RESEARCH PRODUCTIVITY OF SCIENTISTS: A CASE STUDY OF NATIONAL CENTRE FOR CELL SCIENCE (NCCS), PUNE

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Abstract

This paper presents a scientometric analysis of the research output of the scientists. Ten years i.e., 2008 to 2017 research output was drawn from Web of Science online indexing and abstracting databases. Used scientometric tools such as biblioshyni, bibexcel, and VOS viewer software for the study of publication growth, form, and type of publications, a collaboration of researchers with foreign countries, authorship pattern, and productive author.

Keywords: Scientometric, NCCS, Scientist, Web of Science, Research Productivity

Introduction

The National Centre for Cell Science (NCCS), an autonomous organization aided by the Department of Biotechnology, Government of India, was established to facilitate cell biology research in India. It is an almost thirty-three years old organization in the field of Cell Science.

Research Institutes' research output helps the policymakers to take appropriate action for human power and infrastructure development of the concerned institutes. Research publications and their citationshelp to draw their research productivity. The researcher used the Web of Science online database for the study.

Profile of the Institute

Initially established as a National Cell Repository, NCCS serves the nation by maintaining and distributing a large number of animal cell lines to various colleges, universities, and research institutions in India. The need to study the fundamental animal and human cell culture and develop existing cell lines. The National Centre for Cell Science (NCCS), took birth as National Tissue Culture Facility in 1986 with a mandate of basic research, teaching & training, and as a national repository for cell lines/hybridomas, etc. The centre has expanded its scientific charter to strengthen basic research in the areas of cancer biology, cell biology, immunology, genomics, and proteomics.

Table 1.: Showing the total Number of Employees working with the Institute:

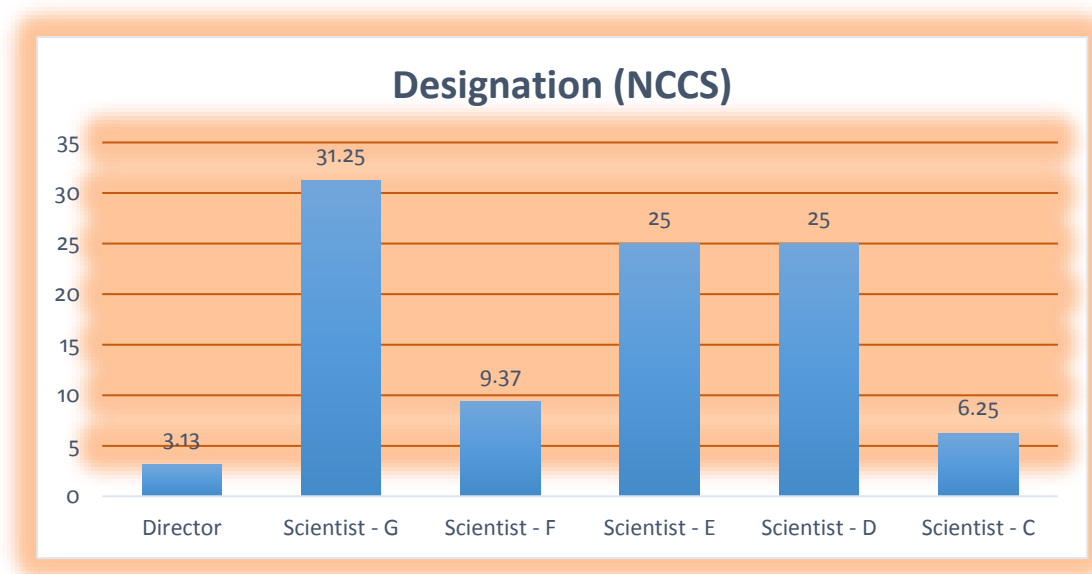| Designation	Total
Scientist G	11
Scientist F	03
Scientist E	08
Scientist D	08
Scientist C	02
Scientific and Technical support	09
Staff	16
Multi-Tasking Staff	07
Total	**64**

Figure 1.: Frequency of designation in NCCS

Besides a team of academicians, the institute also has a team of 24 research scholars, research associates, project associates, and Ph.D. students for working with the faculties and the Institute for their work.

Review Literature

Moin, Mahmoudi, and Rezaei (2005) examined Iran's scientific output from 1967 to 2003 and compared it to that of 15 other countries. They discovered that Iran's growth has been expanding since the Iraq-Iran war. Wen et al. (2007) concluded in a survey titled "Scientific production of electronic health record research, 1991–2005" that the number of published publications has increased significantly over every 5 years. The majority of articles (98 percent) were published in English and were from the Americas region (57 percent). The top ten journals (out of 374 total) accounted for 41% of all published articles. An examination of the number of publications connected to the population revealed a high level of publication production for relatively tiny countries such as Switzerland, the Netherlands, and Norway. In general, they discovered a significant growth in the literature of "electronic health research" from 1991 to 2005.Mukherjee (2008) examined the authorship patterns of the four most active Indian academic institutions over eight years, from 2000 to 2007. The data show that among the four universities, the authors from Delhi University contributed the most publications, followed by those from Banaras Hindu University. There is also a growing trend among Indian authors toward joint research, as well as more regular collaboration with international authors. Two of the most active research topics at these four Indian universities are biochemistry and molecular biology. The average number of references per item is 28, and the average number of citations obtained per item is 3.56. From 1990 to 2006, Osareh and McCain (2008) investigated the conceptual structure of Iranian chemistry research in the Science Citation Index (SCI). According to the findings of this study, Iranian chemistry research, as represented in the SCI, has developed at a rate of around 26% since 1990, with 7 significant clusters forming over the study period. The first topic was Organic Chemistry, and the second was Analytical Chemistry. Tian, Wen, and Hong (2008) used the Science Citation Index to undertake a bibliometric analysis of global scientific production of Geographic Information System (GIS) articles from 1997 to 2006. The results showed that GIS research increased consistently over time, with yearly paper production in 2006 is roughly three times more than in 1997.Arruda et al. (2009) examined the distribution of some features of computer scientists in Brazil by area and gender.According to the findings, Brazilian computer scientists had 5.3 journal publications per male researcher and 6.0 journal publications per female researcher in the areas of artificial intelligence, computers in education, and human-computer interface, and the difference is statistically significant. For

conferences, males and females have productivity rates of 23.73 and 30.92, respectively. On the other hand, there is no statistically significant difference between male and female productivity in hardware, networking, distributed systems, and theory. In terms of geographical differences, there are some statistically significant variances in productivity among regions, as well as differences in the concentration of researchers in a few study fields.

Need for the Study

The purpose of this study is to investigate quantitatively NCCS research output by using scientometric analysis and mapping techniques using the Web of Science database.

The objectives of the Study

- To study year-wise publication, type of publication
- To measure Authorship pattern
- To understand the collaboration pattern of publications
- To find out the collaboration of scientists with other Institutions at national and international levels
- To find out the journals where the scientists their articles/ papers
- To measure the impact and productivity of a scientists

Methodology

The data was retrieved from the Web of Science online databases. Used basic search string such as 'National Centre for Cell Science, Pune'. Clarivate Analytics, Web of Science online databases are well known and appreciated by the research fraternity throughout the world. Clarivate Analytics Journal Impact Factor and Elsevier's journal ranking are allotted to the best quality of the publications. The analysis is based on the research output of the scientists of NCCS, Pune. The period was set from 2008 to 2017 as covered in the Web of Science core collection.

Statistical Tools/Techniques:

The following are the statistical tools that will be used by the researcher.

- ➤ Software: - R. Bilioshiny, Bibexcel, VOS viewer
- ➤ Google Docs: - Data Collection Tool
- ➤ Microsoft Excel: - Data Storage Tool
- ➤ Microsoft word: - Data Presentation.

The scientific productivity of research organizations has been studied and analysis will be derived with the use of statistical tools.

Tools for Scientometrics Analysis:

From MS excel percentage analysis and an average of the variables were drawn and prepared charts and diagrams in the research as and when it was suitable for explaining data.

➤ **VOS viewer Mapping Tool**

VOS viewer, a computer program developed for constructing and viewing bibliometric maps. Mostly used for bibliometric mapping, VOS viewer focuses on the graphical representation of bibliometric maps.

➤ **Bibexcel**

Bibexcel is a bibliometric tool that is specifically developed to manage the Bibliometrics data and build maps. Bibexcel is freely accessible for academic non-profit use. Bibexcel can read data retrieved from different bibliographic sources.

➤ **R and Biblioshyni**

The biblioshiny: The shiny app for bibliometrix from R Statistical Package (https://bibliometrix.org/Biblioshiny.html) was used to carry out a present bibliometrics analysis.
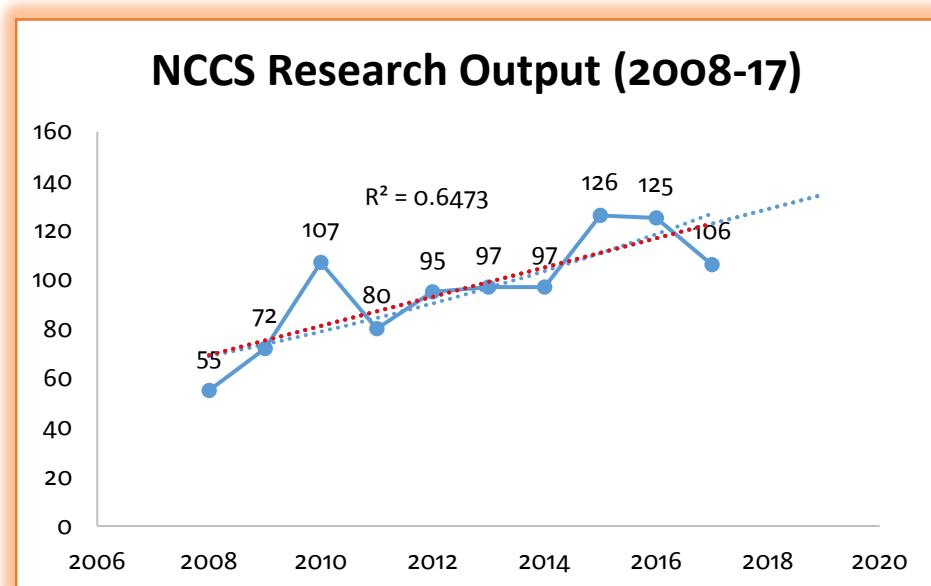
ANALYSIS AND DISCUSSION

Figure 2. NCCS Research Output (2008-2017)

Above figure 2 shows that NCCS research output in 10 years was linear.
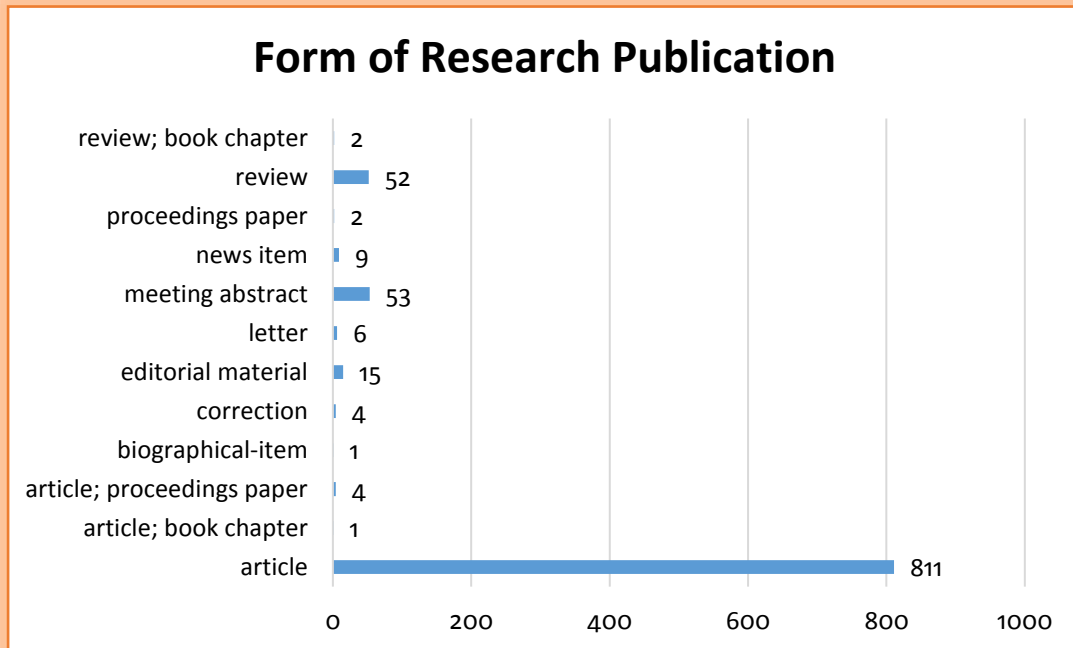
Figure3. Form of Research Publication

Above figure 3 shows that 811 research papers are in the article form, 53 are meeting abstracts, 15 editorial material, and 52 publications are in the form of review.
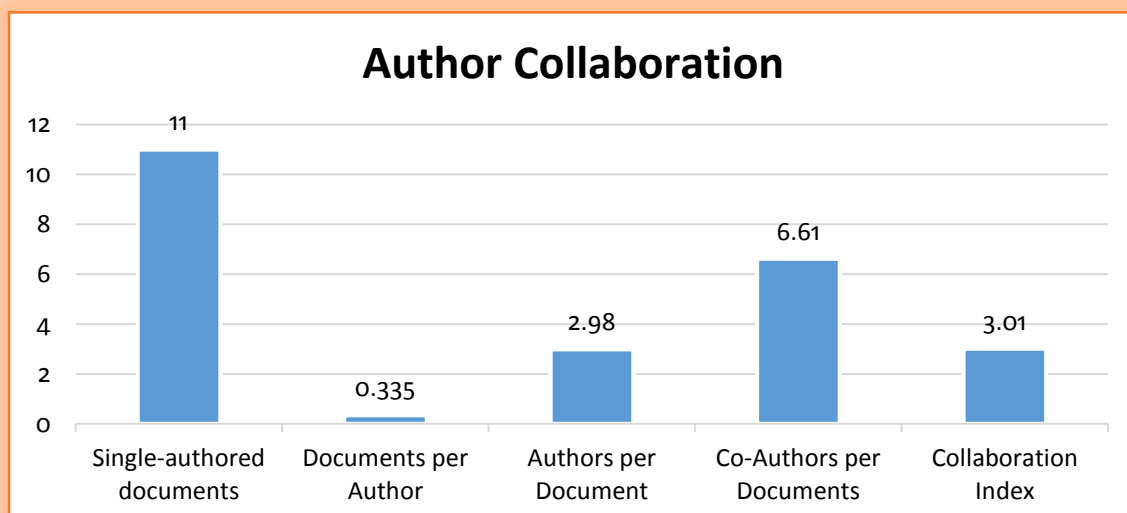

Figure 4. Author Collaboration

Above figure 4. shows that 11 single-authored documents, 2,98 authors per document, 6.61 co-authors per document, and 3.01 collaboration index.

Table 2. Most preferred journals for research output publications

Sr. No.	No. of Research Paper	Name of Journal
1	50	PLOS ONE
2	27	International Journal of Systematic and Evolutionary Microbiology
3	25	Scientific Reports
4	24	Journal of Immunology
5	17	Biochemical And Biophysical Research Communications
6	16	Current Science
7	14	Journal of Proteomics

To find the most preferred journals by the scientists of NCCS, the journals in which more than 10 articles were published are taken in to consideration. Above table 2 shows that PLOS ONE journal is the most preferred journal as 50 articles published in it, followed by International Journal of Systematic Evolutionary Microbiology (27 articles); Scientific Reports (25 articles), Journal of Immunology (24 articles); Biochemical And Biophysical Research Communications (17 articles); Current Science (16 articles) and Journal of Proteomics (14 articles).
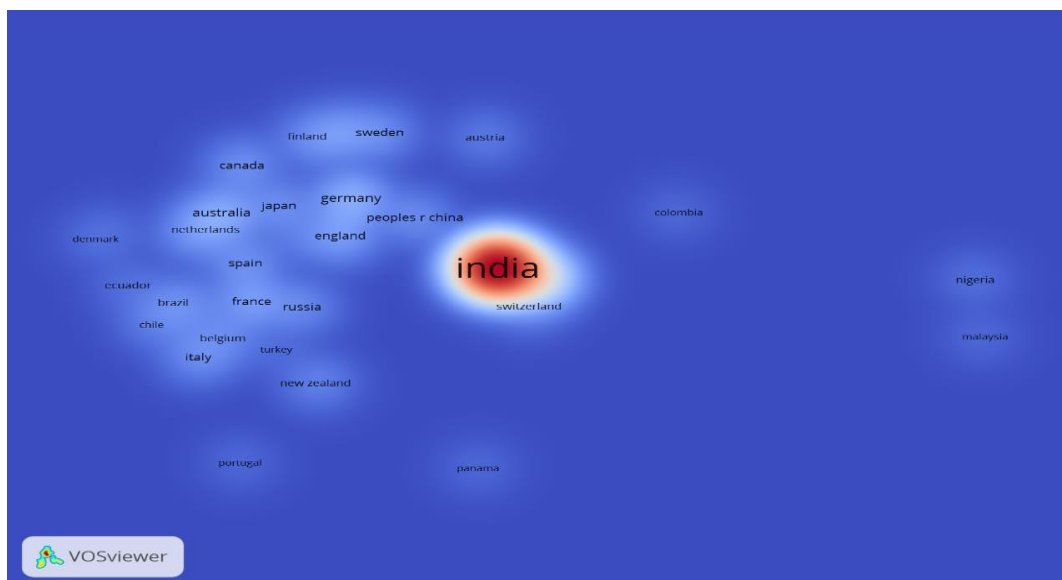

Figure 5: **Country wise Co-Authorship**

Figure 5 indicates that NCCS scientists have collaboration with 56 countries. Out of total collaboration with 56 countries, 39 countries have published at least 2 documents.

India leads with 958 documents, 20191 citations, and a total link strength of 359 followed by the USA with 103 documents, 2410 citations, and a total link strength of 237, and Spain with 11 documents, 425 citations, and a total link strength of 111.

These 39 countries have formed 6 clusters. The first cluster consists of 16 countries while the second cluster consists of 10 countries and the third and fourth clusters consist of 4 countries. While the fifth cluster consists of 3 countries namely New Zealand, Panama, and Turkey, the sixth cluster consists of France and Portugal.

Table 3. Research with foreign country scientist collaboration

No. of Research Paper	Countries
103	USA
26	Germany
20	Australia
18	UK
16	France
11	Spain
11	Canada
10	Peoples R China
10	Sweden
10	Japan
10	Italy

Table 3 shows that 103 research papers are published in collaboration with USA scientists, 26 research paper with Germany scientists, 20 research papers with Australian scientists and 18 research paper are published with UK scientists.

Table 4. Collaboration with Indian scientists

Institutes from India	Articles
National Centre For Cell Science	436
SPPU Pune	94
Indian Institute Technology, Bombay	48
National Chemical Laboratories	45
Agharkar Research Institute	25
Biochemical Sciences Division	23
Indian Institutes of Science Education And Research	21
Bose Institute	19
Bharati Vidyapeeth University	17
Indian Institute of Chemical Biology	17
National Institute of Oceanography	15

Interpretation:

From table 4 it is clear that 436 research papers were published in collaboration with their own organisation's scientists i.e. NCCS. 94 papers were published in collaboration with faculty members of SPPU Pune and 48 papers were published with the scientists of IIT Bombay and 45 papers were published with CSIR- National Chemical Laboratories scientists.

Table 6. Authorship Pattern

Number of publication	Authorship Pattern
11	1
52	2
162	3
174	4
197	5
116	6
83	7
54	8
41	9
70	10 or more authors

Above table 6 was generated by using bibexcel scientometric tool for total 960 publications published in 10 years i.e. 2008 to 2017 by NCCS scientists. Only 11 research papers were written by a single author and 52 research papers written by 2 authors and174 research papers written by 3 authors, 167 research papers written by 4 authors, 197 research papers written by 5 authors and 116 research papers written by 6 authors which indicate that multi authorship pattern exists in NCCS, Pune.
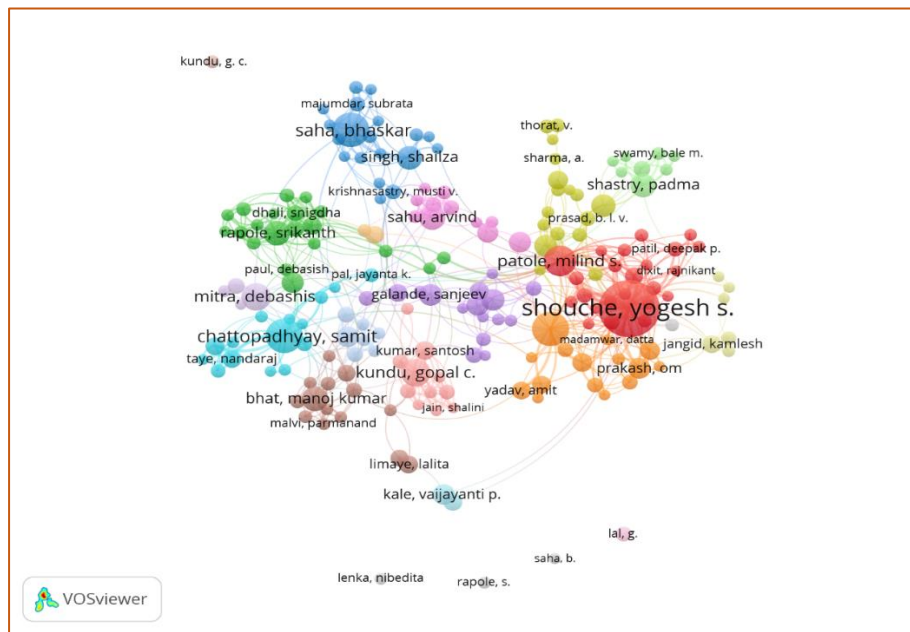
Figure 6.: **Co-Authorship**

Figure 6 shows that out of 2899 authors, 197 authors have published a minimum number of 5 documents each. These 197 authors are form 22 clusters. The first cluster has 24 authors, the second cluster with 20 authors, the third cluster with 19 authors, the fourth cluster with 17 authors, and the fifth cluster with 16 authors.

Shouche, Yogesh S. has published 136 documents which have received 2751 citations with the total link strength of 259; Chattopadhyay, Samit with a total link strength of 99, and Patole, Milind S with a total link strength of 91. Saha, Bhaskar has published 50 documents that have received 1071 citations with a total link strength of 77.
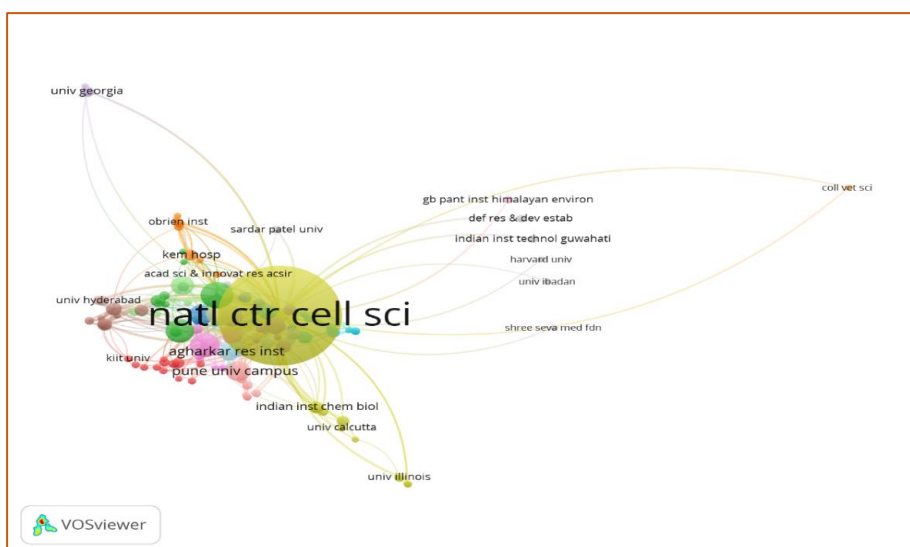

Figure 7 indicates that out of collaboration with total 632 organizations, 125 organizations have published at least 3 papers. These 125 organizations have formed 25 clusters. The first

cluster has 12 organizations. The second cluster has 11 organizations, third, fourth, fifth, and sixth clusters have 10 organizations each, the seventh cluster has 9 organizations and the eighth cluster has 8 organizations.

The organization ' Natl Ctl Cell Sci' has published 761 documents with 15521 citations and a total link strength of 667 followed by Indian Inst Technol with a total link strength of 88 and Univ Pune with a total link strength of 74. Natl Chem lab has achieved a total link strength of 72.

Table 5. Productive Author

Sr. No.	Author	h-index	articles	citations
1	Shouche YS	30	136	2751
2	Kundu GC	24	39	1451
3	Shouche Y	19	57	1073
4	Chattopadhyay S	19	56	1070
5	Patole MS	19	55	1178
6	Bhat MK	18	34	904
7	Saha B	18	56	1176
8	Shiras A	16	26	896
9	Mitra D	16	35	815
10	Kumar S	16	29	683

From the year 2008 to 2017 table 5 is self-explanatory it clearly shows that among the 34scientists from NCCS, Pune above 10 scientists is more productive authors and Dr. Shouche YS is themost productive author with an h-index 30, 136 papers published and 2751 citations received.

Conclusion

This study clearly shows year-wise publication and type of publication. 201 research papers are published in collaboration with scientists of USA. Dr. Shouche Y. S. is a most productive author with 30 h-index and 136 papers published which has received 2751 citations. 11 publications were published by a single author and 949 publications were published in collaboration with other scientists which indicate that multi authorship is predominant in the NCCS, Pune.

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