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# Scholarly Research Trends of State Universities of Gujarat: A bibliometric Study

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## **Abstract**

The paper is describing bibliometric analysis of research publications of six state government universities of Gujarat during the year 2015-2019 indexed in SCOPUS database. The study exploring the various aspects of bibliometric analysis i.e. Number of publications and citation of the universities, the most productive author, the most productive publication source, the most preferred type of publication, the highest cited paper, and authorship pattern of 3825 bibliographic records. Analysis of the study is helpful to understand research output of the universities and which university has to do more effort to promote research activities and need to focus more on research productivity.

**Keywords:** Bibliometric, Research Output, University, Gujarat, Scopus, Journal, Author, Citation

## **Introduction**

Bibliometric is an important field of information science because it presents unique set of techniques for the monitoring and analysis of information resources. Bibliometric methods are

used in studies of properties and behavior of recorded knowledge, for analysis of the structures of scientific and research area and for evaluation of research activity and administration of scientific information. Various statistical methods are applied to study to measure, authorship, citation and publication pattern, the relationship within scientific domains and research communities and to structure of specific field. In this sense bibliometric is also relevant for researchers outside the libraries and information science field to track the trend in the specific field in their research work. Bibliometric study uses quantitative method such as statistics and mathematical analysis to examine documents. However, the study of bibliometrics is also concerned with document surrogates, the relation that might be derived or inferred related to production, manipulation or redistribution. Bibliometric references to the various methodologies of measurement applied to the artifacts of human communication forms, previously thought of primarily as books or other textual representatives and now it is intended to include new information and communication forms such as databases and other methods of recording information. Bibliometric study is helpful in management of scientific literature measuring the utility of periods and relationship between publication and subject area and also in knowing the most productive contribution in the given field. There are many government and private universities in the Gujarat State. Among these, the present growth and research output bibliometric study covers only six state government universities such as The Maharaja Sayajirao University of Baroda(MSU), Gujarat University (GU), Veer Narmad South Gujarat University(VNSGU), Saurashtra University(SU), Hemchandracharya North Gujarat University (HNGU) and Maharaja Krishnakumar Sinhji Bhavnagar University(MKSBU).

### **Literature Review**

Anil Kumar H., Dora Mallikarjun & Desai Asha (2015) aimed at the bibliometric analysis of the research publications of Gujarat University using Scopus database for the period 2004-2013. Data analysis of the paper revealed that stable addition in the number of publications was found from 2008 in the Gujarat University. Authors highlighted the further aspects also like most productive authors, mutual authorship patterns and trends, most preferred publications, and so on. While Azmi Nazrul Islam (2016) in his paper entitled “Bibliometric Analysis of Research Publications of Geology Department, Delhi University, India, 2001 – 2015” analyzed research productivity of faculty members at the Geology department of Delhi University more than 15

years, the citations received and authorship patterns. Author had used SCOPUS database for the bibliographic and citation data. Same as Sa, M. K. (2015) in his paper on “Research output of institute of minerals and materials technology India indexed in Scopus during 2004-2013: a bibliometric analysis” presented with various aspects i.e the yearly distribution of publication, growth rate, most productive authors, most preferential subject area, most favored document type, most productive journal, most frequent keywords, most productive institutions, most productive country, most favored source type, authorship pattern, degree of collaboration, multiple authors vs. single author, length of the publications, most cited authors etc. Maharana, Rabindra K. and Sethi Bipin Bihari (2013) discussed about research output of Sambalpur University in their paper entitled "A bibliometric analysis of the research output of Sambalpur University's publication in ISI Web of Science during 2007-11". While Batcha M, Sadik (2018) had published his paper on "Research Output Analysis of Most Productive Universities of Tamil Nadu, India: A Scientometric Analysis" his study identified research trend, characteristics growth and collaboration, pattern of published literature.

### **Objectives of the Study**

1. To find out the growth and scholarly contributions of the universities
2. To examine the year-wise distribution of the articles
3. To find out the authorship pattern of the publications
4. To analyze the form of the documents cited in the journal articles.
5. To identify about the highly cited publication
6. To know about most productive authors and journals
7. To find out most preferred type of publication
8. To find out the research trends of universities of Gujarat

### **Methodology of the Study**

In order to find out data, the present study used the SCOPUS database and retrieved data of the publications from the year 2015-2019 of the six state government universities of the Gujarat. Scopus is world largest citation database and 3825 publication data of selected universities has been retrieved from the database and exported into MS Excel and to make analysis of the data, the data were arranged in an organized way.

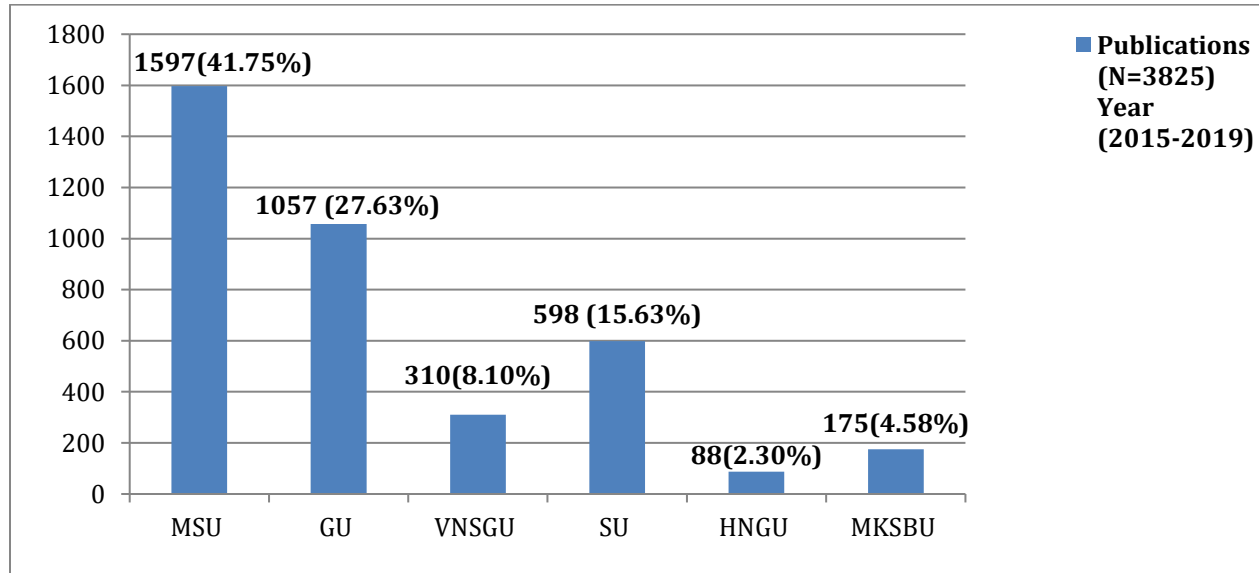
### Scope and limitations of the study

Research productivity of six state government Universities of Gujarat has been assessed in this study, which have been indexed in SCOPUS during 2015 to 2019. These Universities are i.e The Maharaja Sayajirao University of Baroda(MSU), Gujarat University(GU),Veer Narmad South Gujarat University(VNSGU),Saurashtra University(SU), Hemchandracharya North Gujarat University(HNGU) and Maharaja Krishnakumar Sinhji Bhavnagar University(MKSBU).

### Data Analysis and Interpretation

Year	University Name	Publications (N=3825)	Percentage %
2015-2019	MSU	1597	41.75
2015-2019	GU	1057	27.63
2015-2019	SU	598	15.63
2015-2019	VNSGU	310	8.10
2015-2019	MKSBU	175	4.58
2015-2019	HNGU	88	2.30

**Table 1 : University wise total Publications in Five Years**



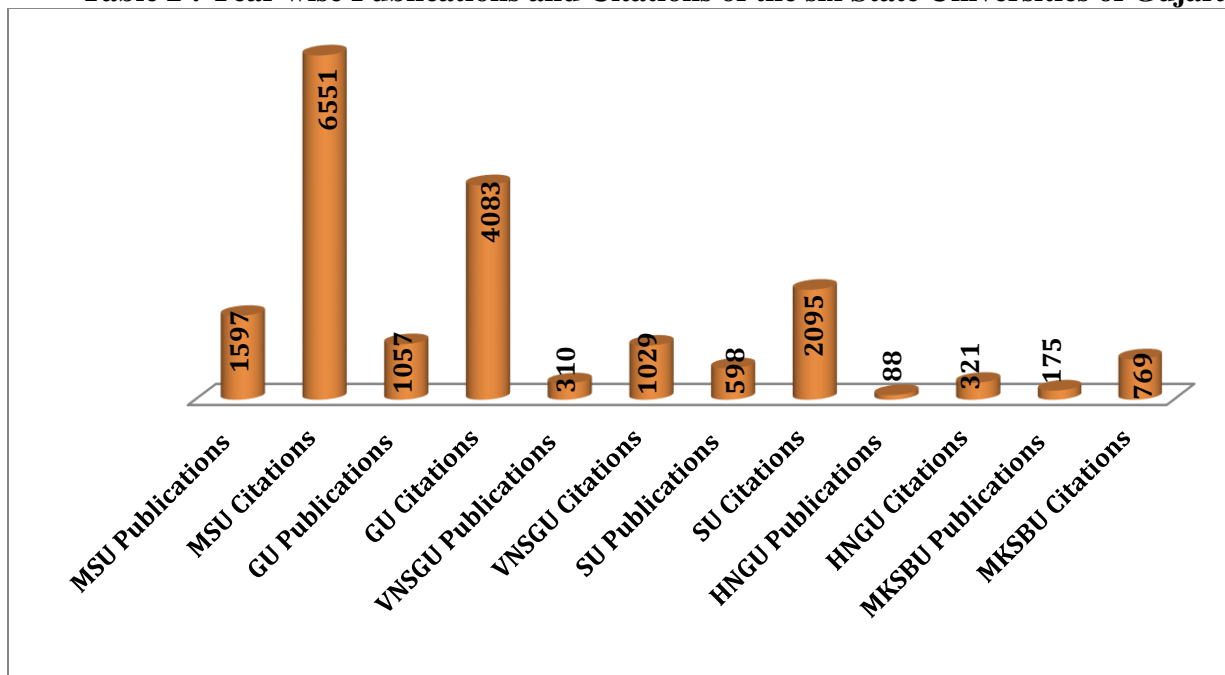
**Figure 1 : University wise total Publications in Five Years**

The above table and figure reveal the university wise of publications by six state universities of Gujarat state during 2015 to 2019. It can be observed that out of total 3825 publications published on the duration of the period of study, utmost 1597 (41.75%) numbers of publications published by MSU- The Maharaja Sayajirao University of Baroda followed by 1057 (27.63%)

numbers of publications published by GU-Gujarat University, 598 (15.63%) numbers of publications published by SU-Saurashtra University,310 (8.10%) numbers of publications published by VNSGU-Veer Narmad South Gujarat University.175(4.58%) numbers of publications published by MKSBU-Maharaja Krishnakumar Sinhji Bhavnagar University,88(2.30%) numbers of publications published by HNGU - Hemchandracharya North Gujarat University

Year	MSU		GU		VNSGU		SU		HNGU		MKSBU	
	(P)	(C)	(P)	(C)	(P)	(C)	(P)	(C)	(P)	(C)	(P)	(C)
2019	313	180	197	111	55	38	90	57	13	2	14	4
2018	336	972	257	425	61	117	110	298	14	22	45	92
2017	307	1324	229	974	54	192	127	391	19	59	34	161
2016	313	1740	213	1446	80	301	130	445	17	32	50	353
2015	328	2335	161	1127	60	381	141	904	25	206	32	159
TOTAL	1597	6551	1057	4083	310	1029	598	2095	88	321	175	769

**Table 2 : Year wise Publications and Citations of the six State Universities of Gujarat**



**Figure 2 : Five Year (2015-2019) Total Publications and Citations of the Universities**

P-Publications, C-Citations

The above mentioned table and figure divulge the year wise allocation of publications with total number of citations of six state universities of Gujarat during 2015 to 2019. Information draw attention to that out of total 3825 publications published for the duration of the period of study, maximum 1597 numbers of publications published by MSU and every year (2015 to 2019) average 300 publications ratio maintained by MSU and also having good number of citations while Gujarat University publications numbers are average 200 in 2018,2017,2016 but less publications are observed in the year 2019. Same way the trend of publications by VNSGU,SU,HNGU,MKSBU are less in the latest year 2019 in compare to the previous years.

Rank	Most Productive Journals/Publication source	Number of publications	Document Type
1	AIP Conference Proceedings	256	Conference Paper
2	Molecular Crystals and Liquid Crystals	131	Article
3	RSC Advances	51	Article, Review
4	Journal of Molecular Liquids	47	Article, Review
5	ChemistrySelect	42	Article
6	Advances in Intelligent Systems and Computing	28	Book Chapter, Conf.Paper
7	International Journal of Biological Macromolecules	25	Article, Review, Erratum
7	Materials Today: Proceedings	25	Conference Paper
7	New Journal of Chemistry	25	Article
8	Arabian Journal of Chemistry	24	Article, Article in Press
9	Biomedical Chromatography	22	Article
9	Synthetic Communications	22	Article, Review
10	Physica B: Condensed Matter	21	Article
11	Current Science	20	Article, Note, Letter
11	Journal of Pharmaceutical Analysis	20	Article
12	AAPS PharmSciTech	19	Article
12	Indian Journal of Chemistry - Section B Organic and Medicinal Chemistry	19	Article
12	Journal of Alloys and Compounds	19	Article, Erratum
12	Physical Chemistry Chemical Physics	19	Article
12	Scientific Reports	19	Article, Erratum
13	Ceramics International	18	Article, Review
13	Genomics Data	18	Article
13	Journal of Heterocyclic Chemistry	18	Article, Review
13	Journal of Materials Science: Materials in Electronics	18	Article
13	Materials Research Express	18	Article

14	Journal of Drug Delivery Science and Technology	17	Article, Review
14	Journal of Molecular Structure	17	Article
15	Colloids and Surfaces A: Physicochemical and Engineering Aspects	16	Article
15	International Journal of Agricultural and Statistical Sciences	16	Article
15	International Journal of Hydrogen Energy	16	Article
15	Journal of Biomolecular Structure and Dynamics	16	Article, Review, Letter
15	Physical Review C	16	Article
16	Journal of Environmental Chemical Engineering	15	Article
16	PLoS ONE	15	Article

**Table : 3 Most Productive Journals/Publication source**

In the present study, preferred type of publication sources are ranked based on their published paper, ranks have been given only up to 16 of 34 publication sources as per the data of number of publications from maximum 256 to minimum 15. There are 564 total publication sources. Table 4 shows the data of most preferred source of publication by authors. It is found that AIP Conference Proceedings ranked number one choice with 256 papers published by the authors. Molecular Crystals and Liquid Crystals ranked second with 131 published papers by authors and RSC Advances ranked third with 51 published papers by the Authors, same as other all the journals and publication source ranked respectively as per the published papers by the authors.

<b>Rank</b>	<b>Preferred Types of publications</b>	<b>Publications (N=3825)</b>	<b>Percentage %</b>
1	Article, Article in Press	2959	77.36
2	Conference Paper	509	13.31
3	Review	153	4.00
4	Book Chapter	126	3.29
5	Erratum	16	0.42
6	Letter	14	0.37
7	Note	13	0.34
8	Editorial writing	11	0.29
8	Book	11	0.29
9	Miscellaneous	6	0.16
10	Data Paper	5	0.13
11	Short Survey	2	0.05

**Table 4 : Preferred Types of publications**



Table 4 elucidates the preferred type of publication by the authors for publications. Out of 3825 publications data, 2959 (77.36%) are Articles, 509 (13.31%) are Conference papers, 153(4%) reviews,126(3.29%) Book Chapters, 16 (0.42%) Erratum,14(0.37%) letters, 13 (0.34%) notes,11(0.29%) Editorial writing and Book. Data papers and short survey are very less percentages preferred for publication.

Rank	Title	Authors	Year	Source Title	Cited Times	University Name
1	Green synthesis of silver nanoparticles from marigold flower and its synergistic antimicrobial potential	Padalia H., Moteriya P., Chanda S.	2015	Arabian Journal of Chemistry	88	SU
1	Bioactive benzofuran derivatives: An insight on lead developments, radioligands and advances of the last decade	Radadiya A., Shah A.	2015	European Journal of Medicinal Chemistry	88	SU
2	Evaluation of biological properties and clinical effectiveness of Aloe vera: A systematic review	Radha M.H., Laxmipriya N.P.	2015	Journal of Traditional and Complementary Medicine	87	MSU
3	Antimonene: A monolayer material for ultraviolet optical nanodevices	Singh D., Gupta S.K., Sonvane Y., Lukašević I.	2016	Journal of Materials Chemistry C	79	GU
4	Adsorptive removal of nickel(II) ions from aqueous environment: A review	Raval N.P., Shah P.U., Shah N.K.	2016	Journal of Environmental Management	76	GU
5	Destruction of azo dyes by anaerobic-aerobic sequential biological treatment: a review	Popli S., Patel U.D.	2015	International Journal of Environmental Science and Technology	73	MSU

6	Polyethylenimine: A versatile, multifunctional non-viral vector for nucleic acid delivery	Pandey A.P., Sawant K.K.	2016	Materials Science and Engineering C	66	MSU
6	Retailer's decision for ordering and credit policies for deteriorating items when a supplier offers order-linked credit period or cash discount	Shah N.H., Cárdenas-Barrán L.E.	2015	Applied Mathematics and Computation	66	GU
7	Recent progress on supported polyoxometalates for biodiesel synthesis via esterification and transesterification	Narkhede N., Singh S., Patel A.	2015	Green Chemistry	65	MSU
8	A new look on factors affecting microbial degradation of petroleum hydrocarbon pollutants	Varjani S.J., Upasani V.N.	2017	International Biodeterioration and Biodegradation	64	GU
8	Distribution, sources and ecological risk assessment of PAHs in historically contaminated surface sediments at Bhavnagar coast, Gujarat, India	Dudhagara D.R., Rajpara R.K., Bhatt J.K., Gosai H.B., Sachaniya B.K., Dave B.P.	2016	Environmental Pollution	64	MKSBU
9	Insulin resistance: an additional risk factor in the pathogenesis of cardiovascular disease in type 2 diabetes	Patel T.P., Rawal K., Bagchi A.K., Akolkar G., Bernardes N., Dias D.S., Gupta S., Singal P.K.	2016	Heart Failure Reviews	61	MSU

10	Critical review on biosurfactant analysis, purification and characterization using rhamnolipid as a model biosurfactant	Varjani S.J., Upasani V.N.	2017	Bioresource Technology	59	GU
11	Biodegradation of petroleum hydrocarbons by oleophilic strain of Pseudomonas aeruginosa NCIM 5514	Varjani S.J., Upasani V.N.	2016	Bioresource Technology	56	GU
12	Synergistic ex-situ biodegradation of crude oil by halotolerant bacterial consortium of indigenous strains isolated from on shore sites of Gujarat, India	Varjani S.J., Rana D.P., Jain A.K., Bateja S., Upasani V.N.	2015	International Biodeterioration and Biodegradation	53	GU
13	Probiotics, prebiotics and colorectal cancer prevention	Ambalam P., Raman M., Purama R.K., Doble M.	2016	Best Practice and Research: Clinical Gastroenterology	51	SU

**Table 5 : Most Cited Publications**

Citations are increasingly used as performance indicators in research policy and within the research system. Usually, citations are assumed to reflect the impact of the research or its quality (Aksnes, Langfeldt & Wouters, 2019). Table 5 listed top 13 papers cited minimum 50 times by researchers. The paper titled “Green synthesis of silver nanoparticles from marigold flower and its synergistic antimicrobial potential” by Padalia H., Moteriya P., Chanda S. published in Arabian Journal of Chemistry and paper entitled “Bioactive benzofuran derivatives: An insight on lead developments, radioligands and advances of the last decade” by Radadiya A., Shah A. published in European Journal of Medicinal Chemistry, both papers are highest cited papers of faculty of Saurashtra University, which have been cited 88 times followed by “Evaluation of biological properties and clinical effectiveness of Aloe vera: A systematic review” by Radha M.H., Laxmipriya N.P., published in Journal of Traditional and Complementary Medicine by faculty of MSU, cited 87 times. Paper entitled “Antimonene: A monolayer material for

ultraviolet optical nano devices” published in Journal of Materials Chemistry C by Gujarat University faculty, cited 79 times, “Adsorptive removal of nickel(II) ions from aqueous environment: A review”, published in Journal of Environmental Management by Gujarat University faculty, cited 76 times. Paper entitled “Destruction of azo dyes by anaerobic and aerobic sequential biological treatment: a review” published in International Journal of Environmental Science and Technology by MSU faculty, cited 73 times. Same way other all the papers have been cited respectively with good number of citations.

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>5 &gt;</b>	<b>Publications (N=3825)</b>
2015	28	180	186	137	89	127	747
2016	24	208	182	144	92	152	802
2017	22	199	167	128	106	148	770
2018	19	192	177	146	105	184	823
2019	20	173	115	129	76	170	683
<b>Total</b>	<b>113</b>	<b>952</b>	<b>827</b>	<b>684</b>	<b>468</b>	<b>781</b>	<b>3825</b>
%	2.95	24.89	21.62	17.88	12.24	20.42	100.00

**Table 6 : Authorship Pattern**

### **Authorship Pattern**

Table 6 explored various authorship patterns. The analysis of data signifies the ascendancy of 2 authored publications contributing utmost publications i.e. 952 (24.89%), followed by 3 authors with 827 (21.62%) publications, 5 > authors with 781 (20.42%) publications, 4 authors with 684(17.88%) publications, 5 authors with 468 (12.24%) publications and only 113 (2.95%) publications contributed by single author.

### **Discussion and conclusion**

The present study highlights a statistical picture of the research outputs of the six old government universities of the Gujarat state.

MSU-The Maharaja Sayajirao University of Baroda found the most prolific university among the six state universities of the study with 1597 (41.75%) numbers of publications. In year wise distribution and citation of publications by universities, analysis revealed that out of total 3825 publications published during the period of study, maximum 1597 numbers of publications published by MSU and every year (2015 to 2019) average 300 publications ratio maintained by

MSU and also having good number of citations while Gujarat University publications numbers are average 200 in 2018,2017,2016 but less publications are observed in the year 2019. Same way the trend of publications by VNSGU,SU,HNGU,MKSBU are less in the latest year 2019 in compare to the previous years.

‘AIP Conference Proceedings’ is recognized as a Most Productive Publication source with 256 of publications followed by Journal Molecular Crystals and Liquid Crystals ranked second with 131 published papers by authors

Article is the majority preferred publication type with 77.36% of total publications which come into views to be fairly expected. “Green synthesis of silver nanoparticles from marigold flower and its synergistic antimicrobial potential” by Padalia H., Moteriya P., Chanda S. published in Arabian Journal of Chemistry and paper entitled “Bioactive benzofuran derivatives: An insight on lead developments, radioligands and advances of the last decade” by Radadiya A., Shah A. published in European Journal of Medicinal Chemistry, both papers are highest cited papers of faculty of Saurashtra University, which have been cited 88 times followed by “Evaluation of biological properties and clinical effectiveness of Aloe vera: A systematic review” by Radha M.H., Laxmipriya N.P., published in Journal of Traditional and Complementary Medicine by faculty of MSU, cited 87 times.

Authorship pattern reflected that collaborative publications are very much preferred by the authors, data shows that the ascendancy of 2 authored publications contributing upmost publications i.e. 952 (24.89%) followed by 3 authors with 827 (21.62%) publications, 5 authors with 781 (20.42%) publications and only 113 (2.95%) publications contributed by solo author.

Research is the key factor for any higher educational institute; especially for Universities. Being the leading institutions of higher education appropriate emphasis on research and publications should be given by the universities. In this study, all the six universities are funded by government and very old universities but there is big gap in their research output and analysis also revealed that research publication trend in few universities are in decreasing manner which are matter of concern for the universities. Universities have to create such a facilities and

platforms to encourage faculty members and research scholars to produce more valued research and publications, not merely to increase publications but qualitative research publication because the purpose of the academicians and academic institutes is to develop themselves to achieve their academic and research goals, support the society and ultimately serve the nation.

### **Acknowledgment**

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