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## RESEARCH ARTICLE

### RESEARCH PERFORMANCE OF UNIVERSITIES IN KARNATAKA BASED ON WEB OF SCIENCE

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#### ABSTRACT

Paper deals with the analysis of citations of research papers covered by the Web of Science database. The period covered is for 30 years; citations depicted by Web of Science for the period January 1989 to December 2018. Study projects the research performance of six well established universities in the state of Karnataka with regard the number of research papers covered by scholarly journals and number of scholars who have cited these research papers. Also projected is the average citations per research paper and h-Index of authors. Paper also shows the performance of top faculty members in India who are involved in publishing research papers. Collaboration with authors of foreign countries in doing research work and publishing papers are also comprehended in the study, including the trends in publishing research papers which depict the decreasing and increasing trends of research.

## INTRODUCTION

Of late, there is emphasis on improving the originality of research papers as well as, quality of research papers on the whole. In this direction, national academic and research bodies including assessment and accreditation agencies such as University Grants Commission, All India Council of Technical Education, Indian Council of Agricultural Research, Council of Scientific and Industrial Research, National Assessment and Accreditation Council and National Board of Accreditation do rely upon impact factor of journals and h-Index derived from citation indices to determine the quality of research publications. Impact factor and h-Index depicts the quality of papers based on the extent of use. The extent of originality of research papers is projected by the plagiarism check using anti-plagiarism software such as iThenticate and Turnitin. The database of the platform covers more than 65 billion pages web content. However, the software scans within 10 minutes and shows how far the research papers submitted by scholars is original. It also retrieves the sources from where the text contents are copied and, finally enables to verify manuscript with already published research papers side-by-side. In this present survey, attempt is made by the authors to project the research performance of well established six universities in the state of Karnataka.

The research papers covered by the Web of Science citation index for the period January 1989 to December 2018 is considered. Further, attempt is made to project the collaborative research with the authors of foreign countries and the extent of use of papers based on citations. Attempt is also made here to show the performance of faculties of popular universities in India so that, a comparison can be made as to their research contributions. In the present survey, h-Index is derived from Web of Science database. Web of Science is the science citation index of M/s. Clarivate Analytics. Earlier it was the product of M/s. Thomson and Reuters, USA. Web of Science covers citations mainly from scholarly journals in the disciplines of science and technology. As of now, 18000 journals are covered by Web of Science. Another popular citation index available to determine the h-Index is Scopus. It is the product of Elsevier, USA which covers 22500 journals. Grant giving organizations and assessment bodies usually rely upon either of these American citation indices. Here, h-index is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar. The index is based on the set of the scientist's most cited papers and the number of citations that they have received in other publications. The h-index method of calculating the performance of authors was suggested in 2005 by Jorge E. Hirsch, an American Physicist. The calculation made and indicated as the *Hirsch index* or *Hirsch number*. The advantage of the h-index is that it combines productivity (i.e., number of papers produced) and impact

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When we say the h-Index of an author or organization is 20, which means, 20 of his papers have been used and cited by more than 20 authors while writing their papers. For each of these 20 papers, there will be minimum of 20 citing authors. Thus, the quality is determined based on the extent of use. Hirsch reckons that after 20 years of research, an h index of 20 is good, 40 is outstanding, and 60 is truly exceptional. Altogether, there are 27 universities in the state of Karnataka. Considering the year of establishment of state universities, the University of Mysore is the oldest of all which came into being in the year 1916. Karnatak University, Dharwar is the second one established in the year 1950 and Bangalore University came into being in 1964. The three other universities depicted above were established during 1980s. The authors of Bangalore University though published 3265 papers, there are 45129 citations depicting an h-Index of 76. The average citation per item stands at 13.82. The total publications of the University of Mysore though showing 5003 papers, the total citation depicted is 41138 with an h-Index of 66. The University of Mysore is at the second place.

Further, Bangalore University has contributed 2841 papers with average citation per item stands at 11.09. Gulbarga University though established in 1980, the h-Index is showing 50 as of December 2018. As regards total number of papers contributed, University of Mysore is on the top with 5003 papers. However, considering the discipline-wise contribution, maximum number of papers are found in the discipline of crystallography from University of Mysore as well as, Mangalore University with 847 and 444 papers respectively. Similarly, from Karnatak University and Bangalore University, maximum number of papers are in the discipline of Chemistry (Multidisciplinary) with 509 and 311 respectively. Further, 129 papers are depicted on Biotechnology and Applied Microbiology from Gulbarga University and 163 papers on Electrochemistry from Kuvempu University being the maximum number of papers contributed. The data in the above table clearly depict that except in Mangalore University, there is decreasing trend as to the number of publications are considered in all the universities of the state.

**Table 1. Universities in Karnataka State selected for the study**

Sl. No.	Universities	Place	Year of Establishment
01	University of Mysore	Mysuru	1916
02	Karnatak University	Dharwar	1950
03	Bangalore University	Bengaluru	1964
04	Mangalore University	Mangalore	1980
05	Gulbarga University	Kalbargi	1980
06	Kuvempu University	Shimoga	1987

**Table 2. Extent of the use of research papers based on citations**

Sl. No.	Universities	No. of Research Papers	No. of Times Cited	Average Citation per item	h-Index
01	Karnatak University	3265	45129	13.82	76
02	University of Mysore	5003	41138	8.22	66
03	Bangalore University	2841	31520	11.09	66
04	Mangalore University	3157	26292	8.32	61
05	Kuvempu University	1440	18759	13.03	55
06	Gulbarga University	1407	16456	11.70	50

**Table 3. Subject Areas in which maximum number of papers published**

Sl. No.	Universities	Subject Areas	No. of Papers
01	University of Mysore	1. Crystallography	847
		2. Chemistry, Multidisciplinary	581
02	Karnatak University	1. Chemistry, Multidisciplinary	509
		2. Polymer Science	278
03	Bangalore University	1. Chemistry, Multidisciplinary	311
		2. Material Science	310
04	Mangalore University	1. Crystallography	444
		2. Chemistry, Multidisciplinary	298
05	Gulbarga University	1. Biotechnology & Applied Micro Biology	129
		2. Mechanics	128
06	Kuvempu University	1. Electrochemistry	163
		2. Organic Chemistry	128

**Table 4. Increasing / Decreasing trend in publishing research papers in Karnataka**

Sl. No.	Universities	2018	2017	2016	2015
01	Mangalore University	182	148	140	121
02	Kuvempu University	117	143	120	108
03	Karnatak University	176	181	196	172
04	University of Mysore	250	283	295	317
05	Bangalore University	155	178	166	159
06	Gulbarga University	56	57	75	83

**Table 5. Increasing trend in publishing in some universities in the country**

Sl. No.	Universities	2018	2015	2011	2007	2000	1991
01	JNU	758	635	339	207	150	138
02	University of Madras	563	552	401	424	189	130
03	Osmania University	386	353	226	132	146	176
04	University of Calcutta	754	864	569	331	182	219
05	University of Hyderabad	667	747	509	329	203	169

**Table 6. No. of Countries collaborated for publishing research papers**

Sl. No	Universities	No. of Papers	No. of countries Collaborated	No. of collaborated Papers	Percentage of collaborated Papers
1	Univ of Mysore	5003	83	1833	36.64
2	Karnatak Univ	3265	91	917	28.08
3	Bangalore Univ	2841	63	1577	55.50
4	Mangalore Univ	3157	53	636	20.15
5	Gulbarga Univ	1407	33	217	15.42
6	Kuvempu Univ	1440	45	335	23.26

**Table 7. Research performance of some popular universities in the country**

Sl. No.	Universities	No. of Papers	No. of Citations	Average Citation per item	h-index
01	University of Hyderabad	10272	157660	15.34	124
02	University of Rajasthan	5821	76823	13.20	103
03	University of Madras	9563	115521	12.08	100
04	JNU	8248	98763	11.97	99
05	University of Calcutta	11310	114790	10.50	90

**Table 8. Performance of Faculty based on No. of papers and Citations**

Sl. No.	Universities	Faculty	No. of Papers	No. of Citations	Average Citation per item	h-index
01	Karnatak University	Aminabhavi TM	416	17473	42.00	66
		Nandibewoor ST	371	3836	10.34	30
02	Bangalore University	Kamath PV	142	3735	26.3	35
		Suresh Babu VV	146	1104	7.56	19
03	Mangalore University	Gowda BT	546	2936	5.38	32
		Narayana B	567	3064	5.4	22
04	University of Mysore	Rangappa KS	361	3995	11.07	30
		Yathirajan HS	558	2463	4.41	19
05	Kuvempu University	Swamy BEK	137	2453	17.91	29
		Venkatesha TV	131	2569	19.61	29
06	Gulbarga University	Mulimani VH	74	884	11.95	18
		Umavathi JC	70	720	10.29	16

**Table 9. Highly cited papers of faculty in Karnataka**

Sl. No.	Faculty	University	Name of the Journals	No. of times cited
01	Aminabhavi T.M	Karnatak	Journal of controlled release, Vol.70 (1-2) 2001	2020
			Journal of controlled release, Vol.70 (1-2) 2004	1365
02	Byrappa K &	Mysore	Progress in crystal growth characterization of materials, Vol. 53 (2) 2007	500
			Talanta, Vol. 38 (8), 1991	373
03	Ahmed S.A & Dinesan H.K	Mysore	Chemistry of Materials, Vol. 12 (5), 2000	360
04	Kamath P.V	Bangalore	Life Sciences, Vol.80 (21), 2007	300
05	Girish K. & Kemparaju K	Mysore		

**Table 10. Performance of faculty of some universities in the country**

Sl. No.	Name of Faculty	University	No. of Papers	No. of Citations	Average citation per item	h-index
01	Bhatnagar V	University of Delhi	1312	51210	39.03	92
02	Desiraju G.R.	University of Hyderabad	260	25762	99.08	71
03	Nangia A	University of Hyderabad	260	9790	37.65	55
04	Ghosh A	University of Calcutta	394	6447	16.36	42
05	Ghosh S	University of Calcutta	583	5161	8.85	35
06	Prasad R	JNU	173	3802	21.98	33

There is gradual increase in the number of papers contributed from Mangalore University. During 2015 there were only 121 papers and the number increased to 182 in 2018, depicting steady growth. The data also indicates that there is steady decrease in the number of papers contributed from the University of Mysore. The rest of the four universities also depicted the decreasing trend. It is clear that the performance of some of the well established old universities in the country have shown steady progress as far as the research output is concerned. Increasing trend of research papers can be observed in these universities during the last 27 years. However, of late, there is decreasing trend in two of the universities i.e., University of Calcutta and University of Hyderabad. However, a good performance is projected by these popular universities of the country.

Table shows number of foreign countries collaborated in research work and also in contributing the research papers. Authors of the University of Mysore have collaborated with the authors of 83 foreign countries and the percentage of papers represent 36.64. Karnatak University has collaborated with the authors of 91 foreign countries and the percentage of papers represent 28.08. Bangalore University authors have collaborated with the authors of 63 foreign countries and percentage of contributed papers represent 55.50, being the highest among all the universities. Gulbarga University and Kuvempu University have collaborated with 33 countries and 45 countries respectively and the percentage of contributed papers represent 15.42 and 23.26 respectively. Performance of well established universities in the country is depicted in the above table.

Considering the h-Index as the criterion, University of Hyderabad stands first among all with 124 h-Index. 10272 research papers have been cited 157660 times by authors across the world. This is considered as the best research performance in the country. The University of Rajasthan with 103 h-Index and University of Madras with 100h-Index have projected their best performance. Jawaharlal Nehru University is also among the top performers with an h-Index of 99 and the University of Calcutta with an h-Index of 90. When h-Index is said to be 90 which means 90 research papers have been cited by minimum of 90 authors across the world; for each of the 90 papers, there are minimum of 90 citing authors from various scholarly journals. The table depicts the best performance of the faculty members of six universities based on number papers and citations. Prof. Aminabhavi T.M. of Karnatak University, Dharwar has published 142 papers, with an h-Index of 66. For each of his papers, on an average there are 42 citations. From the same university, Prof. Nandibewoor S.T. has published 371 papers and his h-Index is 30. Next best performance is of Prof. Kamath P.V. from Bangalore University with 142 papers and an h-Index of 35. Prof. Suresh Babu from same university has 146 papers and the h-Index is 19. Prof. Gowda B.T. of Mangalore University has contributed 546 papers with h-Index of 32 and Prof. Narayana B. has contributed 567 papers which happens to be the highest number of papers from faculties in Karnataka, with an h-Index of 22. Prof. Yathiraj H.S. and Prof. Rangappa K.S. have contributed 558 and 361 papers respectively during the past three decades. However, the performance of Prof. Rangappa happens to be the best from the University of Mysore as the h-Index is depicting 30. Prof. Swamy B.E.K. and Prof. Venkatesha T.V. have contributed 137 and 131 papers respectively and the h-Index of both the authors is 29. Prof. Mulimani and Prof. Umavathi are the best performers from Gulberga University with the h-Index of 18 and 16 respectively.

Among the faculties of the six universities in Karnataka, the best notable performance is of Prof. Amina bhavi and Prof. Nandibewoor of Karnatak University, Prof. Kamath of Bangalore University, Prof. Rangappa of the University of Mysore and Prof. B.T. Gowda of Mangalore University. Performance is based on number of papers contributed and further, the criterion of h-Index. The above table projects the research papers which are highly cited as per web of science database. The paper of Prof. Aminabhavi T.M of Karnatak University has contributed a paper entitled “ Biodegradable polymeric nanoparticles as drug delivery devices” published in Journal of Controlled Release, Vol. 70 No. 1&2, 2001 has a total of 2020 citations and average citation per year stands at 106.37. The research paper entitled “Hydrothermal technology for nanotechnology” of Prof. K. Byrappa from the University of Mysore has published in Progress of Crystal Growth Characterization of Materials, Vol. 53 No. 2, 2007. There are altogether 500 citations and an average citation per year stands at 38.31. Similarly, one of the review papers of Prof. Syed Akheel Ahmed and Dinesan H.K. published in Talanta Vol.38 No.8, 1991 has a total of 373 citations. The paper of Prof. Kamath of Bangalore University has published in Chemistry of Materials, Vol. 12 No.5 2000 for which there are 360 citations. Further, Prof. Kemparaju K. and Girish K. of the University of Mysore have published a paper in Life Sciences, Vol. 80 No. 21, 2007 which has a total of 300 citations. These are the authors having highest number of citations for their research papers.

The table shows the best performers in some of the popular Indian universities. Prof. Bhatnagar V. from Delhi University has published 1312 papers during the last three decades. These papers have a total of 51210 citations, cited by the authors across the world. The h-Index is 92 with an average citation of 39.03 per paper. Prof. Desiraju from the University of Hyderabad has contributed just 260 papers but, they have been cited up to 25762 times during the last 30 years. The h-Index of Prof. Desiraju is 71. Further, Prof. Nangia from the same university has contributed 260 papers. However, the total citations is 9790 with an h-Index of 55. While referring to the performance of Prof. Ghosh A and Ghosh S from University of Calcutta, the h-Index depicted is 42 and 35 respectively. Prof. Prasad of Jawaharlal Nehru University has contributed 173 papers. However, there are 3802 citations with an h-Index of 33. The research contributions of some of the well established old universities have to be appreciated because of good number of contributed papers with good number of citations and appreciable h-Index.

### Findings and conclusion

The number of papers being contributed by the faculties is gradually decreasing in all most all the universities in Karnataka. It is mainly because of the fact that most of the senior professors in the universities of Karnataka have attained superannuation and the posts of professors are vacant since a long time. Even one hundred year old university (University of Mysore) and seventy year old (Bangalore University) are facing inadequacy of teaching staff even to discharge effectively the routine functions of teaching and research. However, this trend is not so in case of popular and old universities of the country such as University of Madras, University of Calcutta, JNU, University of Hyderabad and Osmania University. There is steady increase in the research contribution. Impact factor of journals, h-Index of individual faculty and institution and percentage of similar content are the factors to be considered for quality performance in research. Considering the factor of h-Index, the performance of Karnatak University, Dharwar has to be appreciated as it is going beyond 76. Except Gulberga University, a large percentage of the research contributions is from the discipline of chemistry. Most of the research papers contributed pertains to chemistry (Multidisciplinary) and crystallography. Performance of faculties of all the universities of the state with regard to collaboration with the authors of foreign countries for research and publications is excellent. A good percentage of papers have been published in association with foreign authors: co-authorship. The contributions of Prof. Aminabhavi of Karnatak University is excellent with an h-Index of 66. Further, his research papers have been cited by so many authors; two of his papers have been cited by 1365 and 2020 authors. For each of his 416 papers, on average there are 42 citing authors. This happens to be the best performance. The grant giving organizations and quality performance assessment bodies do rely upon reports based on citation studies, especially those studies dependent on Web of Science and Scopus. Hence the importance of citation studies and bibliometric studies.

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