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Publications Productivity of Karnatak University, Dharwad: A Scientometric Analysis

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Abstract

The present study analyses the scientific productivity of Karnatak University, Dharwad for the period from 1960 to 2019 using the Scopus citation database. Karnatak University, Dharwad is one of the premier higher educational institutions that cater to the educational needs of North Karnataka. A total of 4990 publications were extracted from the Scopus database. The investigation endeavors to quantify the growth of KUD's scholarly literature in terms of the authorship pattern, year-wise distribution of publications and citations, domain-wise distribution of publications, a ranking of authors, ranking of highly cited publications, collaboration, and so on. The results indicate that the Science faculty has contributed 4785 (95.89 %) publications out of 4990. Among the Departments, the Department of Chemistry contributed to 1701 (34.09 %) publications, followed by Physics (870, 17.43 %) and Polymer Science (523, 10.48 %). T.M. Aminabhavi found to be the most prolific author in Karnatak University, Dharwad (491, 9.84 %), followed by S.T. Nandibewoor (364, 7.29 %). The Indian Institute of Science, Bengaluru was the most collaborated institute with Karnatak University, Dharwad (102 publications), followed by Chonbuk National University, South Korea (94 publications). USA was the most collaborated country (258 publications, 8104 citations), followed by South Korea (161 publications, 3300 citations).

KeyTerms: Karnatak University, Scientific Productivity, Publications Productivity, Collaboration, Scientometric Analysis, Scopus

Introduction

The reputation and prestige of any institution greatly depend upon its research productivity and impact. The present study examines the research output of Karnatak University, Dharwad using scientometric techniques. Scientometrics was first defined by Nalimov & Mulchenko as "the quantitative methods of the research on the development of science as an information process"[1]. According to Vinkler "Scientometric is a field of science dealing with the quantitative aspects of people or groups of people, matters, and phenomena in science and their relationships, but which do not primarily belong within the scope of a particular scientific discipline"[2]. The main ability is the examination of the quantitative features of the information process. It can be considered as the study of the quantitative aspects of science and technology as a process of communication. Some of the main themes include ways of measuring the research quality and impact, citations, mapping scientific disciplines and the use of indicators in management and research policy. Scientometrics focuses on communication in the sciences, the social sciences and the humanities (Mingers & Leydesdorff[3]) .

The quality publication to the research output of an individual institution or the group adds to the intellectual capital of that institution. Normally, the research output is evaluated by a competent authority. Lin discusses that the evaluation of research productivity can be conducted for various reasons in academic institutions be it recruitment, awards and rewards, promotion, professional recognition, allocation of resources and ranking of educational institutions[4]. Evaluation is the chief component for the measurement and development of a particular field or discipline. Keeping in view this in mind, the present study is conducted to analyse the publication productivity of Karnatak University, Dharwad using the Scopus database for the period from 1960 to 2019.

Karnatak University, Dharwad: A Brief Profile

The Karnatak University was established in 1949 through the Karnatak University Act 1949. It became a statutory University on 1st March 1950. The jurisdiction of the University covers Dharwad, Gadag, Haveri and Uttar Kannada districts. The campus is located at an altitude of over 750 meters on a stretch of 750 acres perched on a gently sloping hillock called Chota Mahabaleshwar. The founders and architects of the University with true nationalistic spirit have laid a sound foundation to build a distinct institution of higher learning in this part of independent India. Today, it is an icon of higher education and operation literacy that was launched 71 years ago in this part of Karnataka. It has been one of the major knowledge disseminating centers in several disciplines in South Central India catering to the needs of millions of students. The University identifies the regional needs and overall development of the students. The University has been awarded the coveted 'University with Potential for Excellence' (UPE) by the University Grants Commission with the financial assistance of Rs. 50 crores for undertaking research activities and development of campus amenities. The University attracts students from various countries especially African Countries like Nigeria, South Africa, UAE, Bangladesh, Iran, etc. The Department of Foreign Languages offers courses in Russian, German and French Languages. The Central library is equipped with thousands of books on all subjects including Journals and educational CD-ROMs. The University is a part of the UGC-INFONET which affords access to more than 5000+ electronic journals for advanced study and research. In all, the University provides a congenial ambiance for advanced learning and shaping one's career (www.kud.ac.in) (Karnatak University[5] .

Literature Review

Kumbar et al., studied the growth and impact of research contribution of the University of Mysore (UoM), Mysuru for the period from 1996 to 2006 based on the data retrieved from the Scopus database[6]. The study shows that the UoM researchers had published nearly 106 publications in a single journal, i.e. Acta Crystallographica Section E: Structure Report online. Almost 14% of UoM publications were through international collaboration with USA, Germany, Japan, Canada, etc. UoM published a total of 1518 articles of which 17 papers have rated highly cited papers. The study also reveals that the UoM had significant growth in terms of average citations per paper from 1.53 in 1996 to 2.62 in 2003. The university had published articles in nearly 16 disciplines in Science and Technology; the most prominent areas are Chemistry, Physics and Astronomy, Biochemistry, Genetics and Molecular Biology, and Agriculture, Molecular Biology, etc. Another study was conducted by Shree Rekha & Husna Jabeen at the University of Mysore, Mysuru based on the Scopus database for the period from 2011 to2015[7]. The results of the study reveal that Mysore University had published 2415 research publications. 22.11% of the total papers were published during 2013. The highest numbers of citations i.e. 33.81% were received in the year 2011. Further, the study indicates that retired faculty from the University of Mysore has contributed more in terms of publications.

Baby & Kumaravel examined the research contribution of Periyar University for the period from1998 to 2010 based on the data gathered from the Scopus database[8]. During the period, Periyar University had published 322 scholarly publications. The highest percentage of the articles were published in the year 2010 (31.68%) and 2009 (22.67%) respectively. The results indicate that three authored publications predominate among the authorship pattern and the year 2010 was a highly productive year. The Relative Growth Rate and Doubling Time are 0.45 and 2.27 respectively. Further, the study shows that the application of Lotka's and Bradford's law does not fit the literature analysed. Swain et al., portray the scientific contributions of Kalinga Institute of Industrial Technology (KIIT) University, Odisha based on the data retrieved from the Scopus database for the period from 2000 to 2013[9]. KIIT University had published 361 research papers during the period. The results of the study indicate that multi-authorship dominates the research publications. The highest number of articles were published in the year 2011 (107), followed by 2012 (90), and 2010 (72) respectively. *Communications in Computer and Information Science* found to be a highly preferred journal.

Aswathy & Gopikuttan examined the contribution of three universities in Kerala viz., Mahatma Gandhi University, University of Kerala and the University of Calicut[10]. The University of Kerala and Mahatma Gandhi University received the highest number of citations in the year 2007, while the University of Calicut had the highest number of contributions in the year 2009. The Degree of Collaboration among the faculty of the University of Kerala is more compared to the other universities under study. Gopikuttan & Aswathy study the research productivity of the University of Kerala with particular reference to the faculty members of the Science department for the period from 2000 to 2012[11]. The study was based on the data retrieved from the Web of Science (WOS) database. The research shows that the University of Kerala had a total of 1068 publications during the period. Out of the total 1068 articles, 1012 publications were in the form of articles, followed by proceedings (28) and meeting abstracts (19). Further, the study reveals that the researchers from the Department of Chemistry produced more publications compared to other departments. The researchers from the University of Kerala preferred Indian journals to publish their research work, followed by journals from the UK. Cherukodan & Mumthas conducted a scientometric study of fifty-one years of research at the University of Calicut, India[12]. The authors found that a total number of 2158 scholarly articles published by the university, more papers were published on Agricultural and Biological Sciences (30%). The majority of articles (58%) were published during the last ten years (58%).

Maharana & Das analysed the research output of Sambalpur University, Odisha, as reflected in the ISI Web of Science (WoS) database during 2007-2011[13]. The study reveals that the researchers from Sambalpur University had published 170 research articles and were productive in collaborated works. The average number of publications per year was between 21 and 49. Chemistry was the most preferred subject discipline, followed by Astronomy and Astrophysics, Plant Science, Engineering and Materials Science. Further, the study also reveals that the articles published by Sambalpur University had received 541 citations. Vellaichamy & Jeyshankar examined the research contribution of Pondichery University, Pondicherry for the period from 1987 to 2013 based on the Scopus database[14]. The study shows that the majority (84.8%) of the researchers from Pondicherry University preferred multi-authorship patterns to their research publications and the average Degree of Collaboration ranges to 0.88. Further, the study reveals that the discipline of Physics and Astronomy produced the highest number of publications. S.A. Abbasi was the most productive author contributing 132 research papers.

Gautam & Mishra studied the research trends in Banaras Hindu University (BHU), Varanasi based on the data retrieved from the Indian Citation Index (ICI) during 2004-2013[15]. Out of

1041 articles retrieved, 404 articles published in SCIE indexed journals and 637 in non-SCIE indexed journals. Further, the study indicates that BHU had collaborated with 18 countries and 28 Indian states. The journals Current Science, Indian Journal of Physics and Journal of Geological Society of India were the top three journals preferred by BHU researchers. Siwach & Satish Kumar analysed the research contribution of Maharshi Dayanand (MD) University, Rohtak for the period between 2000 and 2013 based on the data retrieved from the Scopus database[16]. The study reveals that MD University had published 1247 research articles during the period and the year 2013 was the most productive year with 219 papers. MD university had the highest collaboration (66 articles) with Guru Jambeshwar University of Science and Technology, Haryana, India and has 56 articles collaborated with South Korea and 26 papers with the United States of America. Jange et al., examined the output of Gulbarga University, Kalaburgi based on the data retrieved from the Web of Science (WOS) database for the period from 1989 to 2014[17]. The study shows that the researchers from Gulbarga University have published 1119 articles in leading national and international journals. Further, the study indicates that journal articles were given preference, resulting in 94.55% of the total research output. During the period the Gulbarga University had received 8500 citations, and an average number of citations per paper was 7.60.

Gogoi et al., studied the research performance of Dibrugarh University, Assam based on the Web of Science database for the period from 2006 to 2015[18]. The study shows that there were 533 articles published by Dibrugarh University. During the period the university had the highest (88) articles in the year 2014 and lowest (15) in the year 2006. Further, the study also reveals that researchers from Dibrugarh University had 53 papers per year on average and the researchers have preferred multi-authorship pattern having 95% of the total output. Khanna et al., examined the contribution of Guru Nanak Dev University, Punjab based on the data extracted from the Scopus database during 2006-2015[19]. The study reveals that the Guru Nanak Dev University had 652 publications with 7.01% average citations per paper. Six papers have received 50 to 100 citations. Further, the study also compared the research contributions of Guru Nanak Dev University with the 24 most prolific Indian Universities. Among these universities, GNDU ranked 23rd in terms of the publication output (652) and 18th in highly cited papers. Kalimuthu et al., portray the publication productivity of Bharathiar University, Tamil Nadu based on the data reflected through the Scopus database for the period between 2006 and 2016[20]. The study reveals that Bharathiar University had published 4265 research papers. In the year 2016, the university published the highest number of articles (814), and the collaboration trend was towards multi-authored papers.

Patel & Bhatt carried out a study on the quantitative analysis of Gujarat University research publications published during 2008-2017 based on the Scopus database[21]. The objectives of the study were to find out the annual literature growth of the university, author productivity, etc. 1248 records were analysed and figured out 0.96 Degree of Collaboration. The study inferred that 32.11 average contributions were from USA only. Santhakumar et al., illustrate the research productivity of Madras University for a period of ten years from 2009 to 2018[22]. A total of 3283 publications were retrieved from the Web of Science database. The authors observed that there was a fluctuating trend in the pattern of publication growth. The chemistry discipline has the highest publications in Madras University. The faculty and research scholars preferred to publish their research output in UK journals. V. Narayanan from the Department of Inorganic Chemistry was the most prolific author with 146 publications (3614 citations with h-index-26). Yadav et al., evaluate the research productivity of Mizoram University based on the data collected from the Indian Citation Index for fourteen years from 2004 to 2017[23]. A total of 265 articles were collected from the Indian Citation Index and used various collaborative indices to measure, CI, CC, DC, MCC, etc. The results indicate that U.K. Sahoo (Department of Forestry) emerged as the most prolific author with 25 publications. *Current Science* journal was the most preferred journal by the academic community. The discipline Biological Science has the highest publications (54). Among the type of documents, articles with 230 records have the highest contribution.

The review of the literature underlines the importance of individual studies from various perspectives. Most of the studies conducted by the previous authors reflect only ten to twenty years of data using different citation databases. But the present study has been conducted on the scientific productivity of Karnatak University, Dharwad for a period of sixty years from 1960 to 2019 using the Scopus database.

Objectives

- Study the growth of publications and citations of Karnatak University, Dharwad during the period of study
- Know the faculty and department wise distribution of the publications
- Examine the productive authors of Karnatak University, Dharwad and authorship pattern
- Analyze the subject-wise distribution of publications
- Study the collaboration with other institutions and country of collaboration
- Determine the journals preferred by the authors of Karnatak University, Dharwad

Methodology

For the present study, the data were collected for Karnatak University, Dharwad from 1960 to 2019 using an advanced search option in the Scopus International Citation database Scopus[24]. The string Organization-Enhanced was used for "Karnatak University". The search was limited for the time-span of sixty years i.e., from 1960 to 2019. A total of 4990 records were retrieved which were scattered in 1210 journals. The data were exported to CSV file format, where the tabulation and simple statistical methods have been applied.

Data Analysis

The Productivity of Institutions in Karnataka State

Table 1 depicts the productivity of institutions in Karnataka State. Some of the institutions were established after 1960 hence considered from that period only. Among the top twenty institutions Indian Institute of Science, Bengaluru ranked first with 55,770 publications to its credit (9,92,666 citations, h-index 260), followed by Manipal University, Manipal with 21,735 publications (1,50,869 citations, 106 h-index), the University of Mysore with 8,008 (72,440 citations, 83 h-index) ranked second to third respectively. The Karnatak University, Dharwad has published 4,990 publications, received 67,110 citations and has 96 h-index. Out of the top twenty institutions, nine belong to universities, others belong to national importance institutions and R&D institutions. Indian Institute of Science, Bengaluru and Manipal University, Manipal together have published more than 50 % of the total publications out of the top twenty publications.

Table 1: Productivity of Institutions in Karnataka State

Sr. No.	Research / Academic Institution	Duration	Publications	Citations	Average Citations per Publication	H-Index
1	Indian Institute of Science, Bangalore	1960-2019	55,770	992666	17.8	260
2	Manipal University, Manipal	1960-2019	21,735	150869	6.9	106
3	University of Mysore, Mysore	1960-2019	8,008	72440	9.0	83
4	National Institute of Technology, Surathkal	1968-2019	6,744	46035	6.8	70
5	National Institute of Mental Health and Neuro Sciences, Bangalore	1967-2019	6,459	83535	12.9	97
6	Jawaharlal Nehru Centre for Advanced Science & Research (JNCASR), Bangalore	1990-2019	6,302	191262	30.3	156
7	Centre for Food and Technological Research Institute, Mysore	1960-2019	5,660	132704	23.4	131
8	Karnatak University, Dharwad	1960-2019	4,990	67110	14.16	96
9	Bangalore University, Bangalore	1960-2019	4,926	56729	11.5	87
10	Mangalore University, Mangalore	1979-2019	4,402	38832	8.8	70
11	Kasturba Medical College and Hospital, Mangalore	1960-2019	3,303	19799	6.0	47
12	National Aerospace Laboratories, Bangalore	1961-2019	3,212	43027	13.4	78
13	University of Agricultural Science, Bangalore	1960-2019	2,983	34757	11.7	77
14	Raman Research Institute, Bangalore	1960-2019	2,930	60859	20.8	93
15	Indian Institute of Astrophysics, Bangalore	1960-2019	2,928	37442	12.8	68
16	Kuvempu University, Shimoga	1992-2019	2,354	31978	13.6	67
17	National Centre for Biological Sciences Bangalore	1992-2019	2,262	67306	29.8	105
18	Gulbarga University, Gulbarga	1981-2019	2,120	27868	13.1	67
19	University of Agricultural Sciences, Dharwad	1973-2019	1,395	6653	4.8	37
20	Indian Statistical Institute, Bangalore	1961-2019	946	6560	6.9	30

Block-Wise Distribution of Publications

A total of 4990 publications were extracted from the Scopus database for Karnatak University, Dharwad. Table 2 and figure 1 present the block-wise (five years) distribution of publications. The average publication per year was 83.1. Almost an exponential growth of publications was observed throughout the study period. The block period 2015-19 has produced the highest number of publications and 1960-64 was the lowest, i.e. 55. The block period 2005-09 was fruitful in terms of publications, citations received (20,638) and average citations per publication (26.94). The block period 2005-09 has received the highest average citations per publication (30.74). The block periods 2000-04 and 2005-09 were the productive ones compared to other block periods.

Table 2: Block-Wise Distribution of Publications of Karnatak University, Dharwad

5 Years Block	Articles	%age of 4990	Total Citations	ACPP
1960-64	55	1.10	69	2.30
1965-69	100	2	377	5.03
1970-74	97	1.94	885	11.49
1975-79	122	2.44	1434	14.78
1980-84	180	3.61	1653	11.02
1985-89	234	4.69	1508	8.47
1990-94	251	5.03	4549	20.31
1995-99	317	6.35	5458	19.02
2000-04	544	10.9	14203	30.74
2005-09	852	17.07	20638	26.94
2010-14	1036	20.76	11255	13.72
2015-19	1202	24.09	5081	6.14
Total	**4990**	**100**	**67110**	**14.16**

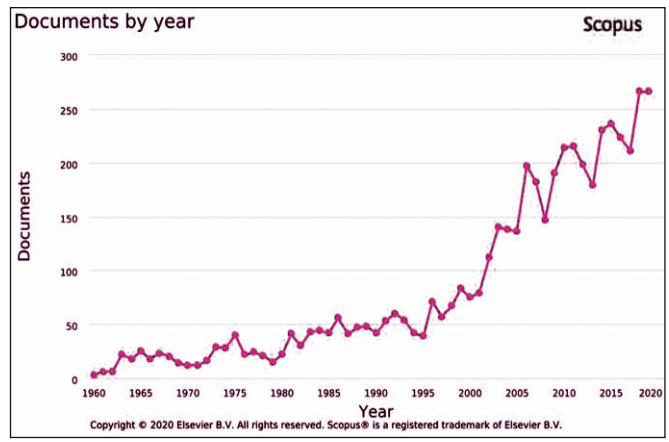

Fig. 1: Distribution of Publications: Year wise

Faculty and Department-Wise Distribution of Publications

Table 3 depicts the faculty and department wise distribution of publications. The Science faculty alone has contributed 95.89 % (4785 publications) of the total publications, followed by Social Sciences (194 publications with 3.89%). The contribution from Arts, Commerce, Education, Law and Management faculty was in single digit. Among the Science faculty, the publications of the Department of Chemistry was very high, i.e. 1701, followed by Physics (870), Polymer Science (523), Zoology (466) and Botany (382). Among the Social Sciences faculty, the Department of Psychology has produced 68 publications during the period, followed by the Department of Library and Information Science (44) and History and Archeology (39) respectively.

Table 3: Faculty and Department-Wise Distribution of Publications

Faculty	Publications	% age w.r.t. Sub. Discipline	Departments	Publications	% age w.r.t. Dept.
Arts	4	0.08	English	4	0.08
Commerce	3	0.06	Commerce	3	0.06
Education	1	0.02	Education	1	0.02
Law	2	0.04	Law	2	0.04
Management	1	0.02	Management	1	0.02
Science	4785	95.89	Chemistry	1701	34.09
			Physics	870	17.43
			Polymer Science	523	10.48
			Zoology	466	9.34
			Botany	382	7.66
			Mathematics	295	5.91
			Biotechnology and Microbiology	127	2.55
			Geology	115	2.30
			Biochemistry	104	2.08
			Statistics	96	1.92
			Marine Biology	31	0.62
			Computer Science	28	0.56
			Applied Genetics	14	0.28
			Sericulture	11	0.22
			Electronics	10	0.20
			Geography	6	0.12
			Ocean Sciences	4	0.08
			Engineering	2	0.04
Social Sciences	194	3.89	Psychology	68	1.36
			Library and Information Science	44	0.88
			History and Archaeology	39	0.78
			Anthropology	19	0.38
			Economics	10	0.20
			Sociology	7	0.14
			Political Science	4	0.08
			Social Work	3	0.06
Total	**4990**	**100**	**Department -Wise**	**4990**	**100**

The visualization presented in fig. 2 indicates that each circle represents a department out of 5354 organizations, 218 meet the thresholds with a minimum number of 5 documents of an organization. Large circles represent departments that have many publications. Small circles represent departments with only a few publications. In general, the closer of two departments are located to each other in the visualization, the more strongly they are related to each other based on the bibliographic coupling. In other words, departments that are located close to each other tend to cite the same publications, while departments that are located far away from each other usually do not cite the same publications. Colors indicate clusters of departments that are relatively strongly related to each other.

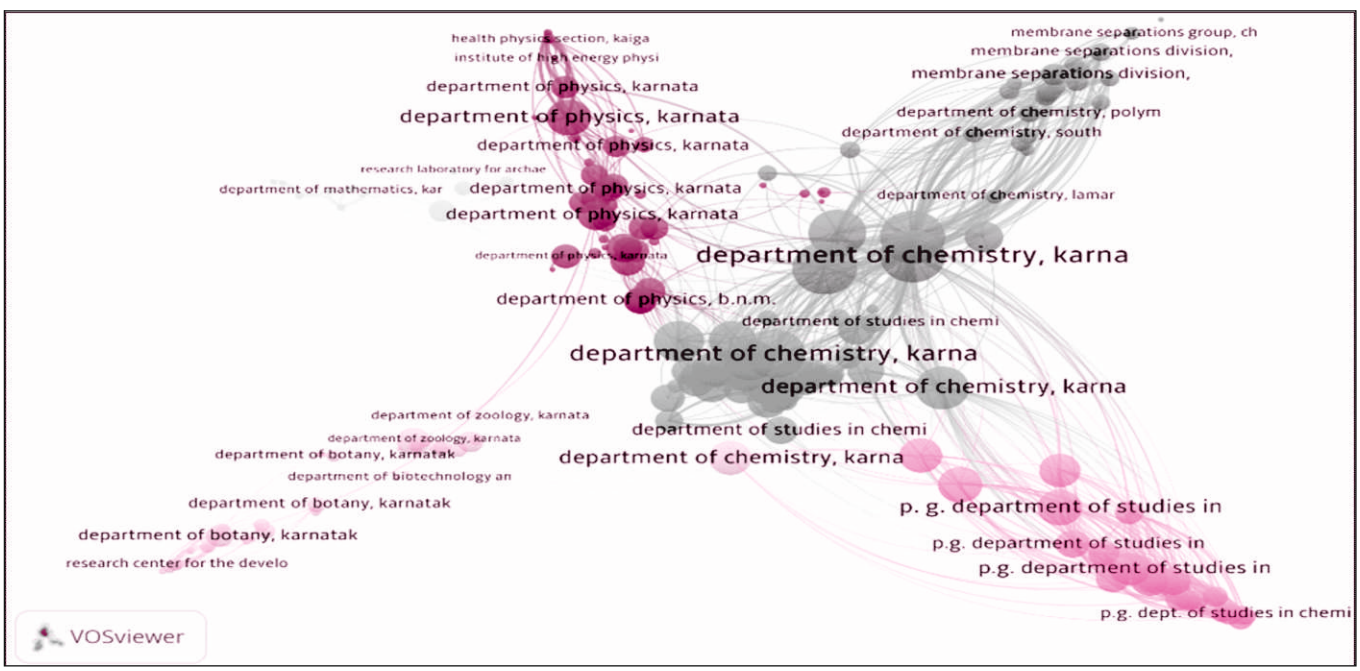

Fig. 2: VOS Viewer Bibliographic Coupling of Departments

Productive Authors of Karnatak University, Dharwad

Table 4 presents the list of top authors who have contributed at least 65 or more publications during the study period. 4657 authors contributed 4990 publications during the period 1960-2019. T.M. Aminabhavi (from Polymer Science) was found to be the leading author with 491 publications (21630 citations, 47.66 ACPP). The same author alone has received more than 32 % of the overall citations of Karnatak University, Dharwad. S.T. Nandibewoor (from the Chemistry discipline) has contributed 364 publications (4585 citations, 13.93 ACPP). 208 authors contributed 4 articles each, 632 authors contributed 3 articles each, 359 authors contributed 2 articles each and 2219 authors contributed 1 article each during the period. Out of the top twenty authors, eleven authors belong to the Chemistry discipline, followed by four authors belong to the Physics discipline.

Table 4: Productive Authors of Karnatak University, Dharwad

Sl. No.	Author	Department	Publications	(%age)	Citations Received	(%age)	ACPP
1	Aminabhavi, T.M.	Polymer Science	491	9.84	21630	32.23	47.66
2	Nandibewoor, S.T.	Chemistry	364	7.29	4585	6.83	13.93
3	Murthy, H.N.	Botany	164	3.29	3415	5.09	22.46
4	Seetharamappa, J.	Chemistry	123	2.46	2914	4.34	25.35
5	Kulkarni, M.V.	Chemistry	112	2.24	1352	2.01	15.09
6	Saidapur, S.K.	Zoology	112	2.24	1086	1.62	10.96
7	Mulimani, B.G.	Physics	111	2.22	1170	1.74	12.71
8	Chimatadar, S.A.	Chemistry	103	2.06	1039	1.55	11.41
9	Karidurаganavar, M.Y.	Chemistry	97	1.94	1890	2.82	23.04
10	Badiger, N.M.	Physics	96	1.92	1101	1.64	12.85
11	Hosamani, K.M.	Chemistry	89	1.78	1907	2.84	23.25
12	Gudasi, K.B.	Chemistry	79	1.58	1186	1.77	14.82
13	Inamdar, S.R.	Physics	77	1.54	1242	1.85	12.67
14	Kubakaddi, S.S.	Physics	71	1.42	605	0.90	10.61
15	Revankar, V.K.	Chemistry	71	1.42	1138	1.70	14.40
16	Bujurke, N.M.	Mathematics	67	1.34	667	0.99	10.93
17	Biradar, N.S.	Chemistry	66	1.32	1080	1.61	16.61
18	Shanbhag, B.A.	Zoology	66	1.32	596	0.89	10.45
19	Kamble, R.R.	Chemistry	65	1.3	517	0.77	9.94
20	Patil, S.A.	Chemistry	65	1.28	3140	4.68	33.76

Authorship Pattern in Karnatak University, Dharwad

Table 5 depicts the authorship pattern and analyzed to determine the percentage of single and multiple-authored publications. The study reveals that the two authored publications were more with 1535(30.76 %) publications, followed by three authored publications with 1392(27.90%) publications. Single authored publications account for 212(4.25%). There are 1054(21.12%) articles with more than or equal to five authors published during the study period.

Table 5: Authorship Pattern at Karnatak University, Dharwad

Year	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	Total	%age
One	21	32	18	12	12	19	10	11	18	13	21	25	212	4.25
Two	24	58	60	86	102	117	106	117	170	169	259	267	1535	30.76
Three	9	10	17	19	41	63	86	113	213	272	290	259	1392	27.90
Four	1	0	1	2	21	29	35	39	74	181	195	219	797	15.97
Five	-	-	1	2	4	6	9	21	46	124	137	147	497	9.96
Six	-	-	-	-	-	-	4	9	14	51	66	114	258	5.17
Seven	-	-	-	1	-	-	1	-	6	15	28	65	116	2.32
Eight	-	-	-	-	-	-	-	3	-	14	14	39	70	1.40
Nine	-	-	-	-	-	-	-	1	1	-	9	17	28	0.56
Ten	-	-	-	-	-	-	-	2	-	-	4	14	20	0.40
Eleven	-	-	-	-	-	-	-	-	-	1	2	9	12	0.24
Twelve	-	-	-	-	-	-	-	-	1	-	2	6	9	0.18
Thirteen	-	-	-	-	-	-	-	-	-	3	4	5	12	0.24
Fourteen	-	-	-	-	-	-	-	-	-	1	-	1	2	0.04
Fifteen	-	-	-	-	-	-	-	1	-	3	2	-	6	0.12
Sixteen	-	-	-	-	-	-	-	-	-	1	1	-	2	0.04
Seventeen	-	-	-	-	-	-	-	-	-	2	-	-	2	0.04
Eighteen	-	-	-	-	-	-	-	-	1	-	2	2	5	0.10
Nineteen	-	-	-	-	-	-	-	-	-	1	-	-	1	0.02

Year	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	Total	%age
Twenty	-	-	-	-	-	-	-	-	-	-	-	4	4	0.08
Twenty-One	-	-	-	-	-	-	-	-	-	-	-	2	2	0.04
Thirty-One	-	-	-	-	-	-	-	-	-	-	-	1	1	0.02
Thirty-Two	-	-	-	-	-	-	-	-	-	-	-	1	1	0.02
Thirty-Three	-	-	-	-	-	-	-	-	-	-	-	2	2	0.04
Thirty-Four	-	-	-	-	-	-	-	-	-	-	-	1	1	0.02
Forty-Two	-	-	-	-	-	-	-	-	-	-	-	1	1	0.02
Forty-Four	-	-	-	-	-	-	-	-	-	-	-	1	1	0.02
Ninety-Five	-	-	-	-	-	-	-	-	-	1	-	-	1	0.02
Total	**55**	**100**	**97**	**122**	**180**	**234**	**251**	**317**	**544**	**852**	**1036**	**1202**	**4990**	**100**

Subject-Wise Distribution of Publications

Table 6 summarizes the data on the subject wise distribution of publications for sixty years. Chemistry discipline alone has contributed more number of publications, i.e. 2046(23.34%), followed by Materials Science (973 publications, 11.10%) and Physics and Astronomy (941 publications, 10.73%). The top three disciplines contributed close to 44 % of the total publications. It is inferred from the study that lab-oriented subjects have more publications that have international coverage.

Table 6: Subject-Wise Distribution of Publications

Subject	Publications	%age
Chemistry	2046	23.34
Materials Science	973	11.10
Physics and Astronomy	941	10.73
Biochemistry, Genetics and Molecular Biology	850	9.70
Agricultural and Biological Sciences	644	7.35
Chemical Engineering	524	5.98
Pharmacology, Toxicology and Pharmaceutics	515	5.87
Engineering	425	4.85
Mathematics	327	3.73
Environmental Science	312	3.56
Medicine	238	2.72
Social Sciences	162	1.85
Earth and Planetary Sciences	138	1.57
Energy	106	1.21
Computer Science	105	1.20
Multidisciplinary	103	1.17
Immunology and Microbiology	102	1.16
Psychology	78	0.89
Arts and Humanities	60	0.68
Health Professions	24	0.27
Decision Sciences	23	0.26
Economics, Econometrics and Finance	18	0.21
Nursing	16	0.18
Business, Management and Accounting	14	0.16
Neuroscience	13	0.15
Veterinary	7	0.08
Dentistry	2	0.02

In the visualization presented in fig. 3, each circle represents a term. The size of a circle indicates the number of publications that have the corresponding term (23503 keywords, 2634 meet the threshold in their title or abstract). Terms that co-occur a lot tend to be located close to each other in the visualization. VOSviewer has grouped the terms into 6 clusters, of which five are of significant size. The red cluster, located in the left area in the visualization consists of scientometric terms related to Physics. The green, purple and sky cluster located in the upper left to the right area, covers terms related to General Chemistry. In the center to the right area in the visualization, the blue and yellow clusters consist of terms related to Biological Sciences.

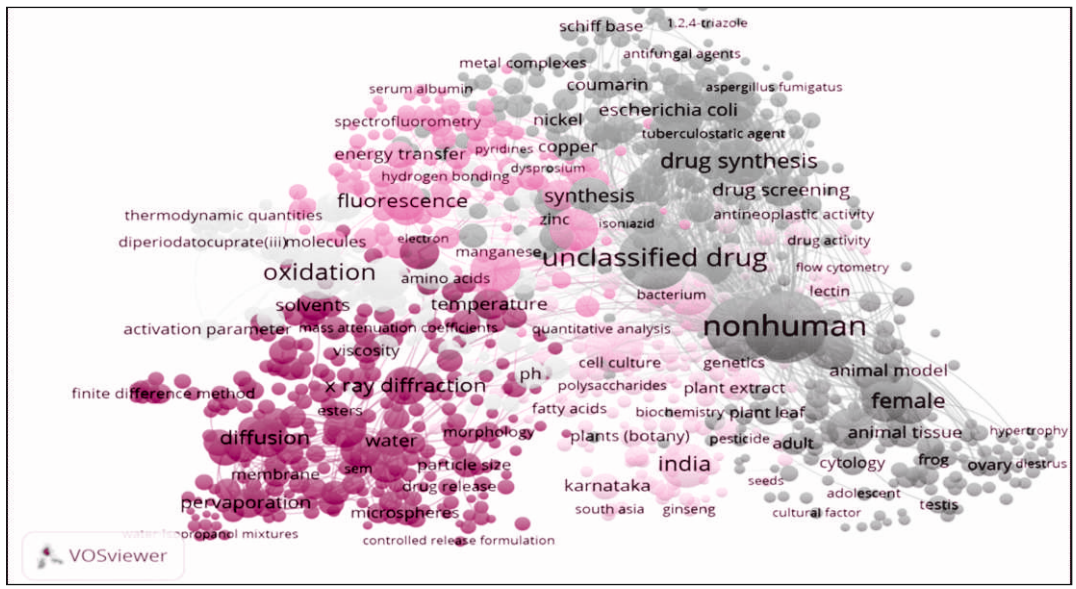

Fig. 3: VOS viewer Visualization of a Term Co-Occurrence Network

The collaboration of KUD with other Institutions

Table 7 reveals the collaboration of KUD with the other institutions. The study reveals that the authors of KUD collaborated 102 publications with the Indian Institute of Science, Bengaluru, followed by Chonbuk University, Jeonju, South Korea (94 publications), P.C. Jabin Science College, Hubballi (92 publications) respectively. Karnatak University has collaborated with 159 institutions within India and overseas institutions. Out of twenty top collaborated institutions, one institution of South Korea and two institutions of the United States of America have found the place.

Table 7: Collaboration of KUD with other Institutions

Sl. No.	Institution / Organization	Publications	Country
1	Indian Institute of Science, Bengaluru	102	India
2	Chonbuk National University, Jeonju	94	South Korea
3	P.C. Jabin Science College, Hubballi	92	India
4	Bangalore University, Bengaluru	86	India
5	University of Mysore, Mysuru	81	India
6	KLE Technological University, Belagavi	72	India
7	Mangalore University, Mangaluru	70	India
8	SDM College of Engineering and Technology, Dharwad	69	India
9	Soniya Education Trust's College of Pharmacy, Dharwad	65	India
10	Kuvempu University, Shivamogga	57	India
11	Gulbarga University, Kalaburgi	51	India
12	Lamar University, Texas	46	United States of America
13	Indian Institute of Chemical Technology, Hyderabad	44	India
14	Bhabha Atomic Research Centre, Mumbai	44	India
15	RamaiahInstitute of Technology, Bengaluru	43	India
16	Yuvarajas College, Mysore	40	India
17	Nuclear Power Corporation of India Limited, Mumbai	36	India
18	Texas State University, Texas	34	United States of America
19	Jawaharlal Nehru Medical College, Belagavi	30	India
20	KLS Gogte Institute of Technology, Belagavi	29	India

Country of Collaboration

Table 8 presents the data on the top twenty countries collaborated with Karnatak University, Dharwad. A total of 99 countries have collaborated with Karnatak University during the study period. The United States of America collaborated 258 publications and received 8104 citations, followed by South Korea 161 publications (3300 citations), the United Kingdom with 104 publications ranked first to third respectively. The other countries' information is detailed in table 8.

Table 8: Country of Collaboration with Karnatak University, Dharwad

Sl. No.	Country	Publications	Citations Received	ACPP
1	United States of America	258	8104	37.22
2	South Korea	161	3300	21.71
3	United Kingdom	104	2372	24.70
4	China	66	662	11.82
5	Egypt	38	488	14.78
6	Japan	38	453	16.77
7	Australia	34	1724	55.61
8	South Africa	32	250	9.61
9	Germany	28	310	12.91
10	Turkey	28	291	11.64
11	Canada	25	507	24.14
12	Saudi Arabia	25	360	15.00
13	Finland	23	157	7.13
14	France	20	414	24.35
15	Switzerland	19	163	9.58
16	Netherlands	17	212	13.25
17	Iran	16	146	13.27
18	Portugal	16	103	8.58
19	Viet Nam	16	174	14.50
20	Taiwan	15	625	44.64
	Other Countries	99	67710	--

The largest set of connected countries consists of 99 countries in 5 clusters. Figure 4 illustrates the collaborative network of countries publishing more than 10 documents (44 of the 99 countries). Clusters are formed by the frequency of co-occurring terms representing each country, the more often the terms tend to co-occur they get colored into clusters. The size of circles represents the number of publications of the country and the thickness of lines depicts the size of collaboration. For example, the link strength (collaboration) between the United States of America and India was 253 and it represents a thick line. On the other hand, the line between South Korea and India had a link strength of 160. The green cluster shows collaborative links strength (1179) between the largest circles of India, United States of America representing orange color circle (449) and South Korea representing with yellow color circle (243) authors affiliated to these countries.

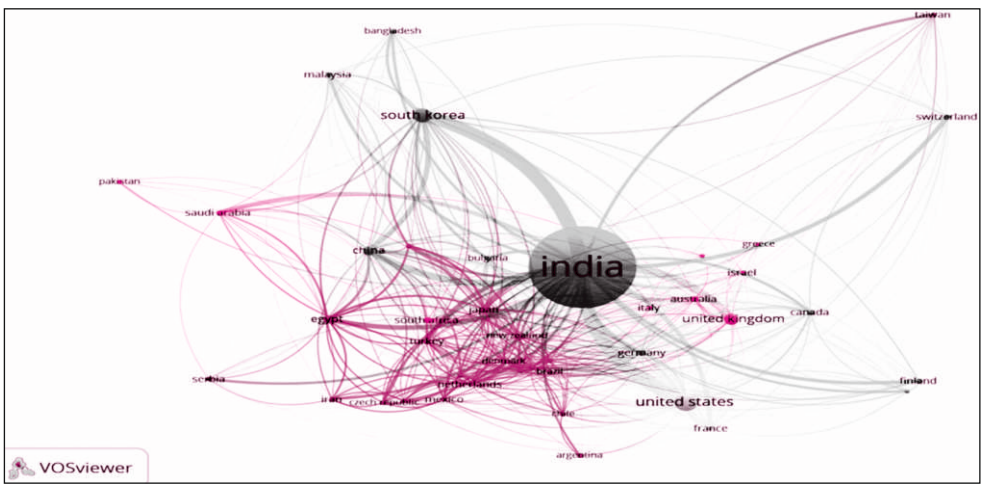

Fig. 4: VOS viewer Network Visualization Map of Country Co-Authorship (International Collaboration)

Journals preferred by the authors of Karnatak University

Table 9 provides the rank list of the top 20 journals preferred by the authors of Karnatak University, Dharwad. The Journal of Applied Polymer Science was the most preferred source of publication with 130 publications published by John Wiley & Sons Inc., United States of America, followed by Acta Crystallographica Section E Structure Reports Online with 81 publications published from the United Kingdom and AIP Conference Proceedings with 73 publications ranked second to third respectively. Out of the top twenty journals, six journals belong to India, four publications each belong to the United States of America and Netherlands and three were from the United Kingdom. Out of 4990 publications, 4753 were journaled publications published in 1211 journals and 596 journals have only 1 publication in their journals.

Figure 5 shows the bibliographic coupling of the journals with overlay visualization. The minimum number of publications of a journal was 5. Of the 1311 sources, 255 meet the thresholds. For each of the 20 journals, the total strength of the bibliographic coupling source links with other journals was calculated. The journals with the greatest total strength link were selected. The Journal of Applied Polymer Science had the greatest number of publications (130), but it had 3374 citations and had 11148 total link strength. So, this journal meets the criteria and was included. The number two was Acta Crystallographica Section E Structure Reports Online with 81 publications, 166 citations, and more than 3272 total link strength. The Journal of Controlled Release had 10 publications, having the highest i.e. 5378 citations and had 965 total link strength. Therefore, Transition Metal Chemistry with 69 publications, 1252 citations and 18412 highest total link strength.

Table 9: Journals Preferred by the Authors of Karnatak University, Dharwad

Rank	Journal	Publications	Impact Factor	Country	Publisher
1	Journal of Applied Polymer Science	130	2.188	United States of America	John Wiley & Sons Inc.
2	Acta Crystallographica Section E Structure Reports Online	81	0.347	United Kingdom	International Union of Crystallography
3	AIP Conference Proceedings	73	0.396	United States of America	American Institute of Physics
4	Transition Metal Chemistry	69	1.016	Netherlands	Springer Nature
5	Spectrochimica Acta Part A Molecular and Biomolecular Spectroscopy	65	2.931	United Kingdom	Elsevier BV
6	Journal of Chemical and Engineering Data	64	2.298	United States of America	American Chemical Society
7	Monatshefte Fur Chemie	56	1.501	Germany	Springer Nature
8	Journal of the Indian Chemical Society	50	0.158	India	Scientific Publishers
9	Indian Journal of Chemistry Section B Organic and Medicinal Chemistry	44	0.509	India	Scientific Publishers
10	Indian Journal of Experimental Biology	44	0.934	India	Scientific Publishers
11	Indian Journal of Chemistry Section A Inorganic Physical Theoretical and Analytical Chemistry	42	0.483	India	Scientific Publishe rs
12	European Journal of Medicinal Chemistry	41	4.833	Netherlands	Elsevier BV
13	Journal of Molecular Structure	41	2.120	Netherlands	Elsevier BV
14	Current Science	39	0.756	India	Indian Academy of Sciences
15	Polymer News	37	0.156	United Kingdom	Taylo r & Francis
16	Inorganica Chimica Acta	36	2.433	Netherlands	Elsevier BV
17	Cytologia	34	0.922	Japan	Japan Mendel Society
18	Indian Journal of Heterocyclic Chemistry	33	0.068	India	National Academy of Chemistry
19	Industrial and Engineering Chemistry Re search	32	3.375	United States of America	American Chemical Society
20	Oxidation Communications	30	0.489	Bulgaria	Scientific Bulgarian Communication

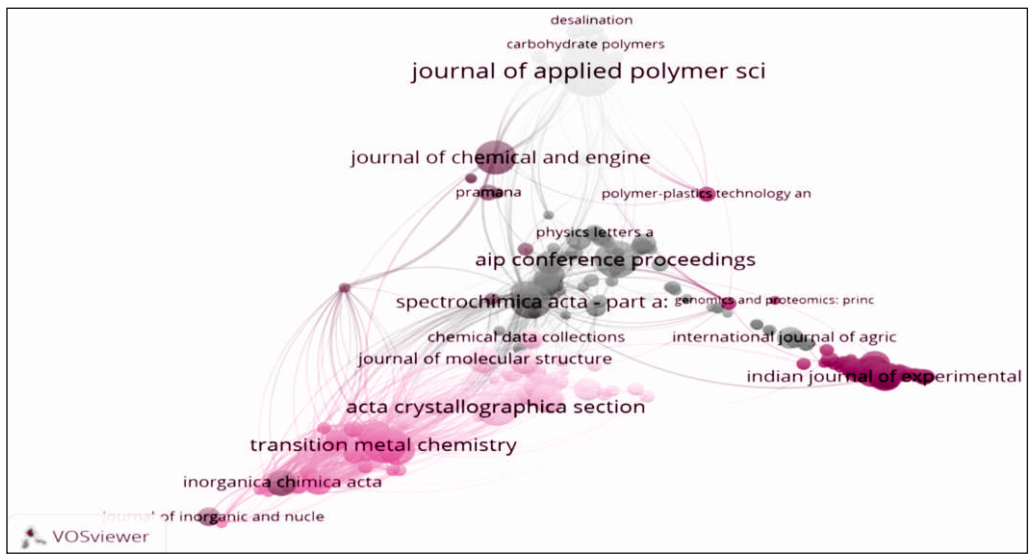

Fig. 5: VOSviewer Bibliographic Coupling of the Sources

Table 10: Highly Cited Papers

Rank	Source Details	Scopus Citations	Google Scholar Citations
1	Soppimath, K. S., Aminabhavi, T. M., Kulkarni, A. R., & Rudzinski, W. E. (2001). Biodegradable polymeric nanoparticles as drug delivery devices. Journal of Controlled Release, 70(1–2), 1–20.	2434	3771
2	Agnihotri S.A., Mallikarjuna N.N., & Aminabhavi T.M. (2004). Recent advances on chitosan - based micro and nanoparticles in drug delivery. Journal of Controlled Release, 100(1), 5–28.	1670	2586
3	Colman, P. M., Freeman, H. C ., Guss, J. M., Murata, M., Norris, V. A., Ramshaw, J. A. M., & Venkatappa, M. P. (1978). X -ray crystal structure analysis of plastocyanin at 2.7 Å resolution. Nature, 272(5651), 319–324.	724	767
4	Kandagal, P. B., Ashoka, S., Seetharamappa, J., Shaikh, S M. T., Jadegoud, Y., & Ijare, O. B. (2006). Study of the interaction of an anticancer drug with human and bovine serum albumin: Spectroscopic approach. Journal of Pharmaceutical and Biomedical Analysis, 41(2), 393 –399.	390	499
5	Aminabhavi T.M. & Gopala krishna B. (1995). Density, Viscosity, Refractive Index, and Speed of Sound in Aqueous Mixtures of N, N -Dimethylformamide, Dimethyl Sulfoxide, N, N -Dimethylacetamide, Acetonitrile, Ethylene Glycol, Diethylene Glycol, 1,4 -Dioxane, Tetrahydrofuran, 2 -Methoxyethanol, and 2-Ethoxyethanol at 298.15 K. Journal of Chemical & Engineering Data, 40(4), 856–861.	286	364

Highly Cited papers

Table 10 provides the top five highly cited papers of Karnatak University. The paper published by T.M. Aminabhavi et al. on Biodegradable polymeric nanoparticles as drug delivery devices (Journal of Controlled Release) received 2434 citations. Followed by Agnihotri S.A., Mallikarjuna N.N., & Aminabhavi T.M. published on "Recent advances on chitosan-based micro and nanoparticles in drug delivery" in the year 2004 has received 1670 citations. Out of five highly cited papers T.M. Aminabhavi has published three papers and received the highest citations together.

Results And Conclusion

The present study is conducted to analyse the scientific productivity of Karnatak University, Dharwad (one of the premier higher educational institutions that cater to the educational needs of North Karnataka) for a period of sixty years from 1960 to 2019. A total of 4990 records were extracted from the Scopus citation database. A review of the literature was conducted from 2008 to 2020. The block periods 2000-2004 and 2005 to 2009 witnessed the highest contribution by the authors of Karnatak University, Dharwad and 14,203 and 20,638 citations (30.74 and 26.94 ACPP) respectively. The Science faculty alone has contributed 95.89 % (4785 publications) of the total publications, followed by Social Sciences (194 publications with 3.89%). T.M. Aminabhavi (from Polymer Science) was found to be the leading author with 491 publications (21630 citations, 47.66 ACPP). The same author alone has received more than 32 % of the overall citations of Karnatak University, Dharwad. The two authored publications were more with 1535 (30.76 %) publications, followed by three authored publications with 1392 (27.90%) publications. Chemistry discipline alone has contributed more number of publications, i.e. 2046 (23.34%), followed by Materials Science (973 publications, 11.10%). The authors of KUD collaborated 102 publications with the Indian Institute of Science, Bengaluru, followed by Chonbuk University, Jeonju, South Korea (94 publications). The United States of America collaborated 258 publications and received 8104 citations, followed by South Korea's 161 publications (3300 citations). The Journal of Applied Polymer Science was the most preferred source of publication with 130 publications (published by John Wiley & Sons Inc.), United States of America, followed by Acta Crystallographica Section E Structure Reports Online with 81 publications published from United Kingdom.

The present study helps the authorities of the Karnatak University, Dharwad and decision makers/policymakers of the Government of Karnatakta take appropriate measures and to identify the productive disciplines to develop a feasible plan of action to increase their productivity. The research scholars and faculty members of Karnatak University are involved in new knowledge creation (in terms of publications) especially from the Science discipline. Contributions from other faculties such as Arts, Education, Commerce, and Management are less compared to Science and Social Sciences. The authors of such faculty need to be proactive in publishing their research outcomes in reputed journals.

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