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## CITATION STUDY OF RESEARCH PAPERS OF BEST PERFORMING UNIVERSITIES IN KARNARAKA

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# CITATION STUDY OF RESEARCH PAPERS OF BEST PERFORMING UNIVERSITIES IN KARNARAKA

Kodandarama<sup>1</sup> and C.P.Ramasesh<sup>2</sup>

## ABSTRACT:

*[Paper depicts the results of the analytical study of the citations of the research papers contributed by the authors of the six state universities of Karnataka. The citations covered by the Scopus Index of Elsevier Publisher, USA is the basis of the study. The period of coverage of Scopus Citation Index for the study is complete; citations as depicted by Scopus up to December 2020 are considered. Study furnishes the research performance of well-established six universities of the state of Karnataka with regard the number of research papers contributed, number of citations received, average citations per paper and h-index. Paper also depicts the best performance of faculty members who have contributed research papers in scholarly journals. Collaboration with authors of foreign countries in publishing research work, including the highly cited research papers of some of the authors of the universities are covered under the study.]*

## 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 of research papers. 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 these anti-plagiarism software packages covers more than 65 billion pages web content. However, the software scans within 15 minutes and shows how far the research papers submitted by scholars are 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.

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Attempt is made in the present survey by the authors to project the research performance of old and well established six universities in the state of Karnataka. All these universities were established before 1988. The research papers and citations covered by the Scopus Citation Index till December 2020 is considered for the present study. Further, attempt is made to project the extent of the use of research papers, as well as, the collaborative research work with the authors of foreign countries based on the citations. Attempt is also made here to show the individual performance of some of the faculties of the universities.

The performance based on the h-Index is derived from Scopus database. Scopus is the citation index covering the scholarly journals belonging to science, as well as, social sciences is the product of M/s. Elsevier Publishers. As of now, 39000 journals are covered by Scopus Citation Index. Another popular citation index available to determine the h-Index is Web of Science. It is the product of Clarivate Analytics, USA which covers 33500 journals. Grant giving organizations and assessment bodies usually rely upon either of these American citation indices to assess the research performance of institutions and the extent of use of publications.

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 (number of citations) in a single number.

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 20 and 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.

Of late, institutions also prefer to rely upon I-10 criterion to determine the research performance. Here, it is calculated considering how many papers of a given author is used and cited by 10 and more than 10 authors. Occasionally, performance is determined based on G-Index as well.

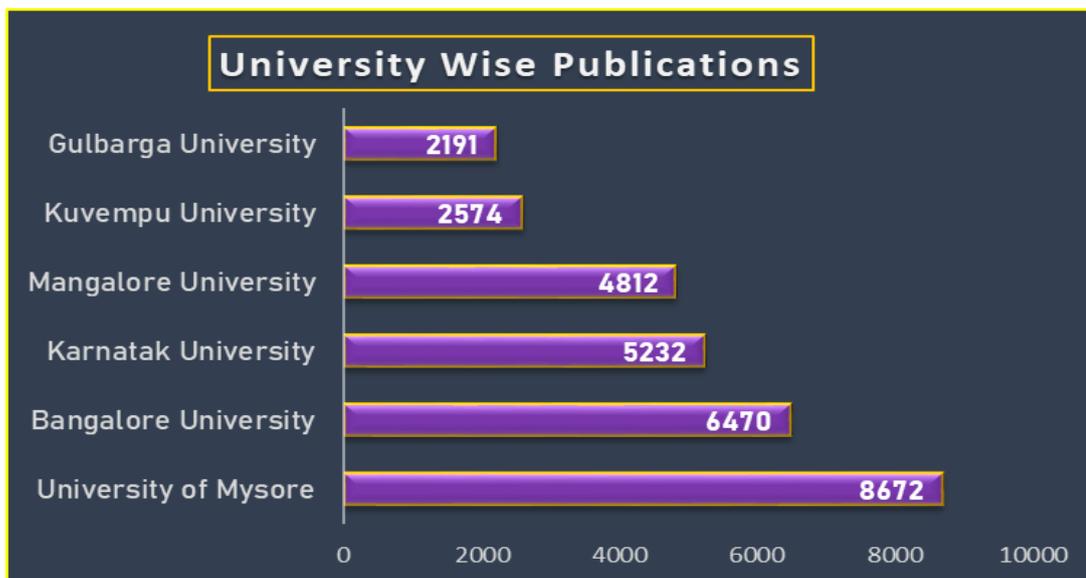
The data rendered in the tables depict the best performance of some of the authors of the six universities. Here the various forms of the names of the authors have been consolidated. Many a time it is difficult to identify and decide various forms of the names belonging to the same author. However, the authors of the paper have tried their level best to consolidate the names and project the number of papers, as well as, the number of citations, along with the h-index.

**Table 1: Universities in the State of Karnataka Covered in the Study**

<b>Sl. No.</b>	<b>Universities</b>	<b>Place</b>	<b>Year of Establishment</b>
01	University of Mysore	Mysuru	1916
02	Karnatak University	Dharwad	1950
03	Bangalore University	Bengaluru	1964
04	Mangalore University	Mangalore	1980
05	Gulbarga University	Kalburgi	1980
06	Kuvempu University	Shimoga	1987

As of 2020, 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 and was established in the year 1916. Further, Karnatak University, Dharwad is the second one which came into being in the year 1950. Bangalore University was established in the year 1964. The three other universities shown in the above table were established during 1980s.

**Chart 1: Number of Research Papers Contributed by the Universities**



Among the universities depicted above, University of Mysore has contributed 8672 research papers which in fact is the highest when compared to other universities of the state. Bangalore University with 6470 research papers is in the second place. Further, Karnatak University with 5232 research papers and Mangalore University with 4812 research papers are in the subsequent places. The performance of Bangalore University and Mangalore University have to be placed on record as they have contributed quite a good number of papers though established during 1964 and 1980 respectively.

**Table 2: Disciplines in Which Maximum Number of Papers Published**

Sl. No.	Universities	Disciplines	No. of Papers
1	University of Mysore	1. Chemistry 2. Physics	3140 1960
2	Mangalore University	1. Chemistry 2. Physics	2416 2165
3	Karnatak University	1. Chemistry 2. Material Science	2146 1041
4	Bangalore University	1. Chemistry 2. Engineering	1660 1619

5	Kuvempu University	1. Chemistry	913
		2. Pharmacology and Toxicology	434
6	Gulbarga University	1. Engineering	549
		2. Physics	528

As regards total number of research papers contributed, University of Mysore is on the top with 8672 research papers. However, considering the discipline-wise contribution, maximum number of papers are found in the discipline of chemistry from all the five universities except Gulbarga University which has contributed most of the research papers in the disciplines of physics and engineering sciences. University of Mysore and Mangalore University have published 3140 and 2416 papers respectively in the discipline of chemistry being the highest while considering discipline-wise number of papers. Considering contributions from Karnatak University and Bangalore University, maximum number of papers are again in the discipline of Chemistry (multidisciplinary) with 2146 and 1660 respectively. Further, 913 papers are contributed on chemistry and 434 papers on pharmacology and toxicology from Kuvempu University. Finally, 549 papers on engineering science and 528 papers on physics are the major contributions from Gulbarga University.

**Table3: Extent of Use of Research Papers Based on Citations and H-Index.**

Sl No	Universities	No. of Research Papers	No. of Times Cited	Average Citations per item	h-Index
01	Karnatak University	5232	75319	14.39	98
02	Bangalore University	6470	74145	11.45	95
03	University of Mysore	8672	79228	9.14	87
04	Kuvempu University	2574	35369	13.74	73
05	Mangalore University	4812	42098	8.74	72
06	Gulbarga University	2191	29699	13.55	69

Above table depicts the extent of the use of research papers based on number of citations. The authors of Karnatak University, Dharwad though published 5232 papers, there are altogether 75319 citations depicting an h-Index of 98. The average

citation per item stands at 14.39. Though the total publications of the University of Mysore depicted here is 8672, the total number of times cited is 79228 with an h-Index of 87. Therefore, the University of Mysore is at the third place. Further, Bangalore University has contributed altogether 6470 papers and average citation per item is 11.45. Kuvempu University though established in 1987, has contributed a total of 2574 papers, they have been cited 35369 times. It is pertinent here to highlight that the average citation per paper stands at 13.74 and the h-Index is depicting 73 as of December 2020. The research performance of Kuvempu University is to be appreciated in this regard. Even Gulbarga University though contributed 2191 research papers, they have been cited 29699 times and the average citation per paper stands at 13.55 which is again worth placing on record.

**Table 4: Number of Papers Collaborated with Authors of Foreign Countries**

<b>Sl. No</b>	<b>Universities</b>	<b>No. of Papers</b>	<b>No. of countries Collaborated</b>	<b>No. of collaborated Papers</b>	<b>Percentage of collaborated Papers</b>
1	Univ of Mysore	8672	75	2677	30.86
2	Mangalore Univ	4812	83	2052	42.64
3	Karnatak Univ	5232	104	1594	30.46
4	Bangalore Univ	6470	71	1309	20.23
5	Kuvempu Univ	2574	56	526	20.43
6	Gulbarga Univ	2191	37	303	13.82

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 75 countries and the percentage of collaborated papers represent 30.86. Further, altogether there are 2676 collaborated research papers from the University of Mysore. Mangalore University authors have collaborated with authors of 83 foreign countries and the number of papers is 2052 and the percentage of collaborated papers stands at 42.64, being the highest among all the universities of Karnataka State. Karnatak University authors have collaborated with 104 countries and the percentage of collaborated papers is depicting 30.46. Karnatak University has collaborated here with more number of countries when compared to other universities of the state. Further, the authors of Kuvempu University and Gulbarga University

have collaborated with 56 and 37 foreign countries respectively for research work and publications.

**Table 5: Performance of Authors Considering Number of Papers and h-Index**

Universities	Authors	No. of papers	No. of Citations	Average Citations	H-Index
University of Mysore	Rangappa K S	464	6729	14.50	43
	Yathirajan H.S.	713	3711	5.20	24
Karnatak University	Aminabhavi, T.M.	493	23202	47.06	76
	Nandibewoor S.T	389	5111	13.13	35
Bangalore University	Venugopal K R	398	1611	4.04	16
	Suresh Babu V. V.	237	2327	9.81	24

Mangalore University	Narayana B.	781	5009	6.41	28
	Gowda B. T.	577	3191	5.53	28
Kuvempu University	Swamy B.E.K.	231	4407	19.07	36
	Gireesha B.J.	208	3511	16.87	35
Gulbarga University	Umavathy J.C.	109	1491	13.68	20
	Naduvnamani N.B.	80	851	10.64	17

The table depicts the best performance of the faculty members of six universities based on number papers contributed and h-index. Prof. K.S. Rangappa has contributed 464 research papers which have been cited to the extent of 6729 and the h-index is depicting 43. Prof. H.S.Yathirajan has contributed 713 papers which is second highest among all the authors. Further, Prof. Aminabhavi T.M. of Karnatak University, Dharwad has published 493 papers, these papers have been cited 23202 times. It is highlighting factor that the h-index of Prof. Aminabhavi is depicting 76 with an average citation per paper is 47.06. The research contributions of Prof. Aminabhavi has to be placed on record with appreciation. For each of his papers, on an average there are 47.06 citations. From the same university, Prof. Nandibewoor S.T. has published 389 papers and his h-Index is 35.

Among the authors of Bangalore University, Prof. K.R.Venugopal and Prof. V.V.Suresh Babu have contributed 398 and 237 research papers respectively with the h-index of 16 and 24. As regards Mangalore University, Prof. B.Narayana has

contributed 781 research papers which in fact is the highest amongst all the authors of Karnataka. The involvement in research work is to be highlighted here. His individual h-index stands at 28. Prof. B.T.Gowda from the same university has contributed 577 papers with an h-index of 28.

While referring to Kuvempu University, Prof. B.E.K.Swamy has contributed a total of 231 research papers and they have been cited 4407 times as per Scopus. It is highlighting fact that his average citation per paper stands at 19.07 with the h-index of 36, which is worth placing on record with appreciation. Prof. B.J.Gireesha from the same university with 208 research papers is highlighted here as the average citation per paper stands at 16.87 with an h-index of 35.

While referring to Gulbarga University, the contributions of Prof. J.C. Umavathy and Prof. N.B. Naduvinamani is to be highlighted here. They have contributed 109 and 80 research papers with an h-index of 20 and 17 respectively. However, their average citations per paper is highlighting. In fact, 13.68 average citations per paper of Prof. Umavathy and 10.64 average citations per paper of Prof. Naduvinamani are highlighting factors.

Among the faculties of the six universities in Karnataka, the notable performance is of Prof. T.M. Aminabhavi of Karnatak University, Prof. K.S. Rangappa of the University of Mysore and Prof. B.E.K. Swamy of Kuvempu University. Performance is based on number citations per paper contributed and further, the criterion of h-Index.

**Table 6: Performance of Authors Based on Average Citations per Paper**

<b>Name of Authors</b>	<b>University</b>	<b>Discipline</b>	<b>Average Citations</b>
Aminabhavi T.M.	Karnatak University	Chemistry	47.06
Swamy B.E.K.	Kuvempu University	Chemistry	19.07
Gireesha B.J.	Kuvempu University	Mathematics	16.87
Rangappa K S	University of Mysore	Chemistry	14.50
Umavathy J.C.	Gulbarga University	Mathematics	13.68
Nandibewoor S.T	Karnatak University	Chemistry	13.13
Naduvinamani N.B.	Gulbarga University	Mathematics	10.64
Suresh Babu V. V.	Bangalore University	Chemistry	9.81

Average citations per paper shows the quality of the research papers based on the extent of use. In fact the criterion here is how many scholars across the world have made use the published papers. When there is more of citing authors, those papers are treated as useful ones. While referring to the above table, it is highlighting that the research papers of Prof. Aminabhavi of Karnatak University, Prof. B.E.K.Swamy of Kuvempu University, Prof. Rangappa of University of Mysore and S.T.Nandibevoor of Karnatak University from the discipline of chemistry and allied subjects possess good number of average citations. Further, from the discipline of mathematics, the papers of Prof. B.J. Gireesha of Kuvempu University, Prof. J.C.Umavathy of Gulbarga University and Prof. N.B. Naduvinamani of Gulbarga University possess good number of average citations per paper. The publications of Prof. V.V.Suresh Babu of Bangalore University from the discipline of chemistry also attracted scholars to cite his papers to make average citation per paper worth highlighting.

Chart 2: Performance Based on Average Citations per Paper

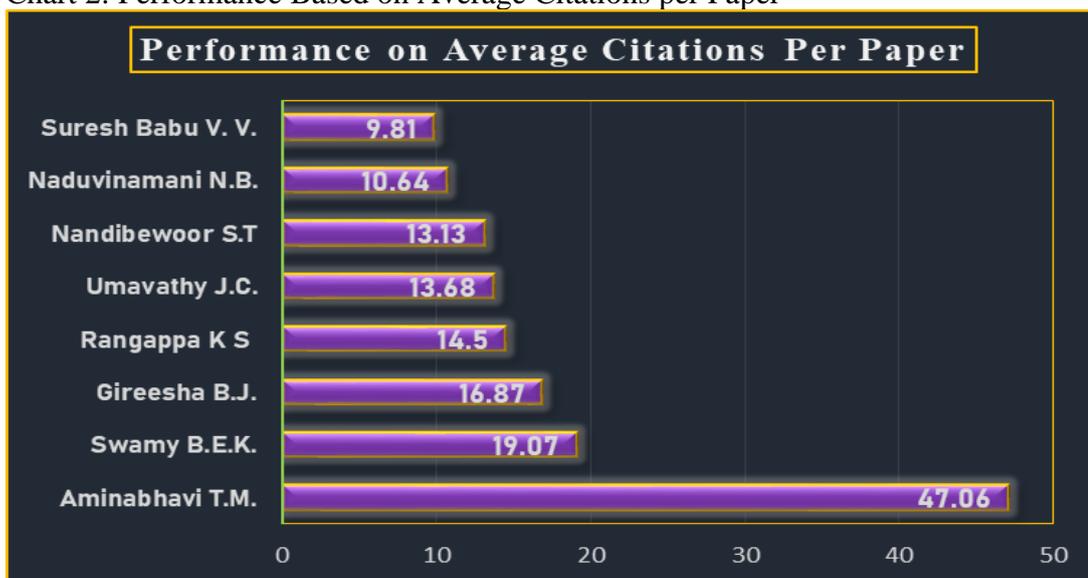


Table 7. University-Wise Highly Cited Research Papers of Authors

Sl. No.	Faculty	University	Name of the Journals	No. of times cited
1	Soppimath, K.S., Aminabhavi, T.M., Kulkarni, A.R., Rudzinski, W.E.	Karnatak	Journal of Controlled Release. 70(1-2) 2001, pp. 1-20	2625

2	Kumar S.G., Devi L.G.	Bangalore	Journal of Physical Chemistry A. 115(46) 2011, pp. 13211-13241	1304
3	Patani G.A., LaVoie E.J.	Mangalore	Chemical Reviews. 96(8) 1996, pp. 3147-3176	896
4	Kavi Kishor P.B., Sangam S., Amrutha R.N., Sri Laxmi P., Naidu K.R., Rao K.R.S.S., Rao S.,	Gulbarga	Current Science. 88(3) 2005, pp. 424-438	845
5	Byrappa, K., Adschiri, T	Mysore	Progress in Crystal Growth and Characterization of Materials. 53(2) 2007, pp. 117-166	647
6	Sherigara, B.S., Kutner, W., D'Souza, F.	Kuvempu	Electroanalysis. 15(9), 2003, pp. 753-772	320

The above table projects the research papers which are highly cited as per Scopus Citation Index. The paper of Prof. K.S. Soppimath, et.al of Karnatak University entitled “Biodegradable polymeric nanoparticles as drug delivery devices” published in Journal of Controlled Release, Vol. 70 No. 1&2, 2001 has a total of 2625 citations.

The paper published in Journal of Physical Chemistry, A. Vol.115 (46) 2011 by Prof. S.G.Kumar and L.G.Devi of Bangalore University has been cited 1304 times. Further, the paper published in Chemical Reviews Vol. 96(8) 1996 by Prof. G.A. Patani and Prof. E.J. La Voie of Mangalore University has been cited 896 times.

Further, Prof. P.B. Kavi Kishor, et.al of Gulbarga University have contributed a paper to Current Science Vol. 88 No. 3, 2005 which has been cited 845 times. The contribution of Prof. K .Byrappa and Prof. T. Adschiri from the University of Mysore in Progress in Crystal Growth and Characterization of Materials Vol. 53 (2) 2007 has a total of 647 citations. Publication of Sherigara, B.S. et.al. in Electroanalysis. Vol. 15(9) 2003 has received 320 citations as per Scopus Citation Index. These are the authors having highest number of citations for their specific research papers.

## **CONCLUSION:**

The refereed journals and their impact factor, including h-Index of individual faculty and institution and the percentage of similar content are the factors to be considered for quality performance in research. Considering the factor of h-Index, the performance of all the six universities in general and Karnatak University, Dharwad in particular (with h-index of 98) have to be appreciated for their good research performance. The universities which have been established during 1980s have also shown good performance in respect of number of citations, average citations per paper and h-index.

A large percentage of the research contributions is from the discipline of chemistry and allied subjects. Most of the research contributions pertain to chemistry (multidisciplinary). Performance of faculties of all the six universities of the state with regard to collaboration with the authors of foreign countries for research and publications is worth highlighting. 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 76 according to Scopus and, h-Index of 72 according to Web of Science. Further, his research papers have been cited by many authors in scholarly journals; one of his papers published in Journal of Controlled Release has been cited 2625 times. For each of his 493 papers, on average there are 47.06 citations. This happens to be the best performance in the present survey.

The number of papers being contributed by the faculties is gradually decreasing in some of 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

The grant giving organizations and quality performance assessment bodies do rely upon reports based on citation studies, especially dependent on Web of Science and Scopus. Hence, there is emphasis on citation studies and bibliometric studies.

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