

Collaborative Research in the Field of Biotechnology

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ABSTRACT

The study of collaborative research of the literature is most facet area of research in the LIS community. The collaboration study of scientific field helps in finding the trend in collaboration as well as the importance for collaboration among scientist across the institution, state and countries. The present paper analyses the collaborative research in biotechnology journals. The data from 5 biotechnology journals for the period of ten years were collected with 8251 articles. The results shows dominance in multi-authored 93.08% articles over single authored articles with 6.19% and the degree of collaboration is 0.93. The Indian research output among the journal is 2.81%.

Keywords: scientometrics, collaborative study, biotechnology, authorship pattern, citation analysis.

Introduction

The study of collaboration in the field of science and social science in the past shown trend in multi-authored articles than single authors. As predicted by Price in his research article on chemical abstracts that the single authored article or solo research should have been extinct by 1980, the prediction has been proved wrong by majority of researchers in past, even our research shows the existence of single authored articles or solo research, but there is a decrease in single authored articles over years. The bibliometric studies of literature give insight on the growth of literature over the period. Citation analysis gives a clear picture of impact of the research of particular area of study. The reasons behind growing collaboration research are many like increased use of ICT which lessens the gap between institutions and countries, there may other scientific and socio-economic reasons for growth of collaboration. Research in the life sciences is increasingly collaborative, both at the national and international levels. The increase in collaborative research shows the growing tendency of researchers to associate with other researchers for better research output and sharing of ideas.



Objectives of the study

The specific objectives of the present study are as follows,

- To determine the year wise growth of literature in selected biotechnology journals.
- To determine the citation analysis and h-index of selected biotechnology journals.
- To determine the country-wise contribution of articles in biotechnology journal
- To determine the institution-wise contribution of articles in biotechnology journal.
- To determine the proportion of single vs. Multi-authored articles in selected biotechnology journals.
- To determine the degree of collaboration among the biotechnology articles.

Scope and Limitations of the study

The scope of study is limited to five biotechnology journals for the period of ten years. The five journals are Animal Biotechnology journal, Biotechnology, Bio-Science and Bio-chemistry journal, Biotechnology advances, Bio-technology and Bio-process engineering journal and Current opinion in Biotechnology. The data collected from the five biotechnology journals is 8251 articles for the period ten years from 2003-2012. The collected data was further analysed based on bibliometric criteria's to attain the objectives of the study.

Methodology

The present study is concerned with analysis of biotechnology articles of five journals. The selection of journals is purely on basis of availability in University of Mysore and journals which are indexed in Web of Knowledge. The data of 8251 articles collected from five biotechnology journals for the period of ten years i.e. 2003-2012 were extracted to MS –excel from web of Knowledge and analysed using criteria's like year-wise, country-wise etc. and further analysed for degree of collaboration. The analysed data is presented in the form of tables and graphs along with interpretations.

Data analysis and Interpretation

Growth of literature

To understand the basic publishing pattern the collected data was analysed on the basis of year-wise growth along with growth rate for the period of ten years.

Table-1 Year-wise distribution of publication

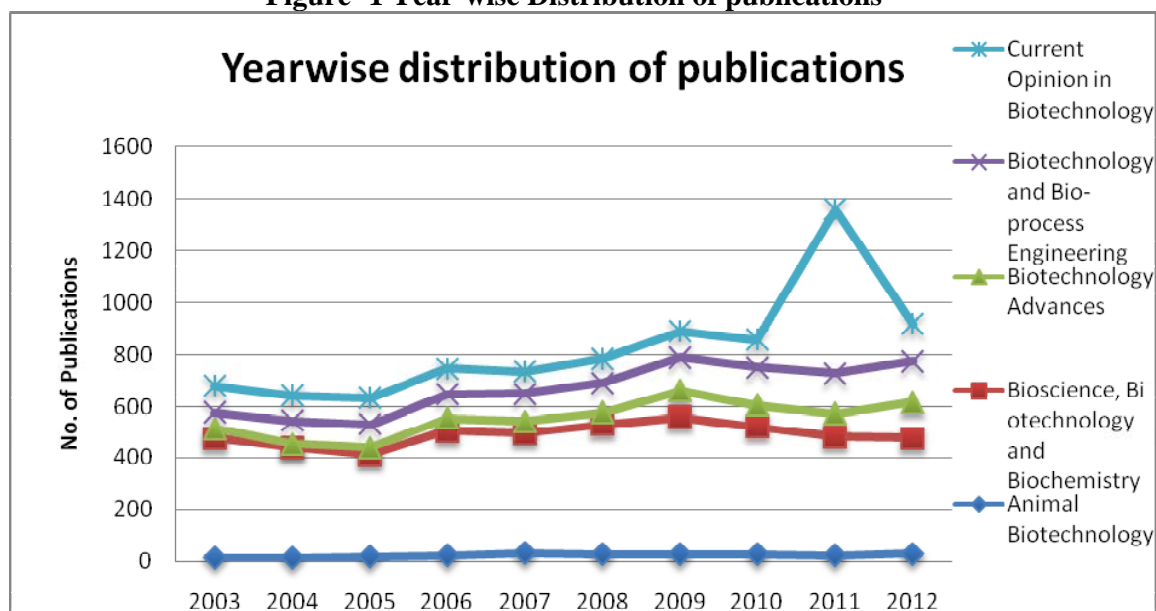
Name of Journals	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total Paper	Percentage
Animal Biotechnology	17	15	18	23	33	27	28	27	25	31	244	2.95
Bioscience, Biotechnology and Biochemistry	459	425	393	482	464	503	530	494	457	445	4652	56.38
Biotechnology Advances	38	15	28	48	45	48	104	85	90	142	643	7.79
Biotechnology and Bio-process Engineering	63	92	92	95	107	112	127	144	156	157	1145	13.87



Current Opinion in Biotechnology	103	97	102	100	87	95	102	108	631	142	1567	18.99
Total	680	644	633	748	736	785	891	858	1359	917	8251	100
Percentage	8.24	7.8	7.67	9.06	8.92	9.51	10.79	10.39	16.47	11.11	100	

Table -1 analyses the year-wise growth of biotechnology articles in five journals. The highest percent of article were published in the year 2011 with 16.47%, followed by 11.11% percentage in 2012 and Lowest in ten years is in 2005 with 7.67%, from the above table it is observed that there is slow progressive growth in no of articles from year to year in all the five journals.

Figure -1 Year-wise Distribution of publications



Citation Analysis

The citation analysis of all the five journals were carried with the data obtained from web of science database. The obtained data was further tabulated for identification of average citation per paper and h-index. The citation analysis gives a clear view of the impact of articles published in these journals. The journals in table -2 have been listed according high h-index to less h-index i.e. in descending order of h-index among five journals.

Table-2 Citation analysis of journals

Name of Journals	Total Paper	Total citation	ACPP	ACPP %	H-Index
Current Opinion in Biotechnology	1567	39160	24.99	0.6381	95
Biotechnology Advances	643	23077	35.89	1.5552	71
Bioscience, Biotechnology and Biochemistry	4652	35016	7.53	0.215	50
Biotechnology and Bio-process Engineering	1145	5818	5.08	0.8731	23
Animal Biotechnology	244	1269	5.2	4.0977	5.2



Table -2 shows the citation analysis of biotechnology journals obtained from Web of Science. Out of five journals the Current opinion in biotechnology has received highest h-index with 95 for 1567 articles with 3910 citation for all the ten years. The Biotechnology Advances journal stands second with h-index 71 with 643 articles receiving 23077 citations, and Bioscience, Biotechnology and Biochemistry which has highest number articles among five journals stands three with 50 h-index for 4652 articles with 35016 citations, Biotechnology and Bio-Process Engineering has 23 h-index for 1145 articles with citation 5818 citations. Animal biotechnology stands last among journals with 5.2 h-index for 244 articles with 1269 citations.

Indian Research output

The analysis was carried out understand the contributions of Indian biotechnologist in this journals. The result from the analysis was quite unpredicted that Indian research output of Biotechnology journals.

Table-3 Indian Research Output

Sl. No	Journal	No. of articles	Percentage of 8251
1	Biotechnology and bioprocess engineering	105	45.25
2	Biotechnology Advances	89	38.36
3	Animal Biotechnology	20	8.62
4	Bioscience, Biotechnology and Biochemistry	15	6.46
5	Current Opinion of Biotechnology	3	1.29
	Total	232	100

Table -3 depicts the Indian research output in biotechnology journal for ten years. Highest numbers of articles were published in biotechnology and bioprocess engineering with 145.25%, with 38.36% in Biotechnology Advances journal followed by 20 articles with 8.62% of articles in animal biotechnology journal, 6.46% of articles in bio-science, biotechnology and bio-chemistry journal and last with less number of articles in Current opinion of biotechnology journal with 1.29% though the Current opinion of Biotechnology journals stands number one among select journals in H-index. All together when compared with world research output of 8251 were Indian research Output stands very low with 2.81% i.e. 232 articles.

Prolific Authors

Analysis was carried to recognize the most productive authors in select biotechnology journals

Figure-2 Prolific Authors of Biotechnology Journals

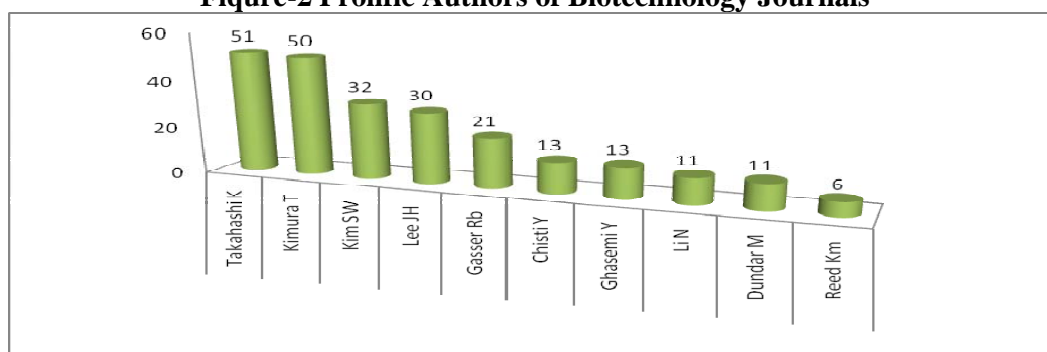


Figure -2 shows prolific authors of biotechnology journals. The top-10 authors have been shown. Takahashi k stands top one with 51(0.61%) of articles, followed by Kimura T with 50 (0.60%) of articles. Kim S W stands Top -3 with 32 (0.38%) of articles and Top-10 is Reed K M with 6 (0.07%).

Figure -3 Country-wise contribution of articles

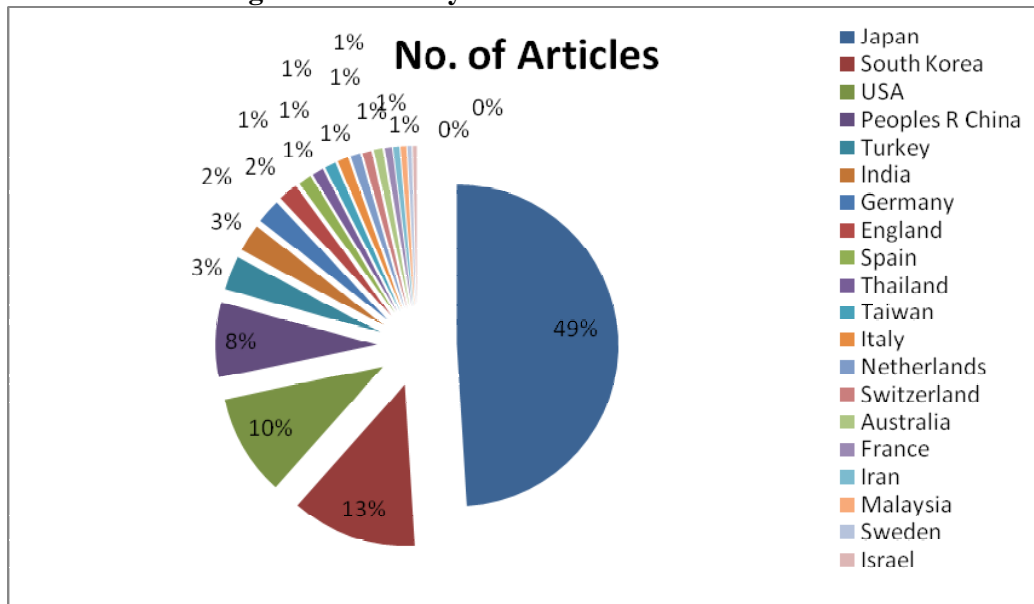


Figure -3 highlights the country wise distribution of biotechnology articles. Top-20 countries have been shown in figure with Japan as ranking Number -1 with 4077 (49.41%) articles, followed by South Korea with 1044 (12.65%)

Figure-4 Institute-wise Distribution of articles

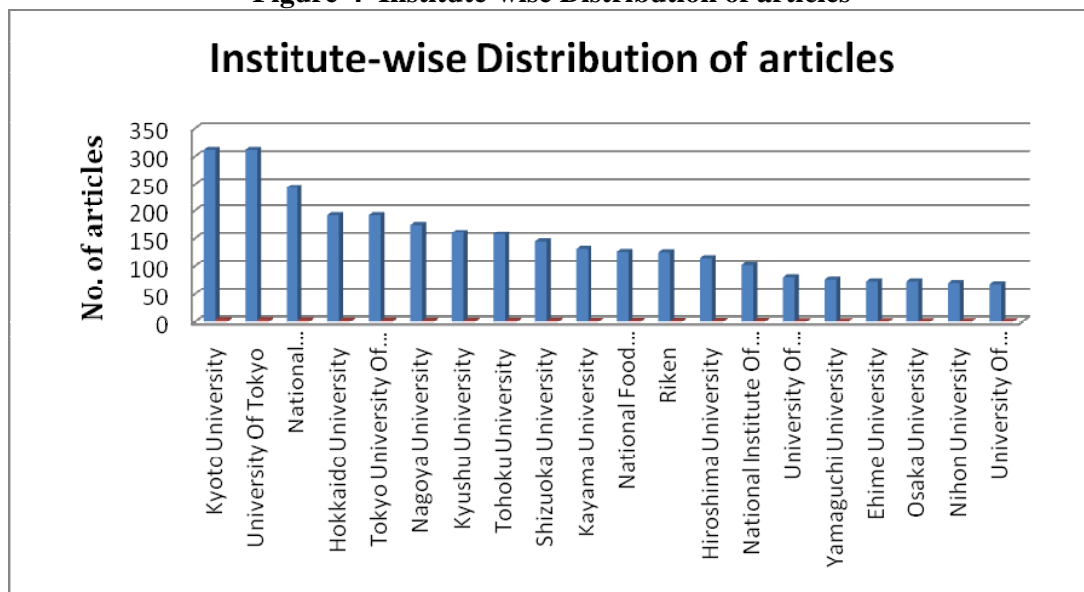


Figure-4 shows the Institute-wise distribution of articles. Top-20 institutes have been shown in figure were Kyoto university and University of Tokyo stands first with 312(3.78%) articles, followed by National Agricultural research canter Japan with 214(2.95%) articles. Hokkaido University stands third on position with 192 articles; University of Shizuoka stands Twentieth position with 69(0.83%) articles.



Authorship Pattern

The authorship pattern shows the trend in collaboration of any specific subject/literature. The detailed analysis will identify the increase in collaborative work and decrease in single authorship. The year-wise analysis of authorship pattern will enhance the identification of growth in collaboration.

Table-4 Authorship pattern in Biotechnology

Sl. No	Years	1	2	3	4	5 & Above	Total	Percentage
1	2003	47	111	118	116	288	680	8.24
2	2004	43	90	102	111	298	644	7.8
3	2005	39	99	115	104	276	633	7.67
4	2006	59	100	114	103	372	748	9.06
5	2007	44	100	103	110	379	736	8.92
6	2008	35	98	114	132	406	785	9.51
7	2009	38	123	141	135	454	891	10.79
8	2010	49	109	158	124	418	858	10.39
9	2011	111	164	255	226	603	1359	16.47
10	2012	46	109	149	147	466	917	11.11
Total		511	1103	1369	1308	3960	8251	100
Percentage		6.19	13.36	16.59	15.85	47.99	100	

Table -4 identifies the authorship pattern in select biotechnology for the ten years period. There is steady growth in collaborative authorship from 2003 to 2012. The percentage of single authorship is 6.19%, two authored articles 13.36%, three authored articles 16.59%, four authored 15.85%, 5 and more than five authored articles with 47.99%. The highest number of articles was published in the 2011 year with 16.47%, followed by 11.11% percent in 2012, followed by 10.79% in 2009 and less number of articles in 7.67% in the 2005 year.

Degree of collaboration

The Subramanyam (1983) formula for degree of collaboration is applied i.e. $C = \frac{Nm}{Nm + Ns}$

Where C= Degree of collaboration

Nm= Number of Multi-authors

Ns=Number of single author

The identification of degree of collaboration between authors in multi-authored articles will bring out the collaborations degree, a measuring agent which will bring the collaboration closeness among authors.

Table-5 Degree of Collaboration

Sl. No	Years	Single author	Multi-authorship	Total	Degree of collaboration
1	2003	47	633	680	0.9308
2	2004	43	601	644	0.9332
3	2005	39	594	633	0.9383
4	2006	59	689	748	0.9211
5	2007	44	692	736	0.9402
6	2008	35	750	785	0.9554



7	2009	38	853	891	0.9573
8	2010	49	809	858	0.9428
9	2011	111	1248	1359	0.9183
10	2012	46	871	917	0.9498
TOTAL		511	7740	8251	0.938

Table-5 depicts the degree of collaboration of biotechnology articles. The degree of collaboration vary slightly from 2003 to 2005 i.e. 0.93 in 2006 there is fall from 0.93 to 0.92 degree of collaboration. The highest degree of collaboration is noted in 2009 with 0.95 and less in the year 2011 with 0.91 degree of collaboration.

Table-6 Productivity of Authors

Sl. No	Years	No. of articles	No. of authors	AAPP	PP
1	2003	680	2815	4.13	0.24
2	2004	644	2761	4.28	0.23
3	2005	633	2654	4.19	0.23
4	2006	748	3245	4.33	0.23
5	2007	736	3267	4.43	0.22
6	2008	785	3537	4.5	0.22
7	2009	891	3971	4.45	0.22
8	2010	858	3745	4.36	0.22
9	2011	1359	5726	4.21	0.23
10	2012	917	4095	4.46	0.22
Total		8251	35816	4.34	0.23

Table-6 shows the productivity of authors per paper and average authors per paper for ten years. The average author per paper varies from 4.13 to 4.50 i.e. almost 4 to 5 authors per paper, the average value shows that 4.34 authors per paper overall. The author productivity per paper 0.22 to 0.24 and overall productivity rate 0.23

Results

- There is slow progressive growth of literature from year to year which is seen in table-1 showing the growth of literature of biotechnology articles in each journal.
- Current opinion in biotechnology journal stands top among five journals in terms of citation analysis and impact factor, the animal biotechnology journal is least with less number of articles and less citations.
- The Indian research output in these biotechnology journals is low with only 2.81%, which is quiet interesting to note. The Indian biotechnologists are very active when compared with other research outputs.
- There is steady growth in collaborative authorship which is shown table-4, the highest number of articles i.e.47.99% were published by five and more than five authors.
- The degree of collaboration of biotechnology articles in these journals is 0.93 which differs slightly from year to year.



Conclusion

The collaborative research in any field is impact of growing interests among scientist to collaborate for betterment of research results. The tendency of growing interest in collaboration has been resulted in various previous studies also even these study supports that there is growth in collaboration in biotechnology field also. The degree of collaboration in biotechnology journals is almost 0.94 which indicates the increase or more authors collaborating together in the biotechnology. It can be concluded that there is growth in literature along with growth in collaboration of biotechnologist. The country wise contribution indicates that the Japan as number country with more than 49% of articles in this selected journals. The reasons promoting the collaborations is many i.e. laboratory facilities, rich human power, intellect power etc.

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