Research Productivity of Social Scientists in Tamilnadu State Universities: A Bibliometric Study

N. Rajalakshmi, *Research Scholar*
M. Surulinathi, *Assistant Professor*
S. Srinivasaragavan, *Professor and Head*
R. Balasubramani, *Assistant Professor*
Department of Library and Information Science, Bharathidasan University
Tiruchirappalli-24, Tamilnadu, India
surulinathi@gmail.com

Abstract

Bibliometric studies are increasingly being used for research assessment. Bibliometric indicators are strongly methodology-dependent but for all of them, various types of data normalization are an indispensable requirement. This paper attempts to analyze the social science research output in Tamil Nadu state universities, as reflected in 2198 publication output covered by Scopus online database during 2001-2017. 1192 Publications (54.23%) has produced by Anna University followed by Annamalai University with 232 (10.56%), University of Madras with 189(8.60%). 50% Universities not yet reached 100 Publications. Totally 3405 authors were contributed. Among those highest productivity authors were ranked according to their publications. The analysis covers mainly the research productivity of State Universities, Preferred journals for published by scholars, highly productive authors, highly cited papers and degree of Collaboration co-efficient of State Universities.

Keywords: *Bibliometrics, Research productivity, Highly Cited Papers*

INTRODUCTION

Bibliometric indicators are increasingly being used as a tool for research performance evaluation. These indicators are based on bibliographic databases, which are designed primarily for Information retrieval purposes so informetrics studies represent only a secondary use of the systems. This causes many technical and interpretative problems, including methodological considerations: One of the most crucial objectives in bibliometric analysis is to arrive at a consistent and standardised set of indicators. At the same time there is always a considerable risk of ignoring important differences in the societal impact of a research programme, because this can not be captured using bibliometric method.

Bibliometrics can be described as the use of mathematical techniques to investigate publishing and communication patterns in the distribution of information (1). The examination of where and when references are cited, otherwise known as citation analysis, represents one of the most common methods in this field. Citation analysis and its application for scientific journals

was pioneered by Eugene Garfield in the mid-1950s, and from early on it had been noticed that a relatively small group of core journals were collecting the majority of citations. To help facilitate the dissemination and retrieval of scientific literature (2) Garfield founded the Institute for Scientific Information (ISI) and produced the journal Impact Factor as a means for comparing periodicals regardless of their size, given that smaller journals would be disadvantaged if evaluation methods relied solely on publication numbers or citation counts (3). The field of citation analysis has continually evolved since that time, particularly in recent years, as researchers now use increasingly comprehensive data sets and analytical techniques to establish trends and patterns in the academic literature.

Bibliometrics has proved a powerful tool for the evaluation of scientific research. The application of bibliometric method to research in disciplinary areas in which consensus is reached has become almost routine. Bibliometric work is facilitated in such areas because their literature exhibits certain characteristics: research is published predominantly in English language journals and references predominantly recent papers in a set of core journals recognised for their high quality and impact. Thus, a focused body of citations is generated which is fairly current and is accessible if a bounded set of journals is indexed. The Science Citation Index of course takes advantage of these characteristics to provide the indispensable basis for citation analysis of scientific output. If research outcomes are to be evaluated, patent citations to scientific literature are available (Narin, 1997), and these are almost as well indexed and well behaved as the journal literature. They are also becoming more useful as more and more public sector researchers patent (Hicks et al., 2001).

RELATED LITERATURE

The study of authorship and collaboration pattern with bibliometrics as tool is not a new concept. There are any studies on this area. A few prominent ones are summarized. Ramesh [et al] analysed the papers published in the quarterly International Rice Journal from 1986-1995 and found that multiple author contributions constituted the maximum proposition (87.82 percent) and the degree of collaboration over this period varied from 0.90 – 0.95. The length of the articles with 1-5 pages was found to be at the maximum with 78.3 percent.

Thangavel Rajagopal, et al. (2013) have Analysed the growth and development of pheromone biology research pro-ductility in India in terms of publication output as reflected in Science Citation Index (SCI) for the period 1978–2008. It includes 330 publications from India, including 285 articles, 22 notes, 18 reviews, 4 letters and 1 conference paper, from 200 institutions. About 9.4 % of publications is contributed by Indian Institute of Technology, Kanpur followed by Bhabha Atomic Research Centre, Bombay (7.27 %). All the papers published by Indian researchers have appeared in journals with impact factors between 0.20 and 4.14. About 24.24 % of authors contributed single articles. The growth rate of publications varied from 0.30 to 9.09 % per year. The annual growth rate was highest in the year 2006 at 9.09 %. The study reveals that the output of pheromone biology research in India has gradually increased over the years.

Surulinathi, M and Ankasetty, K., (2013) have presented a citation based mapping of data on global scientific activities from University of Mysore research publications using Web of Science Database. Using different scientometric approaches, a continuous increase of both quantitative and qualitative parameters such as h-index and Global Citation Scores. In this 2551 articles were published during the time period 2001-2012 and cited at least 60 times by end of 2012 were analyzed.

OBJECTIVES OF THE STUDY

- To study the growth rate of Social science research productivity in State Universities of Tamil Nadu ;
- To measure and calculate the relative growth rate and doubling time for publications;
- To identify the Bibliographical form wise distribution;
- To identify the highly Cited papers and High Productive University.
- To examine the Source wise distribution of research output ; and
- To analyse the type of co-authorship pattern and examine the extent of research collaboration.

METHODS AND TECHNIQUES

The whole data form of Social Science research output in Tamil Nadu state universities for the period 2001 – 2017 were retrieved from Scopus Database. The search strategy for general search of Social science literature was as follows: Database=Limited to Social Science Citation Index; Document Type=All documents; Time Span=2001-2017; Tamil Nadu A total of 2198 records of various types, comprising Articles, Meeting Abstracts, Reviews, Bibliographic Items, Editorial Material, Letters, Corrections, and News Items was retrieved. The collected data were analysed using MS-Excel Spreadsheet and MS-Word.

BIBLIOMETRIC INDICATORS

Relative Growth Rate (RGR)

The relative growth rate is the increase in the number of publications per unit of time. The mean relative growth rate R-(1-2) over a specified period of interval can be calculated from the following equation.

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

Where,

R (1-2) = Mean relative growth rate over the specified period interval;
W1 = log w1 (Natural log of initial number of publications)
W2 = log w2 (Natural log of initial number of publications)
T2-T1 = the unit difference between the initial time and final time.

The relative growth rate for publications can be calculated separately. Therefore,

R (a) = Relative growth rate per unit publication per unit of time (year).

DOUBLING TIME

It is also calculated that there is a direct equivalence existing between the relative growth rates and doubling time. If the number of publications of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. If one uses natural logarithms, this difference has a value of 0.693. Thus, the corresponding doubling time for publications can be calculated by the following formula:

Doubling time

$$(Dt) = \frac{0.693}{R(a)}$$

Therefore,

Doubling time for publications Dt(a) = 0.693 / R (a)

COLLABORATIVE COEFFICIENT (CC)

The pattern of co-authorship among different countries have been examined by making use of Collaborative Coefficient (CC) suggested by Ajiferuke e.tal (1988). The formula used for calculating CC is as follows. Where

$$CC=1-[\sum_{J=1}^{k} (1/j)Fj/N]$$

Fj=the number of authored papers

N=total number of research published; and

k=the greatest number of authors per paper

According to Ajiferuke, CC tends to zero as single-authored papers dominate, and to 1-1/j as j-authored papers dominate. This implies that higher the value of CC, higher the probability of multi-authored papers.

DEGREE OF COLLABORATION

In order to identify the degree of collaboration, the research or has adopted K. Subramanyam's formula 3.

The formula is C = Nm/(Nm+Ns)

Where,

C = Degree of collaboration in a discipline

Nm = Number of multiple authored papers

Ns = Number of the single authored papers

RESULTS AND DISCUSSIONS

Tamil Nadu state universities research output

There are 20 State Aided Universities in Tamil Nadu, of which, only 11 find place in the research publication in the Scopus Database. Anna University has the highest publication count which 54.23 per cent of the total research output followed by Annamalai University and University of Madras. Bharathiyar University ranks fourth in the research output. The correlation coefficient of year of establishment of the Universities and their research productivity works out to 0.05 (0.049) which is positive and low showing that the older Universities have much higher research productivity.

Table1 Social Science Research productivity of State Universities in Tamilnadu

S.No	Universities	Year of established	Age of the University	Research Output	%	Rank
1	Alaggappa University	1985	32	89	4.05	**6**
2	Anna University	1978	39	1192	54.23	**1**
3	Annamalai University	1929	88	232	10.56	**2**
4	Bharatiyar University	1982	35	118	5.37	**4**
5	Bharathidasan University	1982	35	102	4.64	**5**
6	Gandhigram Rural University	1956	61	79	3.59	**7**
7	Madurai Kamarajar University	1965	52	73	3.32	**8**
8	Manaonmaniyam Sundaranar University	1998	19	70	3.18	**9**
9	Periyar University	1992	25	51	2.32	**10**
10	Thiruvalluvr University	2002	15	3	0.14	**11**
11	University of Madras	1857	160	189	8.60	**3**
TOTAL				**2198**	**100**	

Year wise distribution of Publications

The annual research output of Social science research in Tamil Nadu state Universities for the period 2001 – 2017 has been presented in Table 2. The result indicates that the number of publications was 2198 during the study period. The highest output was observed in 2013 that accounts for 11.97 percent of total output over the period of study and followed by 11.87 per cent for the year 2011. It was found that a steady growth in terms of productivity was observed throughout the period of study. However, there was a sudden increase in 2006 and 2008 while there was a declining trend observed in 2007 and 2013.

Table 2 – Year wise distribution of Publication

Year	Research Output	%	Cumm %
2001	26	1.18	1.18
2002	32	1.46	2.64
2003	26	1.18	3.82
2004	21	0.96	4.77
2005	38	1.73	6.50
2006	123	5.60	12.10
2007	68	3.09	15.19
2008	111	5.05	20.24
2009	110	5.00	25.25
2010	138	6.28	31.53
2011	261	11.87	43.40
2012	185	8.42	51.82
2013	263	11.97	63.78
2014	212	9.65	73.43
2015	228	10.37	83.80
2016	198	9.01	92.81
2017	158	7.19	100.00
TOTAL	**2198**	**100.00**	

GROWTH RATE AND DOUBLING TIME FOR PUBLICATION

Table 3 predicts data of relative growth rate and doubling time for Tamil Nadu state Universities social science research output. It is observed that its relative growth rates have contracted progressively from 0.21 at 2002 to 0.23 in the year of 2017. The whole study period sample mean relative growth rate is 0.11. Contrary to this, the Doubling Time for publication of all sources of Tamil Nadu State Universities social science research output has decreased from 0.10 years at 2006 to 0.92 years at 2017. During the study period doubling time value is 0.59.

The above table reveals that Growth Rate of social science Research output; it is found that the growth rate was at a maximum in the year 2006 and at its minimum in 2015. Further it is found that the growth rate of research output was found to be negative during the following

years, 2003,2004, 2007, 2009 , 2012, 2014 and 2016**.** The remaining years are indicating positive growth. Relative growth rate has shown wealthy trend, which means the rate of increase is low in terms of segment, and this has been highlighted by doubling time for publications, which is more than the relative growth rate.

Table 3-- GROWTH RATE AND DOUBLING TIME FOR PUBLICATION

S. No.	Years	Records	Cumulative	Log W1	Log W2	R(a)	DT
1	2001	26	26	-	3.26	--	0.69
2	2002	32	58	3.26	3.47	0.21	0.49
3	2003	26	84	3.47	3.26	0.21	0.90
4	2004	21	105	3.26	3.04	0.21	0.91
5	2005	38	143	3.04	3.64	0.59	0.10
6	2006	123	266	3.64	4.81	1.17	0.48
7	2007	68	334	4.81	4.22	0.59	1.29
8	2008	111	445	4.22	4.71	0.49	0.20
9	2009	110	555	4.71	4.70	0.01	0.70
10	2010	138	693	4.70	4.93	0.23	0.47
11	2011	261	954	4.93	5.56	0.64	0.06
12	2012	185	1139	5.56	5.22	0.34	1.04
13	2013	263	1402	5.22	5.57	0.35	0.34
14	2014	212	1614	5.57	5.36	0.22	0.91
15	2015	228	1842	5.36	5.43	0.07	0.62
16	2016	198	2040	5.43	5.29	0.14	0.83
17	2017	158	2198	5.29	5.06	0.23	0.92
	TOTAL	**2198**	**Mean R(a) = 1.80(0.11)**				**9.98(0.59)**

Bibliographical form wise distribution of Publications

Table 4 presents a complete scenario of different forms of periodical and non periodical which were used by Social science researchers in Tamil Nadu State Universities for their

research publications. The analysis of publications of 2198 records based on Social Science Citation Index Expanded revealed that journal articles occupy predominant position sharing 63.88 percent of total research output. The other ranked sources include Conference papers (24.29 percent), Book Chapter (5 percent), Reviews (2.96 percent), Editorial (1.89 per cent), Note (1.59 percent) Books (0.45 per cent).

Table 4: Source wise Distribution of Research Output

Sources	No of Publications	Per cent	Cumm %
Article	1404	63.88	63.88
Book Chapter	110	5.00	68.88
Conference Paper	534	24.29	93.18
Review	65	2.96	96.14
Book	10	0.45	96.59
Editorial	40	1.82	98.41
Note	35	1.59	100.00
TOTAL	**2198**	**100**	

AUTHORSHIP PATTERN

Table 5 projects the overall analysis of the pattern of authorship and its percentage in contributing research output to the field social sciences. The authors are classified according to their contribution that they have published. It could be observed from the results that two authored publications rank first in order sharing 51.72 percent of the total research output. The three authored papers follow second in order taking 22.61 percent of the total research contributions. Four authored contributions take the third position in order sharing 12.28 percent of the total research output during the study period. Single authored papers rank next in order reporting 206 contributions that amounts to 9.37 percent of total research output followed by five, and six authored contribution sharing 6.96 percent, and 3.05 percent respectively

Table 5 Authorship pattern

Authorship Pattern	No. of Contribution	Percentage of Authors	Cumulative Percentage
1	206	9.37	9.37
2	917	41.72	51.09
3	497	22.61	73.70

4	270	12.28	85.99
5	153	6.96	92.95
6	67	3.05	95.99
7	28	1.27	97.27
8	20	0.91	98.18
9	7	0.32	98.50
10 and More than 10	33	1.50	100.00
Total	**2198**	100	

Figure 1. Shows Authorship pattern

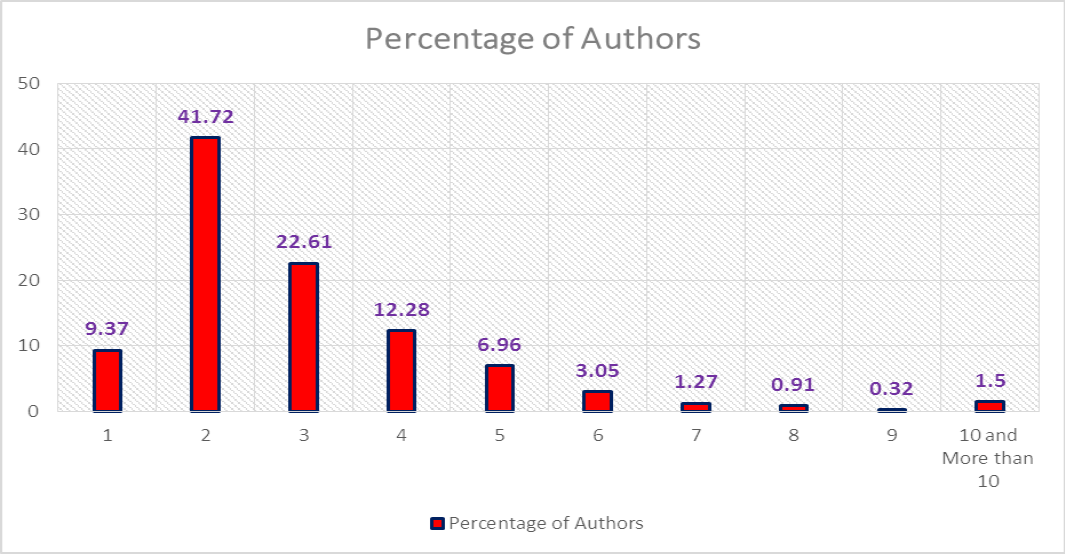

Figure shows the authorsphip pattern of publications. It could be concluded from the above discussion that the research publication brought out by Social science researchers in the Universities of Tamil Nadu intended to take collective participation in research and problem solving activities. It has been proved from the analysis that single authored papers have declining trend and thereby collective contributions reported an increasing performance in research output of the resources in the field of Social Science sciences.

DEGREE OF COLLABORATION

To analyses the nature of the researchers participation in research activity, author productivity is tested. In this context the researcher aims at analysing the degree of collaboration on scientific output made by Faculty members of Tamil Nadu Universities. It enables one to examine the research trends in terms of author productivity

Based on the data presented in Table 5, the Degree of Collaboration (DC) using equation (3) was calculated for three different periods such as 2001- 2006, 2007-2012, and 2013-2017. Table 6 revealed that the computed value of DC for different years does not show much variation. However, the lowest DC (0.55) was found during 2001-2006 whereas the highest DC (0.93) was observed during 2013-2017. This indicates that social science research in universities of Tamil Nadu is fairly collaborative.

Table 6 SHOWING YEAR WISE DISTRIBUTION OF DEGREE OF COLLABORATION

Year	NM	Ns	NM +Ns	c= Nm(Ns+Nm)
2001-2006	43	237	280	0.85
2007-2012	96	767	863	0.89
2013-2017	77	978	1055	0.93
TOTAL	**216**	**1982**	**2198**	**0.90**

HIGHLY CITED PAPER IN SOCIAL SCIENCE RESEARCH

Totally 3405 authors were contributed. Among those highest productivity authors were ranked according to their publications. From the below table analysis most prolific authors, their publication productivity, started year of their research, Sources and Citations.

Table 7 HIGHLY CITED PAPERs IN SOCIAL SCIENCE RESEARCH

S.No	Author	Highly cited papers	Year	Source titles	Cited
1	Dingus, T.A., Mcgehee, D.V., **Manakkal, N., (...),** Carney, C., Hankey, J.M.	Human factors field evaluation of automotive headway maintenance/collision warning devices	2001	Human Factors 39 (2), pp. 216-229	106
2	Dingus, T.A., Hulse, M.C., Mollenhauer, M.A., (...), Mcgehee, D.V., **Manakkal, N**.	Effects of age, system experience, and navigation technique on driving with an advanced traveler information system	2001	Human Factors 39 (2), pp. 177-199	96
3	**Duraisamy, P.**	Changes in returns to education in India, 1983-94: By gender, age-cohort and location	2002	Economics of Education Review 21 (6), pp. 609-622	70
4	Namasivayam, C., **Sangeetha,** D., Gunasekaran, R.	Removal of anions, heavy metals, organics and dyes from water by adsorption onto a new activated carbon from Jatropha husk, an agro-industrial solid waste	2007	Process Safety and Environmental Protection 85 (2 B), pp. 181-184	50
5	**Joseph, K.**	Stakeholder participation for sustainable waste management	2006	Habitat International 30 (4), pp. 863-871	45
6	**Jayakanthan, R.**	Application of computer games in the field of education	2002	Electronic Library 20 (2), pp. 98-102	43

7	**Nachiappan, R.M., Anantharaman, N.**	Evaluation of overall line effectiveness (OLE) in a continuous product line manufacturing system	2006	Journal of Manufacturing Technology Management 17 (7), pp. 987-1008	41
8	Joseph, K., Nithya, N.	Material flows in the life cycle of leather	2009	Journal of Cleaner Production 17 (7), pp. 676-682	34
9	Basak, S.C., Sathyanarayana, D.	Pharmacy education in India.	2010	American journal of pharmaceutical education 74 (4), pp. 68 Open Access	26
10	**Ghani, K.A.,** Jayabalan, V.	Advanced manufacturing technology and planned organizational change	2000	Journal of High Technology Management Research 11 (1), pp. 1-18	26

The table 7 revels that research shows the total global citation score. The analysis depicts the productivity of authors during the period of study. **Manakkal** is the most productive author who has received 106 Global Citation Scores with first place (Dingus, T.A., Mcgehee, D.V., **Manakkal, N., (...),** Carney, C., Hankey, J.M et al. (2001) Human factors field evaluation of automotive headway maintenance/collision warning devices Human Factors 39 (2), pp. 216-229) and the above table shows only top 10 authors with Citations.

FINDINGS AND CONCLUSION

It could be concluded from the above discussion that the research publication brought out by Social science research productivity in Universities of Tamil Nadu intended to take collective participation in research and problem solving activities. The highest output was observed in 2013 that accounts for 11.97 percent of total output. The whole study period sample mean relative growth rate is 0.11. Contrary to this, the Doubling Time for publication of all sources of Tamil Nadu State Universities social science research output has decreased from 0.10 years at 2006 to 0.92 years at 2017. During the study period doubling time value is 0.59. It has been proved from the study that single authored papers have declining trend and thereby collective contributions have an increasing performance in research output in the field of Social Science. A unique observation that the Indian contributors to Social science researcher have made their research publications in two forms only journals and conference proceedings. More such studies could be conducted and brought to light to help finding areas need improvement.

REFERENCES

- ***Savita Nandan Bhatkal, M. Surulinathi, R. Balasubramani and S. Srinivasaragavan (2020),*** *Geographical Information System Research in India: A scientometric Mapping of Publications, Gedrag and Organizatie Review, 33(3), 327-342.*
- ***S. Laksham, M. Surulinathi, R. Balasubramani and S. Srinivasaragavan (2020),*** *mapping the Research output on Coronavirus: A Scientometric Study, Gedrag and Organizatie Review, 33(2), 163-186.*
- ***T.Rajagopal, M.Surulinathi, Arulmozhi Manimozhi, Ponnirul Ponmanickam, Govindaraju Archunan (2020),*** *Global research output in Antelope species: A case study, International Journal of Zoology Studies, 5(2), 31-41.*
- ***Hicks, D. Breitzman, A., Olivastro, D., Hamilton, K. (2001).*** *The changing composition of innovative activity in the U.S.—a portrait based on patent analysis. Research Policy, 30, 681–703.*
- ***Narin, F., Hamilton, K.S., Olivastro, D. (1997).*** *The increasing linkage between U.S. technology and public science. Research Policy, 26 (3), 317–330.*
- ***Ramesh, [et al] (2000).*** *Publication Pattern in Oryza (Oryza Sativa L.) from 1986-1995: A Bibliometric Study. SRELS Journal of Information Management, 37: 215-227.*
- ***Surulinathi, M., Balasubramani, R., and Kalisdha, A. (2013).*** *Continent wise Analysis of Green Computing Research: A Scientometric Study. Journal of Advances in Library and Information Science, 2(1), 39-44.*
- ***Surulinathi, M and Ankasetty, K., (2013).*** *Highly Cited Papers from University of Mysore: A Citation Mapping. 14.139.186.108.*
- ***Laksham, S., Surulinathi, M., Balasubramani, R., & Jayasuriya, T. (2020).*** *Research output on Coronavirus: The Indian Perspective, Journal of Information and Computational Science, 10(4), 568-584.*
- ***Surulinathi, M., Karthik, M., Srinivasaragavan, S., & Balasubramani, R. (2020).*** *Mapping the Research output on Hantavirus: The Global Perspective, NOVYI MIR Research Journal, 5(4), 136-148.*
- ***Surulinathi, M., Karthik, M., & Balasubramani, R. (2020).*** *Research output on Hantavirus: A Scientometric Study, Journal of Shanghai Jiaotong University, 16(7), 323-3368.*
- ***Poornima A. and Surulinathi, M. (2019).*** *A Scientometric study on Yoga research during 1989-2018, Asian Journal of Information Science Technology, 9(2), 17-22.*
- ***M. Surulinathi, N. Prasannakumari and B. Neelakandan (2016)*** *Research Publication Trends among Faculty of Bharathidasan University: A Scientometric Study. International Journal of Next Generation Library and Technologies, 1(4), 1-11.*