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Article

Research Productivity of Academics as Reflected in Web of Science: A Scientometric Study

Basavaraja MT[1], BT Sampath Kumar[2]

[1]Librarian, Acharya Institute of Technology, Bengaluru, Karnataka, India.
[2]Professor, Department of Studies and Research in Library and Information Science Tumkur University, Tumakuru, Karnataka, India.

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Corresponding Author:
Basavaraja MT, Acharya Institute of Technology, Benguluru, karnataka, India.
E-mail Id:
basumnc@gmail.com
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A B S T R A C T

Research productivity refers to an innovative thoughts and ideas which after theoretical and applied studies lead to publication of articles in leading journals, patent registration or documentation. In this context, the present study aims to identify the research productivity of University of Mysore and Bangalore University during 1989 to 2018. The study also tried to retrieve the information regarding the total number of citations, h-index, average citation per article of the faculty members of University of Mysore and Bangalore University using Web of Science. In order to get the research output of the universities, the search terms 'University of Mysore' and 'Bangalore University' are entered in the search box of the "Web of Science". The result of the study shows that 4838 records of the University of Mysore and 2784 records of the Bangalore University have been included in the Web of Science database, out of which, majority (University of Mysore-91.28% and Bangalore University-91.38%) of the records are research articles. The study identified that among the faculty members of University of Mysore, Rangappa has received highest number of citations (4027), followed by Yathirajan hasreceived 2425 citations. Similarly, Kamath faculty member of the Bangalore University has received the highest number of citations (3691), Devi has received 2994 citations.In this context, the study recommends that the faculty members of the both universities need to publish their research articles in peer reviewed journals with high Impact Factor.

Keywords: Research Productivity, University of Mysore, Bangalore University, Web of Science

Introduction

Publication in high status refereed journals has become a major criterion of academic success in the competitive environment of global higher education. Universities are engaged in a global arms race of publication, the academics are the shock troops of the struggle (Altbach, 2014). It is useful to keep in mind that the publications and rankings games are limited to a very small part of the academic system in any country. In recent years, there has been increasing interest among researchers and policy makers in the notion of researchproductivity. Research productivity is one of the major measures of university academic performance and a core indicator for calculations of university rankings. However, it isobvious that there exists the significance of cultural heritage for the styles of

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knowledge production by Asian academics as well. Higher education in Asia is approaching a historical moment, and recently, the average annual growth rates ofresearch publications have been particularly high in Asia(National Science Foundation, 2012). Research productivity is easier to measure than other kinds of academic work teaching has been mentioned, and community engagement and such important functions as university-industry linkages are also difficult to define and quantify. Thus, research is not only the gold standard, but almost the only semi reliable variable. But even measuring research productivity is problematical (Altbach, 2014).

The global rankings count journals that are indexedin main global indices such as the Science Citation Index, Web of Science, Scopus, their equivalents for other disciplines. These indices list only a small number of journals and tend to favor publications in English, the global scientific language. The rankings and other national evaluations also count research grants and other awards. Again, this may be appropriate for the hard sciences, but not necessarily for other disciplines. The rankings also do not take into account the vast differences among countries and academic institutions. Neither the indices nor most universities recognize a range of other measures of productivity as well as significant changes in knowledge distribution that have taken place in recent years.

Thus, this study examined the research productivity of faculty members of University of Mysore and Bangalore University using Web of Science. It also made an attempt to know the subject wise distribution of records, growth of records, ranking of authors based on the total number of citations received for the research articles.

Review of Literature

In present years many studies have been conducted to know the growth of literature in various subjects using Scientometrics study. Bar-Ilan and Al (2007) compared the rankings of the publications of highly-cited Israeli researchers induced by the citations counts reported by Web of Science, Scopus and Google Scholar. The computed measures show high similarity between Scopus and Web of Science and lower similarities between Google Scholar and the other tools, indicating that Google Scholar's coverage is considerably different from that of Web of Science and Scopus.

A study by Gupta and Bala (2010) analyzed Indian Science and Technology publications of 1996-2010. This study conducted on the basis of Scopus database and examined several quantitative measures. The study found that India contributed 538609 papers in science and technology during 1996 to 2010 with an annual average growth rate of 9.32 percent. The study found that top 100 most productive Indian organisations contributed 54.92 per cent share (295827 papers). The study shows that among the India's contribution to global research output in broad 20 subjects during 1996-2010, the largest publications share (5.49 per cent) comes from veterinary science. The study carried out by Bagalkoti (2013) on Scientometric analysis of Indian science publication output as reflected in Scopus Database found that 7,01,900 papers received 36,65,095 citations during the period 1997-2011. India was ranked 10th among the 50 productive countries of the world in Science and Technology. The study shows that global publications share of India during 1997-2011 was 2.73%, which has increased from 1.93 in 1997 to 4.00 in 2011 and India has published 1,59,110 (22.29%) international collaborative papers. As per the study Physical sciences subjects together contributed the highest publications share (57.59%), followed by Life Sciences (26.91%), Medicine (15.51%). The study found that Indian Institute of Science contributed the highest publications, i.e., 26161 articles with 14.41% to total output and among universities, the largest number of papers 11685 (4.81%) is published by Jadavapur University, followed by Banaras Hindu University 11680 (4.80%).

Biswas and According to Rasolabadi et al., (2015), the aim of this study was to analyze Iran's research performance on diabetes in national and international context. This Scientometric analysis is based on the Iranian publication data in diabetes research retrieved from the Scopus citation database till the end of 2014. The study found that Iran's cumulative publication output in diabetes research consisted of 4425 papers from 1968 to 2014, with an average number of 96.2 papers per year and an annual average growth rate of 25.5 per cent. Iran ranked 25th place with 4425 papers among top 25 countries with a global share of 0.72 per cent. Average of Iran's publication output was 6.19 citations per paper.

After reviewing the existing literature, it was found that there were various studies have been carried out to know the growth of publications by various subject, comparison the Google Scholar, Web of Science and Scopus. Henceforth, there were few studies conducted to measure the institutional productivity, thus the present study has been undertaken to measure the research productivity of University of Mysore and Bangalore University.

Objective of the Study

- To know the Relative Growth Rate and Doubling time of records of universities
- To identify the different types of records included in the Web of Science
- To know the number of records included in the Web of Science in various subject
- To identify the most productive authors based on the number of citations

Scope and Methodology

The scope of the study is confined to know the research productivity of two universities viz., University of Mysore and Bangalore University in Karnataka State. In order to know the research productivity of these universities the Web of Science database has been used. The search term "University of Mysore" and "Bangalore University" are entered in the search box of the Web of Science. The number of records retrieved was saved in a separate file. The data downloaded from the Web of Science was analysed for further analysis. The Correlation test has been applied to know the correlation between the years and growth of records.

Analysis and Interpretation of Data

Relative Growth Rate (RGR)

Relative Growth Rate (Rt) and Doubling Time (DT) has been applied, RGR means an increase in the number of articles per unit of time. The mean Rt of articles over the specific period of interval is represented as:

R_t = Relative Growth Rate of articles over the specific period of time.

= Logarithm of initial number of articles
= Logarithm of final number of articles

Similarly, RGR of subject's articles has increased in the number of articles per unit of time. The mean RGR of subject articles R_t(SA) over the period the specific period of time is determined as:

$$R_t(SA) = \frac{1}{t}\left[\log_e p(t) - \log_e p(0)\right]$$

R_t (SA) = Relative Growth Rate of articles over the specific period of time.

$\log_e p(0)$ = Logarithm of initial number of articles
$\log_e p(t)$ = Logarithm of final number of articles

Doubling Time (D_t)

D_t (Doubling Time) has been calculated using the following formula:

Doubling Time or D_t = 0.693/R

D_t (Doubling Time) is directly related to RGR and is defined as the time required for the articles to become double of the existing amount. If the number of articles in subject doubles during a given period, then the difference between the logarithms of number at the beginning and at the end of this period must be the logarithm of the number 2. We used Napier logarithm and the token value of $\log_e 2$ is 0.693. Hence, an average growth rate has calculated, Napier logarithm has increased to 0.693. So the Doubling time is calculated as:

$$D_t(SA) = \frac{\log_e 2}{R_t(SA)} = \frac{0.693}{R_t(SA)}$$

Table 1.Relative Growth Rate (Rt) and Doubling time (Dt) of records of University of Mysore

Year	Records	Cumulative records	$\text{Log}_e 1^p$	$\text{Log}_e 2^p$	R_t (P)	Mean R_t (P)	D_t (P)	Mean D_t (P)
1989	44	44	3.78		0.00		0.00	
1990	55	99	4.01	4.60	0.81		0.85	
1991	59	158	4.08	5.06	1.06		0.66	
1992	73	231	4.29	5.44	1.36		0.51	
1993	66	297	4.19	5.69	1.40	0.93	0.49	0.50
1994	54	351	3.99	5.86	1.67		0.41	
1995	55	406	4.01	6.01	2.02		0.34	
1996	45	451	3.81	6.11	2.10		0.33	
1997	94	545	4.54	6.30	2.49		0.28	
1998	69	614	4.23	6.42	1.88	2.03	0.37	0.35
1999	108	722	4.68	6.58	2.35		0.30	
2000	78	800	4.36	6.68	2.00		0.35	
2001	111	911	4.71	6.81	2.46		0.28	
2002	150	1061	5.01	6.97	2.26		0.31	
2003	111	1172	4.71	7.07	2.06	2.22	0.34	0.31
2004	158	1330	5.06	7.19	2.48		0.28	
2005	198	1528	5.29	7.33	2.27		0.31	
2006	262	1790	5.57	7.49	2.20		0.31	

2007	304	2094	5.72	7.65	2.08		0.33	
2008	201	2295	5.30	7.74	2.02	2.02	0.34	0.32
2009	264	2559	5.58	7.85	2.54		0.27	
2010	286	2845	5.66	7.95	2.38		0.29	
2011	301	3146	5.71	8.05	2.40		0.29	
2012	206	3352	5.33	8.12	2.41		0.29	
2013	216	3568	5.38	8.18	2.85	2.52	0.24	0.28
2014	238	3806	5.47	8.24	2.87		0.24	
2015	305	411	5.72	8.32	2.85		0.24	
2016	289	4400	5.67	8.39	2.67		0.26	
2017	269	4669	5.59	8.45	2.78	2.79	0.25	0.25

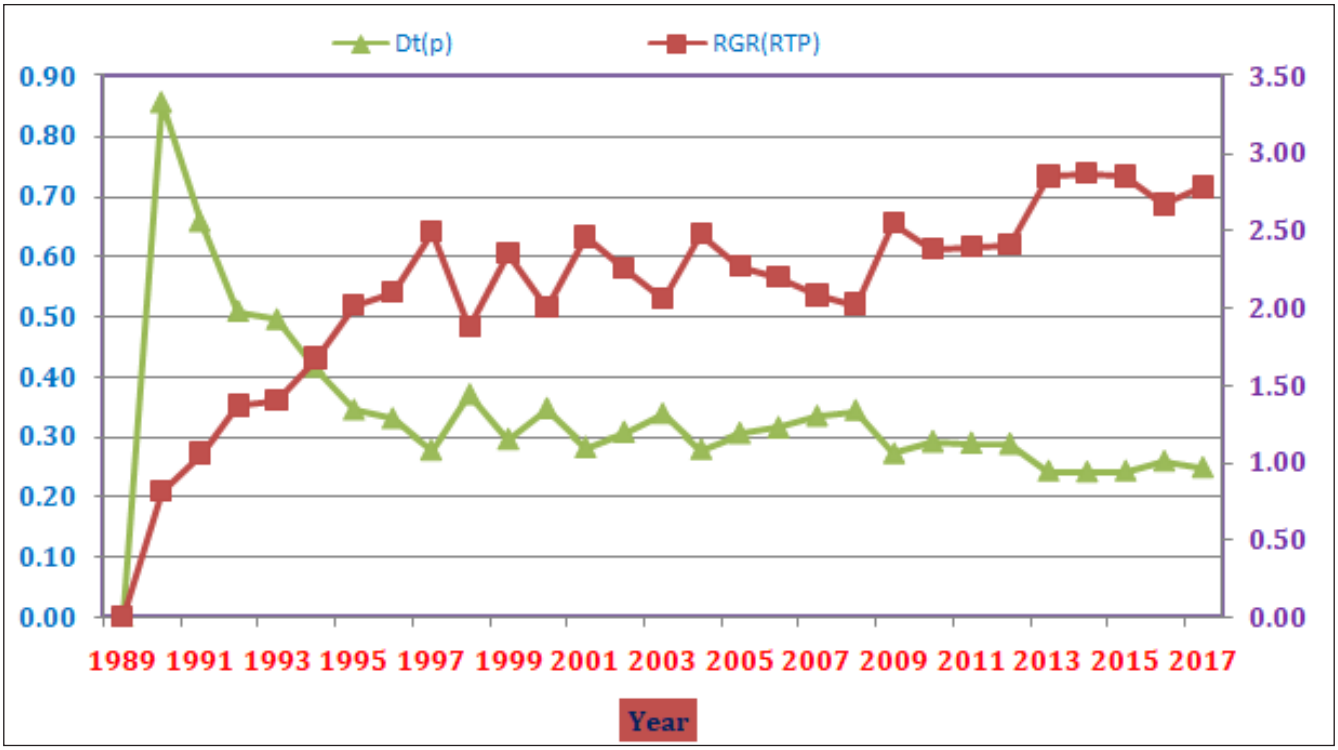

Figure 1.Growth Rate of Records of University of Mysore

The Table 1, indicates the Relative Growth Rate (Rt) and Doubling time (Dt) of the records of University of Mysore. The table indicates that the RGR has beenincreased to from 0.81 in the year 1990 to 2.78 in the year 2017. The highest mean relative growth rate is recorded between the year 2013-2017 is 2.79 and the least relative growth rate recorded between1989 to 1993 is 0.83, From the data presented in the table, it is found that there is positive correlation between the year and number of articles (r=.868, p=.000) and Correlation is significant at the 0.01 level. The Relative Growth Rate (Rt) doubling time (Dt) of records of Bangalore University is presented in the Table 2. The growth rate has been increased from 0.63 to 2.82 between the years 1989-2017. The Table depicts that the highest mean relative growth rate was recorded between the year 2009-2013 is 2.80 and the lowest mean relative growth rate for the year 1989 to 1993 is 1.00. From the data presented in the table, it is found that there is positive correlation between the year and number of articles (r=.933, p=.000) and Correlation is significant at the 0.01 level. Table 3, represents the type of records included in the Web of Science database. It is observed from the table that the 91.09% of the articles of University of Mysore and 91.38% of the articles of Bangalore University have included in the Web of Science. It reflects that the authors have produced more number of research articles as compared with the other forms. Table also shows that only 2.11% of proceedings paper of the University of Mysore and 2.55% of proceedings papers of Bangalore University have included in the Web of Science database. It is observed from the table that only 0.02% of corrections.

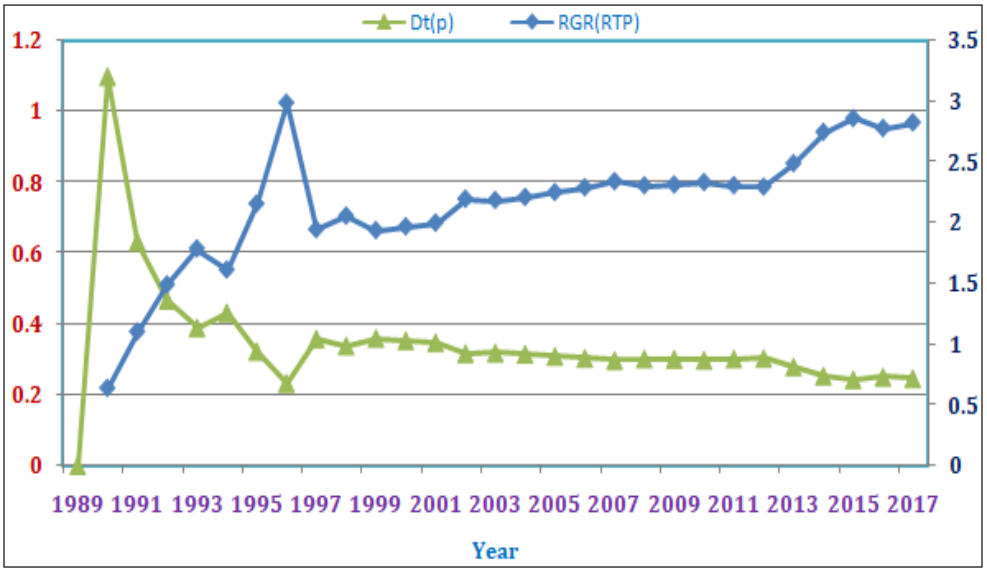

Figure 2.Growth Rate of Records of Bangalore University

Table 2.Relative Growth Rate (Rt) and Doubling Time (Dt) of Records of Bangalore University

Year	Records	Cumulative records	$Log_e 1^P$	$Log_e 2^P$	R_t (P)	Mean R_t (P)	D_t (P)	Mean D_t (P)
1989	34	34	3.53		0.00		0.00	
1990	30	64	3.40	4.16	0.63		1.10	
1991	26	90	3.26	4.50	1.10		0.63	
1992	25	115	3.22	4.74	1.49		0.47	
1993	34	149	3.53	5.00	1.79	1.00	0.39	0.52
1994	21	170	3.04	5.14	1.61		0.43	
1995	11	181	2.40	5.20	2.15		0.32	
1996	37	218	3.61	5.38	2.99		0.23	
1997	40	258	3.69	5.55	1.94		0.36	
1998	54	312	3.99	5.74	2.05	2.15	0.34	0.34
1999	62	374	4.13	5.92	1.94		0.36	
2000	69	443	4.23	6.09	1.97		0.35	
2001	65	508	4.17	6.23	2.00		0.35	
2002	75	583	4.32	6.37	2.19		0.32	
2003	83	666	4.42	6.50	2.18	2.06	0.32	0.34
2004	90	756	4.50	6.63	2.21		0.31	
2005	97	853	4.57	6.75	2.25		0.31	
2006	104	957	4.64	6.86	2.29		0.30	
2007	121	1078	4.80	6.98	2.34		0.30	
2008	135	1213	4.91	7.10	2.31	2.28	0.30	0.30
2009	149	1362	5.00	7.22	2.31		0.30	
2010	172	1534	5.15	7.34	2.33		0.30	
2011	191	1725	5.25	7.45	2.31		0.30	
2012	169	1894	5.13	7.55	2.29		0.30	
2013	139	2033	4.93	7.62	2.49	2.35	0.28	0.30

2014	133	2166	4.89	7.68	2.75		0.25	
2015	154	2320	5.04	7.75	2.86		0.24	
2016	157	2477	5.06	7.81	2.78		0.25	
2017	169	2646	5.13	7.88	2.82	2.80	0.25	0.01

Table 3.Type of Records Included in Web of Science

Type of Records	University of Mysore		Bangalore University	
	Total	Percentage	Total	Percentage
Journal articles	4407	91.09	2544	91.38
Proceedings papers	102	2.11	71	2.55
Reviews	102	2.11	45	1.62
Meeting abstracts	66	1.36	34	1.22
Notes	50	1.03	28	1.01
Editorial materials	30	0.62	19	0.68
Letters	24	0.50	24	0.86
Book reviews	16	0.33	10	0.36
Corrections	15	0.31	5	0.18
News items	15	0.31	-	-
Biographical items	3	0.06	3	0.11
Book chapters	3	0.06		-
Retracted publications	2	0.04	-	-
Correction addition	1	0.02	-	-
Discussion	1	0.02	1	0.04
Reprint	1	0.02	-	-
Total	4838	100	2784	100

Table 4.Research Productivity by Subject (Top 10)

University of Mysore		
Subject	**Records**	**Percentage**
Crystallography	834	16.87
Chemistry multidi-sciplinary	571	11.55
Chemistry organic	307	6.21
Materials science multidi-sciplinary	297	6.01
Biochemistry molecular biology	280	5.66
Chemistry medicinal	250	5.66
Pharmacology pharmacy	250	5.06
Polymer science	211	4.27
Plant sciences	202	4.08
Food science technology	197	3.98

The Table 4, shows the research productivity of University of Mysore and Bangalore University by subject. It can be seen from the table that 16.87% of records of the University of Mysore published articles in Electrochemistryfollowed by Chemistry multidisciplinary (11.55%), OrganicChemistry (6.21%) and Materials science (6.01%). The table also shows that only 3.98% of articles are published in Food science technology. It is identified that majority of records are included in the field of Crystallography and Chemistry.

Bangalore University published articles in Chemistry multidisciplinary (11.06%) followed by Materials science multidisciplinary (11.03%) and Organic Chemistry (10.13%). The result of the study shows that the faculty members of these departments have published their research work in highly reputed and indexed journals. Table also indicates that 3.34% of the articles published in Electrochemistry department among the top ten subjects. The study also tried to know the ranking of authors based on the total number of citations. The Table 5, shows that, among the faculty members of the University of Mysore, Rangappa KS, has received highest number of citations. (4027).

Table 5.Ranking of Authors Based on the Total Number of Citation (University of Mysore)

	Articles	Citations	h-index	Average Citations	Rank
Rangappa KS	358	4027	30	10.97	1
Yathirajan HS	556	2425	19	4.36	2
Narayana B	345	1451	15	4.21	3
Prasad JS	194	1039	13	5.36	4
Basavaiah K	194	924	13	4.76	5
Sridhar MA	172	815	12	4.74	6
Somashekar R	142	762	13	5.37	7
Jasinski JP	180	485	9	2.69	8
Lokanath NK	138	478	11	3.46	9
Butcher RJ	139	425	9	3.06	10

Table 6. Ranking of Authors Based on the Total Number of Citation

	Articles	Citations	h-index	Average Citations	Rank
Kamath PV	140	3691	35	26.36	1
Devi LG	63	2994	25	47.52	2
Pasha MA	122	1415	20	11.6	3
Chandrappa GT	60	1321	21	22.02	4
Suresh Babu VV	144	1075	19	7.47	5
Shivakumara IS	102	983	16	9.45	6
Siddeshwar PG	67	824	17	11.94	7
Babu VVS	80	635	13	7.94	8
Puttaswamy	94	448	13	4.77	9
Begum SM	69	234	9	3.30	10

Discussion and Conclusion

The measurement of academic productivity is neither straightforward nor easy. The key function of teaching quality is seldom measured adequately in part because the assessment of teaching effectiveness is not easy and there are not widely accepted parameters.

Less than a half-century ago, the bulk of the world's academic knowledge was communicated by a relatively small number of refereed journals that were widely recognized by the academic community.

The result of the study indicates that the majority of the records of University of Mysore (91.28%) and Bangalore Universityand (91.38%) are articles. This indicates that faculty members of both universities have been published research articles as compared to other forms of records indexed by the Web of Science. The study identified that among University of Mysore faculty members, Rangappa KS. has received highest citations followed by Yathirajan HS, Similarly, Kamath PV, faculty member of the Bangalore University has received highest citations followed by Devi. It clearly shows that the faculty members of University of Mysore and Bangalore University have published their research articles in highly reputed and indexed journals and they have done quality research.In this context, the study recommends that the faculty members of the universities need to publish their research articles in highly reputed and peer reviewed journals.

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