



RELATIVE GROWTH RATE (RGR) AND DOUBLING TIME (DT) OF BIOTECHNOLOGY LITERATURE PUBLISHED IN INDIAN JOURNAL OF BIOTECHNOLOGY: A BIBLIOMETRIC STUDY

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ABSTRACT:

Present research study covered Biotechnology literature published in Indian Journal of Biotechnology Journal (2007-2016). Total 10 Volumes and 39 issues are considered for this study. Study also presents the Review articles 40, Papers 590 and short communications articles are 119. Total 749 articles are published during the study period. Maximum 87 articles are published in 2007 and minimum 63 articles are published in the 2016. The value of Relative Growth Rate (RGR) of articles decreased gradually from 0.68 to 0.09 from 2007 to 2016. Doubling time is increasingly from 2007 to 2016. Minimum doubling time is found in 2008(1.02) and maximum doubling time is found in 2016(7.89).



KEYWORDS: Relative Growth rate, Doubling Time, Indian Journal of Biotechnology, Bibliometric Study, etc.

1. INTRODUCTION

The fast growing information technology world has generated fast access to information resulting in information explosion. It brought certain problems such as information access, updates and information retrieval and proliferation of all kinds of information systems. The task of information manager is made critical as he has to make a tough selection from the inflation and rise of prices of information materials. It necessitated measuring the information system, services and products. The positive and basic initiatives are pivotal to redefine the priorities, to reallocate the budget, to maintain important collections, to provide access to latest information resources and to support research and development programme based objectives. These require a scientific approach to evaluating information systems and service. So, in the evaluation process, the analytical techniques like Bibliometrics, Scientometrics, Informatics and Webometrics can prove fruitful.

The Bibliometrics, Scientometrics, Librametrics, Webometrics, Content Analysis and Citation analysis studies have been conducted on literature in different bibliographic forms viz. databases, journals, books, thesis, websites etc. The research problem selected by the researcher is a bibliometric study of the scientific research journal in the field of biotechnology. **Indian Journal of Biotechnology (IJBT) (2007-2016)** source journal is selected for the present study.

2. SOURCE JOURNAL

Indian Journal of Biotechnology (IJBT) published quarterly journal, was started in 2002, with various sections. It publishes full research Review, Papers, and Short communications in agricultural, animal, environmental, industrial, medical, and microbial biotechnology, bioinformatics, and socio-legal and ethical

aspects in biotechnology. The researcher has selected the source journal Indian Journal of Biotechnology (IJBT) out of 18 NISCAIR research journals. (Patairiya M. K., 2016)

Indian Journal of Biotechnology (Khan, 2013) (IJBT) is the leading journal in the field of biotechnology. It is published by The National Institute of Science Communication and Information Resources (NISCAIR), New Delhi on a quarterly basis since 2002. It is an open access journal with ISSN: 0972-5849 (Print), 0975-0967 (Online). Research articles are published under the following subject's agricultural biotechnology, animal biotechnology, environmental biotechnology, industrial biotechnology, medical and microbial biotechnology, bioinformatics, and socio-legal and ethical. The latest research and developments in biotechnology are published under the Notes and News columns.

3. METHODOLOGY

The Researcher downloaded the data from the Indian Journal of Biotechnology's website from the period 2007-2016. The study covers 10 volumes and 39 issues published during 2007-2016. There were 749 papers published in the journal under study. In this journal articles are published in three main columns i.e. Review, Papers, and Short Communications. Those articles have been analyzed on different parameters in this research article.

4. OBJECTIVES OF THE STUDY

For this present study following objectives are framed:

- To know the issue and year wise articles published in Indian Journal of Biotechnology
- To know the cumulative growth of Biotechnology Literature published in Indian Journal of Biotechnology
- To know the Relative Growth Rate (RGR) and Doubling Time(Dt) of Biotechnology Literature published in Indian Journal of Biotechnology

5. REVIEW OF LITERATURE

Swapan Kumar Patra and Prakash Chand (Patra & Chand, 2005) studied on "Biotechnology research profile of India." The study explores the chronological growth of Indian Biotechnology. **Pranali S. Waghmare and Vaishali S. Khaparde** (Waghmare & Khaparde, 2016) carried out the Relative Growth study in their research, 'Authorship Pattern of Library Web 2.0: A Study Based on Scopus Database.' The study focuses on growth of papers (year wise), authorship pattern, degree of collaboration, Relative Growth Rate[RG] and Doubling Time[Dt] of the publications. **Ravichandra I.K. Rao and Divya Srivastava** (Rao & Srivastava, 2010) explained the details of growth of literature in their article, 'Growth of journals, articles and authors in malaria research.' **Bala Adarsh and B. M. Gupta** (Adarsh & Gupta, 2010) carried out research in article, 'Research activities in biochemistry, genetics and molecular biology during 1998-2007 in India: a scientometrics analysis.' This study attempts to analyze the research profile of biochemistry, genetics and molecular biology research in India during 1998-2007, country's performance based on its research output, its publication share and rank in global context, and annual publication growth rate. **R. Sevukan and J. Sharma** (Sevukan & Sharma, 2008) analysis presented in 'Bibliometric analysis of research output of biotechnology faculties in some Indian Central Universities.' The result indicated that the growth of literature in biotechnology had steadily increased from 15 articles in 1997 to 43 articles in 2006 and two-authored publications predominated. **R. S. Bajwa and K. Yaldram** (Bajwa & Yaldram, 2013) disclose in, "Bibliometric analysis of biotechnology research in Pakistan." An analysis pertaining to the trends in biotechnology, this data belongs to Pakistan, for the period 1980-2011. Starting with just 15 publications in 1980 with a negligible annual growth rate for the initial 15 years, the number of publications reached 3,273 in 2011 with an annual growth rate of 22 % for the last 15 years. **S. S. Waghmode and S. H. Urkudkar** (Waghmode & Urkudkar, 2016) (Waghmode & Urkudkar, 2016) studied bibliometric study of Indian Journal of Biotechnology in their research article.

6. DATA ANALYSIS

a. Year, Volume and Issue wise growth Research Articles

Table 1 Year, Volume and Issue wise growth Research Articles

Year	Vol. No.	Issue wise articles				Vol. wise articles
		1	2	3	4	
2007	6	21	22	22	22	87
2008	7	21	21	21	22	85
2009	8	18	16	16	17	67
2010	9	16	16	16	16	64
2011	10	21	16	16	15	68
2012	11	17	19	21	20	77
2013	12	18	23	20	18	79
2014	13	20	19	20	20	79
2015	14	20	20	20	20	80
2016	15	20	20	23		63
Total Articles		192	192	195	170	749

Table 1 reveals that volume wise and issue wise publication of journals. Total 10 volumes and 39 issues are considered for this study. Maximum 87 articles are published in 2007 and minimum 63 articles are published in the 2016.

b. Cumulative Growth of Biotechnology Literature

Table 2 Cumulative Growth of Biotechnology Literature

Year	Vol. No.	Review	Cumul. Review	Papers	Cumul. Papers	Short Commun.	Cumul. Short Commun.	Total articles	Cumul. Total
2007	6	7	7	61	61	19	19	87	87
2008	7	5	12	70	131	10	29	85	172
2009	8	8	20	53	184	6	35	67	239
2010	9	3	23	50	234	11	46	64	303
2011	10	1	24	58	292	9	55	68	371
2012	11	4	28	55	347	18	73	77	448
2013	12	4	32	60	407	15	88	79	527
2014	13	2	34	65	472	12	100	79	606
2015	14	4	38	67	539	9	109	80	686
2016	15	2	40	51	590	10	119	63	749
Total		40		590		119		749	

Table 2 shows that there are three types of sections in the journal. All articles are published in three sections. These three columns sequence are: 1) Review, 2) Papers and 3) Short Communications published in the journal. The table also presents the Review articles 40, Papers 590 and short communications articles are 119. Total 749 articles are published during the study period.

c. The Relative Growth Rate (RGR) and Doubling Time (Dt)

The relative growth rate (RGR) was calculated using the following equation described by Jackson (1980) (Pistori, Camargo, & Henry-Silva, 2004):

$$RGR = \frac{\ln M_2 - \ln M_1}{T_2 - T_1}$$

or

$$1 - 2^{\bar{R}} = \frac{\text{Log}_e W_2 - \text{Log}_e W_1}{T_2 - T_1}$$

$1 - 2^{\bar{R}}$ = Mean relative growth rate over the specific period of interval

$\text{Log}_e W_1$ =log of initial number of articles

$\text{Log}_e W_2$ = Log of final number of articles after a specific period of interval

$T_2 - T_1$ = The unit difference between the initial time and the final time

Here the year can be taken as a unit of time. The RGR for articles is calculated. $1 - 2^{\bar{R}}$ (aa-1 year-1) can represent the mean relative growth rate per unit of articles per unit of year over a period (Tague, Beheshti, & Rees-Potter, 1981).

Krishnamurthy, Ramakrishnan and Devi (Krishnamoorthy, Ramakrishnan, & Devi, 2009) cited the definition of Doubling Time of Bradford (1934) in their paper. There is a direct equivalence between the relative growth rate and doubling time. The numbers of articles or pages are doubles during a specific period. Then the difference between the logarithm of the initial and final period must be the logarithm of a number is 2. Natural logarithm of 2 is 0.693.

The doubling time was obtained using the formula described by D. S. Mitchell (Mitchell, 1974):

$$DT = \frac{\ln 2}{RGR}$$

Where DT = doubling time

RGR= Relative Growth Rate

$$\text{Doubling Time (Dt)} = \frac{\ln 2}{1 - 2^{\bar{R}}}$$

Therefore,

$$\text{Doubling Time (Dt)of articles(a)} = \frac{0.693}{1 - 2^{\bar{R}}(aa - 1 \text{ year} - 1)}$$

And

$$\text{Doubling Time (Dt)of pages(p)} = \frac{0.693}{1 - 2^{\bar{R}}(pp - 1 \text{ year} - 1)}$$

d. Relative Growth and Doubling Time of Literature (Overall Data)

Table 3 Relative Growth and Doubling Time of Literature (Overall Data)

Year	Vol. No.	No. of Articles	Cumulative No. of Articles	W ₁	W ₂	Relative Growth Rate R(a)	Mean of R(a)	Doubling Time (Dt)	Mean of Dt
2007	6	87	87	0.00	4.47				

2008	7	85	172	4.47	5.15	0.68	0.68	1.02	1.02
2009	8	67	239	5.15	5.48	0.33		2.11	
2010	9	64	303	5.48	5.71	0.24	0.28	2.92	2.51
2011	10	68	371	5.71	5.92	0.20		3.42	
2012	11	77	448	5.92	6.10	0.19	0.20	3.68	3.55
2013	12	79	527	6.10	6.27	0.16		4.27	
2014	13	79	606	6.27	6.41	0.14	0.15	4.96	4.62
2015	14	80	686	6.41	6.53	0.12		5.59	
2016	15	63	749	6.53	6.62	0.09	0.11	7.89	6.74
Total Articles		749							
Average Mean Value						0.24		3.98	

Table 3 shows that overall articles relative growth and doubling time of literature in this study. As the Table clearly indicates, the value of Relative Growth Rate (RGR) of articles decreased gradually from 0.68 to 0.09 from 2007 to 2016. Maximum RGR found in 0.68 in 2007 and minimum RGR calculated in 2016. For the first two years, RGR mean value is 0.68, i.e. 2007 to 2008. And last two years i.e. 2015 to 2016 is 0.11. It means RGR is chronologically decreasingly in whole the study period. The average mean value of RGR is 0.24.

It can be observed that from table doubling time is increasingly from 2007 to 2016. Minimum doubling time is found in 2008(1.02) and maximum doubling time is found in 2016(7.89). Mean doubling time mean value is for first two years (2007 to 2008) 1.02 two year 2015 to 2016 Dt is 6.74. It means minimum mean value (1.02) of doubling time is double in next two years (2.51). The average mean value of Doubling Time is 3.98.

However, its relative growth is low in terms of proportion of doubling time for publication, which is more than the relative growth rate.

7. CONCLUSION

In this study total 10 Volumes and 39 issues are considered for this study. Study also presents the Review articles 40, Papers 590 and short communications articles are 119. Total 749 articles are published during the study period. Maximum 87 articles are published in 2007 and minimum 63 articles are published in the 2016. The value of Relative Growth Rate (RGR) of articles decreased gradually from 0.68 to 0.09 from 2007 to 2016. Doubling time is increasingly from 2007 to 2016. Minimum doubling time is found in 2008(1.02) and maximum doubling time is found in 2016(7.89).

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