out the rate of obsolescence, as given below:

Rate of Obsolescence (R)

$$= L + (N/2 - C) * h/f,$$

Where Lower Limit (L) =20,

Total Citation with Publication Years(N)=11106;
 N/2=5553, Cumulative Frequency (C)=3629; Width of the Year (h) =10, Frequency (f)=2449

Rate of Obsolescence (R) =27.8563

The rate of obsolescence for overall citations is found to be 27 years, 10 months and 8 days.

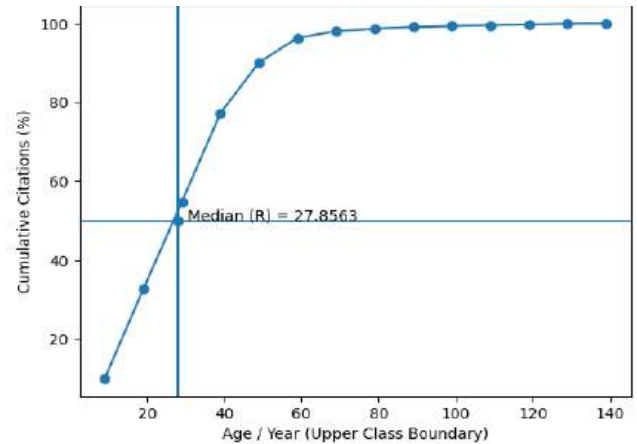


Fig. 4 Intersection Point where Citations Half-Life of Economics PhD Theses falls

From the dataset shown in Appendix A, it is observed that half the cumulative frequencies exceeded 5553 in 1988. Thus, the rate of obsolescence for overall citations is found to be 27 years, 10 months and 8 days. This finding shows that 50% of the cited literature was published between 1988 and 2018, and the remaining 50% literature was published before 1988. The analysis revealed that the majority of citations fall within the age range of 10-29 years. This finding suggested that economic research relies heavily on moderately recent literature while still valuing older, theoretically foundational work.

D. Application of Bradford's Law of Scattering and Identification of Core Journals:

The dataset consists of 3660 journal articles from the 813 cited sources, constituting 27.22%. The frequency of the journal citations in the dataset is extracted using MS Excel, which also ranks journals. Though, the data is small in number, careful observations should be made. 3660 journal articles were found distributed in 813 journal titles. In the process, to identify core journals in the dataset, bibliometric measures such as Bradford's Law of Scattering and the Leimkuhler Model are used to test the validity of the possibilities based on the data.



TABLE VISCATTERED ARTICLES CITED IN JOURNALS

Bradford's Law of Scattering applied to the Cited Journals				
Zones	No. of Journals	No. of Citations	% of Citations	Bradford Multiplier (n)
1	5	1203	32.87	
2	64	1225	33.47	12.80
3	744	1232	33.66	11.63
	813	3660	100	12.21

Table VI shows Nucleus Zone consists of 5 journals, Second Zone with 64 Journals, and Third Zone with 744 Journals. The calculated mean value of Bradford's Multiplier is n=12.21

Mathematically,

Bradford's Law of Scattering are arranged in the geometrical series, 1: n: n² - (1)

$$\text{Error}(\%) = \frac{\text{Tot. Cal. Value of Jls} - \text{Tot. Given Value of Jls}}{\text{Total (Tot.) Given Value of Journals (Jls)}} \times 100 \text{ ----(2)}$$

In equation (1) above, Bradford's Multiplier Value, n=12.21 is applied,

$$\text{Then, } 1: n: n^2: 5: (5 \times 12.21): [5 \times (12.21)^2]$$

Therefore, the total value of journals derived is =
 $5 + 61.05 + 745.42 = 811.47 \text{ - (3)}$

Putting the derived value of journals i.e. 811.47 from (3) in equation (2),

$$\text{ErrorPercentage} (\%) = \frac{811.47 - 813}{813} \times 100 = -0.19\%$$

[Total Given Value of Journals = 813]

Since the percentage (%) Error is still high, the dataset does not fit into the Bradford's Law of Scattering.

Egghe (1990) introduced a new mathematical formula, which modifies Leimkuhler's model for calculating Bradford's multiplier 'k'. The proposed model is given below

$$k = (e_y \times Y_m)^{1/p} \text{ - (4)}$$

where,

$e_y = 1.781$ (Euler's constant; sometimes represented as e^y in texts)
 Y_m = number of articles (or citations) in the **most productive source** (i.e., the journal with the most articles in the dataset) = 655

p is the **number of Bradford zones** (groups that contain similar number of articles) = 3

Using the value from the dataset,

New Bradford's Multiplier

$$k = (1.781 \times 655)^{1/3} \approx 10.53 \text{ - (5)}$$

Mathematically, the number of journals in the nucleus zone of Bradford is calculated using the formula given below with new modifier:

$$r_o = \frac{T(k-1)}{(k^p-1)}$$

where,

T = Total Number of Journals = 813

$$r_o = \frac{813(10.53-1)}{(10.53^3-1)} = \frac{7747.89}{1166.39} \approx 6.64 \text{ - (6)}$$

Then the value in the subsequent new zones is calculated as given below:

$$r_1 = r_o * k = 6.64 \times 10.53 = 69.92 \text{ - (7)}$$

$$r_2 = r_o * k^2 = 6.64 \times (10.53)^2 = 736.25 \text{ - (8)}$$

Now, putting the values of (5) (6), (7) and (8) in Bradford New Zone of Scattering

i.e. $r_o : r_1 : r_2$
 $6.64: 6.64 \times 10.53: 6.64 \times (10.53)^2$
 $6.64: 69.92: 736.25$

Then, the value becomes 812.81 - (9)

Next, Error (%) = $\frac{812.81-813}{813} \times 100$
 $= \frac{-0.19}{813} \times 100 = -0.02\%$

Therefore, it is found that calculation the percentage error becomes absolute low which can be neglected. Hence, the Bradford's law of scattering fits very well in the present dataset for the New Bradford multiplier $k = 10.53$

Newly derived Bradford's Zones are shown below:

TABLE VII NEW BRADFORD'S ZONE VALUE USING NEW MODIFIER VALUE I.E. 10.53

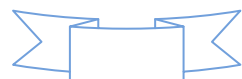
Zone (S)	No. of Journals	No. of Citations	% of Citations	New Bradford Multiplier (k)
1	6.64	1361	37.19	
2	69.92	1123	30.68	10.53
3	736.25	1176	32.13	10.53
	813	3660	100	10.53

Table VIII highlights zone-wise journals and distributed articles or citations. Nucleus Zone consists of 7 journals, Second Zone with 70 Journals, and Third Zone with 736 Journals. The calculated mean value of New Bradford's Multiplier is $k=10.53$

1) Bradford Zones derived based on the New Bradford's Multiplier 'k' fits in the present dataset

TABLE VIII COMPUTED BRADFORD'S ZONES WITH NEW BRADFORD MULTIPLIER $k = 10.53$

Zone (s)	No. of Journals	Citations	Pattern
1	~7 (approx.)	1361	Core journals
2	~70 (approx.)	1123	Secondary journals
3	~736 (approx.)	1176	Peripheral journals



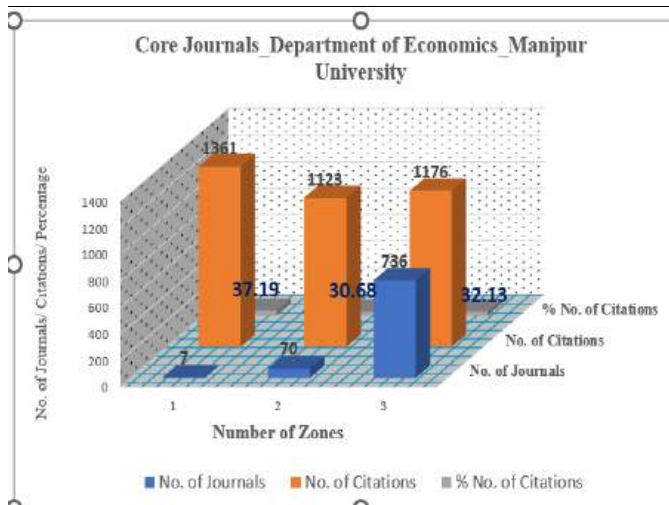


Fig. 5 Depicts Pictorial Representation of Bradford's Law of Scattering

Table VIII and Fig. 5 of the above shown the distributed citations and the number of journals in the respective zones. The components of each zone are as follows: Zone 1 contains 7 journals with 1361 citations; Zone 2 contains 70 journals with 1123 citations; and Zone 3 contains 736 journals with 1176 citations.

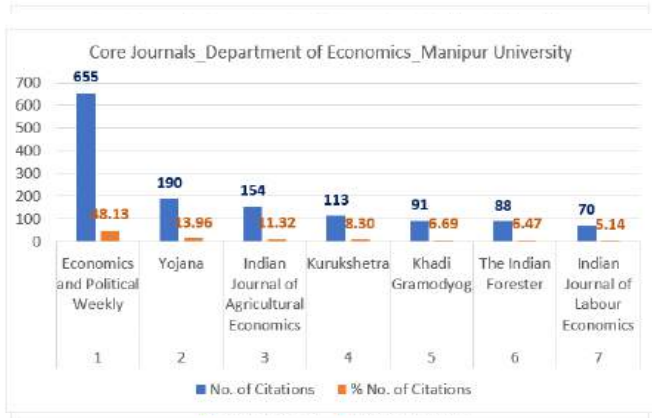
2) Core Journals in Bradford's Zones Using Leimkuhler Model:

The study has identified the top 7 journals in the core zone of the Bradford Laws of Scattering, which includes 1361 citations, approximately one-third of all citations. These journals shown in the core journals and lower frequencies.

TABLE IX EXHIBITS 7 CORE JOURNALS PREFERRED BY THE ECONOMICS SCHOLARS

Sl. No.	Cited Sources	No. of Citations	% No. of Citations	Cum. Citations	% Cum. Citations
1	Economics and Political Weekly	655	48.13	655	48.13
2	Yojana	190	13.96	845	62.09
3	Indian Journal of Agricultural Economics	154	11.32	999	73.40
4	Kurukshetra	113	8.30	1112	81.70
5	Khadi Gramodyog	91	6.69	1203	88.39
6	The Indian Forester	88	6.47	1291	94.86
7	Indian Journal of Labour Economics	70	5.14	1361	100

Fig.6 Graphical Representation of 7 Core Journals



This study confirmed that there are seven (7) core journals in the citation distributions. These seven highly cited core journals are shown in the above Table IX and Fig. 6. The identified the seven (7) core journals preferred by Economics scholars are 1. Economics and Political Weekly having cited 655 times on the top followed by 2. Yojana (190 Citations); 3. Indian Journal of Agricultural Economics (154); 4. Kurukshetra (113); 5. Khadi Gramodyog (91); 6. Indian Forester (88); and 7. The Indian Journal of Labour Economics (70).

VIII. CONCLUSION:

The present study shows that the top-cited sources are books (34.10%), followed by journal articles (27.14%) and government publications (16.06%), indicating that research in the field heavily relies on basic and policy-oriented literature. In the study, scholars preferred low web resources and suggested including digital resources to broaden coverage.

The analysis also highlights the nature of authorship and collaboration in scholarly works. The study found that the major categories of the cited sources, including books and journal articles, are predominant in single-authored works. It is also revealed that in economic research, there is a gradual shift from solo to collaborative research, particularly during the period 1996-2005, which showed the highest degree of collaboration, reflecting collaborative and interdisciplinary research practices. Above that, the rise in CI values during 2006-2015 indicates a growing trend toward multi-authored research publications.

The analysis also examined the obsolescence of cited literature, calculated the citation half-life to understand the trends in scholars' literature use patterns, and found it to be 27 years and 10 months. This finding suggested that scholars in the field used classical works and applied foundational theories in their research.

The analysis using Bradford's Law identified seven core journals, with Economics and Political Weekly emerging as the most cited source among the journals. The study also mentioned that the concentration of citations within a limited number of journals still enables scholars to rely on the centralised sources. Ultimately, the study reveals traditional scholarly practices alongside rising collaborative trends, with a strong reliance on core literature.

This study will benefit a wider range of stakeholders, including researchers, faculty members, librarians, policymakers, and academic institutions. The findings will provide insights into trends in authorship and the collaborative nature, identify the most preferred cited sources, and understand the citation behaviours exchanged among scholars, thereby helping researchers and faculty members improve research strategies and appropriate



directions. It also helps librarians and information professionals make informed decisions based on evidence and includes identified core journals in the subscription list, strengthening the backbone of the university's research support system. or university administrators and policymakers, the study offers valuable insights for evaluating research performance, promoting collaborative research, and framing institutional research policies. This study may serve as a reference for future studies in other disciplines.

IX. RECOMMENDATIONS:

The following recommendations are proposed based on the analysis's findings.

- 1) The identified core journals should be given priority in the subscription as they form the backbone of economics research.
- 2) Scholars should be given due opportunity to participate in interdisciplinary research activities collaboratively to produce enriched research outputs.
- 3) Institutional procurement should include digital resources and encourage scholars to use them effectively, including recent journal articles, to keep abreast of research in their respective fields of study.
- 4) Similar studies in other disciplines may be conducted to compare patterns and trends and to provide a broader understanding.

X) DATA SOURCES:

<https://tinyurl.com/s7yvzf99>

QR Code:



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