

Scientometric Assessment of Publication Productivity of JNTBGRI, Thiruvananthapuram

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ABSTRACT

The article explores the scientometric assessment of publication productivity of Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI). The data for the study was taken from the Annual report of the JNTBGRI from 2001-2010 which were then tabulated and analysed. The scientists of JNTBGRI prefer mostly Indian journals to publish their articles. *Journal of Economic Taxonomic Botany* tops the list with the highest number of articles 50 (9.11 %), followed by *Zoos (Print Journal)* with 39 articles. India is the leading country with 54.67 % of total journals. The collaboration coefficient of journal article during the year 2010 is found to be 0.7541. The articles published in the journal *Current Science* got 45 citations and *Journal of Ethnopharmacology* got only 5 citations. The article tries to analyse the country-wise distribution of journals, collaboration-coefficient in research and subject areas in which research has been done.

Keywords: Collaboration coefficient, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, publication, productivity, scientometrics

1. INTRODUCTION

Scientific research is an information-producing activity, the essence of which is communication. According to Merton¹, scientific communication is a highly complex system. Evaluating the productivity of an institution's research activity highlights the contribution of the institution and the individual scientists engaged in research. It also provides some insights into the complex dynamics of research activity and enables the policy makers and administrators to make available adequate facilities and direct the research activities in a proper direction. A well known productivity indicator is the number of publications produced by the scientists of an institution. The institution which is generating a good number of quality research papers in particular field may be considered as a frontier institution in that field.

Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), formerly Tropical Botanical Garden and Research Institute is an autonomous institute established by the Government of Kerala on 17 November 1979 at the capital city of Kerala. It functions under the umbrella of the Kerala State Council for Science, Technology & Environment (KSCSTE), of Government of Kerala. The Royal Botanic Gardens (RBG), Kew played an exemplary

and significant role in shaping and designing of the garden's layout in its formative stages².

2. OBJECTIVES

The objectives of the present study are to:

- (i) Find communication behaviour of scientist in terms of the country of publication of journals and their impact factor.
- (ii) Identify the country-wise distribution of journals
- (iii) Calculate the collaborative-coefficient of journal articles and the pattern of collaboration of scientists
- (iv) Identify type of documents used for communicating research results like, journal articles, conference papers or technical reports or book chapters, etc.
- (v) Identify the areas of work in which the scientists publish, and
- (vi) Make an analysis of the citation received by the papers published from *Web of Science*.

3. REVIEW OF LITERATURE

Lee³, et al., examined the impact of collaborating patterns on the R&D performance of public research

institutions (PRIs) in Korea's science and engineering fields. For the construction of R&D collaborating networks based on the co-authorship data of 127 institutions in Scopus. This paper proposes four types of collaborations by categorising network analyses into two dimensions: structural positions (density, efficiency, and betweenness centrality) and the relational characteristics of individual nodes (eigenvector and closeness centralities). The empirical results suggest that excessively cohesive alliances might end up in 'lock-in' relations, hindering the exploitation of new opportunities for innovation. These findings are implicit in relation to the Korean Government's R&D policies on collaborating strategies to produce sustained research results with the advent of the convergence research era.

Vasishta⁴ examined the contribution and impact of research output of PEC University of Technology as reflected in its publications covered in Scopus international multidisciplinary database. The study described the broad characteristics of research publications of PEC during 1996-2009, its growth, format, media of communication, national and international collaboration profile and overall citation impact, distribution of research output and impact under broad subjects and under different subject departments, most productive authors, and highly cited papers. The result shows that in all 177 research papers were published during 14 years period, i.e., from 1996 to 2009, by the nine departments of the PEC showing an annual average growth rate of 131.85 %. Growth in the academic research output was seen after the PEC has acquired the deemed university status. Contribution to engineering and technology literature from this institute was steadily increasing since then.

Bhatia⁵ analyse quantitatively research publications published by the scientists of National Institute of Occupational Health (ICMR) Ahmedabad, India, during 2000–2006. The result shows that more publications are observed in journals dealing in occupational health and occupational medicine, which is related to institutional research field. Multiple-author articles are more than single-author articles because research format in occupational health is multi-disciplinary. To carry out research in multiple disciplines/parameter one requires more scientists and core subject in occupational health and occupational medicine.

Mahbuba⁶, *et al.*, provided a scientometric comparison between two health and population research organisations, namely the International Centre for Diarrhoeal Research in Bangladesh (ICDDR, B) and the National Institute of Cholera and Enteric Diseases (NICED) in India, during the period 1979-2008. These institutes conduct similar research and collaboration ties. Data was collected from the *Web of Science (WoS)* as well as from official records of these two organisations.

The analysis presents the evolution of publication activities. Special attention is given to research impact through time series of the institutional *h*- and *R*-indices, as well as to the trend in yearly citations received. Types of publications, international collaboration with other countries, top scientists and most cited articles co-authored by scientists from these institutions are highlighted. It is observed that female scientists play a minor role in these two institutes.

Sharma⁷ analysed a total of 2603 research articles published by the scientists of Central Potato Research Institute (CPRI) during 1991-2007 were collected by scanning of annual reports of CPRI and *Journal of the Indian Potato Association*. Analysis show that majority of the scientists preferred to publish research papers in joint authorship (82.67 %) having 0.82 degree of collaboration. Study further shows no uniform pattern of literature growth but factors like fund availability, scientists' recruitment and their availability, and years that had special occasions like conferences, seminars, etc., have impact over scientific productivity of the scientists during the period under review.

Rani & Jinju⁸ analysed the productivity of scientists of Rajiv Gandhi Centre for Biotechnology. Analysis of 632 publications of RGCB scientists during 1995-2006 show that the publications of RGCB scientists include journal articles, conference papers, patents, book chapters, and PhD guided. The year 2005-2006 with 112 articles (25.87 %) published was the most productive year in the case of journal articles. The productivity of the scientists of RGCB shows substantial growth quantitatively and qualitatively with the development of the institution.

Kademani⁹, *et al.*, presented a scientometrics analysis of the papers published by the analytical chemistry division of Bhabha Atomic Research Center (BARC) in India. The main objective was to document quantitatively the publication behavior of scientists at BARC to determine their publication productivity, domain-wise research productivity, and to identify the most prolific authors and author productivity, among others. It also traces the growth in publications of the analytical chemistry division since 1972.

Dutta & Sen¹⁰ made a study on the scattering of articles over a journal system as observed from the viewpoint of Bose-Einstein Statistics. Rank vs. number of articles distribution pattern of a journal system has been investigated from the viewpoint of Bose-Einstein statistics assuming a subject as equivalent to a phase space, a specific or microsubject as equivalent to a phase cell and corresponding journals as the Bose-Einstein particles.

4. METHODOLOGY

The publication data for the study was taken from the annual reports of the JNTBGRI for the period 2001-2010. The data collected for the study was fed into MS Excel with variables such as male

and female authors, number of authors, bibliographic form of publications, title of the book (s), name of the journal, publisher of the books, pages, place, and country and was analysed using SPSS software.

5. ANALYSIS

5.1 Rank List of Journals

In the field of S&T, in every subject there are some journals which are frequently referred by the researchers because of the close relation between the subject of the journals and the areas of research works. These highly cited journals are termed as 'core journals' of a specific subject. The core journals always contain a higher concentration of relevant articles on a particular discipline and the rest of the papers on the subject are scattered over a large number of journals (Table 1).

The '*Journal of Economic Taxonomic Botany*', published from India showed maximum no. of articles published, came in the 1st position with 50 articles, '*Current Science*' with 11 articles having impact factor of 0.935 and '*Journal of Ethnopharmacology*' with 10 articles having impact factor of 2.755 came in 2nd and 3rd position.

5.2 Country-wise Analysis of Journals

The journals are analysed according to their country of origin. The list of countries is quite long as 24 countries published 150 journals. Out of the 24 countries India ranks first (Table 2).

From Table 2, it has been observed that India is the leading country with 82 journals (54.67 %). USA is in the second position with 18 journals.

5.3 Collaboration Coefficient

Collaboration coefficient (CC) is a measure of collaboration in research that rejects both the mean number of authors per paper as well as the proportion of multi-authored papers. According to Savanur & Srikant¹¹, although CC lies between the values 0 and

1, and is 0 for a collection of purely single-authored papers, it is not 1 for the case where all papers are maximally authored, i.e., every publication in the collection has all authors in the collection as co-authors.

Table 2. Country-wise analysis of journals

S. No.	Country	No. of journals (%)
1.	India	82 (54.67 %)
2.	USA	18 (12.0 %)
3.	UK	10 (6.67 %)
4.	Netherlands	9 (6.0 %)
5.	Germany	4 (2.67 %)
6.	Pakistan	4 (2.67 %)
7.	Austria	3 (2.0 %)
8..	Australia	2 (1.33 %)
9.	Malaysia	2 (1.33 %)
10.	Poland	2 (1.33 %)
11.	Belgium	1 (1.67 %)
12.	Brazil	1 (1.67 %)
13.	Croatia	1 (1.67 %)
14.	Egypt	1 (1.67 %)
15.	France	1 (1.67 %)
16.	Hongkong	1 (1.67 %)
17.	Ireland	1 (1.67 %)
18.	Papua New Guinea	1 (1.67 %)
19.	Portugal	1 (1.67 %)
20.	Russia	1 (1.67 %)
21.	Singapore	1 (1.67 %)
22.	South Africa	1 (1.67 %)
23.	Switzerland	1 (1.67 %)
24.	Taiwan	1 (1.67 %)
	Total	150

Table 1. Rank list of journals

S. No.	Rank	Name of journal	No. of articles	Publishing country	SCI journals	Impact factor
1.	1	<i>Journal of Economic Taxonomic Botany</i>	50	India	No	-
2.	2	<i>Zoo's Print Journal</i>	39	India	No	-
3.	3	<i>Journal of Essential Oil Research</i>	29	U.K.	No	-
4.	4	<i>Rheedea</i>	25	India	No	-
5.	5	<i>Indian Journal of Science and Technology</i>	18	India	No	-
6.	6	<i>Journal of Mycopathological Research</i>	16	India	No	-
7.	7	<i>Indian Journal of Botanical Research</i>	15	India	No	-
8.	8	<i>Indian Phytopathology</i>	13	India	No	-
9.	8	<i>Journal of Tropical Medicinal Plants</i>	13	Malaysia	No	-
10.	9	<i>Current Science</i>	11	India	Yes	0.935
11.	9	<i>Journal of Non Timber Forest Products</i>	11	India	No	-
12.	10	<i>Journal of Ethnopharmacology</i>	10	New York	Yes	2.755

The derivation of the new measure is almost the same as that of CC, as given by Ajiferuke¹², *et al.*

$$\begin{aligned} \kappa &= \alpha \{1 - E[1/X]\} \\ &= \alpha \left\{1 - \sum (1/j)P(X = j)\right\} \quad (1) \\ &= \alpha \left\{1 - \frac{\sum_{j=1}^A (1/j)f_j}{N}\right\} \end{aligned}$$

where, α is a normalisation constant to be determined. Setting $\alpha = 1$ yields the measure CC. the requirement that $\kappa = 0$ for single authorship does not restrict α . If all N articles involve all the A authors, then $E [1/X] = 1/A$. If one wants κ to satisfy the requirement that $\kappa = 1$ for maximal collaboration, then one must set

$$\alpha = \left(1 - \frac{1}{A}\right)^{-1} = \frac{A}{A-1} \quad (2)$$

It can be obtained from Eqns. (1) and (2) the final expression for Measured Collaboration Coefficient (MCC) is:

$$\begin{aligned} \kappa &= \left(1 - \frac{1}{A}\right)^{-1} \{1 - E[1/X]\} \\ &= \frac{A}{A-1} \left\{1 - \frac{\sum (1/j)P(X = j)}{A}\right\} \\ \kappa &= \frac{A}{A-1} \left\{1 - \frac{\sum_{j=1}^A (1/j)f_j}{N}\right\} \quad (3) \end{aligned}$$

The single authorship was high (17) in 2006, two author collaboration was high (19) in 2009. The MCC for distribution of authorships for 2001 in Table 3 is calculated using Eqn. 3, as:

$$\kappa = \frac{A}{A-1} \left\{1 - \frac{\sum_{j=1}^A (1/j)f_j}{N}\right\}$$

$$\begin{aligned} &= 52/(52-1) [1-\{(1*8 + 1/2*11 + 1/3* 20 + 1/4 * 9 + 1/5*2 + 1/6 + 1/7\} / 52)] \\ &= 1.0196 * [1- \{(1/52) * (8+5.5+6.6666+2.25+0.4+0.1666+0.1428)\}] \\ &= 1.0196 * (1 - 0.4447) \\ &= 1.0196 * 0.5553 \\ &= 0.566 \end{aligned}$$

The MCC was high (0.8079) in 2007 and was low (0.4842) in 2002 (Table 4).

Table 4. Measured collaboration coefficient

Year	Measured collaboration coefficient (MCC)
2001	0.5661
2002	0.4842
2003	0.5458
2004	0.5708
2005	0.5589
2006	0.5124
2007	0.8079
2008	0.6133
2009	0.6536
2010	0.7541

5.4 Subject Areas Preferred by Scientists

In the multidisciplinary applied scenario of S&T, scientists concentrated their research in different branches of Botany (Table 5). Botany came in the 1st position with 383 articles and Conservation Biology with 61 articles.

Table 3. Year-wise distribution of authorships

No. of authors	Year										
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
1	8	15	9	9	5	17	3	9	5	1	
2	11	13	12	10	13	16	7	9	19	1	
3	20	18	13	22	11	16	27	16	23	2	
4	9	10	10	9	7	11	22	18	13	3	
5	2	2	4	3	2	7	7	9	4	1	
6	1	-	1	1	-	3	1	2	1	-	
7	1	-	-	1	-	1	-	2	5	1	
8	-	-	-	1	-	-	2	-	2	-	
9	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	1	-	4	2	
11	-	-	-	-	-	-	-	-	3	-	
Total	52	58	49	56	38	71	70	65	79	11	

Table 5. Subject areas preferred by scientists

S. No.	Subjects	Published papers
1.	Botany	383
2.	Conservation Biology	61
3.	Ethnomedicine and Ethnopharmacology	35
4.	Microbiology	20
5.	Biotechnology and Bioinformatics	28
6.	Biology	22
	Total	549

Table 6. Citations received by the articles indexed in Web of Science

S. No.	Name of journal	No. of articles	Total citations
1.	<i>Current Science</i>	11	45
2.	<i>Journal of Ethnopharmacology</i>	10	5

6. FINDINGS AND CONCLUSIONS

On verification, it is found that *Journal of Economic Taxonomic Botany* tops the list with the highest number of articles 50 (9.11 %). It is followed by *Zoo's Print Journal* with 39 articles. Among the journals *Current Science* got an impact factor of 0.935 and *Journal of Ethnopharmacology* got 2.755. The scientists of JNTBGRI prefer mostly Indian journals to publish their articles. The collaboration coefficient of journal article during 2010 is found to be 0.7541. Botany came in the first position with 383 articles and Conservation Biology with 61 articles. The articles published in the journal *Current Science* got 45 citations and *Journal of Ethnopharmacology* got only 5 citations.

Scientometric analysis and studies of such kind, namely, bibliometrics, informetrics, and webometrics have gained much importance in the field of Library and Information Science. These techniques can be used to identify the emerging research areas in any branch of knowledge to evaluate the research performance of scientists, research groups and countries, to map the cognitive or intellectual structure of a research area and to study the relation between authors, institutions and journal articles.

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