Scientific Productivity of University of Madras : A Scientometric Analysis

Shivanand F. Mulimani
Research Scholar,
Visvesvaraya Technological University,
Belagavi, Karnataka

Shreekant G. Karkun
Librarian,
Basaveshwar Engineering College,
Bagalkot, Karnataka

Abstract

This paper examines and reports the analysis of research performance of faculty & Scientists of University of Madras is based on the Web of Science (WoS) Citation Database for the time period 2008- 2018 for asses & evaluate the research output in this University. During the period of study, it analysed 3633 research publications. It also gives a comparative examines, evaluation, asses, and performance of various types of scientometric study i.e. Subject wise, journal wise distributions, document type, highly prolific authors and language wise, such as number of publications, number of citations and collaboration from India. The research analysis found the there is a significant variation in the growth and deliberation of research output of University of Madras research among the selected countries and Institutions.

Keywords: *Scientometrics Analysis, Scientific Productivity, University of Madras, Web of Science, Institutional Productivity*

Introduction :

The Scientometrics analysis presented here would be useful to make out significant and authentic information and characteristics of publications produced as an outcome performance of research by the faculties. WOS-Web of Science is a wide & major citation database, which facilitate to access to the world's best & quality scholarly literature. University of Madras is one of the best & quality higher education institutes, which cater to the educational needs of the Tamilnadu and southern India. The present study asses, examine and evaluates the research productivity and outcome performance of University of Madras, Chennai based on the data collected and retrieved from Web of Science over a period of ten years from 2008-2018. This study attempts to analyse the overall performance of the faculty members of the Science Departments of University of Madras in research productivity. The norms & parameters such as form-wise, year-wise, subject-wise classification and grouped the published scientific papers, most productive authors & the most preferred and top impact factor journals, etc. are considered for the study. The impact factor and the citation received were also analysed. The result shows that the research productivity of the University of Madras is much recognised at international level.

University of Madras :

The University of Madras, Chennai, Tamilnadu is the oldest and leading state university in India. The University was established in the year 1857. It is a collegiate research university and has 06 campuses in the city like Marina, Chetpta, Chepauka, Guindy, Taramani & Maduravoyal. At presently, more than 233 courses offering under 87 various academic departments classified under nineteen schools, covering different areas & subjects such as basic sciences, social sciences, arts, humanities, management and medicine along with 109 affiliated colleges and 52 approved research centres & institutions. The NAAC has given 05 accreditation to the university. University granted the status of 'University with Potential for Excellence' by UGC.



Methods and Materials :

For this study, the data retrieved from the online multidiscipline database "Web of Science" (WoS) science citation database which is international indexing & abstracting most popular & authentic database. The further necessary data was collected from the SCI-Citation Index and SSCI-Social Science Citation Index and AHCI-Arts, Humanities Citation Index is available through the Web of Science (WoS). The Study period is 2008 – 2018 selected and. a total of 3633 records were found & downloaded. The researcher used term 'University of Madras" was used for retrieving online literature, the collected final data has been grouped and classified using Microsoft Excel for the purpose of asses, analysis and evaluate the retrieved data. Statistical tools such as frequency distribution, percentage analysis were used for this study. Analysis and examine the data on year-wise distribution, subject, domain coverage and organisations which contributed papers were covered.

Literature Review :

There are many scientometrics studies have been done & conducted to assess, examine & evaluated the scientific research productivity of various research institutions and universities. Commonly of these studies depended on multiple databases to measure research outputs of centres, institutions, and universities. The pattern of research outcome of a center, academic institutions or country can be determined by using different types of bibliometric analysis such as their publication growth, research impact, author productivity, citation counts and collaboration pattern, authorship pattern, etc.

Sethi & Maharana (2013) assessed scientific research outcome of Sambalpur University, Jyothivihar, Burala, Orissa, India to evaluate the research outcome of the university from period 2007-2011. The study reveals that Chemistry subject is the most preferred research domain followed by other domain like Physics, Astronomy, Plant science and etc.



Savanur & Konnur (2012) examined the quantitative growth & development of the Bangalore University, Karnataka state in the technology & science domain in terms of publication outcome from the period of 1970-2010. The results present that furnished period 1996-2000 the growth rate of the publications was highest of all the years of the previous publications that are 131.86% publications output. Subsequently, there was a decrease in the growth rate in the 05 blocks of 2001-2005 & 2006 - 2010. Bangalore University has collaborated with twenty seven countries & the United States of America is the highest collaborating country with 74 - (31.09%) of papers followed by France country with 20(8.4%). Authorship & collaboration trend was towards the multi-authored paper. The prolific writers are S. M. Mayanna with 113 papers & N. Rudraiah with 101 papers. P. V. Kamath with 98 papers with the highest h and p values 21 and 26.52, respectively.

Vasishta assessed the significant contribution & impact of research outcome of PEC University of Technology. The research outcome of the PEC was increased with the least annual growth rate of 131.85% period 1996-2009. Growth in the academic research outcome is seen after the P.E.C has granted the status of a deemed university. Collaborative research activities in the university are still very slow, it is just 6.21%.

Kao & Pao(2003) examined the evaluation of research outcome in the management domain for 168 universities in Taiwan city. In addition to the popular indicators of SCI journal publications & citations, projects funded by the NSCT-National Science Council of Taiwan was used to account for the special characteristic of the area of management domain. The results reveal that public universities performed well and better than the private universities so this reason due to more financial aid from the public universities with perfect missions had comparable performance outcome to comprehensive ones.

Prathap & Gupta(2009) assessed the ranking of Indian universities for their research performance based on its scientific outcome. They projected a more logical procedure for ranking the research performance of universities by identifying indicator that combines quality along with quantity.

Sharma & Sevukan(2007) examined the research outcome of biotechnology domain & faculty in central universities of India from the period 1997-2006. They originate that the growth of literature in biotechnology domain has augmented.

Kumar & Dora(2011) conduct the study on the research performance of Indian Institute of Management, Ahmedabad, Gujrat. During the year 1999-2010. The results show & present that the number of paper publications was increased over the years 1999-2010. The authorship pattern shows that increased collaboration among writers at national & international level. Non-collaborative papers mean single author publications are decreased very continuously. Writers are chosen Indian journals & International journals for their paper publication.

Gupta & Dhawan(2003) analysed the features of contry physics publications performance outcome. The study reveals that physics domain related contribution is appreciably high 86% in SCI-Science Citation Index covered journals, of which 26.4 % was in good impact factor scientific journals (IF = 1.5). The physics domain research activity is lead by the number of centres & institutions in India. The academic side, being the biggest of all the sectors in terms of participating centres & institutions, made the much contributions to the physics domain outcome, followed by Research and Development field, industrial sector & government sector. However, the significant share of the academic side in much impact journals was at 2nd rank; the Research and Development sector top in the list.



Research and Development side also exceeds all other fields & sectors in terms of publication outcome per institution.

Objectives of the Study :

- To examine the growth of University of Madras during the period 2008 – 2018
- To identify the document type of the publications in University of Madras
- To examine the Language wise distribution of records in the University of Madras
- To identify the organisations conducting the research in University of Madras
- To identify and analyse the research contribution in the subject field of University of Madras
- To identify the top source titles those, carry the research productions in University of Madras
- To identify the top prolific authors in the University of Madras
- To identify the top 24 collaborative countries.

Data Analysis, Result, and Interpretation :

1. Year Wise Growth Rate of Publications:

This part provides the results after the application of scientometric tools to analyze the outcome. Table-1 indicates the year-wise productivity of University of Madras. The global research output in scientific research has increased 388 in 2009 to 350 in 2008 and 350 in 2017 and 356 in 2018 publications identified.

Table 1. Year Wise Growth Rate of Publications

Years of Publications	TP	TC	ACP	H-index	% of 3633
2018	336	757	2.25	11	9.249
2017	350	1506	4.3	15	9.634
2016	317	2714	8.56	22	8.726
2015	319	4083	12.8	28	8.781
2014	343	4408	12.85	32	9.441
2013	298	5701	19.13	33	8.203
2012	285	4126	14.48	32	7.845
2011	351	4726	13.46	34	9.661
2010	296	6875	23.23	35	8.148
2009	388	5825	15.01	35	10.68
2008	350	6490	18.54	40	9.634

TP: Total Publication, TC:Total Citations, ACP:Average Citations per paper

It could be clearly observed from the table-1 the research output of University of Madras and average citations per papers have produced 3633 papers & received 4721 citations with 9.091 average citations per paper during the period 2008–2018. In the year of 2008 were produced with 350 articles (6490 citations) with 18.54 of average citations per paper and h-index is 40, followed by the year of 2009 produced 388 papers and received 5825 citations with an average of 15.01 and his h-index is 35, in the year of 2018 published 336 publication, 757 citations with h – Index is 11, The table shows that India has contributed the total number of publications on engineering as per the Web of Science database 2008 – 2018. Highest publications (388) were published in 2009 and the lowest publications (285) were published in the year of 2012.

2. Distribution of Publications Based on Document Types:

The publications in University of Madras publications were contributed in different bibliographical forms such as Research article, Reviews, Conference Proceedings papers Editorials Materials, Book Review, Book Chapter, News Item, Letter, etc and the same is shown in Table 2.

Table 2. Distribution of Publications Based on Document Types

Document Types	Records	% of 3633
Article	3443	94.77
Meeting Abstract	62	1.707
Review	57	1.569
Letter	44	1.211
Proceedings Paper	38	1.046
Correction	15	0.413
Editorial Material	7	0.193
Biographical Item	3	0.083
Retracted Publication	2	0.055
Book Review	1	0.028
News Item	1	0.028

Table-2 shows that a maximum number of papers are published in the form of articles i.e. 3443 (94.77%) are published in journals. This followed by Meeting Abstract 62 (1.707%) are published, Reviews 57 (1.569%) are published, Letters 44 (1.211%) are published, Proceedings papers 38 (1.046%), Correction 15 (0.413%) are published, Editorial Material 7 (0.193%) are published, Biographical Item 3 (0.083), Retracted publications 2 (0.55%) are published, Book review 1 (0.028%), News items 1 (0.028%) papers are published. It could be noted that only 1 (0.00%) publication is available in Book review and news items.



3. Language Based Distribution of Publications:

Language is a significant medium to disseminate scientific productivity in any subject area. Therefore, the researcher tried to know the language in which the author preferred to publish. Study.

Table 3. Language Based Publications

Languages	Records	% Of 3633
English	3632	99.972
Portuguese	1	0.028

The table 3 reveals the language-wise distribution of publications, the scientist's researchers from University of Madras research are published in different languages; English, and Portuguese. It is observed from the data that 99.972% of articles published in the English language and 0.028 % articles published in Portuguese language and a very small number of articles are published in remaining languages.

4. Research Output of Major Research Institutions and Universities in India:

Table-4 shows the ranking list of most top 25 highly productive Research centres and institutions in India based on their highest publications, citations, average citations per publication and h-index. As per the web of science citation database Anna University contributed the highest publications i.e. 206 publications, followed by Anna University of Chennai published i.e. 198 (5.45%), Council Of Scientific Industrial Research CSIR published 161 (4.432%), Presidency University Kolkata published 125 (3.441%), Indian Institute Of Technology System It System published 108 (2.973%), Central Leather Research Institute India

published 95 articles and received (22.615%), Indian Institute Of Technology IIT Madras produced 79 (2.175%), Alagappa University produced 61 (1.652%), Bharathidasan University published 60 (1.652%), Madurai Kamaraj University published 59 (1.624%), Srm Institute Of Science Technology produced 50 papers and received (1.376%), Loyola College India produced 48 (1.321%) papers and Pondicherry University published 42 papers (1.156%). The study has identified the most active selective 25 institutions only.

Table 4. Research Output of Major Research Institutions and Universities in India

S.No	Organizations-Enhanced	records	% of 3633
1	Anna University	206	5.67
2	Anna University Chennai	198	5.45
3	Council Of Scientific Industrial Research Csir India	161	4.432
4	Presidency University Kolkata	125	3.441
5	Indian Institute Of Technology System Iit System	108	2.973
6	Central Leather Research Institute India	95	2.615
7	Indian Institute Of Technology IIT Madras	79	2.175
8	Alagappa University	61	1.679
9	Bharathidasan University	60	1.652
10	Madurai Kamaraj University	59	1.624
11	SRM University	56	1.541
12	SRM Institute Of Science Technology	50	1.376
13	Loyola College India	48	1.321
14	Pondicherry University	42	1.156
15	Prist University	41	1.129
16	Annamalai University	40	1.101
17	Bharathiar University	39	1.073



18	Sathyabama Institute Of Science Technology	37	1.018
19	Vellore Institute Of Technology	35	0.963
20	Shanmugha Arts Science Technology Research Academy Sastra	34	0.936
21	Cpcl Polytech College	33	0.908
22	Govt Arts Autonomous College	33	0.908
23	Madras Medical College General Hospital	29	0.798
24	Sri Ramachandra University	29	0.798
25	Indira Gandhi Centre For Atomic Research	28	0.771

5. Sources Wise Distribution of University of Madras Research in India during 2008 – 2018

The data retrieved & collected for the study indicate that from the 3633 publications of the source from various most preferred journals in the field University of Madras Research over the 10 years period.

Table 5. Source Wise Distribution of the University of Madras Research Output

SN	Source Titles	records	% of 3633
1	Acta Crystallographica Section E Structure Reports Online	187	5.147
2	Acta Crystallographica Section E Crystallographic Communications	109	3
3.	Rsc Advances	89	2.45
4	Tetrahedron Letters	57	1.569
5	International Journal Of Biological Macromolecules	48	1.321
6	New Journal Of Chemistry	41	1.129
7	Molecular And Cellular Biochemistry	39	1.073



8	Synthetic Communications	38	1.046
9	Spectrochimica Acta Part: A Molecular & Biomolecular Spectroscopy	37	1.018
10	Journal Of Materials Science Materials In Electronics	34	0.936
11	Journal Of Molecular Structure	33	0.908
12	Chemico Biological Interactions	32	0.881
13	Journal Of Nanoscience And Nanotechnology	28	0.771
14	Biomedicine Pharmacotherapy	25	0.688
15	Colloids And Surfaces B Biointerfaces	25	0.688
16	Materials Science Engineering C Materials For Biological Applications	25	0.688
17	Plos One	23	0.633
18	Marine Pollution Bulletin	22	0.606
19	Synlett	22	0.606
20	Chemistryselect	21	0.578
21	Asian Journal Of Chemistry	20	0.551
22	Environmental Monitoring And Assessment	20	0.551
23	European Journal Of Pharmacology	20	0.551
24	Journal Of Biomolecular Structure Dynamics	20	0.551

Table-5 shows that the total Indian publications output in University of Madras research 93.36 % appeared in Journals. The top 24 most productive journals accounted for ten years. Based on the publications the Acta Crystallographica Section E Structure Reports Online published the highest publications i.e. 187 (5.147%) articles, followed Acta Crystallographica Section E Crystallographic Communications published 109 (3%,) articles , RSC Advances published 89 (2.45%) articles, Tetrahedron Letters published 57 (1.569%) articles, International Journal Of Biological Macromolecules published 48 (1.321%) articles, New



Journal Of Chemistry published 41 (1.129%) papers, Molecular And Cellular Biochemistry published 39 (1.073%) papers, Synthetic Communications published 38 (1.046%) papers, (1.265%), etc. during 2008 – 2018.

6. Subject - Wise Productivity of University of Madras Research Output:

Table 6 indicates the subject-wise productivity of University of Madras research in India. Chemistry with 1049 (28.874%) publications, Biochemistry Molecular Biology with 428 (11.781%) publications, Materials Science 412 (11.34%) publications, Crystallography 365 (10.047%) publications, Physics 342 (9.414%) publications, Pharmacology Pharmacy 334 (9.194%) publications, Science Technology Other Topics 185 (5.092%) Toxicology 3790 (5.092%) publications, Biophysics 140 (3.454%) publications, Environmental Sciences Ecology 139 (3.826%) publications, Engineering 128 (3.523%) publicationsCell Biology 116 (3.193%) publications, Polymer Science 114 (3.138%) publications, Biotechnology Applied Microbiology 110 (3.028%) publications, Mathemetincs 98 (2.2697%) publication, Electrochamistry 83 (2.285%) publications, Microbiology 73 (2.009%) publications, Oncology 69 (1.899%) publications, Endocrinology Metabolism 67 (1.844%) publications, Immunology 65 (1.789%) publications, Neurosciences Neurology 56 (1.541%) publication Research Experimental Medicine 55 (1.514%) publicaions, and others.

Table 6. Subject-Wise Productivity of University of Madras Research Output

S.N	Research Areas	Records	% of 3633
1	Chemistry	1049	28.874
2	Biochemistry Molecular Biology	428	11.781
3	Materials Science	412	11.34
4	Crystallography	365	10.047
5	Physics	342	9.414
6	Pharmacology Pharmacy	334	9.194
7	Science Technology Other Topics	185	5.092
8	Toxicology	175	4.817
9	Biophysics	140	3.854
10	Environmental Sciences Ecology	139	3.826
11	Engineering	128	3.523
12	Cell Biology	116	3.193
13	Polymer Science	114	3.138
14	Biotechnology Applied Microbiology	110	3.028
15	Mathematics	98	2.697
16	Electrochemistry	83	2.285
17	Microbiology	73	2.009
18	Oncology	69	1.899
19	Endocrinology Metabolism	67	1.844
20	Immunology	65	1.789
21	Neurosciences Neurology	56	1.541
22	Research Experimental Medicine	55	1.514
23	Geology	52	1.431
24	Food Science Technology	50	1.376
25	Plant Sciences	49	1.349

7. International Collaboration:

Due to the interdisciplinary & multidisciplinary expansion of subject/ domain, the scientific knowledge is very rapidly-growing. More & more area of specialization in the subject fields is achieved by the faculty/scientists, which is a resulted of the increased contribution of a group of researchers from different subject disciplines and scientific domains. It has been found from previous studies that collaboration in research varies from discipline to discipline & multidisciplinary and for the same discipline from period to period and from one country to another country. Collaborative research has become a well established & orghanised feature in the subject domain of chemical science. It is observed that there is constantly growing development towards collaboration among various branches of chemical science which leads to collaborative authorship in the literature (Chaman, Dharani & Biradar, 2018).

Table 7. Top 24 Collaborative Countries

SN	Countries/Regions	Records	% of 3633
1	USA	175	4.817
2	South Korea	139	3.826
3	Japan	91	2.505
4	Malaysia	61	1.679
5	Saudi Arabia	49	1.349
6	Taiwan	34	0.936
7	South Africa	33	0.908
8	France	28	0.771
9	Germany	26	0.716
10	Peoples R China	25	0.688



11	Singapore	24	0.661
12	Mexico	22	0.606
13	Chile	19	0.523
14	Italy	18	0.495
15	Portugal	18	0.495
16	Canada	17	0.468
17	England	16	0.44
18	Australia	12	0.33
19	Brazil	12	0.33
20	Israel	11	0.303
21	Poland	9	0.248
22	Russia	9	0.248
23	Sweden	8	0.22
24	Austria	7	0.193

Table-7 shows the international collaborative papers of India with top 24 countries during 2008 – 2018. The largest number of collaborative publications 3633 of University of Madras research, followed by the USA contributed 175 papers with 4.817% of total share, South Korea published 139 (3.826%) papers Japan produced 91 (2.505%) papers, Malaysia 61 (1.679%) papers published, Saudi Arabia contributes 49 (1.349%) paper Taiwan published 34 (0.936%) papers South Africa has contributed 33 (0.908%) papers, France produced 28 (0.771%) publications, Germany contributed 26 (0.716%) papers, Peoples of China produced 25 (0.688%) papers, Singapur published 24 (0.661%) papers, Mexico produced 22 (0.606%) papers, Chile published 19 (0.523%) papers, Italy published 18 (0.468%) papers, Portugal published 18 (0.468%) papers, Canada published 17 (0.468%) papers and etc,. Many countries are present with below 1% share with India University of Madras research during 2008 to 2018.

8. Most Prolific Authors in University of Madras Research Output:

According to study highest publications are by Narayanan V ,occupies first rank with 150 articles (4.129%) followed by Velmurugan D published 148 papers, Raghunathan R published 143 papers (3.936%), Mohanakrishnan AK 135 papers (3.716%), Ponnuswamy MN produced 118 papers (3.248%), Rajakumar P published 95articles (2.615%), Stephen A published 83 (2.285%) papers, Bakthadoss M published 65 (1.789%) papers, Suthanthiraraj SA published 59 (1.624) papers, Suresh R published 55 (1.514%) papers, Ramesh P published 54 (1.486%) papers Manivannan V published 52 (1.431%) papers, Ramamurthy P published 51 (1.404%) papers Narayanan S.S. and Pandian K published 50 (1.376%) papers Ravichandran K published 49 (1.349%) papers, Devaraj SN published 48 (1.321%) papers, Arunakaran J and Dhayalan V published 46 (1.266%) papers, Sudhandiran G published 45 (1.211%) papers, Venkateswaran C published 45 (1.239%) papers and Kalaichelvan PT published 44 (0.337%) papers, Balasubramanian S published 42 (1.156%) papers. (Table – 8).

Table 8. Most Prolific Authors in University of Madras Research Output

SN	Authors	Records	% of 3633
1	Narayanan V	150	4.129
2	Velmurugan D	148	4.074
3	Raghunathan R	143	3.936
4	Mohanakrishnan AK	135	3.716
5	Ponnuswamy MN	118	3.248
6	Rajakumar P	95	2.615
7	Stephen A	83	2.285
8	Bakthadoss M	65	1.789
9	Suthanthiraraj SA	59	1.624
10	Balakumar S	55	1.514

11	Suresh R	55	1.514
12	Ramesh P	54	1.486
13	Manivannan V	52	1.431
14	Ramamurthy P	51	1.404
15	Narayanan SS	50	1.376
16	Pandian K	50	1.376
17	Ravichandran K	49	1.349
18	Devaraj SN	48	1.321
19	Arunakaran J	46	1.266
20	Dhayalan V	46	1.266
21	Sudhandiran G	45	1.239
22	Venkateswaran C	45	1.239
23	Kalaichelvan PT	44	1.211
24	Balasubramanian S	42	1.156

Conclusion:

The study critically assessed, evaluated, examined & analyses performance of University of Madras, Chennai, Tamilnadu state. With using publications statistics and different quantitative & qualitative measures. The study suggests the need to increase the pace of University of Madras scientific research & and also improve its research quality and related activities. A detail scientometrics analysis of University of Madras research outcome performance and its comparison with other countries is very important to obtain a clear picture and to take necessary measures to upgrade the research performance. It is important to asses & evaluate the research performance outcome of major research institutes and academic institutes, centres of the country and to compare their performance among themselves and similar institutes of other countries.

This study emphasised the perspective of the research activities at the University of Madras. So for 3633 research publications found in this study period from Web of Science Citation Database. It's found that highest

prolific author founded like, Narayanan V-15 (4.129%) articles, Acta Crystallographica Section E Structure Reports Online is highest sources of study i.e. 187 (5.147%) publications, Highest number of papers published in the subject Chemistry 1049 (28.874%) records, English language is almost recorded founded 3632 (99.972%). It's clear from this study that research productivity increased 2008 – 2009 (350 & 388) publications and decreased 2017 – 2018 (336 – 350) publications.

References:

Upadhye, R. P., Kademani, B.S., Surwase, G. and Vijai Kumar. 2010. Scientometric Dimensions of the Nuclear Physics Division at Bhabha Atomic Research Centre. SRELS Journal of Information Management, Vol. 47, No. 4:437-448.

Angadi, Mallikarjun, Koganuramath, M. M., Kademani, B. S. and Kumbar, B.D. 2006. Publication Productivity of Tata Institute of Social Sciences: A Scientometric study. SRELS journal of Information Management, Vol. 43, No.4:363-374.

Kalyane,V L, Kalyane, S V. 1991. Scientometric dimensions of innovation communication productivity system. Annals of library Science and Documentation. Vol. 38, No.1: 8-29

T Leema, Helen. "Research productivity in Madurai kamaraj university scientometric approach." (2014)

http://webofscience.com

www.unom.ac.in/

https://doaj.org/