

Full Length Research Paper

Growth and impact of research output of Bangalore University, 1971-2010: A scientometric study

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In this paper, an attempt has been made to highlight quantitative growth and development of the Bangalore University (BU) in Science and Technology in terms of publication output as per Science Citation Index from 1970 to 2010. During the period of the study, a total of 2,188 publications were published with 9,401 citations in their credit. The average number of publications per year was 54.7. The highest numbers of papers (152) were published in 2008. BU has collaborated with 27 countries and USA is the top collaborating country with 74(31.09%) of papers followed by France with 20(8.4%). Authorship and collaboration trend were towards multi-authored paper. There were 1940(88.66%) multi-authored/collaborative papers and only 248(11.33%) single authored publications. The prolific authors were: S. M. Mayanna with 113 papers, and N. Rudraiah with 101 papers. P. V. Kamath with 98 papers with the highest *h* and *p* values 21 and 26.52, respectively. The most preferred journals for publication by the scientists were: Current Science with 168 publications, Indian Journal of Chemistry-B with 81 publications and Indian Journal of Chemistry-C with 39 publications.

Key words: Publication productivity, citation analysis, authorship pattern, Bradford's law of scattering.

INTRODUCTION

The generation of knowledge today, particularly, scientific knowledge, takes place primarily in universities. Several attempts have been made in the past to evaluate different departments within the universities, the most notable of which were carried out on universities in the United States by the American Council on Education (ACE) (Carter, 1966). Research productivity in higher education is gaining importance for the past one decade in India. Teaching and research are the two major functions of the university faculties. However, research has gained momentum during the past one and half decade, mainly due to support received through Ph.D. Program, in-house projects, and government funding projects (Kumbar et al., 2008).

Bangalore University was established in July 1964 as an offshoot of the University of Mysore. It has completed

forty-six years of fruitful existence and has come to be hailed as one of the largest universities of Asia. Though it originally intended to be a federal university, it has eventually emerged as an affiliating University. The University has been accredited in 2009 by NAAC and has received 'A' Grade Status. Academically, the university is structured into six faculties- Arts, Science, Commerce and Management, Education, Law and Engineering. It has 41 post-graduate departments, one post-graduate Centre at Kolar (started during 1994 to 1995), three constituent colleges, 673 affiliated colleges (of which 108 have PG courses) and several other Centers and Directorates of higher learning and research under its purview. At present, the University offers 51 postgraduate courses.

In this paper, an attempt has been made to describe growth, contribution and impact of research, channels of communication, collaboration, authorship pattern, analysis of strong and weak areas of research carried out by the scientists at Bangalore University in Science and

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Table 1. Quinquennial year-wise productivity of Bangalore University.

| Year | Single aut | 2-aut | 3 -aut | 4 - aut | 5 - aut | 6 -10 aut | 11 -20 aut | Multi aut | Total papers | % | Citation | % | CC |
|------------|------------|-------|--------|---------|---------|-----------|------------|-----------|--------------|-------|----------|-------|-------|
| 1971-1975 | 42 | 91 | 10 | 3 | 0 | 1 | 0 | 105 | 147 | 6.71 | 548 | 5.82 | 0.378 |
| 1976-1980 | 53 | 139 | 37 | 7 | 2 | 0 | 0 | 185 | 238 | 10.88 | 1145 | 12.17 | 0.426 |
| 1981-1985 | 32 | 127 | 78 | 15 | 4 | 0 | 0 | 224 | 256 | 11.7 | 1205 | 12.81 | 0.509 |
| 1986-1990 | 40 | 73 | 54 | 11 | 1 | 0 | 0 | 139 | 179 | 8.19 | 772 | 8.22 | 0.457 |
| 1991-1995 | 5 | 43 | 42 | 12 | 8 | 3 | 0 | 108 | 113 | 5.16 | 972 | 10.33 | 0.601 |
| 1996-2000 | 22 | 108 | 78 | 26 | 9 | 15 | 4 | 240 | 262 | 11.98 | 2033 | 21.65 | 0.568 |
| 2001-2005 | 28 | 145 | 122 | 48 | 43 | 26 | 2 | 386 | 414 | 18.92 | 1876 | 19.95 | 0.6 |
| 2006-2010 | 26 | 160 | 164 | 108 | 58 | 59 | 4 | 553 | 579 | 26.46 | 850 | 9.05 | 0.64 |
| Total | 248 | 886 | 585 | 230 | 125 | 104 | 10 | 1940 | 2188 | 100 | 9401 | 100 | |
| Percentage | 11.33 | 40.5 | 26.74 | 10.51 | 5.7 | 4.75 | 0.47 | | | | | | |
| Citations | 842 | 3696 | 3200 | 840 | 259 | 449 | 115 | 8559 | 9401 | | | | |
| Percentage | 8.96 | 39.31 | 34.04 | 8.94 | 2.76 | 4.78 | 1.22 | 91.04 | 100 | | | | |

Aut = author (s); CC - Collaboration Coefficient.

Technology during the period from 1970 to 2010.

METHODOLOGY

Publication and citation data for the study was downloaded from the Web of Science database. A larger time coverage data has been used from 1970 to 2010 for analyzing the growth and impact of the university research to ensure accurate results. Standard bibliometric fields were analyzed by normal count procedure for various domains such as authors and journals, etc. (Surwase et al., 2008).

The index is based on the distribution of citations received by a given researcher's publications. "A scientist has index h if h of [his/her] N_p papers have at least h citations each, and the other ($N_p - h$) papers have at most h citations each." The index was suggested by Hirsch (2005), a physicist at UCSD, as a tool for determining theoretical physicists' relative quality. p -index (performance-index) is the new performance indicator suggested by Prathap (2010). The p -index strikes the best balance between activity (total citations C) and excellence (mean citation rate C/P). The aforementioned two popular indices (h and p) were used to evaluate the publications and their impact.

RESULTS AND DISCUSSION

Publication productivity

BU had published 2,188 publications during 1970 to 2010, among which highest 152 papers published in 2008. The average number of publications per year was 54.7. Quinquennial period-wise trends in publications such as the single-authored, multi-authored, cumulative number of papers and citations are shown in Table 1 and Figure 1. Out of 2,188 publications, 248 (11.33%) were single authored and 1940 (88.66%) were multi-authored papers. Out of which 886 (40.5%) papers were double-authored with 3696 (39.31%) of citations, 585 (26.74%) papers were publications written by three authors with 3200 (34.04%) citations, 230 (10.51%) of papers were four-authored with 840 (8.94%) of citations and only 10 (0.47%) papers with 115 (1.22%) citations of authors eleven to twenty.

During the period of this study, 2188 papers have been cited 9401 times, and 29,489 cited references were found. Years 2008, 2009 and 2007 are the most productive years with 152, 149 and 133 papers respectively. To measure the collaborative research pattern an indicator called Collaborative Coefficient (CC) (Ajiferuke et al., 2005) was used. The highest CC was 0.65 during 2006 to 2010, and the average CC was 0.52.

Growth of publications

Figure 2 illustrates the growth rate of publications in different five year blocks. During 1971 to 1975 the growth rate of publications was very low and in the years 1986 to 1990 and 1991 to 1995 no exponential growth was observed. Thereafter, during 1996 to 2000 the growth rate of the publications was highest of all the years of the publications that is, (131.86%) with 262

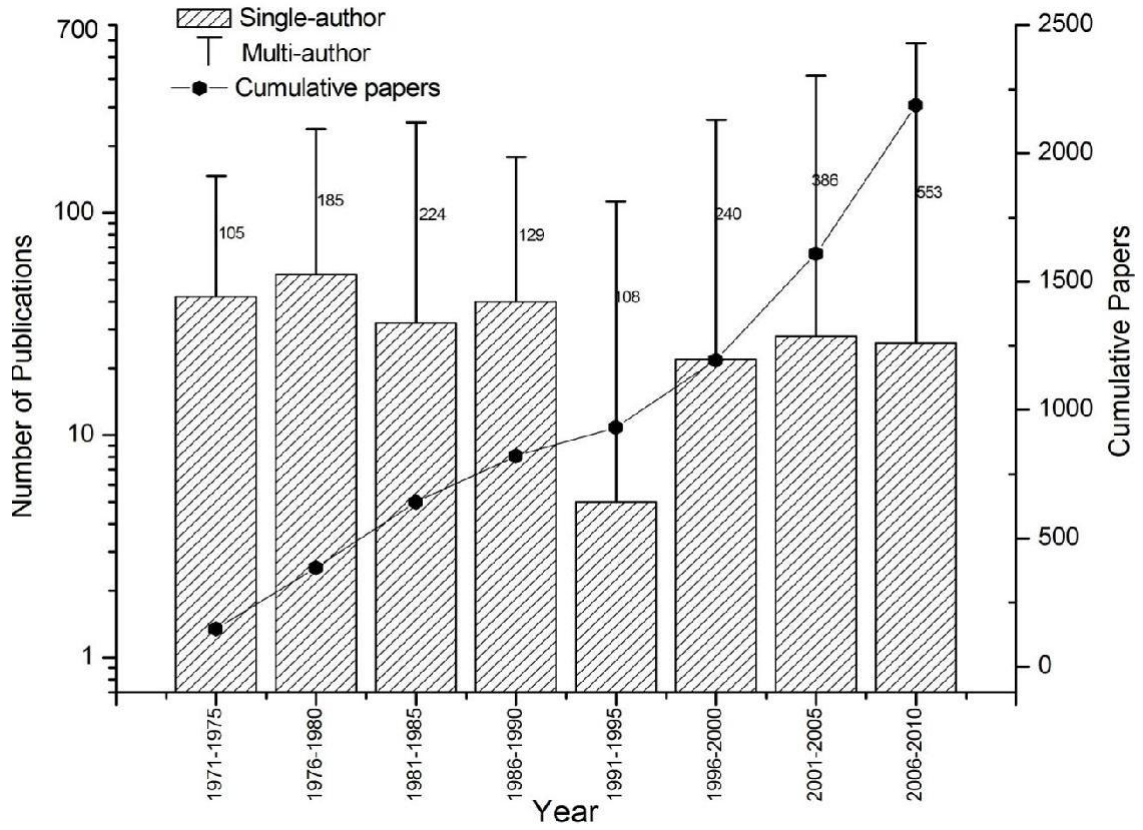


Figure 1. Year-wise publication productivity of Bangalore University, Bangalore.

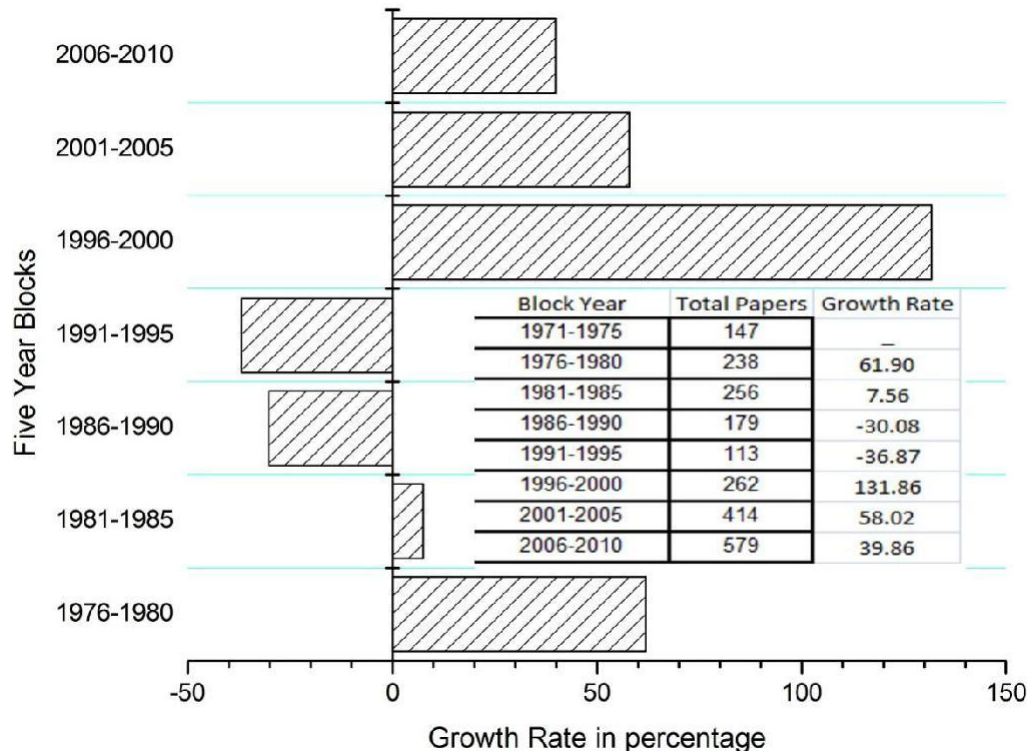


Figure 2. Growth rate in percentage.

publications. Subsequently there was a gradual decrease in the growth rate in the five-year blocks of 2001 to 2005 and 2006 to 2010 (Girap et al., 2009).

Most prolific author and their productive profile

A sum of 1,840 authors contributed 2,188 papers during the period of the study 1971 to 2010. The prolific authors and their publications, citations, years of association, and h & p -indices are recorded in Table 2, which confirm 117 most productive authors with more than 10 publications. The most productive authors were: SM Mayanna (Central College, Dept Post Graduate Studies Chemistry) is the most productive author with (113) papers with (806) citations during 1973 to 2008 and N Rudraiah (Dept. Mathematics, UGC Centre for Advanced Studies in Fluid Mechanics) with (101) papers with (600) citations during 1973 to 2009. PV Kamath (Central College, Dept Post Graduate Studies Chemistry) has got the highest citations (1, 352) from (98) papers during 1991 to 2009. The top 10 authors account about 32.13% of entire publications and 4,408(46.89%) of whole citation counts.

h -index and p -index

The index is based on the distribution of citations received by a given researcher's publications. "A scientist has index h if h of (his/her) N_p papers have at least h citations each, and the other ($N_p - h$) papers have at most h citations each." The index was suggested by Hirsch (2005), a physicist at UCSD, as a tool for determining theoretical physicists' relative quality.

p -index (performance-index) is the new performance indicator suggested by Prathap (2010). The p -index strikes the best balance between activity (total citations C) and excellence (mean citation rate C/P).

Figure 3 shows the h and p values of the scientists and the collaborators of BU. It was found that PV Kamath (Central College, Dept Post Graduate Studies Chemistry) in his 20 years span of research career has published 98 papers which have got 1352 citations, has the highest p - and h values that is 26.52 and 21, respectively. Followed by M. Jayananda (Department of Geology) with p and h value 20.38 and 11 respectively. Here we observe that the p value is much larger than h value, because p captures the larger citations that h fails to capture.

International collaboration of the university

Figure 4 gives the country-wise collaboration trend of Bangalore University. Out of 2188 publications 238 (10.88% of total) publications have international collaboration. BU has collaborated with 27 countries, out of which the leading collaborating country is USA with 74

(31.09%) papers, followed by France 27 (11.34), Canada 20 (8.4%), UK 19 (7.98%) and Japan 18(7.56%).

Channels of communication

The Bangalore University has published its 2188 research output in 615 peer reviewed national and international source journals in different disciplines of Science and Technology. The top two journals in terms of publications were: Current Science (168) and Indian Journal of Chemistry Section B (81) papers. Top two journals in terms of Citations were: Journal of Applied Electrochemistry (281) and Journal of the Electrochemical Society (275) citations. The publication density was 3.58.

Frequency distribution of papers in various journals, citations, impact factors is presented in the Table 3 and Figure 5.

Bradford distribution

Bradford's law is one of several statistical expressions that describes how the literature on a particular subject is scattered or distributed in various journals. If journals are ranked by the number of articles they contain on a given topic they can be divided into three zones; the first zone deemed as a central nucleus of the most important journals and followed by other two zones each containing the same number of articles as the nucleus (but each containing many more journals) (Bence and Oppenheim, 2004). In addition, Zipf's Law (1972) describes the frequency distribution of words in a given text, with familiar words being used many times and many words being used only once. Bradford's and Zipf's laws have been shown to be mathematically identical (Brookes, 1968) and so the distribution is often referred to as the Bradford-Zipf distribution. Zone-wise papers and journals can be divided as shown in Table 4.

In this case the Bradford Multiplier is 5.05 and average Bradford multiplier is 4.85. According to this multiplier the number of journals in the third zone should be 535. In reality, it is 488. We found that the number of journals in the third zone was closer to the actual number, but the data does not strictly follow Bradford law.

Conclusion

The analysis is based on publication data consisting of 2,188 research papers, published by the university staff during 1970 to 2010. The quality of research in progressed in terms of citations per paper is 4.29. The growth rate of publications was low in the beginning, but picked up during 1966 to 2000 to 131.86%. The research publication trend was collaborative. The international

Table 2. Highly productive authors and collaborators of Bangalore University during 1970 to 2010.

| S/N | Author | No. of Publications | Total Citations | FPY-LPY | Total Years | h-index | p-index |
|-----|----------------------|---------------------|-----------------|-----------|-------------|---------|---------|
| 1 | Mayanna SM | 113 | 806 | 1973-2008 | 36 | 16 | 17.91 |
| 2 | Rudraiah N | 101 | 600 | 1973-2009 | 37 | 13 | 15.28 |
| 3 | Kamath PV | 98 | 1352 | 1991-2010 | 20 | 21 | 26.52 |
| 4 | Babu VVS | 81 | 374 | 1988-2009 | 22 | 9 | 12.00 |
| 5 | Puttaswamy | 63 | 72 | 1997-2010 | 14 | 4 | 4.35 |
| 6 | Pasha MA | 59 | 240 | 1999-1999 | 1 | 8 | 9.92 |
| 7 | Chandrasekharaiah DS | 55 | 501 | 1976-2010 | 35 | 12 | 16.59 |
| 8 | Gowda NMN | 45 | 249 | 1974-2008 | 35 | 8 | 11.13 |
| 9 | Shakuntala K | 45 | 146 | 1974-2010 | 37 | 7 | 7.80 |
| 10 | Sureshbabu VV | 43 | 68 | 2006-2010 | 5 | 4 | 4.76 |
| 11 | Reddy GKN | 41 | 375 | 1973-2000 | 28 | 9 | 15.08 |
| 12 | Puttaraja | 40 | 89 | 1972-2007 | 36 | 5 | 5.83 |
| 13 | Nagendrappa G | 39 | 114 | 1989-2009 | 21 | 6 | 6.93 |
| 14 | REDDY SR | 37 | 162 | 1974-1989 | 16 | 8 | 8.92 |
| 15 | Sivanandaiah KM | 35 | 282 | 1974-1998 | 25 | 8 | 13.15 |
| 16 | Shivakumara IS | 35 | 147 | 1984-2009 | 26 | 6 | 8.52 |
| 17 | Begum NS | 34 | 67 | 1994-2009 | 16 | 4 | 5.09 |
| 18 | Venugopal KR | 33 | 7 | 2001-2009 | 9 | 1 | 1.14 |
| 19 | Patnaik LM | 32 | 1 | 2006-2009 | 4 | 1 | 0.31 |
| 20 | Sheshadri BS | 31 | 177 | 1975-2006 | 32 | 9 | 10.04 |
| 21 | Siddheshwar PG | 30 | 177 | 1986-2010 | 25 | 8 | 10.15 |
| 22 | Nirmala KA | 30 | 37 | 1975-2008 | 34 | 3 | 3.57 |
| 23 | Kokila MK | 29 | 45 | 1992-2008 | 17 | 3 | 4.12 |
| 24 | Mohan S | 29 | 24 | 1975-2009 | 35 | 3 | 2.71 |
| 25 | NAGESWAR S | 29 | 23 | 1976-1988 | 13 | 3 | 2.63 |
| 26 | Nayeemunnisa | 29 | 15 | 1974-2003 | 30 | 2 | 1.98 |
| 27 | Ahmed MF | 28 | 217 | 1973-2009 | 37 | 9 | 11.89 |
| 28 | RADHA E | 28 | 128 | 1973-1985 | 13 | 7 | 8.36 |
| 29 | Devi LG | 28 | 85 | 1999-2010 | 12 | 5 | 6.37 |
| 30 | Jayananda M | 27 | 478 | 1989-2009 | 21 | 11 | 20.38 |
| 31 | DEVARAJ N | 27 | 84 | 1974-1993 | 20 | 5 | 6.39 |
| 32 | Chandrappa GT | 25 | 160 | 1999-2010 | 12 | 7 | 10.08 |
| 33 | Kulkarni MV | 25 | 68 | 1990-2008 | 19 | 5 | 5.70 |
| 34 | Anavekar RV | 23 | 79 | 1985-2010 | 26 | 6 | 6.47 |
| 35 | Ramesh KP | 23 | 73 | 1985-2009 | 25 | 5 | 6.14 |
| 36 | Chandramani R | 22 | 71 | 1975-2009 | 35 | 4 | 6.12 |
| 37 | Rathod HT | 22 | 34 | 1995-2008 | 14 | 4 | 3.75 |
| 38 | Sullia SB | 22 | 31 | 1973-2006 | 34 | 3 | 3.52 |
| 39 | Lakshminarasappa BN | 22 | 30 | 1983-2010 | 28 | 3 | 3.45 |
| 40 | Ramesh TN | 21 | 92 | 2002-2010 | 9 | 6 | 7.39 |
| 41 | Devi SA | 20 | 106 | 1981-2009 | 29 | 6 | 8.25 |
| 42 | Jayashankara VP | 20 | 104 | 2004-2008 | 5 | 5 | 8.15 |
| 43 | Puttaswamy NG | 20 | 50 | 1975-1999 | 25 | 4 | 5.00 |
| 44 | Mahabaleswar B | 19 | 269 | 1976-2003 | 28 | 6 | 15.62 |
| 45 | Vasanthakumar GR | 19 | 112 | 2000-2005 | 6 | 6 | 8.71 |
| 46 | Shetty NJ | 19 | 85 | 1975-2009 | 35 | 5 | 7.24 |
| 47 | Ramakrishna J | 19 | 67 | 1976-2008 | 33 | 5 | 6.18 |
| 48 | Somashekar RK | 19 | 66 | 1984-2009 | 26 | 4 | 6.12 |
| 49 | Devi ARU | 19 | 63 | 2000-2010 | 11 | 4 | 5.93 |
| 50 | Singh F | 19 | 29 | 2003-2009 | 7 | 3 | 3.54 |
| 51 | Jagadeesh RV | 19 | 10 | 2002-2008 | 7 | 2 | 1.74 |

Table 2. Contd.

| | | | | | | | |
|-----|--------------------|----|-----|-----------|----|----|-------|
| 52 | Gayathri V | 18 | 66 | 1986-2010 | 25 | 5 | 6.23 |
| 53 | Veerabhadrappe PS | 18 | 60 | 1976-1996 | 21 | 4 | 5.85 |
| 54 | Venkatachalappa M | 18 | 49 | 1976-2006 | 31 | 5 | 5.11 |
| 55 | Damle R | 18 | 35 | 1997-2010 | 14 | 4 | 4.08 |
| 56 | Saravanan J | 18 | 0 | 2003-2008 | 6 | 0 | 0.00 |
| 57 | Gopi HN | 17 | 110 | 1998-2002 | 5 | 6 | 8.93 |
| 58 | Ananda K | 17 | 83 | 1998-2002 | 5 | 5 | 7.40 |
| 59 | Tantry SJ | 17 | 48 | 2002-2009 | 8 | 4 | 5.14 |
| 60 | Chakradhar RPS | 17 | 39 | 2005-2009 | 5 | 4 | 4.47 |
| 61 | Girija CR | 17 | 21 | 2003-2008 | 6 | 3 | 2.96 |
| 62 | Subramanyam MVV | 16 | 95 | 1989-2009 | 21 | 6 | 8.26 |
| 63 | Nagabhushana BM | 16 | 43 | 2004-2010 | 7 | 4 | 4.87 |
| 64 | Vaz N | 16 | 1 | 2000-2008 | 9 | 1 | 0.40 |
| 65 | Rajamathi M | 15 | 280 | 1997-2009 | 13 | 10 | 17.35 |
| 66 | Patil BS | 15 | 101 | 2002-2006 | 5 | 5 | 8.79 |
| 67 | Shivakumara C | 15 | 91 | 2005-2009 | 5 | 7 | 8.20 |
| 68 | GURUSIDDAPPA S | 15 | 85 | 1979-1991 | 13 | 5 | 7.84 |
| 69 | GOWDA DSS | 15 | 79 | 1976-1988 | 13 | 4 | 7.47 |
| 70 | Asokan S | 15 | 72 | 1994-2008 | 15 | 5 | 7.02 |
| 71 | Nijalingappa BHM | 15 | 34 | 1974-2001 | 28 | 3 | 4.26 |
| 72 | Tharamani CN | 15 | 32 | 2001-2009 | 9 | 4 | 4.09 |
| 73 | Shivaprakash NC | 15 | 23 | 1992-2006 | 15 | 3 | 3.28 |
| 74 | Chopra D | 15 | 0 | 2003-2008 | 6 | 0 | 0.00 |
| 75 | Kumar SG | 14 | 20 | 2008-2010 | 3 | 2 | 3.06 |
| 76 | Hemantha HP | 14 | 16 | 2007-2010 | 4 | 3 | 2.63 |
| 77 | Chandrasekhara BC | 13 | 175 | 1978-2001 | 24 | 5 | 13.31 |
| 78 | Gowda NMM | 13 | 69 | 1997-2008 | 12 | 5 | 7.15 |
| 79 | CHOWDAIAH BN | 13 | 35 | 1975-1985 | 11 | 4 | 4.55 |
| 80 | Ranganath RM | 13 | 34 | 1982-2009 | 28 | 3 | 4.46 |
| 81 | Mahendra KN | 13 | 24 | 1984-2010 | 27 | 2 | 3.54 |
| 82 | Nagabhushana H | 13 | 24 | 2003-2009 | 7 | 3 | 3.54 |
| 83 | Kanharaju | 13 | 21 | 2002-2010 | 9 | 2 | 3.24 |
| 84 | Puttaraju HP | 13 | 18 | 1985-2009 | 25 | 2 | 2.92 |
| 85 | BAI ARK | 13 | 15 | 1974-1985 | 12 | 3 | 2.59 |
| 86 | Narendra N | 13 | 14 | 2007-2010 | 4 | 3 | 2.47 |
| 87 | NAGARAJ M | 13 | 13 | 1976-1987 | 12 | 2 | 2.35 |
| 88 | Sudarshan NS | 13 | 12 | 2005-2009 | 5 | 2 | 2.23 |
| 89 | Vasu | 13 | 0 | 2003-2007 | 5 | 0 | 0.00 |
| 90 | JAYACHANDRA | 12 | 136 | 1979-1981 | 3 | 6 | 11.55 |
| 91 | Radha AV | 12 | 91 | 2003-2009 | 7 | 7 | 8.84 |
| 92 | Bali G | 12 | 74 | 1987-2009 | 23 | 4 | 7.70 |
| 93 | Aravinda CL | 12 | 52 | 1999-2003 | 5 | 5 | 6.09 |
| 94 | Prakash BSJ | 12 | 41 | 1974-2009 | 36 | 4 | 5.19 |
| 95 | Venkataramanarao R | 12 | 41 | 2006-2008 | 3 | 3 | 5.19 |
| 96 | PONNUCHAMY R | 12 | 38 | 1979-1988 | 10 | 5 | 4.94 |
| 97 | Radhakrishna MC | 12 | 35 | 1997-2009 | 13 | 3 | 4.67 |
| 98 | Nanjundaswamy HM | 12 | 21 | 2004-2007 | 4 | 3 | 3.32 |
| 99 | Vasundhara DE | 12 | 7 | 2006-2009 | 4 | 2 | 1.60 |
| 100 | Jayashree RS | 11 | 227 | 1999-2003 | 5 | 8 | 16.73 |
| 101 | SETTY THV | 11 | 70 | 1973-1976 | 4 | 4 | 7.64 |
| 102 | Acharya KV | 11 | 52 | 1994-2002 | 9 | 4 | 6.26 |
| 103 | Ananthamurthy S | 11 | 52 | 2000-2010 | 11 | 4 | 6.26 |

Table 2. Contd.

| | | | | | | | |
|-----|----------------------|----|-----|-----------|----|---|-------|
| 104 | Tejavathi DH | 11 | 27 | 1977-2010 | 34 | 3 | 4.05 |
| 105 | Choi MS | 11 | 19 | 2004-2010 | 7 | 3 | 3.20 |
| 106 | RAO TA | 11 | 18 | 1981-1988 | 8 | 3 | 3.09 |
| 107 | Karigar CS | 11 | 17 | 2004-2010 | 7 | 3 | 2.97 |
| 108 | Rao CK | 11 | 6 | 1973-1997 | 25 | 2 | 1.48 |
| 109 | Sankarapapavinasam S | 10 | 135 | 1991-2000 | 10 | 6 | 12.21 |
| 110 | Malashetty MS | 10 | 98 | 1982-2009 | 28 | 5 | 9.87 |
| 111 | Thomas GS | 10 | 95 | 2001-2008 | 8 | 5 | 9.66 |
| 112 | WALVEKAR SP | 10 | 41 | 1973-1990 | 18 | 4 | 5.52 |
| 113 | Ramachandrappa R | 10 | 26 | 1998-2002 | 5 | 1 | 4.07 |
| 114 | Min JY | 10 | 17 | 2004-2010 | 7 | 3 | 3.07 |
| 115 | GOWDA HS | 10 | 16 | 1986-1990 | 5 | 2 | 2.95 |
| 116 | Ramani | 10 | 15 | 1975-2008 | 34 | 3 | 2.82 |
| 117 | Chennakrishnareddy G | 10 | 14 | 2007-2010 | 4 | 3 | 2.70 |

Note: Authors having same number of publications, ranked according to their number of citations.

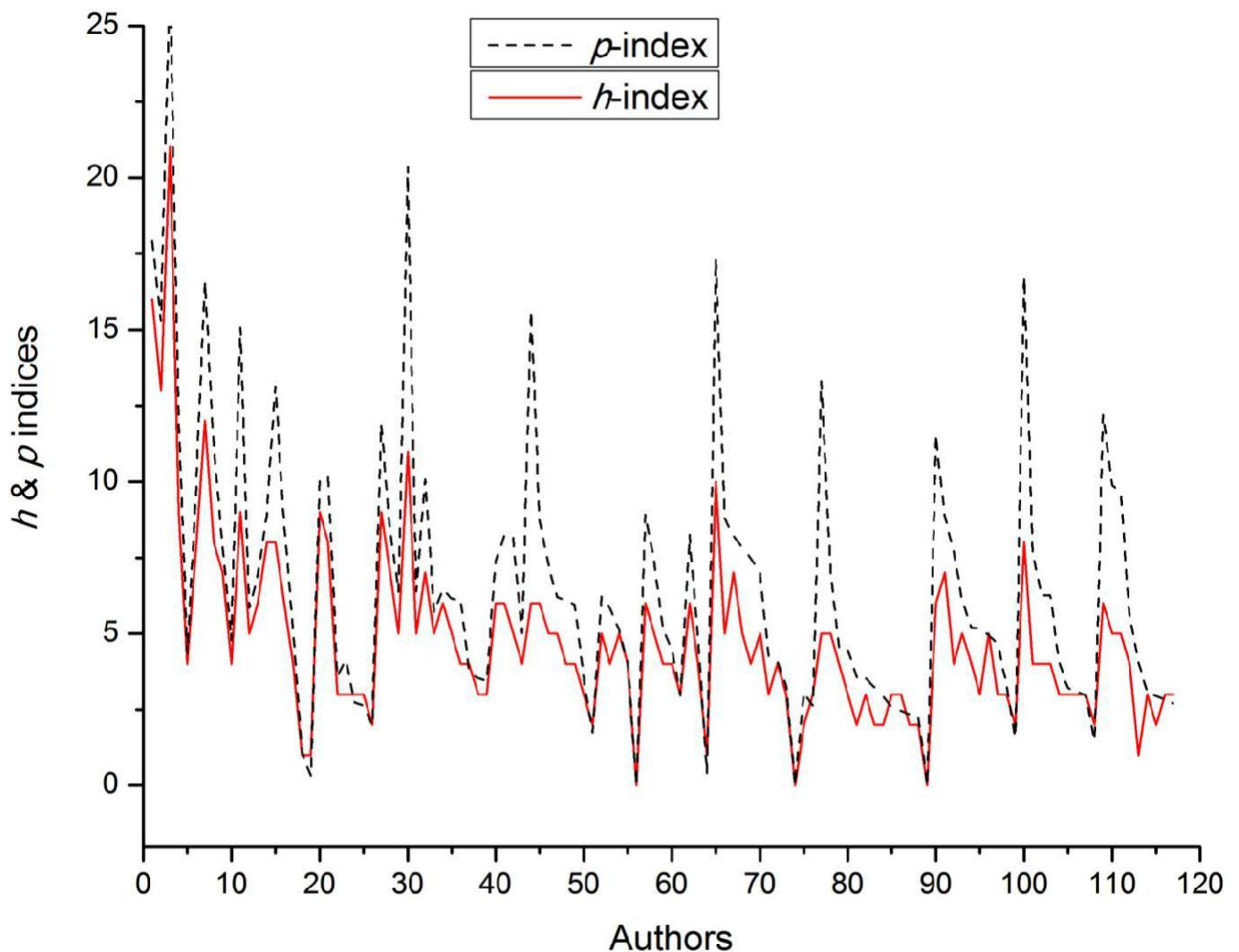


Figure 3. *h* and *p*-indices of authors and collaborators of Bangalore University.

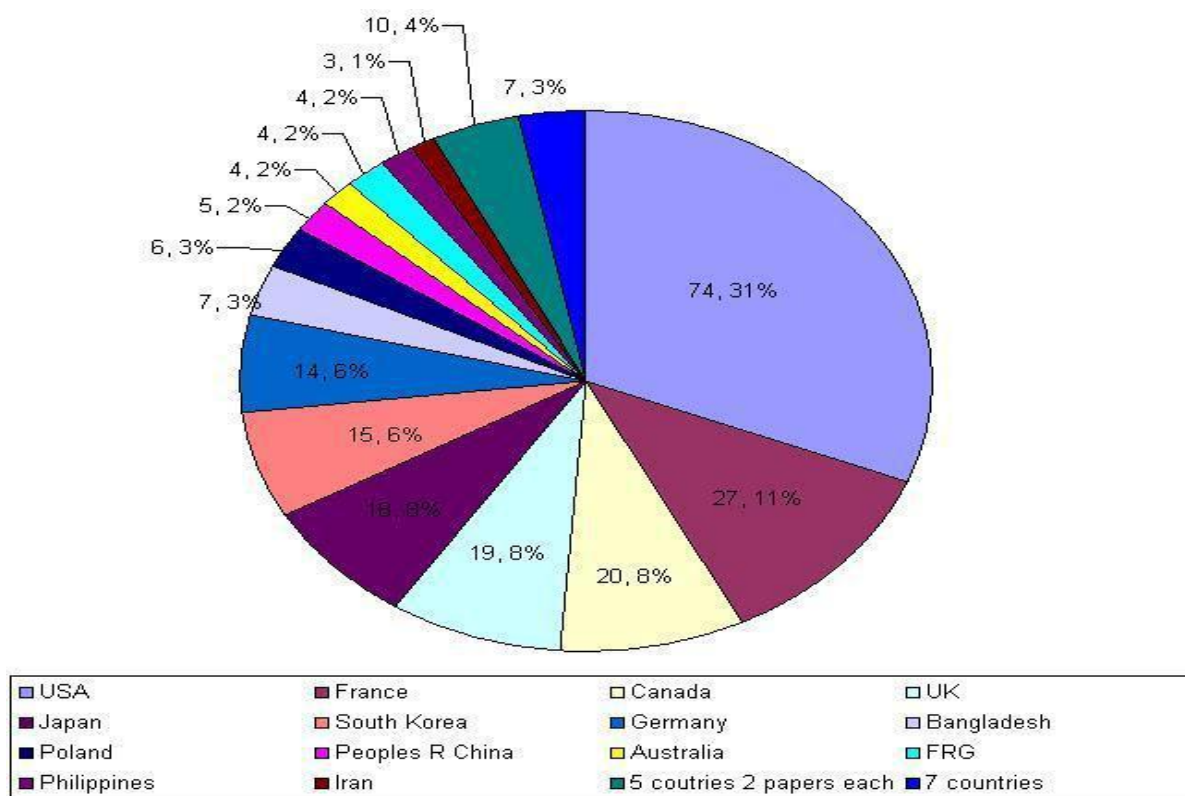


Figure 4. Country-wise distribution of collaborative publications of BU.

Table 3. Journals preferred for publishing articles by the scientists of BU during 1971-2010.

| Rank | Journals | No. of papers | Cumulative papers | Citations | Cumulative citations | Impact factor* |
|------|---|---------------|-------------------|-----------|----------------------|----------------|
| 1 | Current Science | 168 | 168 | 254 | 254 | 0.782 |
| 2 | Indian Journal of Chemistry Section B-Organic Chemistry Including Medicinal Chemistry | 81 | 249 | 208 | 462 | 0.437 |
| 3 | Indian Journal of Chemistry Section A-Inorganic Bio-Inorganic Physical Theoretical & Analytical Chemistry | 39 | 288 | 118 | 580 | 0.617 |
| 4 | Acta Crystallographica Section E-Structure Reports Online | 36 | 324 | 21 | 601 | 0.411 |
| 5 | Journal of the Geological Society of India | 32 | 356 | 50 | 651 | 0.424 |
| 6 | Synthetic Communications | 32 | 388 | 57 | 708 | 0.961 |
| 7 | Acta Crystallographical Section C-Crystal Structure Communications | 31 | 419 | 85 | 793 | 0.782 |
| 8 | Indian Journal of Experimental Biology | 31 | 450 | 52 | 845 | 0.55 |
| 9 | Acta Mechanica | 26 | 476 | 170 | 1015 | 1.137 |
| 10 | Indian Journal of Pure & Applied Mathematics | 24 | 500 | 34 | 1049 | 0.333 |
| 11 | Proceedings of the Indian Academy of Sciences-Animal Sciences | 24 | 524 | 44 | 1093 | 1.956 |

Table 3. Contd.

| | | | | | | |
|---------|--|-----|------|------|------|-------|
| 11 | Proceedings of the Indian Academy of Sciences-Animal Sciences | 24 | 524 | 44 | 1093 | 1.956 |
| 12 | Bulletin of Materials Science | 23 | 547 | 95 | 1188 | 0.783 |
| 13 | Journal of Applied Electrochemistry | 23 | 570 | 281 | 1469 | 1.697 |
| 14 | Oxidation Communications | 21 | 591 | 3 | 1472 | 0.24 |
| 15 | Indian Journal of Pure & Applied Physics | 20 | 611 | 27 | 1499 | 0.246 |
| 16 | Journal of the Indian Chemical Society | 20 | 631 | 65 | 1564 | 0.382 |
| 17 | International Journal of Engineering Science | 19 | 650 | 187 | 1751 | 1.36 |
| 18 | Journal of Chemical Research-S | 19 | 669 | 52 | 1803 | 0.04 |
| 19 | Surface Technology | 19 | 688 | 64 | 1867 | 1.793 |
| 20 | Tetrahedron Letters | 18 | 706 | 222 | 2089 | 2.66 |
| 21 | Indian Journal of Technology | 16 | 722 | 24 | 2113 | |
| 22 | International Journal of Heat and Mass Transfer | 16 | 738 | 227 | 2340 | 1.947 |
| 23 | Journal of the Electrochemical Society | 15 | 753 | 275 | 2615 | 2.241 |
| 24 | Indian Journal of Biochemistry & Biophysics | 14 | 767 | 12 | 2627 | 0.574 |
| 25 | Materials Research Bulletin | 14 | 781 | 114 | 2741 | 1.879 |
| 26 | Proceedings of the Indian Academy of Sciences Section B | 14 | 795 | 18 | 2759 | - |
| 27 | Journal of Power Sources | 13 | 808 | 177 | 2936 | 3.792 |
| 28 | Experientia | 12 | 820 | 21 | 2957 | |
| 29 | Journal of Molecular Catalysis A-Chemical | 12 | 832 | 26 | 2983 | 3.135 |
| 30 | Letters In Peptide Science | 12 | 844 | 52 | 3035 | - |
| 31 | National Academy Science Letters-India | 12 | 856 | 13 | 3048 | 0.173 |
| 32 | Pramana-Journal of Physics | 12 | 868 | 12 | 3060 | 0.349 |
| 33 | Indian Journal of Chemistry | 11 | 879 | 48 | 3108 | - |
| 34 | Indian Journal of Physics and Proceedings of the Indian Association For the Cultivation of Science | 11 | 890 | 11 | 3119 | 0.226 |
| 35 | Proceedings of the Indian Academy of Sciences-Chemical Sciences | 11 | 901 | 33 | 3152 | 0.993 |
| 36 | Synthesis and Reactivity In Inorganic and Metal-Organic Chemistry | 11 | 912 | 31 | 3183 | 0.569 |
| 37 | Caryologia | 10 | 922 | 38 | 3221 | 0.45 |
| 38 | Indian Journal of Chemical Technology | 10 | 932 | 41 | 3262 | 0.267 |
| 39 | International Journal of Chemical Kinetics | 10 | 942 | 54 | 3316 | 1.619 |
| 40 | Journal of Alloys and Compounds | 10 | 952 | 11 | 3327 | 2.135 |
| 41 | Journal of Biosciences | 10 | 962 | 24 | 3351 | 1.956 |
| 42 | Journal of Environmental Biology | 10 | 972 | 20 | 3371 | - |
| 43 | Transition Metal Chemistry | 10 | 982 | 4 | 3375 | 1.223 |
| 44-49 | six journals having 9 articles each | 54 | 1036 | 414 | 3789 | - |
| 50-58 | Nine journals having 8 articles each | 72 | 1108 | 544 | 4333 | - |
| 59-66 | Eight journals having 7 articles each | 56 | 1164 | 264 | 4597 | - |
| 67-82 | Fifteen journals having 6 articles each | 96 | 1260 | 688 | 5285 | - |
| 83-99 | Seventeen journals having 5 articles each | 85 | 1345 | 644 | 5929 | - |
| 100-143 | Forty four journals having 4 articles each | 176 | 1521 | 871 | 6800 | - |
| 144-184 | Forty one journals having 3 articles each | 123 | 1644 | 465 | 7265 | - |
| 185-297 | 113 journals with 2 articles each | 226 | 1870 | 843 | 8108 | - |
| 298-615 | 318 journals with one article each | 318 | 2188 | 1293 | 9401 | - |

*Impact factor 2010.

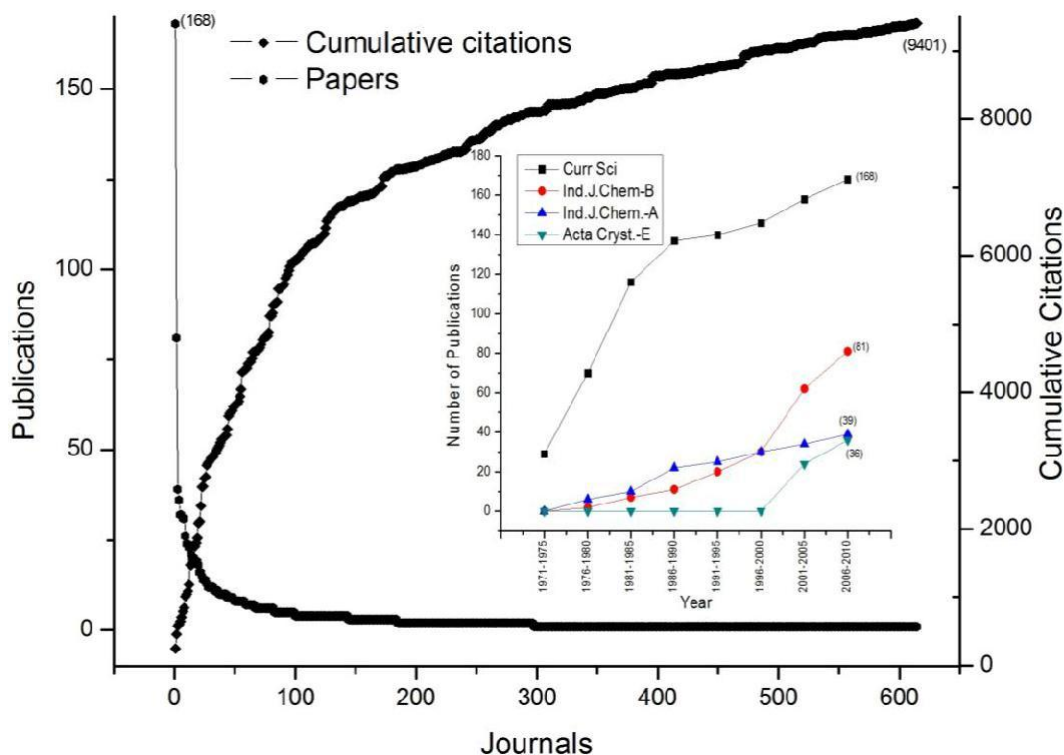


Figure 5. Bradford-Zipf's bibliography of publications of Bangalore University (Inset publication growth in four core journals).

Table 4. Distribution of papers and journals according to zones.

| Zone | No. of journals | No. of papers | Bradford multiplier |
|--------|-----------------|---------------|---------------------|
| First | 21 | 722 | - |
| Second | 106 | 1457 | 5.05 |
| Third | 488 | 2188 | 4.6 |

collaborative research activity in the university is very small, accounting for 10% share. The excellence in research is confined to selecting few authors, where the top 10 authors account for about 703(32.13%) of the total publications and 4408(46.89%) of the total citation counts.

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