

## Research Publication Trends among Faculty of Bharathiar University: A Scientometric Study

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### *Abstract*

*The study examined the analysis of research publications of the faculty of Bharathiar University, Coimbatore. Bibliographic records of 4645 items were retrieved from Scopus database between 1982 and 2015 and increasing publications trends were seen in Bharathiar University. The average output of the organization was 137 per year. Among the 4645 papers published in the span of 34 years, highest number of 748 papers was published in the year 2015. The total numbers of citation received by the papers were 50964 and the citing articles were 3559. The average citation per article was 14.3.*

**Keywords:** *Bibliometrics, scientometrics, collaboration pattern, publication density, Bharathiar University*

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### **INTRODUCTION**

The quality of research output is totally depending on the information used and produced as a result of research. Metrics studies have an important role in understanding the growth of a discipline and assist in designing national policies for implementation and improving the research level of their institutions/organizations. Scientific output in the form of publications can be measured by using bibliometric/scientometric techniques. In this study, the researcher has made an attempt to study the research publications productivity of the faculty of Bharathiar University, Coimbatore by using scientometric techniques.

### **REVIEW OF LITERATURE**

Sudhier and Priyalakshmi have studied the research publication trend among the scientists of Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram and found that 87% of the research publications among the 1076 papers were multi authored and most of them were published in foreign journals [1].

Aswathy and Kopikuttan analyzed the publication pattern of three Universities in Kerala viz., University of Kerala, Calicut University and Mahatma Gandhi University and found that there is no significant difference in experience and productivity but

the increase in age and experience has resulted in the more collaborative papers [2].

Mandhirasalam analyzed the publication output of PSG College of Technology (PSGCT) and reported that 2357 papers were published in the span of 44 years i.e. from 1971 to 2014 and 2112 papers (89.6%) were published during the last 10 years [3].

Sivakumar analyzed the publication output of PSG College of Arts & Science (PSGCAS) and reported that 430 papers were published in the span of 15 years i.e. from 2001 to 2015 [4]. The finding of overall growth rate of publications has shown increasing trend during the study period. There is highest publication in the year 2015. Consequently the doubling time for publications has shown an increasing trend. From the analysis, multi-authored contribution occupied extreme position and also degree of collaboration of authorship pattern indicates the trend towards collaborative as well interdisciplinary research.

### **OBJECTIVE OF THE STUDY**

The objectives of the study include:

- To find out the year wise distributions of authorship pattern;
- To find out the author productivity;
- To identify the country wise distribution of publications;

- To identify the degree of collaboration; and
- Mapping of highly cited papers.

**METHODOLOGY**

Data about the research publication of faculty were downloaded from the Scopus database by using the keyword “Bharathiar University” under affiliation category for the period

between 1981 and 2015 (34 years). VOS viewer open source software is used for the mapping of the analyzed data.

**ANALYSIS AND INTERPRETATION**

The Table 1 describes the year wise distribution of number of publication indexed in Scopus database from 1982 to 2015.

*Table 1: Year-Wise Output of Publication.*

S. No.	Year	No. of Records	Cumulative Records	%	Cum %	No. of Articles Cited	Total Citation Score
1.	1982	2	2	0.04	0.04	2	4
2.	1983	6	8	0.13	0.17	4	14
3.	1984	15	23	0.32	0.49	11	151
4.	1985	12	35	0.26	0.75	9	61 13 86 22
5.	1986	8	43	0.17	0.92	5	13
6.	1987	11	54	0.24	1.16	7	86
7.	1988	8	62	0.17	1.33	6	22
8.	1989	20	82	0.43	1.76	11	61
9.	1990	27	109	0.58	2.34	24	147
10.	1991	27	136	0.58	2.92	20	142
11.	1992	49	185	1.05	3.97	43	694
12.	1993	45	230	0.97	4.94	28	582
13.	1994	46	276	1.00	5.94	41	1063
14.	1995	50	326	1.08	7.02	43	1414
15.	1996	56	382	1.21	8.23	50	1493
16.	1997	65	447	1.40	9.63	50	943
17.	1998	57	504	1.23	10.86	44	920
18.	1999	59	563	1.27	12.13	48	855
19.	2000	68	631	1.46	13.59	60	1236
20.	2001	73	704	1.57	15.16	61	3111
21.	2002	127	831	2.73	17.89	116	3252
22.	2003	126	957	2.71	20.6	110	1940
23.	2004	113	1070	2.43	23.03	100	1677
24.	2005	130	1200	2.80	25.83	112	2574
25.	2006	130	1330	2.80	28.63	120	2768
26.	2007	126	1456	2.71	31.34	111	2196
27.	2008	154	1610	3.32	34.66	136	2364
28.	2009	186	1796	4.00	38.66	170	1925
29.	2010	278	2074	5.99	44.65	229	2764
30.	2011	325	2399	7.00	51.65	276	3111
31.	2012	415	2814	8.94	60.59	330	3779
32.	2013	472	3286	10.16	70.75	335	2875
33.	2014	611	3897	13.15	83.9	398	2231
34.	2015	748	4645	16.10	100	328	1458

The above table discussed the year wise distribution of publications during between 1982 and 2015. There was steady growth of publication from the year 2004 onwards. Among 4645 papers published over a period of 34 years, highest publication in the year 2015 is 748. Average number of publications per year is 137.

### Authorship Pattern of Contributors

The following Table 2 discusses the authorship pattern of contributors for the study period between 1982 and 2015; and Table 3 shows the consolidated authorship pattern of contributions.

**Table 2: Authorship Pattern of Contributors.**

Year	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Single	0	0	2	6	0	1	2	5	7	5	2	0	3	3	0	3	2
Double	1	4	4	2	5	8	3	11	16	19	33	28	22	25	29	29	31
Triple	0	2	8	4	3	2	3	4	2	1	8	12	15	16	22	20	8
Four	1	0	1	0	0	0	0	0	2	2	5	3	5	3	3	6	9
Five	0	0	0	0	0	0	0	0	0	0	1	2	1	3	2	5	4
Six	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Seven	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Eight	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ten	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>2</b>	<b>6</b>	<b>15</b>	<b>12</b>	<b>8</b>	<b>11</b>	<b>8</b>	<b>20</b>	<b>27</b>	<b>27</b>	<b>49</b>	<b>45</b>	<b>46</b>	<b>50</b>	<b>56</b>	<b>65</b>	<b>57</b>
Year	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Single	2	1	1	5	1	0	1	1	2	2	3	2	7	3	3	9	10
Double	40	40	37	43	41	42	42	46	28	45	58	79	91	128	153	239	317
Triple	7	8	20	33	37	23	20	28	30	29	44	58	81	98	107	118	163
Four	4	9	8	25	18	17	35	18	26	38	32	45	54	67	84	108	83
Five	4	5	3	12	11	13	20	19	22	19	27	49	40	47	50	51	59
Six	0	3	3	7	13	9	5	10	8	8	15	28	19	29	28	37	47
Seven	1	0	0	2	2	3	2	2	8	9	5	4	10	21	20	21	14
Eight	1	1	0	0	2	0	4	3	1	3	1	9	11	12	9	13	7
Nine	0	0	0	0	1	1	0	1	1	1	0	3	7	7	3	7	10
Ten	0	0	0	0	0	1	0	0	0	0	0	1	2	1	4	2	21
>10	0	1	1	0	0	4	1	2	0	0	1	0	3	2	11	6	17
<b>Total</b>	<b>59</b>	<b>68</b>	<b>73</b>	<b>127</b>	<b>126</b>	<b>1133</b>	<b>130</b>	<b>130</b>	<b>126</b>	<b>154</b>	<b>186</b>	<b>278</b>	<b>325</b>	<b>415</b>	<b>472</b>	<b>611</b>	<b>748</b>

**Table 3: Consolidated Authorship Pattern of Contributions.**

Year	1982–1990	1991–2000	2001–2015	Total
Single	23	21	50	94
Double	54	296	1389	1739
Triple	28	117	889	1034
Four	4	49	658	711
Five	0	27	442	469
Six	0	7	266	273
Seven	0	2	123	125
Eight	0	2	75	77
Nine	0	0	42	42
Ten	0	0	32	32
>10	0	1	48	49
<b>Total</b>	<b>109</b>	<b>522</b>		

**Degree of Collaboration**

To calculate the degree of research collaboration the formula proposed by Subramanyam has been used [5]:

$$DC = Nm / (Nm + Ns)$$

Where,

DC= Degree of Collaboration

Nm= Number of Multiple Authored Papers

Ns= Number of Single Authored Papers

Therefore, DC=4551/4551+94=0.98

**Compound Annual Growth Rate (CAGR)**

CAGR= (End Value/Beginning Value) (1/No. of Years)-1

$$CAGR = ((748/2)^{1/34} - 1)$$

$$= (374)^{(0.03)} - 1$$

$$= 1.1945 - 1$$

$$= 0.1945 \text{ (or) } 19.45\%$$

**Type of Publication**

The productivity of the author based on the document wise distribution of publications is depicted in the following Table 4.

It is found from the Table 4 that the faculties of Bharathiar University publish their research findings in the form of articles 4114 (88.6%) in journals as the medium for publications. They have also presented their papers in the conferences and 400 papers (8.6%) in the proceedings. Remaining forms like review, book chapter etc. is contributed very less 131 with (2.8%) in the total publications.

**Ranking of Authors Based on Publications**

The following Table 5 describes the ranking of top 15 authors of Bharathiar University.

*Table 4: Document Wise Publication.*

Document Type	Records	Percent	No. of Articles Cited	Total Citation Score
Article	4114	88.60	3289	49157
Conference Paper	400	8.60	195	846
Articles in Press	18	0.39	49	864
Review	50	1.10	7	13
Book Chapter	26	0.56	3	4
Erratum	13	0.27	3	3
Note	10	0.22	7	47
Letter	6	0.10	4	9
Editorial	3	0.06	0	0
Short Survey	3	0.06	2	21
Book	2	0.04	0	0
<b>Total</b>	<b>4645</b>	<b>100.00</b>	<b>3559</b>	<b>50964</b>

*Table 5: Ranking of Top 15 Authors of Bharathiar University.*

S. No.	Author	Department	Records	Percent	No. of Articles Cited	Total Citation Score	h-Index
1	Mangalaraj D.	Nanoscience	258	5.55	223	3695	36
2	Balachandran K.	Mathematics	219	4.71	184	2246	23
3	Selvasekarapandian S.	Material Research Center	147	3.16	127	2025	27
4	Natarajan K.	Chemistry	134	2.88	134	3748	34
5	Narayandass SK.	Physics	126	2.71	112	2183	29
6	Kolandaivel P.	Physics	120	2.58	116	1011	15
7	Murugan K.	Zoology	110	2.37	104	1988	27
8	Namasivayam C.	Environmental Science	102	2.2	94	8314	46
9	Rajendra Prasad K.J.	Chemistry	87	1.87	64	362	10
10	Prasad KJR.	Chemistry	86	1.85	67	287	8
11	Rakkiyappan R.	Mathematics	86	1.85	77	1054	29
12	Selvarajan V.	Physics	75	1.61	67	884	17
13	Mohan PS.	Chemistry	74	1.59	61	928	12
14	Govindarajan S.	Chemistry	73	1.57	70	830	18
15	Ponpandian N.	Nanoscience	67	1.44	61	845	25

The above Table 5 and Figure 1 show that Mangalaraj D is the most productive author with 258 (5.6%) publications, followed by

Balachandran K with 219 (4.75) publications and Selvasekarapandian 147(3.16%) publications.

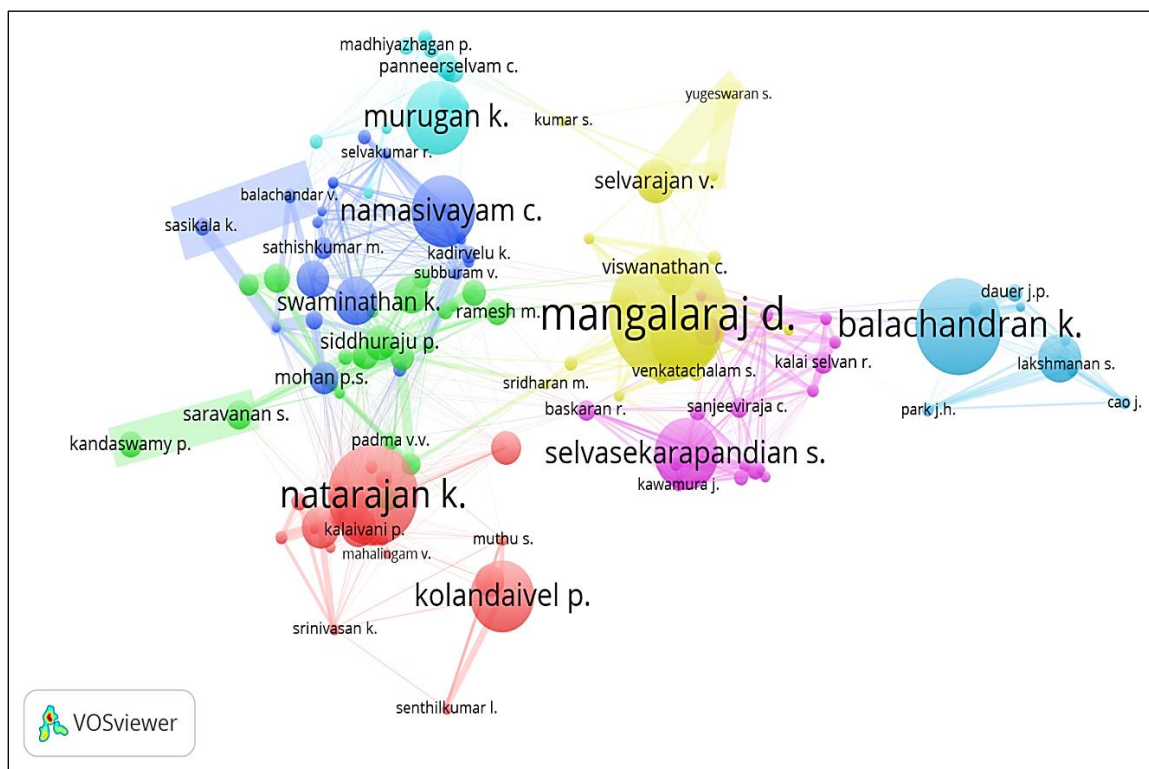


Fig. 1: Mapping of Authorship Pattern.

### Journal Wise Distribution of Documents

The rankings of top 15 journal wise distribution of documents are depicted in the following Table 6.

Table 6: Top 15 Journal Wise Distribution of Documents.

Rank	Journal	Reed	%	No. of Articles Cited	Total Citation Score
1.	International Journal of Applied Engineering Research	124	2.6	11	17
2.	Spectrochimica Acta Part A Molecular and Biomolecular Spectroscopy	83	1.5	82	902
3.	Acta Crystallographica Section E Structure Reports Online	75	1.4	53	139
4.	Rsc Advances	56	1.4	51	578
5.	Indian Journal of Chemistry Section B Organic and Medicinal Chemistry	47	1.4	28	97
6.	International Journal of Pharma and Bio Sciences	44	0.9	25	77
7.	Parasitology Research	39	0.9	38	836
8.	Indian Journal of Science and Technology	38	0.9	40	209
9.	International Journal of Pharmacy and Pharmaceutical Sciences	38	0.9	28	145
10.	International Journal of Chemtech Research	36	0.8	15	64
11.	Asian Journal of Chemistry	35	0.8	16	44
12.	Bioresource Technology	35	0.7	35	3592
13.	Crystal Research and Technology	34	0.6	26	321
14.	Journal of Applied Statistics	33	0.6	27	148
15.	Synthesis and Reactivity in Inorganic and Metal Organic C	30	0.6	30	516

Table 6 reveals that International Journal of Applied Engineering Research published 124 (2.6%) papers, Spectrochimica Acta Part a Molecular and Biomolecular Spectroscopy published 83 papers, (1.5%), Acta Crystallographica Section E Structure Reports published 75 (1.4%) papers and RSC Advances published 56 (1.4%) papers.

**Country Wise Collaborations**

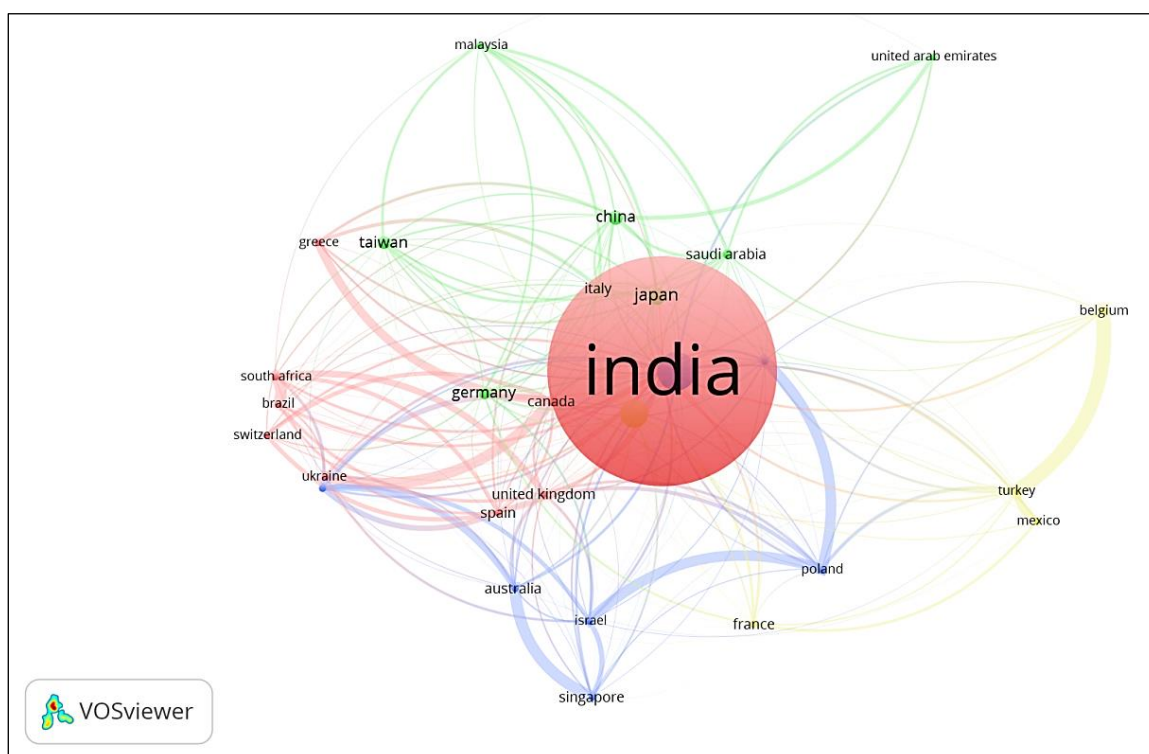
The productivity of the author publications based on the top 15 country wise

collaborations is depicted in the following Table 7.

Table 7 and Figure 2 show that faculty of Bharathiar University has collaborated with South Korea 296 (6.37%) publications followed by United States with 249 (5.36%) publications and Japan with 101 (2.17%) publications. It also shows that Bharathiar University has collaborated and contributed good number of papers with Taiwan, China, Germany and Saudi Arabia.

**Table 7: Country Wise Collaborations.**

Country	Records	Percent	No. of Articles Cited	Total Citation Score
South Korea	296	6.37	269	4639
United States	249	5.36	212	3989
Japan	101	2.17	95	1522
Taiwan	89	1.91	79	1006
China	82	1.76	75	1177
Germany	58	1.25	52	1253
Saudi Arabia	56	1.21	49	547
Canada	46	1.00	43	774
Italy	43	0.93	41	641
United Kingdom	41	0.88	36	694
France	32	0.69	30	835
Singapore	32	0.69	30	515
Australia	31	0.67	28	450
Ethiopia	30	0.65	27	266
Spain	25	0.54	20	441



**Fig. 2: Mapping of Country Wise Collaboration.**



### Ranking of Collaborative Institutions

The productivity of the author publications based on the collaborative institutions is depicted in the following Table 8.

It is found from the Table 8 that researchers from 160 institutions who have collaborated with faculty of Bharathiar University for research and publications. Among them,

Chonbuk National University stands first with 59 (1.2%) publications, followed by Karpagam University and PSG College of Technology.

### Ranking of Subject Wise Distribution

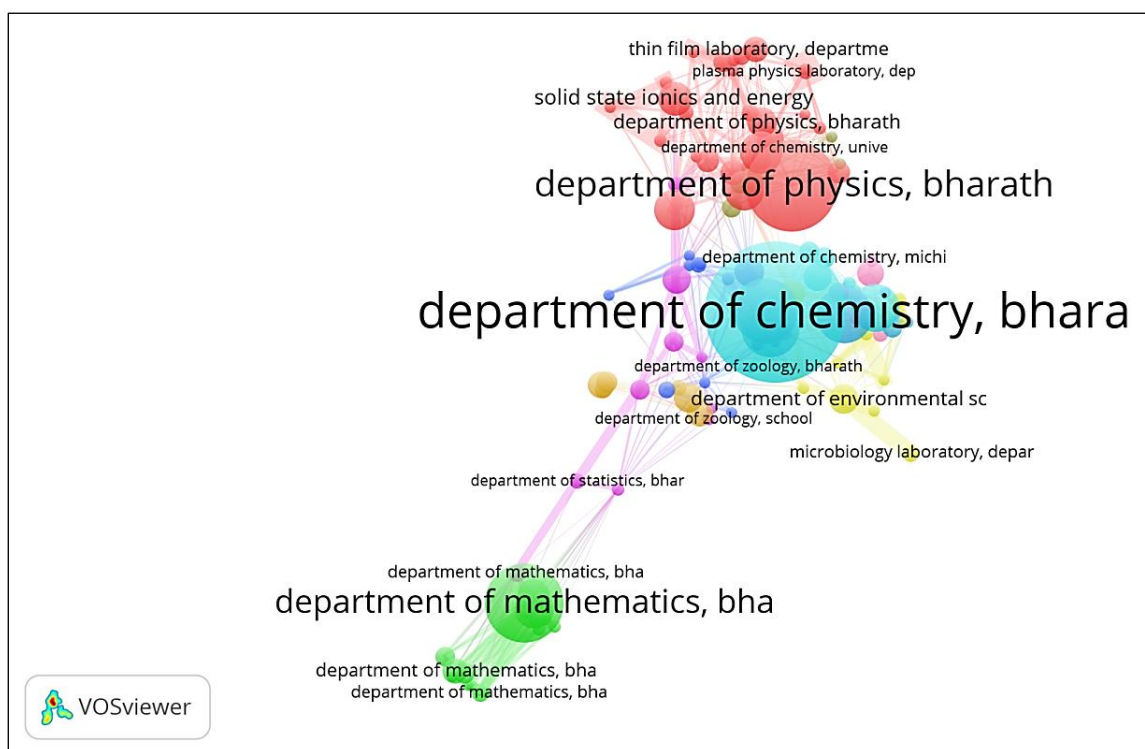
The ranking based on the subject wise distribution of the Bharathiar University is depicted in the following Table 9.

**Table 8: Ranking of Collaborative Institutions.**

Rank	Institution	Recd	%	No. of Articles Cited	Total Citation Score
1	Chonbuk National University	59	1.27	56	1537
2	Karpagam University	59	1.27	15	73
3	PSG College of Technology	58	1.25	51	1248
4	University of Madras	53	1.14	32	568
5	Bharathidasan University	52	1.12	42	615
6	Kongunadu Arts and Science College India	52	1.12	43	361
7	Annamalai University	51	1.1	41	601
8	Bhabha Atomic Research Centre	48	1.03	44	643
9	Periyar University	46	0.99	39	348
10	Indira Gandhi Centre for Atomic Research	45	0.97	40	428
11	Youngstown State University	39	0.84	36	289
12	PSG College of Arts and Science	39	0.84	29	566
13	Sri Ramakrishna Mission Vidyalaya College of Arts and Science	39	0.84	34	338
14	Anna University	34	0.73	26	142
15	Sungkyunkwan University	31	0.67	23	293

**Table 9: Ranking of Subject Wise Distribution.**

Rank	Subject	Recd	%	No. of Articles Cited	Total Citation Score
1	Chemistry	1225	26.37	1037	14559
2	Physics and Astronomy	884	19.03	734	7789
3	Engineering	831	17.89	491	5575
4	Materials Science	811	17.46	675	9681
5	Biochemistry, Genetics and Molecular Biology	656	14.12	522	6669
6	Computer Science	553	11.91	303	2051
7	Agricultural and Biological Sciences	535	11.52	412	4800
8	Mathematics	495	10.66	440	9659
9	Medicine	490	10.55	351	3422
10	Chemical Engineering	450	9.69	390	10437
11	Pharmacology, Toxicology and Pharmaceutics	389	8.37	300	3941
12	Environmental Science	349	7.51	289	6987
13	Immunology and Microbiology	257	5.53	214	6206
14	Energy	99	2.13	65	389
15	Multidisciplinary	89	1.92	77	1592



**Fig. 3: Mapping of Subject wise Distributions.**

Table 9 and Figure 3 show the subject wise distribution. There are 1225 articles (26.37%) which were published by the authors of Bharathiar University on Chemistry followed by Physics and Astronomy with 884 articles (19.03%), Engineering with 831 articles (17.89%), Materials Science with 811 articles (17.9%). The next position was taken by Biochemistry, Genetics and Molecular Biology with 656 articles (14.12%), Computer Science with 553 articles (11.91%), Agricultural and Biological Sciences with 535 articles (11.52%). Authors have contributed papers more or less equally on Mathematics and Medicine. From the above analysis, more number of publications was made on Chemistry and also shows that lot of interdisciplinary research has been done.

### FINDINGS AND SUGGESTIONS

The year wise output of publication clearly states that there is not much variation since the year 1982 to 2000 (Table 1). The 2001 stands as the benchmark year, as there was higher number of research output. From 2002 onwards, this is very significant. After a decade, the year since 2010, a large number of papers were published in reputed journals, which is yet highly significant compared even

to the trend setting years from 2001 to 2010. There is a good scope for Bharathiar University to improve their research performance in the forthcoming years. Contribution of multiple authors is dominating with major contribution of double and three authors; so there is a need of promoting further collaboration [6].

### CONCLUSION

Research productivity in the Bharathiar University among the faculty is significantly high. Though the study started in recent decade but there is really an optimistic growth in the research productivity. Production is the real asset for any institution but as compared to other organization/institution, still, Bharathiar University needs to improve the research performance to a higher level to meet or be at par with leading Universities.

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