

# Contribution and Citation Impact of Indian Universities: A Case Study of Karnataka Universities, 2007-2011

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## Abstract

*The study examined the contribution of six Karnataka universities to the mainstream scientific literature during 2007-2011 comprehending inter-related dimensions of quantity (number of papers, number of international collaborative papers) and quality of research output (assessed through the citation received). A number of relative measures are used for inter-field and inter-university comparisons. Inter-field comparisons are made at the level of 15 macro subject fields.*

## Introduction

Academic research and higher education plays an important role innovation through creation of new knowledge and developing trained manpower. Academic institutions in India are severally under-resourced and have insufficient linkages among themselves and with other sector organizations and with society at large. Much of the time of the university faculty is spent on teaching and the rest is spent on research in terms of guiding Ph.D students and in carrying out their own research projects obtained through sponsored research. University research output mainly consists of research papers, Ph.D theses and few reports and patents. The dominant output remains the research papers published in

peer reviewed journals. The present study evaluates the performance of top five universities of Karnataka, based on their research output in refereed journals and also studies their collaborative linkages among themselves and with other sector organizations. Karnataka is located in Southern part of India. Universities in Karnataka offer courses in under-graduate, post-graduate, doctoral level and also integrated programs in various subject fields. The first university in Karnataka was Mysore University established in the year 1916, and was followed by Karnataka University (1949), Bangalore University (1964), Mangalore University (1964), Gulbarga University (1980) and Kuvempu University (1987).

Using various quantitative and qualitative indicators, the study seeks to analyze the scientific output of the six most productive universities of Karnataka, their research citation impact and the patterns of their scientific collaboration among themselves and with other institutions in India and abroad during 2007-11, based on publications covered in refereed journals indexed in Scopus international multidisciplinary bibliographic database. The study is concerned with the following issues: (i) What is the contribution of these six Karnataka universities to mainstream literature in science and technology?; (ii) What are their collaborative linkages among themselves and with other institutions abroad?; (iii) What are the similarities and differences among the six Karnataka universities with the emphasis given to different scientific fields in their R&D?; and (iv) What are the similarities and differences among the six Karnataka universities among the choice of scientific fields for inter-institutional and international cooperation?

### **Literature Review**

Hussain and Mushtaq<sup>1</sup> analysed 19260 papers of 18 central universities with a view to analyze year-wise and subject-wise distribution of publications, their modes of communication, the most prolific authors, language used and identification of the preferences of source titles for communication. Sevukan, Nagarajan and Sharma<sup>2</sup> analyzed 348 publications in plant sciences by faculty members of central universities derived from SCI, with a focus on document type, authorship pattern, collaboration at different levels, author and journal productivity, etc. Using PUBMED and SCI databases, Sevukan and Sharma<sup>3</sup> analyzed 334 publications during 1997-2006 from biotechnology faculties of 10 central universities with a view to study the growth of literature, source of publications, identification of prolific authors, institutions and journals, etc. Anitha<sup>4</sup> studied the growth of literature, sources of

publications, identification of prolific authors, institutions and core journals in the field of biology by faculties in central universities of India during 2000–10. Kumbar, Gupta and Dhawan<sup>5</sup> studied the growth and impact of research output of University of Mysore during 1996-2006. Kumbar and Gupta<sup>6</sup> made a comparative assessment of Mysore University and Karnatak university output, in terms of its growth, citation impact, weak and strong subject areas, share of international collaborative publications, collaborative linkages with different type of Indian institutions, productivity of most prolific authors and journals. Nagpal<sup>7</sup> examined the contribution of Indian universities to the mainstream scientific literature during 1987–1998, using quantitative and qualitative measures. A number of relative indicators are constructed for inter-field and inter-institution comparisons. Amoji<sup>8</sup> analyzed the 3047 publications of 5 most productive universities of Karnataka by focusing on their growth, productivity, authorship pattern, preference of channels of communication and domain-wise research output.

### **Methodology**

This study used Scopus International Database [<http://www.scopus.com/search/>] to extract relevant publication data on six Karnataka universities from 2007 to 2011. An advanced search strategy was used resulting in downloading of 5885 records. For analyzing individual universities, separate search strategies were constructed for each university. For citations data, three years, two years, one year citation windows have been used for computing average citations per paper in all papers during 2007-09, 2010 and 2011. For example, for papers published in 2007 to 2009, citation window is three years. For papers published in 2010, citation window is two years from 2010-2012, and for papers published in 2011 citation window is one year 2011-12. For identifying international collaborative papers, a separate search strategy

was prepared. For national collaboration linkages, manual count of linkages with different types of institutions of the Karnataka universities was undertaken. For classification of data under various subjects, Scopus classification as provided in the database was used. The study is restricted to 15 main scientific fields. There is some overlapping of papers under these 15 subject fields. As a result, if we count the number of papers published under these subjects in each university, it comes out more than their cumulative publication output.

### Analysis

The 6 universities of Karnataka together have published 5885 papers, constituting 1.74% of the Indian research output during 2007-11. The cumulative output

of these 6 universities of Karnataka increased from 1074 papers in 2007 to 1524 papers in 2011, witnessing an annual average growth rate of 10.20%. The 6 universities of Karnataka together have registered a citation impact per paper of 3.07 during 2007-11, decreasing from 3.86 in 2007 to 1.12 in 2011 (Table 1). These 6 universities of Karnataka have achieved h-index of 40 and have received citations from 1 to 461 since their publication till end of 2012. Of the total papers of 6 Karnataka universities, 3575 papers have received zero citations and 2310 papers 1 to 461 citations. Of the cited papers, 0.03% (2 papers) received citations above 100, 0.36% (21 papers) between 51 to 100, 1.66% (98 papers) between 26 to 50 citations and remaining 37.19% (2189 papers) between 1 to 25 citations.

Table 1. Total Output, Citation Impact and International Collaboration, 2007-11

Year	TP	TC	ACPP	ICP	%ICP
2007	1074	4146	3.86	358	33.33
2008	916	3753	4.10	253	27.62
2009	1098	5234	4.77	245	22.31
2010	1273	3213	2.52	347	27.26
2011	1524	1712	1.12	432	28.35
Total	5885	18058	3.07	1635	27.78

### Productivity, Citation Impact and International Collaboration

On adding individual productivity, impact and international papers of the 6 universities of Karnataka during 2007-11, their total output consists of 6378 papers, varying from 602 to 1838, and witnessing an average productivity per organization of 1063 papers. Two universities have produced more number of papers than the average productivity of all 6 universities. These are University of Mysore with 1838 papers and Mangalore University with 1410 papers. The total papers (6378) of these 6 universities of Karnataka have received 18478 citations on a three year citation window, registering an average citation per paper of 2.90

(varying from 2.18 to 3.72). Three universities have registered higher citation impact per paper than the average impact of all 6 universities. These are Karnataka University with a citation impact per paper of 3.72, followed by Bangalore University (3.39) and Gulbarga University (3.37). The average h-index registered by these 6 universities of Karnataka was 23.67, varying from 22 to 27. Two universities have registered higher h-index values than the average h-index of all 6 universities of Karnataka. They are Karnataka University with h-index value of 27 and Mangalore University (25). The international collaborative publication share of these 6 universities of Karnataka was 30.43%, varying from 8.31% to 69.29%. One university has

achieved international collaborative publication share higher than the average international collaborative publication share of all 6 universities. It is Mangalore University with international collaborative publication share of 69.29%. It is also observed that the two

universities namely Mysore University and Mangalore University although topped in terms of research output and international collaboration share, but lagged behind other universities in terms of average number of citations per paper (Table 2).

Table 2. Publication Profile of Top 6 Karnataka Universities, 2007-11

Name	Abbreviation	2007-11					
		TP	TC	ACPP	HI	ICP	%ICP
University of Mysore	MYSORE-UNIV	1838	4014	2.18	23	562	30.58
Mangalore University	MANGAL-UNIV	1410	3901	2.77	25	977	69.29
Bangalore University	BANGAL-UNIV	1006	3412	3.39	23	153	15.21
Karnataka University	KARNAT-UNIV	916	3403	3.72	27	121	13.21
Gulbarga University	GULBAR-UNIV	606	2045	3.37	22	78	12.87
Kuvempu University	KUEMPU-UNIV	602	1703	2.83	22	50	8.31
		6378	18478	2.90	23.67	1941	30.43

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; HI=h--index; ICP=International Collaborative Papers

**International Collaboration**

The 6 universities of Karnataka together have published 1635 international collaborative papers, constituting 27.78% share in the total output of these universities, decreasing from 33.33% in 2007 to 28.35% in 2011 (Table 1). The 6 universities of Karnataka together collaborated with different 66 countries of the world during 2007-11. Around 27 countries have

published 10 and more collaborative papers with 6 universities of Karnataka during 2007-11. Of these 27 countries, the largest number and share (31.07%) of papers was published with United States, followed by Malaysia (13.88% share), South Korea (7.46% share), U.K (5.69% share), Slovenia (5.32% share), Japan (4.59% share), China (3.00% share), Iran (2.87% share), Thailand (2.51% share), Poland (2.02% share), and rest of the countries between 0.61% to 1.77% (Table 3).

Table 3. Share of Various Countries in the Total International Collaborative Papers of the Six Karnataka Universities, 2007-11

Collaborating Country	No.of Papers	% Share of Papers	Collaborating Country	No.of Papers	% Share of Papers
Germany	508	31.07	Canada	23	1.41
USA	360	22.02	Taiwan	21	1.28
Malaysia	227	13.88	Australia	20	1.22
South Korea	122	7.46	Singapore	20	1.22
UK	93	5.69	Turkey	19	1.16
Slovenia	87	5.32	Finland	18	1.10
Japan	75	4.59	Sweden	15	0.92
China	49	3.00	South Africa	14	0.86
Iran	47	2.87	Portugal	13	0.80
Thailand	41	2.51	Kuwait	11	0.67
Poland	33	2.02	Saudi Arabia	10	0.61
Denmark	29	1.77	Netherlands	10	0.61
France	27	1.65	Israel	10	0.61

## National Collaboration

The national collaboration links of 6 universities of Karnataka consists of 3616, accounting for 56.69% share of their total research output during 2007-11. The share of national collaboration links varies from 33.84% in case of Karnataka University to 66.45% in case of Kuvempu University. Of the total national collaborating links of these 6 universities of Karnataka, 44.42% are to academic institutions

(consisting of universities, colleges, engineering colleges and medical colleges), followed by research institutions (6.07%), institutes of national importance (3.78%), industry (2.18%), and others (0.22%) (Table 4). Also of the total national collaborating links, 80% of the national collaborating links (44.21%) are made to institutions of Karnataka, and the rest to institutions outside the state. It means most of the universities have inward approach for national collaboration (Table 5).

Table 4. National Collaboration Linkages of 6 Universities of Karnataka, 2007-11

Name of the University	TP	TNCL	%TNCL	Share of National Collaboration Links by Type of Institutions				
				Academic Institutions	Research Institutions	Institute of National Importance	Industry	Others
University of Mysore	1838	1162	63.22	52.23	4.62	3.26	2.72	0.38
Mangalore University	1410	838	59.43	52.55	3.62	0.85	2.41	0.00
Bangalore University	1006	573	56.96	37.57	9.54	8.35	0.60	0.70
Karnataka University	916	310	33.84	22.82	6.55	3.38	1.09	0.00
Gulbarga University	606	333	54.95	42.41	7.92	3.96	0.66	0.00
Kuvempu University	602	400	66.45	47.84	7.81	4.98	5.81	0.00
	6378	3616	56.69	44.42	6.07	3.78	2.18	0.22

Table 5. National Collaboration Linkages by Geographical Regions of the Six Universities of Karnataka, 2007-11

Name of the University <sup>1004</sup>	TP	TNCL	National Collaborating links by Region	
			Within State	Outside States
University of Mysore	1838	1162	54.62	8.60
Mangalore University	1410	838	47.52	11.91
Bangalore University	1006	573	42.35	14.61
Karnataka University	916	310	23.47	10.26
Gulbarga University	606	333	39.77	15.51
Kuvempu University	602	400	43.85	22.43
	6378	3616	44.21	12.48

The six universities of Karnataka together made 960 inter-collaborative linkages among themselves. Of these, the maximum number of collaborative linkages (353) is made by Mysore University, followed by Mangalore University (306), Bangalore University (103),

Karnataka University (84), Kuvempu University (63) and Gulbarga University (51). The largest number of inter-university linkages (287) is between Mysore and Mangalore, followed by 40 collaborative linkages between Mysore and Mangalore, 31 collaborative linkages between

Karnataka and Bangalore, 26 collaborative linkages between Karnataka and Gulbarga, 10 collaborative linkages between Mysore and Kuvempu, universities etc.(Table 6).

Table 6. Inter-University Collaboration Linkages among Six Universities of Karnataka, 2007-11

	MYSORE-UNIV	MANGAL-UNIV	BANGAL-UNIV	KARNAT-UNIV	GULBAR-UNIV	KUEMPUNIV	Total
MYSORE-UNIV		287	40	7	0	19	353
MANGAL-UNIV	287		5	4	7	3	306
BANGAL-UNIV	40	5		31	10	17	103
KARNAT-UNIV	7	4	31		26	16	84
GULBAR-UNIV	0	7	10	26		8	51
KUEMPUNIV	19	3	17	16	8		63
Total	353	306	103	84	51	63	

### Subject-Wise Distribution of Papers

**Chemistry** - The 6 universities of Karnataka together contributed 2267 papers in chemistry, constituting 38.52% share of their total publication and 4.34% of the total output of India in chemistry during 2007-11. They have together achieved an h-index of 34 and contributed 779 international collaborative papers, accounting for 34.36% share of their total papers during 2007-11. Of the 2267 papers in chemistry, 28.10% papers have received zero citations and the remaining 71.10% papers have received 1 to 89 citations. Of the cited papers, 9 papers (0.40%) has received 51 to 100 citations, 44 papers (1.94%) between 1 to 26 citations and 1577 papers (69.56%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in chemistry during 2007-11: (i) Three universities output was found to be more than the average productivity (413.83) of all universities. They are Mangalore University with 772 papers, followed by Mysore University (565 papers) and Karnataka University

(437 papers); (ii) Three universities have registered higher citation impact per paper than the average impact (2.76) of all universities. These are Karnataka University with a citation impact per paper of 3.98, followed by Kuvempu University (3.51) and Bangalore University (3.07); (iii) Three universities have registered higher h-index values than the average h-index (17.5) of all universities. They are Karnataka University and Mangalore University with h-index value of 21 and Kuvempu (18); (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (37.45%) of all organizations. They are Mangalore University with international collaborative publication share of 79.27% and Mysore University (41.42%); (v) Three universities have more than the average national collaborative links (61.98%) of all universities. They are Mysore University with national collaboration links of 91.50%, followed by Kuvempu University (80.48%) and Gulbarga University (72.26%) and (vi) Three universities

have institutional share more than the average institutional share (38.93%) of all universities. They are Mangalore University with average institutional share of 54.75%, Karnataka University (47.71%) and Kuvempu University (41.69%)(Table 7).

In terms of inter-university collaboration links among the 6 universities of Karnataka, the largest number of collaboration links (154) was

between Mysore and Mangalore universities in chemistry, followed by Karnataka-Bangalore (17 links), Karnataka-Kuvempu (11 links), Karnataka-Gulbarga (9 links), Mysore-Bangalore (4 links), Mysore-Kuvempu (3 links), Mangalore-Bangalore (3 links), Bangalore-Kuvempu (3 links), Mangalore-Kuvempu (2 links), Gulbarga-Kuvempu (2 links), Mysore-Karnataka (1 link) and Karnataka-Mangalore (1 link).

Table 7. Profile of Karnataka Universities in Chemistry, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MANGAL-UNIV	772	1734	2.25	1410	54.75	21	612	79.27	359	46.50	159
MYSORE-UNIV	565	1165	2.06	1838	30.74	15	234	41.42	517	91.50	162
KARNAT-UNIV	437	1740	3.98	916	47.71	21	35	8.01	191	43.71	39
BANGAL-UNIV	303	931	3.07	1006	30.12	16	24	7.92	158	52.15	27
KUVEMPU-UNIV	251	882	3.51	602	41.69	18	7	2.79	202	80.48	21
GULBAR-UNIV	155	401	2.59	606	25.58	14	18	11.61	112	72.26	11
Total	2483	6853	2.76	6378	38.93	17.5	930	37.45	1539	61.98	419

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCIL=National Collaborative Links; IUCL=Inter-University Collaborative Links

**Physics** - The 6 universities of Karnataka together contributed 1805 papers in physics, constituting 30.67% share of their total publication and 3.67% of the total output of India in physics during 2007-11. They have together achieved an h-index of 25 and contributed 1092 international collaborative papers, accounting for 60.50% share of their total papers during 2007-11. Of the 1805 papers in chemistry, 31.85% papers have received zero citations and the remaining 68.15% papers have received 1 to 160 citations. Of the cited papers, 1 paper (0.05%) has received above 100 citations, 1 paper (0.05%) between 51 to 100 citations, (21 papers (1.16%) between 26 to 50 citations and 1207 papers (66.87%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in physics during 2007-11: (i) Two universities output was found to be more than the average productivity (366.33) of all universities. They are Mangalore University with 1030 papers, followed by Mysore

University (494 papers); (ii) Four universities have registered higher citation impact per paper than the average impact (1.98) of all universities. These are Kuvempu University with a citation impact per paper of 5.29, followed by Karnataka University (3.04), Gulbarga University (2.50) and Bangalore University (2.36); (iii) Two universities have registered higher h-index values than the average h-index (13.17) of all universities. They are Mangalore University and Mysore University with h-index values of 17 and 14; (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (63.80%) of all universities. They are Mangalore University with international collaborative publication share of 88.45% and Mysore University (70.65%); (v) Three universities have more than the average national collaborative links (95.04%) share of all universities. They are Mysore University with national collaboration links of 136.44%, followed by Bangalore University (115.94%) and

Kuvempu University (104.44%) and (vi) One university has institutional share more than the average institutional share (33.52%) of all universities. It is Mangalore University with average institutional share of 73.05% (Table 8).

In terms of inter-university collaboration links among the 6 universities of Karnataka, the largest number of collaboration

links (272) was between Mysore and Mangalore universities in chemistry, followed by Karnataka-Gulbarga (18 links), Karnataka-Bangalore (17 links), Bangalore-Kuempu (9 links), Mangalore-Gulbarga (6 links), Mysore-Bangalore (4 links); Mysore-Kuvempu (4 links), Mangalore-Bangalore (2 links), Bangalore-Gulbarga (2 links), Karnataka-Mangalore (1 link) and Gulbarga-Kuvempu (1 link)

Table 8. Profile of Karnataka Universities in Physics, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MANGAL-UNIV	1030	1583	1.54	1410	73.05	17	911	88.45	579	56.21	281
MYSORE-UNIV	494	943	1.91	1838	26.88	14	349	70.65	674	136.44	280
BANGAL-UNIV	251	593	2.36	1006	24.95	13	53	21.12	291	115.94	34
KARNAT-UNIV	159	483	3.04	916	17.36	13	17	10.69	131	82.39	36
GULBAR-UNIV	159	398	2.50	606	26.24	13	23	14.47	119	74.84	27
KUVEMPU-UNIV	45	238	5.29	602	7.48	9	11	24.44	47	104.44	14
	2138	4238	1.98	6378	33.52	13.17	1364	63.80	1841	95.04	672
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI=Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Material Science** - The 6 universities of Karnataka together contributed 1464 papers in materials science, constituting 24.88% share of their total publication and 3.33% of the total output of India in materials science during 2007-11. They have together achieved an h-index of 27 and contributed 745 international collaborative papers, accounting for 60.50% share of their total papers during 2007-11. Of the 1464 papers in materials science, 344 papers (22.40%) have received zero citations and the remaining 793 papers (77.60%) have received 1 to 160 citations. Of the cited papers, 1 paper (0.07%) has received above 100 citations, 2 papers (0.14%) between 51 to 100 citations, 28 papers (1.91%) between 26 to 50 citations and 1105 papers (75.48%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in materials science during 2007-11: (i) Two universities output was found to be more than the average productivity

(277.83) of all universities. They are Mangalore University with 696 papers, followed by Mysore University (379 papers); (ii) Four universities have registered higher citation impact per paper than the average impact (2.59) of all universities. These are Kuvempu University with a citation impact per paper of 4.89, followed by Karnataka University (3.81), Bangalore (3.34) and Gulbarga University (2.91); (iii) Three universities have registered higher h-index values than the average h-index (14.67) of all universities. They are Mangalore University with h-index values of 16, followed by Bangalore University (16) and Karnatak University (15); (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (53.09%) of all universities. They are Mangalore University with international collaborative publication share of 86.21% and Mysore University (59.37%); (v) Three universities have

more than the average national collaborative links (95.04%) share of all universities. They are Bangalore University with national collaboration links share of 99.04%, followed by Mysore University (88.65%) and Kuvempu University

(71.25%) and (vi) One university has institutional share more than the average institutional share (26.14%) of all universities. It is Mangalore University with average institutional share of 49.36% (Table 9).

Table 9. Profile of Karnataka Universities in Materials Science, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MANGAL-UNIV	696	1290	1.85	1410	49.36	16	600	86.21	323	46.41	153
MYSORE-UNIV	379	887	2.34	1838	20.62	14	225	59.37	336	88.65	157
BANGAL-UNIV	209	699	3.34	1006	20.78	16	25	11.96	207	99.04	25
KARNAT-UNIV	187	712	3.81	916	20.41	15	21	11.23	123	65.78	27
GULBAR-UNIV	116	337	2.91	606	19.14	14	10	8.62	77	66.38	17
KUVEMP-UNIV	80	391	4.89	602	13.29	13	4	5.00	57	71.25	17
Total	1667	4316	2.59	6378	26.14	14.67	885	53.09	1123	67.37	396

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI=Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links

In terms of inter-university collaboration links among the 6 universities of Karnataka in materials science, the largest number of collaboration links (141) was between Mysore University and Mangalore University, followed by Karnataka-Bangalore (12 links), Karnataka-Gulbarga (9 links), Mysore-Kuvempu (7 links), Mysore-Bangalore (6 links), Mangalore-Gulbarga (6 links), Karnataka-Kuvempu (5 links), Bangalore-Kuvempu (4 links), Bangalore-Gulbarga (2 links), Karnataka-Mangalore (1 link), Mangalore-Kuvempu (1 link) and Mangalore-Bangalore (1 link)

**Biochemistry, Genetics & Molecular Biology** - The 6 universities of Karnataka together contributed 1137 papers in biochemistry, genetics & molecular biology, constituting 19.32% share of their total publication and 2.65% of the total output of India in biochemistry, genetics & molecular biology during 2007-11. They have together achieved an h-index of 29 and contributed 448 international collaborative papers, accounting for 39.40% share of their total papers during 2007-11. Of the 1805 papers in chemistry, 344 papers (30.25%)

have received zero citations and the remaining 793 papers (69.74%) have received 1 to 461 citations. Of the cited papers, 1 paper (0.09%) has received above 100 citations, 6 papers (0.53%) between 51 to 100 citations, 27 papers (2.37%) between 26 to 50 citations and 659 papers (57.96%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in biochemistry, genetics & molecular biology during 2007-11: (i) Two universities output was found to be more than the average productivity (366.33) of all universities. They are Mysore University with 406 papers, followed by Mangalore University (346 papers); (ii) Three universities have registered higher citation impact per paper than the average impact (2.60) of all universities. These are Kuvempu University with a citation impact per paper of 5.36, followed by Karnataka University (4.80) and Gulbarga University (2.73); (iii) Three universities have registered higher h-index values than the average h-index (13.33) of all universities. They are Karnataka University with h-index values of 16, followed by Mangalore University (15) and Mysore (14); (iv) Two

universities have achieved international collaborative publication share higher than the average international collaborative publication share (44.92%) of all universities. They are Mangalore University with international collaborative publication share of 85.26% and Mysore University (46.06%); (v) Three universities have more than the average national collaborative links (95.04%) share of all universities. They are Kuvempu University with

national collaboration links share of 110.85%, followed by Bangalore University (100.0%) and Mangalore University (82.37%) and (vi) Three universities have institutional share more than the average institutional share (20.07%) of all universities. They are Mangalore University with average institutional share of 24.54%, followed by Mysore University (22.09%) and Kuvempu University (21.43%) (Table 10).

Table 10. Profile of Karnataka Universities in Biochemistry, Genetics & Molecular Biology, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	406	773	1.90	1838	22.09	14	187	46.06	307	75.62	130
MANGAL-UNIV	346	550	1.59	1410	24.54	15	295	85.26	285	82.37	122
KARNAT-UNIV	149	715	4.80	916	16.27	16	33	22.15	61	40.94	13
BANGAL-UNIV	130	273	2.10	1006	12.92	10	19	14.62	130	100.00	12
KUVEMP-UNIV	129	691	5.36	602	21.43	13	23	17.83	143	110.85	9
GULBAR-UNIV	120	328	2.73	606	19.80	12	18	15.00	52	43.33	4
	1280	3330	2.60	6378	20.07	13.33	575	44.92	978	76.41	290

TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links

In terms of inter-university collaboration links among the 6 universities of Karnataka in biochemistry, genetics & molecular biology, the largest number of collaboration links (121) was between Mysore University and Mangalore University, followed by Karnataka-Bangalore (6 links), Mysore-Bangalore (4 links), Mysore-Kuvempu (4 links), Karnataka-Kuvempu (3 links), Karnataka-Gulbarga (2 links), Mysore-Karnataka (1 link), Karnataka-Mangalore (1 link), Bangalore-Kuvempu (1 link); Bangalore-Gulbarga (1 link) and Gulbarga-Kuvempu (1 link)

**Agricultural & Biological Sciences -**

The 6 universities of Karnataka together contributed 652 papers in agricultural & biological sciences, constituting 11.08% share of their total publications and 1.87% of the total output of India in agricultural & biological sciences during 2007-11. They have together achieved an h-index of 21 and contributed 127 international collaborative papers, accounting for 19.48% share of their total papers during 2007-11. Of the

652 papers in chemistry, 279 papers (42.79%) have received zero citations and the remaining 373 papers (57.21%) have received 1 to 78 citations. Of the cited papers, 2 papers (0.31%) have received between 51 to 100 citations, 15 papers (2.30%) between 26 to 50 citations and 356 papers (54.60%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in agricultural & biological sciences during 2007-11: (i) Two universities output was found to be more than the average productivity (111) of all universities. They are Mysore University with 290 papers, followed by Karnataka University (122 papers); (ii) Two universities have registered higher citation impact per paper than the average impact (2.25) of all universities. These are Karnataka University with a citation impact per paper of 3.34, followed by Mysore University (2.39); (iii) Two universities have registered higher h-index values than the average h-index (8.67) of all universities. They are Mysore University with h-index values of 14,

followed by Karnataka University (11) (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (19.52%) of all universities. They are Mangalore University with international collaborative publication share of 37.29% and Bangalore University (27.37%); (v) Three universities have more than the average national collaborative links (42.34%) share of all universities. They are Kuvempu University with national collaboration links share of 66.67%, followed by Bangalore University (60.0%) and Gulbarga University (48.98%) and (vi) Two

universities have institutional share more than the average institutional share (10.44%) of all universities. They are Mysore University with average institutional share of 15.78%, followed by Karnataka University (13.32%) (Table 11).

In terms of inter-university collaboration links among the 6 universities of Karnataka in agricultural & biological sciences, the largest number of collaboration links (6) were between Mysore University and Bangalore University, followed by Mysore - Kuvempu (3 link), Mysore - Karnataka (2 links), Karnataka - Mangalore (1 link) and Karnataka - Bangalore (1 link).

Table 11. Profile of Karnataka Universities in Agricultural & Biological Science, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	290	692	2.39	1838	15.78	14	51	17.59	119	41.03	11
KARNAT-UNIV	122	407	3.34	916	13.32	11	22	18.03	29	23.77	4
BANGAL-UNIV	95	91	0.96	1006	9.44	5	26	27.37	57	60.00	7
MANGAL-UNIV	59	117	1.98	1410	4.18	8	22	37.29	19	32.20	1
KUVEMPU-UNIV	51	107	2.10	602	8.47	8	2	3.92	34	66.67	3
GULBAR-UNIV	49	85	1.73	606	8.09	6	7	14.29	24	48.98	0
Total	666	1499	2.25	6378	10.44	8.67	130	19.52	282	42.34	26
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Engineering** - The 6 universities of Karnataka together contributed 562 papers in engineering, constituting 9.55% share of their total publications and 0.96% of the total output of India in engineering during 2007-11. They have together achieved an h-index of 17 and contributed 82 international collaborative papers, accounting for 14.59% share of their total papers during 2007-11. Of the 652 papers in engineering, 223 papers (39.68%) have received zero citations and the remaining 339 papers (60.33%) have received 1 to 42 citations. Of the cited papers, 4 papers (0.71%) have received between 26 to 50 citations and 335 papers (59.61%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in engineering during 2007-11: (i) Three universities output was found to be more than the average productivity (98) of all universities. They are Bangalore University with 188 papers, Gulbarga University (137 papers) and Mysore University (106 papers); (ii) Three universities have registered higher citation impact per paper than the average impact (2.35) of all universities. These are Kuvempu University with a citation impact per paper of 3.48, followed by Bangalore University (2.68) and Karnataka University (2.53); (iii) Two universities have registered higher h-index values than the average h-index (9) of all universities. They are Bangalore

University with h-index values of 13, followed by Gulbarga University (11); (iv) Three universities have achieved international collaborative publication share higher than the average international collaborative publication share (15.31%) of all universities. They are Bangalore University with international collaborative publication share of 20.21%, followed by Mysore University (19.81%) and Mangalore University (18.37%); (v) Three universities have more than the average national collaborative links (81.29%) share of all universities. They are Mangalore University with national collaboration links share of 104.98%, followed by Bangalore University (101.60%) and Kuvempu University (90.0%); and (vi) Two

universities have institutional share more than the average institutional share (9.22%) of all universities. They are Gulbarga University with average institutional share of 22.61%, followed by Bangalore University (18.69%)(Table 12).

In terms of inter-university collaboration links among the 6 universities of Karnataka in engineering, the largest number of collaboration links (7) was between Karnataka University and Gulbarga University, followed by Mysore-Bangalore (4 links), Bangalore-Gulbarga (3 links), Gulbarga-Kuvempu (3 links), Mysore-Mangalore (2 links), Mysore-Kuvempu (2 links), Bangalore-Kuvempu (2 links), Karnataka-Bangalore (1 link), Mysore-Karnataka (1 link) and Mangalore-Gulbarga (1 link)

Table 12. Profile of Karnataka Universities in Engineering, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
BANGAL-UNIV	188	503	2.68	1006	18.69	13	38	20.21	191	101.60	10
GULBAR-UNIV	137	297	2.17	606	22.61	11	11	8.03	85	62.04	14
MYSORE-UNIV	106	179	1.69	1838	5.77	8	21	19.81	71	66.98	9
KARNAT-UNIV	68	172	2.53	916	7.42	9	9	13.24	44	64.71	9
MANGAL-UNIV	49	94	1.92	1410	3.48	6	9	18.37	51	104.08	3
KUVEMPU-UNIV	40	139	3.48	602	6.64	7	2	5.00	36	90.00	7
Total	588	1384	2.35	6378	9.22	9	90	15.31	478	81.29	52
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCIL=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Pharmacology, Toxicology & Pharmaceutics** - The 6 universities of Karnataka together contributed 550 papers in pharmacology, toxicology & pharmaceutics, constituting 9.34% share of their total publications and 1.75% of the total output of India in pharmacology, toxicology & pharmaceutics during 2007-11. They have together achieved an h-index of 26 and contributed 44 international collaborative papers, accounting for 8.0% share of their total papers during 2007-11. Of the 550 papers in engineering, 151 papers (27.45%) have received zero citations

and the remaining 399 papers (72.55%) have received 1 to 99 citations. Of the cited papers, 11 papers (2.0%) have received between 51 to 100 citations, 14 papers (2.54%) between 26 to 50 citations and 374 papers (68.00%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in pharmacology, toxicology & pharmaceutics during 2007-11: (i) Three universities output was found to be more than the average productivity (95) of all universities. They are Mysore University with 199 papers, followed by Kuvempu University

(123 papers) and Karnataka University (104 papers); (ii) Two universities have registered higher citation impact per paper than the average impact (4.33) of all universities. These are Mangalore University with a citation impact per paper of 11.08, followed by Karnataka University (5.74); (iii) Four universities have registered higher h-index values than the average h-index (11.67) of all universities. They are Mangalore University with h-index values of 17, followed by Karnataka University (15), Mysore University (13) and Kuvempu (13); (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (8.25%) of all universities. They are Mysore University with international collaborative publication share of 12.06% and Kuvempu University (8.94%); (v) Two universities have more than the average national collaborative links (74.56%) share of all

universities. They are Kuvempu University with national collaboration links share of 122.76%, followed by Mangalore University (110.42%) and (vi) Four universities have institutional share more than the average institutional share (8.94%) of all universities. They are Kuvempu University with average institutional share of 20.43%, followed by Karnataka University (11.35%), Mysore University (10.83%) and Gulbarga University (9.08%) (Table 13).

In terms of inter-university collaboration links among the 6 universities of Karnataka in pharmacology, toxicology & pharmaceuticals, the largest number of collaboration links (5) were between Mysore University and Bangalore University, followed by Mysore-Kuvempu (5 links), Karnataka-Bangalore (2 links), Karnataka-Kuvempu (1 link), Karnataka-Mangalore (1 link), Bangalore-Kuvempu (1 link), Mangalore-Kuvempu (1 link); Mangalore-Bangalore (1 link) and Bangalore-Kuvempu (1 link).

Table 13. Profile of Karnataka Universities in Pharmacology, Toxicology & Pharmaceutics, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	199	697	3.50	1838	10.83	13	24	12.06	118	59.30	10
KUVEMPU-UNIV	123	397	3.23	602	20.43	13	11	8.94	151	122.76	8
KARNAT-UNIV	104	597	5.74	916	11.35	15	8	7.69	54	51.92	4
GULBAR-UNIV	55	87	1.58	606	9.08	6	2	3.64	27	49.09	0
MANGAL-UNIV	48	532	11.08	1410	3.40	17	0	0.00	53	110.42	3
BANGAL-UNIV	41	157	3.83	1006	4.08	6	2	4.88	22	53.66	10
Total	570	2467	4.33	6378	8.94	11.67	47	8.25	425	74.56	35
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Environment Science** - The 6 universities of Karnataka together contributed 410 papers in environment science, constituting 6.97% share of their total publications and 1.93% of the total output of India in environment science during 2007-11. They have together achieved an h-index of 13 and contributed 47 international collaborative papers, accounting for

11.46% share of their total papers during 2007-11. Of the 410 papers in environment science, 209 papers (50.97%) have received zero citations and the remaining 201 papers (49.03%) have received 1 to 61 citations. Of the cited papers, 1 paper (0.24%) has received between 51 to 100 citations, 3 papers (0.73%) between 26 to 50 citations and 197 papers (48.05%) between 1 to

25 citations.

On individually analyzing the profile of 6 universities of Karnataka in environment science during 2007-11: (i) Two universities output was found to be more than the average productivity (71.67) of all universities. They are Mysore University with 115 papers and Bangalore University with 100 papers; (ii) Four universities have registered higher citation impact per paper than the average impact (1.57) of all universities. These are Gulbarga University with a citation impact per paper of 2.24, followed by Bangalore University (1.93), Karnataka University (1.85) and Mangalore University (1.62); (iii) Five universities have registered higher h-index values than the average h-index (6.83) of all universities. They are Bangalore University with h-index values of 8, followed by Mysore University (7), Kuvempu University (7), Mangalore University (7) and Gulbarga University (7); (iv) Four universities have achieved international collaborative publication share higher than the average international collaborative publication share (10.93%) of all universities. They are Mangalore University

with international collaborative publication share of 19.67%, followed by Mysore University (14.48%), Karnataka University (13.46%) and Gulbarga University (12.12%); (v) Three universities have more than the average national collaborative links (50.47%) share of all universities. They are Mangalore University with national collaboration links share of 77.05%, followed by Kuvempu University (63.77%) and Gulbarga University (51.52%); and (vi) Two universities have institutional share more than the average institutional share (6.74%) of all universities. They are Kuvempu University with average institutional share of 11.46%, followed by Bangalore University (9.94%)(Table 14).

In terms of inter-university collaboration links among the 6 universities of Karnataka in environment science, the largest number of collaboration links (13) was between Mysore University and Bangalore University, followed by Bangalore - Kuvempu (2 links), Gulbarga - Kuvempu (2 links), Mysore - Karnataka (1 link); Mysore - Kuvempu (1 link), Karnataka - Mysore (1 link), Karnataka - Kuvempu (1 link) and Mangalore-Bangalore (1 link)

Table 14. Profile of Karnataka Universities in Environment Science, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	115	127	1.10	1838	6.26	7	17	14.78	50	43.48	16
BANGAL-UNIV	100	193	1.93	1006	9.94	8	3	3.00	39	39.00	16
KUVEMPU-UNIV	69	87	1.26	602	11.46	7	4	5.80	44	63.77	6
MANGAL-UNIV	61	99	1.62	1410	4.33	7	12	19.67	47	77.05	1
KARNAT-UNIV	52	96	1.85	916	5.68	5	7	13.46	20	38.46	2
GULBAR-UNIV	33	74	2.24	606	5.45	7	4	12.12	17	51.52	2
Total	430	676	1.57	6378	6.74	6.83	47	10.93	217	50.47	43
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI=Index; ICP=International Collaborative Papers; NCIL=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Computer Science** - The 6 universities of Karnataka together contributed 306 papers in computer science, constituting 5.20% share of their total publications and 0.80% of the total output of India in computer science during 2007-

11. They have together achieved an h-index of 11 and contributed 35 international collaborative papers, accounting for 11.44% share of their total papers during 2007-11. Of the 306 papers in computer science, 181 papers (59.15%) have

received zero citations and the remaining 125 papers (41.85%) have received 1 to 29 citations. Of the cited papers, 1 paper (0.33%) has received between 26 to 50 citations and 124 papers (40.52%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in computer science during 2007-11: (i) One university output was found to be more than the average productivity (53.83) of all universities. It is Mysore University with 168 papers; (ii) Four universities have registered higher citation impact per paper than the average impact (1.01) of all universities. These are Karnataka University with a citation impact per paper of 1.74, followed by Kuvempu University (1.59), Mangalore University (1.09) and Gulbarga University (1.06); (iii) Three universities have registered higher h-index values than the average h-index (4.83) of all universities. They are Mysore University with

h-index values of 7, followed by Gulbarga University (6) and Kuvempu (5); (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (11.46%) of all universities. They are Kuvempu University with international collaborative publication share of 27.27% and Mysore University (14.29%); (v) Four universities have more than the average national collaborative links (66.87%) share of all universities. They are Kuvempu University with national collaboration links share of 145.45%, followed by Bangalore University (95.35%), Mangalore University (94.29%) and Karnataka University (78.95%); and (vi) Two universities have institutional share more than the average institutional share (5.06%) of all universities. They are Mysore University with average institutional share of 9.14%, followed by Gulbarga University (5.94%) (Table 15).

Table 15. Profile of Karnataka Universities in Computer Science, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	168	169	1.01	1838	9.14	7	24	14.29	73	43.45	7
BANGAL-UNIV	43	14	0.33	1006	4.27	3	3	6.98	41	95.35	3
GULBAR-UNIV	36	38	1.06	606	5.94	6	0	0.00	22	61.11	6
MANGAL-UNIV	35	38	1.09	1410	2.48	4	2	5.71	33	94.29	3
KUVEMPU-UNIV	22	35	1.59	602	3.65	5	6	27.27	32	145.45	8
KARNAT-UNIV	19	33	1.74	916	2.07	4	2	10.53	15	78.95	7
Total	323	327	1.01	6378	5.06	4.83	37	11.46	216	66.87	34
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

In terms of inter-university collaboration links among the 6 universities of Karnataka in computer science, the largest number of collaboration links (3 each) was between Mysore University and Mangalore University, Karnataka University and Gulbarga University and Gulbarga University and Kuvempu University, followed Mysore-Bangalore (2 links), Karnataka-Kuvempu (2 links), Bangalore-Kuvempu (2 links), Mysore-Kuvempu (1 link), Mysore-Karnataka (1 link) and

Karnataka-Bangalore (1 link).

**Medicine** - The 6 universities of Karnataka together contributed 293 papers in medicine, constituting 4.98% share of their total publications and 0.76% of the total output of India in medicine during 2007-11. They have together achieved an h-index of 14 and contributed 56 international collaborative papers, accounting for 19.11% share of their total papers

during 2007-11. Of the 293 papers in medicine, 99 papers (33.79%) have received zero citations and the remaining 194 papers (66.21%) have received 1 to 36 citations. Of the cited papers, 4 papers (1.36%) have received between 26 to 50 citations and 190 papers (64.84%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in medicine during 2007-11: (i) Two universities output was found to be more than the average productivity (50.83) of all universities. They are Mysore University with 119 papers and Bangalore University with 59 papers; (ii) Three universities have registered higher citation impact per paper than the average impact (2.55) of all universities. These are Kuvempu University with a citation impact per paper of 3.44, followed by Karnataka University (2.94) and Gulbarga University (2.68); (iii) Three universities have registered higher h-index values than the average h-index (6.83) of all universities. They are Bangalore University with h-index values of 10, followed by Mysore University (9) and Kuvempu University (8); (iv) Four universities have achieved international collaborative publication share higher than the

average international collaborative publication share (20.0%) of all universities. They are Karnatak University with international collaborative publication share of 27.27%, followed by Kuvempu University (26.47%), Mangalore University (22.86%) and Mysore University (20.17%); (v) Four universities have more than the average national collaborative links (62.30%) share of all universities. They are Kuvempu University with national collaboration links share of 102.94%, followed by Mangalore University (85.71%), Gulbarga University (68.00%) and Bangalore University (64.41%); and (vi) Three universities have institutional share more than the average institutional share (4.78%) of all universities. They are Mysore University with average institutional share of 6.47%, followed by Bangalore University (5.86%) and Kuvempu University (5.65%)(Table 16).

In terms of inter-university collaboration links among the 6 universities of Karnataka in medicine, the largest number of collaboration links (5) was between Mysore University and Bangalore University, followed by Mysore - Karnataka (1 link), Karnataka - Mangalore (1 link) and Mangalore - Bangalore (1 link).

Table 16. Profile of Karnataka Universities in Medicine, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	119	303	2.55	1838	6.47	9	24	20.17	52	43.70	6
BANGAL-UNIV	59	149	2.53	1006	5.86	10	8	13.56	38	64.41	6
MANGAL-UNIV	35	46	1.31	1410	2.48	4	8	22.86	30	85.71	2
KUVEMPU-UNIV	34	117	3.44	602	5.65	8	9	26.47	35	102.94	0
KARNAT-UNIV	33	97	2.94	916	3.60	4	9	27.27	18	54.55	2
GULBAR-UNIV	25	67	2.68	606	4.13	6	3	12.00	17	68.00	0
Total	305	779	2.55	6378	4.78	6.83	61	20.00	190	62.30	16
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Chemical Engineering-** The 6 universities of Karnataka together contributed 468 papers in chemical engineering, constituting 7.95% share of their total publications and 2.21% of the total

output of India in chemical engineering during 2007-11. They have together achieved an h-index of 23 and contributed 66 international collaborative papers, accounting for 14.10%

share of their total papers during 2007-11. Of the 468 papers in engineering, 116 papers (24.79%) have received zero citations and the remaining 352 papers (75.21%) have received 1 to 99 citations. Of the cited papers, 2 papers (0.43%) has received between 51 to 100 citations, 18 papers (3.85%) between 26 to 50 citations and 332 papers (70.94%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in chemical engineering during 2007-11: (i) Three universities output was found to be more than the average productivity (80.5) of all universities. They are Karnataka University with 115 papers, followed by Bangalore University (105 papers) and Mysore University (99 papers); (ii) Three universities have registered higher citation impact per paper than the average impact (4.0) of all universities. These are Karnataka University with a citation impact per paper of 6.0, followed by Kuvempu University (4.38) and Gulbarga University (4.33); (iii) Three universities have registered higher h-index values than the average h-index (10.67) of all universities. They are Karnataka University with h-index values of 17, followed by Bangalore University (12) and Gulbarga University (12); (iv) Four universities have achieved international collaborative publication share higher than the average international collaborative publication

share (15.11%) of all universities. They are Bangalore University with international collaborative publication share of 19.05%, followed by Gulbarga University (17.72%), Karnataka University (16.52%) and Mysore University (15.15%); (v) Two universities have more than the average national collaborative links (47.41%) share of all universities. They are Kuvempu University with national collaboration links share of 75.41%, followed by Bangalore University (56.31%); and (vi) Four universities have institutional share more than the average institutional share (7.57%) of all universities. They are Gulbarga University with average institutional share of 13.04%, followed by Karnataka University (12.55%), Bangalore (10.44%) and Kuvempu University (10.13%)(Table 17).

In terms of inter-university collaboration links among the 6 universities of Karnataka in chemical engineering, the largest number of collaboration links (3) was between Karnataka University and Kuvempu University, followed by Bangalore-Gulbarga (2 links), Mysore-Bangalore (1 link), Mysore-Mangalore (1 link), Mysore-Kuvempu (1 link), Mysore-Karnataka (1 link), Karnataka-Gulbarga (1 link), Mangalore-Kuvempu (1 link), Bangalore-Kuvempu (1 link) and Gulbarga-Kuvempu (1 link)

Table 17. Profile of Karnataka Universities in Chemical Engineering, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
KARNAT-UNIV	115	690	6.00	916	12.55	17	19	16.52	36	31.30	5
BANGAL-UNIV	105	406	3.87	1006	10.44	12	20	19.05	59	56.19	4
MYSORE-UNIV	99	172	1.74	1838	5.39	8	15	15.15	43	43.43	4
GULBAR-UNIV	79	342	4.33	606	13.04	12	14	17.72	35	44.30	4
KUVEMPU-UNIV	61	267	4.38	602	10.13	10	5	8.20	46	75.41	4
MANGAL-UNIV	24	57	2.38	1410	1.70	5	0	0.00	10	41.67	2
<b>Total</b>	<b>483</b>	<b>1934</b>	<b>4.00</b>	<b>6378</b>	<b>7.57</b>	<b>10.67</b>	<b>73</b>	<b>15.11</b>	<b>229</b>	<b>47.41</b>	<b>23</b>
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCIL=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Mathematics** - The 6 universities of Karnataka together contributed 275 papers in mathematics, constituting 4.67% share of their total publications and 1.45% of the total output of India in mathematics during 2007-11. They have together achieved an h-index of 11 and contributed 35 international collaborative papers, accounting for 12.73% share of their total papers during 2007-11. Of the 275 papers in mathematics, 165 papers (60.0%) have received zero citations and the remaining 110 papers (40.0%) have received 1 to 42 citations. Of the cited papers, 4 papers (1.45%) have received between 26 to 50 citations and 106 papers (38.54%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in mathematics during 2007-11: (i) Three universities output was found to be more than the average productivity (43.17) of all universities. They are Mysore University with 96 papers, followed by Bangalore University (71 papers) and Karnataka University (53 papers); (ii) Two universities have registered higher citation impact per paper than the average impact (1.29) of all universities. These are Gulbarga University with a citation impact per paper of 4.25, followed by Bangalore University (1.38); (iii) Two universities have registered higher h-index values than the average h-index (4.83) of all universities. They are Gulbarga University

with h-index values of 8, followed by Bangalore University (6); (iv) Two universities have achieved international collaborative publication share higher than the average international collaborative publication share (12.88%) of all universities. They are Bangalore University with international collaborative publication share of 19.72%, followed by Gulbarga University (19.44%); (v) Three universities have more than the average national collaborative links (63.39%) share of all universities. They are Gulbarga University with national collaboration links share of 100.0%, followed by Bangalore University (78.87%) and Karnataka University (77.36%); and (vi) Four universities have institutional share more than the average institutional share (4.63%) of all universities. They are Bangalore University with average institutional share of 7.06%, followed by Gulbarga University (5.94%), Karnatak University (5.79%) and Mysore University (5.22%)(Table 18).

In terms of inter-university collaboration links among the 6 universities of Karnataka in mathematics, the largest number of collaboration links (7) was between Karnataka University and Bangalore University, followed by Bangalore-Gulbarga (3 links), Mysore - Bangalore (2 links); Mysore-Mangalore (2 links), Mysore-Karnatak (2 links), Karnatak-Gulbarga (2 links), Bangalore-Kuvempu (1 link) and Gulbarga-Kuvempu (1 link).

Table 18. Profile of Karnataka Universities in Mathematics, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	96	53	0.55	1838	5.22	4	12	12.50	38	39.58	6
BANGAL-UNIV	71	98	1.38	1006	7.06	6	14	19.72	56	78.87	13
KARNAT-UNIV	53	43	0.81	916	5.79	4	3	5.66	41	77.36	11
GULBAR-UNIV	36	153	4.25	606	5.94	8	7	19.44	36	100.00	3
KUVEMPU-UNIV	21	24	1.14	602	3.49	3	1	4.76	9	42.86	2
MANGAL-UNIV	18	11	0.61	1410	1.28	4	1	5.56	7	38.89	2
	295	382	1.29	6378	4.63	4.83	38	12.88	187	63.39	37
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI=Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Immunology & Microbiology-** The 6 universities of Karnataka together contributed 214 papers in immunology & microbiology constituting 3.36% share of their total publications and 1.84% of the total output of India in immunology & microbiology during 2007-11. They have together achieved an h-index of 14 and contributed 51 international collaborative papers, accounting for 23.83% share of their total papers during 2007-11. Of the 214 papers in immunology & microbiology, 84 papers (39.25%) have received zero citations and the remaining 130 papers (60.75%) have received 1 to 64 citations. Of the cited papers, 1 paper (0.47%) has received between 51 to 100 citations, 4 papers (1.87%) between 26 to 50 citations and 125 papers (58.41%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in immunology & microbiology during 2007-11: (i) Two universities output was found to be more than the average productivity (35.66) of all universities. They are Gulbarga University with 76 papers, followed by Mysore University (51 papers); (ii) Three universities have registered higher citation impact per paper than the average impact (2.73) of all universities. These

are Kuvempu University with a citation impact per paper of 3.48, followed by Gulbarga University (3.34) and Karnataka University (3.30); (iii) Three universities have registered higher h-index values than the average h-index (6.33) of all universities. They are Gulbarga University with h-index values of 11, followed by Kuvempu University (7) and Mysore University (7); (iv) Three universities have achieved international collaborative publication share higher than the average international collaborative publication share (23.83%) of all universities. They are Mysore University and Mangalore University with international collaborative publication share of 33.33% each, followed by Bangalore University (24.0%); (v) Three universities have more than the average national collaborative links (37.85%) share of all universities. They are Kuvempu University with national collaboration links share of 77.78%, followed by Mangalore University (41.67%) and Gulbarga University (39.47%); and (vi) Two universities have institutional share more than the average institutional share (3.36%) of all universities. They are Gulbarga University with average institutional share of 12.54%, followed by Kuvempu University (4.49%)(Table 19).

Table 19. Profile of Karnataka Universities in Immunology & Microbiology, 2007-1

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
GULBAR-UNIV	76	254	3.34	606	12.54	11	16	21.05	30	39.47	0
MYSORE-UNIV	51	121	2.37	1838	2.77	7	17	33.33	14	27.45	0
KUVEMPU-UNIV	27	94	3.48	602	4.49	7	3	11.11	21	77.78	0
BANGAL-UNIV	25	21	0.84	1006	2.49	4	6	24.00	7	28.00	0
KARNAT-UNIV	23	76	3.30	916	2.51	5	5	21.74	4	17.39	0
MANGAL-UNIV	12	18	1.50	1410	0.85	4	4	33.33	5	41.67	0
Total	214	584	2.73	6378	3.36	6.33	51	23.83	81	37.85	0
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCIL=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Earth & Planetary Science-** The 6 universities of Karnataka together contributed 136 papers in earth & planetary science constituting 2.31% share of their total publications and 1.01% of the total output of India in earth & planetary science during 2007-11. They have together achieved an h-index of 8 and contributed 24 international collaborative papers, accounting for 17.65% share of their total papers during 2007-11. Of the 136 papers in earth & planetary sciences, 71 papers (52.21%) have received zero citations and the remaining 65 papers (47.79%) have received 1 to 32 citations. Of the cited papers, 1 paper (0.75%) has received between 26 to 50 citations and 64 papers (47.06%) between 1 to 25 citations.

On individually analyzing the profile of 6 universities of Karnataka in earth & planetary science during 2007-11: (i) Two universities output was found to be more than the average productivity (35.66) of all universities. They are Bangalore University with 50 papers, followed by Mysore University (35 papers); (ii) Four universities have registered higher citation impact per paper than the average impact (1.23) of all universities. These are Mangalore University with a citation impact per paper of 1.57, followed by Karnataka University (1.50), Bangalore (1.48) and Gulbarga University (1.29); (iii) Three

universities have registered higher h-index values than the average h-index (3.67) of all universities. They are Bangalore University with h-index values of 6, followed by Mangalore University (4) and Kuvempu University (4); (iv) Three universities have achieved international collaborative publication share higher than the average international collaborative publication share (17.02%) of all universities. They are Kuvempu University with international collaborative publication share of 28.57%, followed by Mangalore University (26.09%) and Mysore University (17.14%); (v) Three universities have more than the average national collaborative links (65.0%) share of all universities. They are Mangalore University and Gulbarga University with national collaboration links share of 100.00% each, followed by Kuvempu University (78.6%); and (vi) Two universities have institutional share more than the average institutional share (2.21%) of all universities. They are Bangalore University with average institutional share of 4.97%, followed by Kuvempu University (2.33%)(Table 20).

In terms of inter-university collaboration links among the 6 universities of Karnataka in earth & planetary sciences, the number of collaboration links (3) was between Mysore University and Bangalore University during 2007-11.

Table 20. Profile of Karnataka Universities in Earth & Planetary Sciences, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
BANGAL-UNIV	50	74	1.48	1006	4.97	6	8	16.00	27	54.00	3
MYSORE-UNIV	35	24	0.69	1838	1.90	3	6	17.14	19	54.3	3
MANGAL-UNIV	23	36	1.57	1410	1.63	4	6	26.09	23	100.0	0
KUVEMPU-UNIV	14	13	0.93	602	2.33	4	4	28.57	11	78.6	0
KARNAT-UNIV	12	18	1.50	916	1.31	2	0	0.00	5	41.7	0
GULBAR-UNIV	7	9	1.29	606	1.16	3	0	0.00	7	100.0	0
Total	141	174	1.23	6378	2.21	3.67	24	17.02	92	65.2	6
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI-Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Energy-** The 6 universities of Karnataka together contributed 110 papers in energy constituting 1.86% share of their total publications and 1.02% of the total output of India in energy during 2007-11. On individually analyzing the profile of 6 universities of Karnataka in energy during 2007-11: (i) Two universities output was found to be more than the average productivity (19.5) of all universities. They are Mysore University and Bangalore University with 50 papers each; (ii) Four universities have registered higher citation impact per paper than the average impact (1.68) of all universities. These are Karnataka University with a citation impact per paper of 3.20, followed by Gulbarga University (2.90), Bangalore (2.27) and Mangalore University (2.06); (iii) Three universities have registered higher h-index values than the average h-index (3.67) of all universities. They are Bangalore University with h-index values of 7, followed by Karnataka University (5) and Mangalore University (4); (iv) Two universities have achieved

international collaborative publication share higher than the average international collaborative publication share (7.69%) of all universities. They are Mangalore University with international collaborative publication share of 22.22%, followed by Gulbarga University (10.0%); (v) Two universities have more than the average national collaborative links (58.97%) share of all universities. They are Mangalore University with national collaboration links share of 94.44%, followed by Mysore University (63.64%); and (vi) One university have institutional share more than the average institutional share (1.83%) of all universities. It is Bangalore University with average institutional share of 3.28% (Table 21).

In terms of inter-university collaboration links among the 6 universities of Karnataka in energy, the largest number of collaboration links (4) was between Mysore University and Bangalore University, followed by Mysore-Karnataka (1 link), Bangalore-Mangalore (1 link) and Bangalore-Gulbarga (1 link).

Table 21. Profile of Karnataka Universities in Energy, 2007-11

Name (Abbreviated)	2007-11										
	TP	TC	ACPP	TIO	INSH	HI	ICP	%ICP	NCLIN	%NCLIN	IUCL
MYSORE-UNIV	33	7	0.21	1838	1.80	2	2	6.06	21	63.64	5
BANGAL-UNIV	33	75	2.27	1006	3.28	7	2	6.06	17	51.52	6
MANGAL-UNIV	18	37	2.06	1410	1.28	4	4	22.22	17	94.44	1
KARNAT-UNIV	15	48	3.20	916	1.64	5	0	0.00	6	40.00	1
GULBAR-UNIV	10	29	2.90	606	1.65	3	1	10.00	5	50.00	1
KUVEMPU-UNIV	8	1	0.13	602	1.33	1	0	0.00	3	37.50	0
Total	117	197	1.68	6378	1.83	3.67	9	7.69	69	58.97	14
TP=Total Papers; TC=Total Citations; ACPP=Average Citation Per Paper; TIO=Total Papers of the Institute; INSH=Institute Share in Total Papers; HI=Index; ICP=International Collaborative Papers; NCLIN=National Collaborative Links; IUCL=Inter-University Collaborative Links											

**Summary and Conclusion**

The combined publication output of the six universities of Karnataka consisted of 5885 papers, constituting 1.74% of the Indian research output during 2007-11. Their research output has increased from 1074 papers in 2007 to 1524 papers in 2011, witnessing an annual average growth rate of 10.20%. The total output of the six universities of

Karnataka have received together have received 18058 citations, achieving a citation impact per paper of 3.07 during 2007-11, which decreased from 3.86 in 2007 to 1.12 in 2011. The six universities of Karnataka have achieved h-index of 40 and have received citations from 1 to 461 since their publication till end of 2012. Of the total papers of 6 Karnataka universities, 3575 papers have received zero citations and 2310 papers 1 to 461 citations.

The six universities of Karnataka together have published 1635 international collaborative papers, accounting for 27.78% publication share in the total output of these universities, decreasing from 33.33% in 2007 to 28.35% in 2011. The 6 universities of Karnataka together collaborated with different 66 countries organizations of the world during 2007-11, with the largest share (31.07%) of papers coming from United States, followed by Malaysia (13.88% share), South Korea (7.46% share), U.K (5.69% share), Slovenia (5.32% share), Japan (4.59% share), China (3.00% share), Iran (2.87% share), Thailand (2.51% share), Poland (2.02% share), etc.

The national collaboration links of the six universities of Karnataka consists of 3616, accounting for 56.69% share (varying from 33.84% to 66.45%) of their total research output during 2007-11. Of the total national collaborating links of these 6 universities of Karnataka, 44.42% are to academic institutions (consisting of universities, colleges, engineering colleges and medical colleges), followed by research institutions (6.07%), institutes of national importance (3.78%), industry (2.18%), and others (0.22%) (Table). Also of the total national collaborating links, 80% of the national collaborating links (44.21%) are made to institutions of the state of Karnataka and the rest to institutions outside the state. It means most of the universities have inward approach for national collaboration.

The six universities of Karnataka together had 960 inter-collaborative linkages among themselves. Of these, the maximum number of collaborative linkages (353) was from Mysore University, followed by Mangalore University (306), Bangalore University (103), Karnataka University (84), Kuvempu University (63) and Gulbarga University (51). The largest number of inter-university linkages (287) is between Mysore and Mangalore, followed by 40 collaborative linkages between Mysore and Mangalore, 31

collaborative linkages between Karnataka and Bangalore, 26 collaborative linkages between Karnataka and Gulbarga, 10 collaborative linkages between Mysore and Kuvempu, universities etc.

Among the six Karnataka universities, Mysore University tops in research productivity, but ranks at 7<sup>th</sup> place in average citation per paper and 2<sup>nd</sup> rank in international collaborative papers. Mangalore ranks 2<sup>nd</sup> in research productivity, but ranks at 6<sup>th</sup> position in average citation per paper and at top position in international collaborative papers. Bangalore University ranks at 3<sup>rd</sup> position in research productivity, but ranks at 2<sup>nd</sup> position in average citation per paper and at 4<sup>th</sup> position in international collaborative papers. Karnataka University ranks at 4<sup>th</sup> position in research productivity, but ranks at top position in average citation per paper and at 4<sup>th</sup> position in international collaborative papers. Gulbarga University ranks at 5<sup>th</sup> place in research productivity, but ranks at 2<sup>nd</sup> position in average citation per paper and at 6<sup>th</sup> rank in international collaborative papers. Kuvempu University ranks at 6<sup>th</sup> place in research productivity, but at 4<sup>th</sup> rank in average productivity and at 7<sup>th</sup> rank in international collaborative papers.

In terms of average productivity per institution among various subjects, Mangalore University tops the list in chemistry, physics and materials science, Mysore University in biochemistry, genetics & molecular biology, agricultural & biological sciences, pharmacology, toxicology & pharmaceuticals, environmental science, computer science, medicine and mathematics, Bangalore in engineering and earth & planetary sciences, Karnataka in chemical engineering and energy and Gulbarga in immunology & microbiology.

Karnataka University tops the list in terms of highest average citation per paper among various subjects during 2007-11 in chemistry, agricultural & biological sciences, computer science, chemical engineering and energy,

Kuempu University in physics, biochemistry, genetics and molecular biology, materials science, engineering, medicine and immunology & microbiology, Mangalore University in pharmacology, toxicology & pharmaceuticals and Gulbarga University in environment science and mathematics. Here smaller universities have performed better than larger universities.

In terms of average h-index per institution among various subjects during 2007-11, Karnataka University tops the list in chemistry, biochemistry, genetics & molecular biology and chemical engineering, Mangalore University in physics, materials science and pharmacology, toxicology & pharmaceuticals, Mysore University in agricultural & biological sciences and computer science, Bangalore University in engineering, environment science, medicine, earth & planetary sciences and energy and Gulbarga University in mathematics and immunology & microbiology.

Mangalore University tops the list in terms of highest share of international collaborative papers among various subjects during 2007-11 in chemistry, physics, biochemistry, genetics & molecular biology, materials science, agricultural & biological sciences, environment science and energy, Mysore University in pharmacology, toxicology & pharmaceuticals and immunology & microbiology, Bangalore University in engineering, chemical engineering and mathematics, Kuempu University in computer science and earth & planetary sciences and Karnataka University in mathematics.

Kuvempu University tops the list in terms of highest share of national collaborative links among various subjects during 2007-11 in biochemistry, genetics & molecular biology, agricultural & biological sciences, pharmacology, toxicology & pharmaceuticals, computer science, medicine, chemical engineering and immunology & microbiology, followed by Mysore University in chemistry and physics, Bangalore University in materials science, Mangalore University in

engineering, environment science and energy and Gulbarga University in mathematics.

In terms of institutional share (which is a reflection of university specialization), the following universities have fairly better (by achieving above average share among all 6 universities): (i) Mangalore University in physics (with 73.05% share), followed by chemistry (54.75%), materials science (49.36%) and biochemistry, genetics & molecular biology (24.54%); Mysore University in biochemistry, genetics & molecular biology (22.9% share), followed by agricultural & biological sciences (15.78%), pharmacology, toxicology & pharmaceuticals (10.83%), computer science (9.14%), medicine (6.47% and mathematics (5.22%); Bangalore University in engineering (18.69%), environment science (9.94%), medicine (5.86%), chemical engineering (10.44%), mathematics (7.06%), earth & planetary science (4.97%) and energy (3.28%); Karnataka University in chemistry (47.71%), agricultural & biological sciences (13.32%), pharmacology, toxicology & pharmaceuticals (11.35%), chemical engineering (12.55%) and mathematics (5.79%); Gulbarga University in engineering (22.61%), chemical engineering (13.04%), immunology & microbiology (12.54%), pharmacology, toxicology & pharmaceuticals (9.08%), computer science (5.94%) and Kuvempu University in chemistry (41.69%), biochemistry, genetics & molecular biology (21.43%), pharmacology, toxicology & pharmaceuticals (20.43%), environment science (11.46%), chemical engineering (10.13%), medicine (5.65%), immunology & microbiology (4.49%) and earth & planetary sciences (2.33%).

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