

MEASURING THE RESEARCH OUTPUT OF UNIVERSITY OF DELHI 2011-2020: A BIBLIOMETRIC STUDY

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Abstract This article main purpose examine the research output of University of Delhi during the periods 2011 to 2020. To find out the research output of University of Delhi to Scopus database is used to collect research data. This study investigate the most collaborative pattern, Subject wise, open sources research out and highly cited article etc. The Scopus is a major web-based citation database that provides access to the Indian publications across all disciplines published in journals/serials or other documents. The current study evaluated the research productivity of Delhi University based on the data collected from SCOPUS for TEN years from 2011-2020. This study endeavours to analyse the overall performance of the faculty members of the Delhi University in research productivity. During the study, a total of 2 articles were collected from SCOPUS between the 27290 and open access 8957 years 2011-2020. The study endeavours to measure the year-wise distribution of publication output collaborative index, degree of collaboration, collaboration coefficient, modified collaboration coefficient, top-ranked subjects and top-ranked publications based on the collected data. The result of the study indicates that the average research output is 18.93 articles per year. The highest rank publication was medicine with 8095 publications of Delhi University during 2011-2020. The highest rank of Collaboration with National Institute or University Maulana Azad Medical College 2910 Total collaboration.

Keywords: Scientometric, Co-Authorship Index, Collaborative Index, Degree of Collaboration, Collaboration Coefficient, Productive Author, Scopus

INTRODUCTION

The research productivity of the university in the form of research articles in a peer-reviewed journal is being considered as one of the main benchmarks for measuring the performance of the university. The generation and transmission of knowledge through research has long been recognised as an essential requirement for a university to long term growth and competitiveness as well as creating a capacity to solve educational problems, in the present era university play an important role in the generation and dissemination of research and development. Research is the crucial and significant function of any higher education system and faculty members of the higher institutions are encouraging the growth of research by the construction of a research team consisting of junior and senior students. In any educational institution, tacit knowledge is present in the form of published sources for example journal articles, books, research report, course materials, etc. and faculty members, research scholars, decision-makers, administrators share the knowledge.

The University of Delhi, informally known as Delhi University (DU), is a collegiate public central university located in New Delhi, India. It was founded in 1922 by an Act of the Central Legislative Assembly and is recognized as an Institute of Eminence (IoE) by the University Grants Commission (UGC). As a collegiate university, its main

functions are divided between the academic departments of the university and affiliated colleges. Consisting of three colleges, two faculties, and 750 students at its founding, the University of Delhi has since become India's largest institution of higher learning and among the largest in the world. The university has 16 faculties and 86 departments distributed across its North and South campuses. It has 77 affiliated colleges and five other institutes. The Vice President of India serves as the University Chancellor.

LITERATURE REVIEW

Siwach and Parmar (2018) conducted publishing behaviour of researchers of CCS Haryana Agricultural University, Hisar during 2001-2015 with the help of the Scopus database. A total of 2649 articles were calculated and total 15282 citations were receiving. The average publication was 177 per year and an average citation was 5.77 per cent. It was also observed that the publication of five-year slabs was nearly equal numbers in 2001-2005, 2006-2010, and 2011-2015. The Agricultural and Biological Sciences subject was dominating subject with 2038 publications. College of Veterinary Science was the highest collaborative institution with 141 articles and the top ten collaborative institutions are from India. Annals of Biology 325 was the most preferred journal and N. Khetarpaul.

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Department of Food and Nutrition with 63 publications was the most prolific author during the study period. 97.17 per cent publication was with two or more than two authored articles. Three authors' collaboration dominated and the collaboration coefficient was calculated to be 0.668.

Gautam and Mishra (2015) lead a scientometric study of Banaras Hindu University based on Indian Citation Index from 2004 to 2013, a total of 1041 articles were found from ICI. It found that the research productivity was increasing at the average rate of 104.1 publications per years and maximum articles were contributed by joint authors. The most prolific author was A. K. Singh, Department of Physics with 18 articles. Out of 1041 publications, 60 (5.76%) articles have collaborated with 18 different countries of the world. The USA was the highest collaborative country. Indian Agricultural Research Institute (IARI) was the topmost collaborative institute. Journal of Food Science and Technology was the topmost impact factor journal, dominating journal was Current Science with 25 publications and the multi-authorship pattern was dominated in the study. Journal articles contribution was more in comparison to other forms of publications. The most productive author was T.S. Anirudhan from the Department of Chemistry with 114 (10.67%) articles from 2000-2012.

Gopikuttan and Aswathy (2020) evaluated a scientometric study on the publication output of the University of Kerala based on the records collected from the Web of Science database during 2000-2012. It was found that at the early stage of publication was less but it was increasing gradually but there was very ups and down in few years and the year 2011 was the highest publication year which was 126 (11.80%) articles out of 1068 articles during the study period. Maximum articles were published in Indian journals, USA and Netherlands. The collaboration coefficient varied from discipline to discipline and the highest collaboration coefficient was counted in the subject Chemistry (0.37) and the lowest collaboration coefficient was counted in the subject Mathematics (0.22).

Baskaran (2013) analysed a bibliometric study on the research productivity of Alagappa University from 1999-2011 based on the Web of Science database. It found that the growth of the research productivity was increased in the number of the publication. The relative growth rate was in fluctuating trend and doubling time was found in increasing and decreasing trend. Multi-authored articles were more which is 750 (96.64%) and single-authored papers were only 26 (3.35%) from a total of 776 published articles. Degree of collaboration was fluctuating from 0.92 to 0.98 and the mean observed 0.96. South Korea was the most collaborative country with 7.61 per cent articles from total research output. Central Electrochemical Research Institute was the dominating institution with 129 (16.62%) publications and

Material Science with 172 (22.26%) articles was the most dominating subject in the study.

Majhi and Maharana (2012) conducted a scientometric study on the research productivity of Physical Science disciplines at Sambalpur University Orissa during 1971-2010 based on the data collected from the Scopus database. A total of 417 articles were published with 3.48 per capita productivity. It found that the highest 92.35 per cent publication was the multi-authored articles and only 7.65 per cent of articles were single-authored articles which very low in comparison to multi-authored articles during the study period. Chemistry and Physics were highly productivity subjects over the other subjects in Physical Science disciplines. B. K. Mishra Department of Chemistry was the most productivity author in Physical Science and the most preferred journal was Journal of the Indian Chemical Society with 34 articles from the Physical Science disciplines of Sambalpur University during 1971-2010.

Kumbar et al. (2012) analysed the research activity in the University of Mysore in Science and technology based on published data consisting of 1581 articles published by the scientists during 1996-2006. It found that the average growth rate of the publication was 23 per cent per annum. The average citation per paper was found increasing from 1.53 in 1996 to 2.62 in 2003. Chemistry, Physics, and astronomy were the top three most dominating research areas, and Chemical Engineering, Energy and Molecular Biology were emerging areas of research. The university has only 14 per cent international collaboration and the USA (51%) was the largest collaborative country during the study period. The most productive author was H. S. Yathirajan department of Chemistry with 41 articles from a total of 139 articles of Chemistry.

Nafukho et al. (2019) examine the research productivity of faculty in selected two leading public universities in Kenya and showed that the research growth varied by gender, institution, terminal degree, work experience, rank, etc. It was found that experienced faculty were not productive but research students were more productive in comparison to experienced faculty members in the study. Currently in Kenyan public universities enhance research productivity to achieve their vision, mission, and goals.

Bapte and Gedam (2018) analysed the scientometric profile of Sand Baba Amravati University during 1996-2017 from the SCOPUS database. It was found that a total of 1130 with 10.65 per cent average citation per paper published. 20.08 per cent publication was with international collaboration, the university had the largest collaboration with Brazil (69) and United States (21) and the highest H-index was count (17) in the year 2009. Collaborative authors pattern was received maximum (89.17%) citation in the study. Degree of collaboration was 0.96 while the average modified

collaboration coefficient was 0.62 and the journal article was the most popular source for research expression. Mahendra Rai was the most productive author and the maximum article was published in the domain of Physics and Astronomy in the study.

Mondal et al., (2019) evaluated the publication output of the scientist of Indian Association for the Cultivation of Science during 2008-2017 based on the Web of Science database. A total of 4304 articles included 22.58 per cent of international collaboration found in the study. It found that the majority of articles was produced by three authored and maximum citation received by international collaboration articles. The most favoured countries was USA, Japan, Germany, and England by the scientists and Journal of Physical Chemistry C with an average impact factor 3.798 was given the highest articles in the study. Examine the scattering of journals and articles Pareto's 80/20 principle was applied in the study.

OBJECTIVES

The objectives of the study are to:

- Examine the year wise publication and open access publication of University of Delhi during 2011-2020.
- Find out the Top 10 Journals wise publication during 2011-2020.
- Examine the Documents wise publication.
- Find out the Subject wise Publication.
- Find out the Collaboration with national, International Institute or University.
- Find out Top 10 Country wise Collaboration and Article Cite.

ANALYSIS

Table 1: Year Wise Publication of University of Delhi

Year	Total Publication	Open Access Pub.	Percentage Publication	Percentage Open Access Publication
2011	2232	613	8.17	6.8
2012	2433	759	8.9	8.8

Year	Total Publication	Open Access Pub.	Percentage Publication	Percentage Open Access Publication
2013	2453	725	8.95	8
2014	2680	918	9.82	10.24
2015	2626	871	9.6	9.71
2016	2723	965	9.97	10.7
2017	2925	1034	10.71	11.54
2018	2971	925	10.88	10.32
2019	2956	986	10.83	11
2020	3291	1161	12.05	12.96
2011-2020	27290	8957		100%

Data collected on 15/10/2021 in Scopus data base.

Table 1 Year-wise research output of University of Delhi was given in Fig. 1. A total, 27290 publications were published during the study. It is seen that only 3291 publication published in the year 2020 from the university. During 2011-2020, a maximum number of articles were included in i.e. 3291 (12.05%) followed the year 2020 with 12.96 (11.61%) open access publication publications and year 2011 with 2232 (8.17%) articles published during the period of study. Hence the highest publication came in the year 2015 and the lowest publication was in the year 2011.

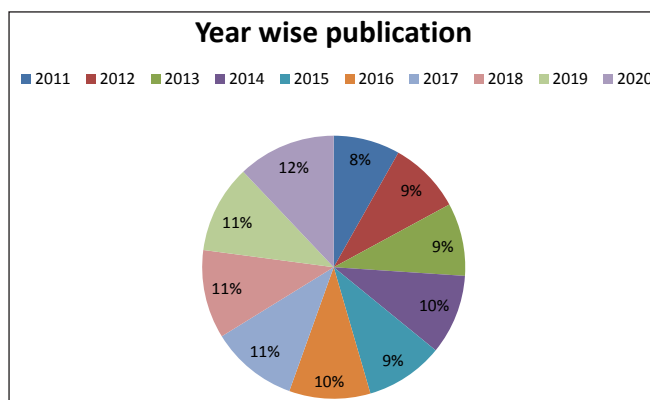


Fig. 1

Table 2: Top 10 Journals Wise Publication during 2011-2020

Name of Source	Total Publication	Total Citation	H-Index	Publication Minimum 1 Citation	Impact Factor
Journal of High Energy Physics	364	12618	58	360	5.875
Indian Pediatrics	348	2126	21	243	1.411
Economic and Political Weekly	324	1057	14	172	0.22
Journal of Clinical And Diagnostic Research	308	1230	12	235	0.638
Physics Letters Section B Nuclear Elementary Particle And High Energy Physics	278	19251	62	277	8.615
Indian Journal of Pediatrics	243	1110	15	187	1.967
Rsc Advances	230	4224	32	227	3.267
Plos One	212	5195	39	209	2.740
Aip Conference Proceedings	201	190	6	84	0.415
Physical Review Letters	180	10383	59	179	9.161

Table 2 represents the top ten ranked publication name which published most of the articles contributed by the authors of Delhi University. From the observation of a particular table, it has been found that Journal Of High Energy Physics was a top-ranked selected journal for publication of articles with 16 (6.04%) articles during the study period. followed by Indian Pediatrics and Economic and Political Weekly with 10 (3.77%) articles each publication consuming 2nd and 3rd rank respectively. It has been also found that three publications Environment and Ecology, The Indian Forester, Journal of the Paleontological Society of India with 8 (3.02%) articles and next three publications Indian Journal of Tropical Biodiversity, Journal of Geological Society of India, and Journal of Tropical Forestry 6 (2.26%) articles each. While Asian Journal of Chemistry with 7 (2.64 %) articles taking 7th rank during the study period.

The above table shows the Journal of High Energy Physics with highest number of name of sources and top citation.

Table 3: Documents Wise Publication

Documents Type	Publication	Percentage
Article	20037	73.4
Conference Paper	1987	7.2
Review	1651	6.19
Book Chapter	1535	5.6
Letter	990	3.6
Note	361	1.3
Editorial	350	1.2
Book	197	0.7
Erratum	111	0.40
Short Survey	46	0.16
Data Paper	12	0.040
Retracted	6	0.021
Undefined	7	0.025
Total	27290	100

Table 3 represents the type of document wise publication during the period of study. After observation Table 6, it has been found that the highest 20037 (86.79%) records were research articles, followed by Conference paper with 1987 (6.04%) records, Review with 1651 (3.02%) records, Book Chapter with 1535 (1.51%) records, Letter and Note with 990 (1.13%) and 361 records both an Editorial with 350 (0.38%) record. This shows that the maximum contribution was researched articles contributed by the authors of Delhi University with 86.79 per cent articles. Research articles were the priority of the authors other were very few in the comparison of research articles which was only 13.21 per cent.

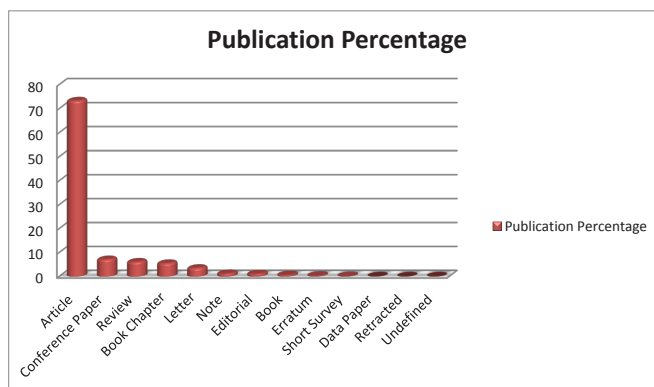


Fig. 2

Above Graph shows the Article publication top rank publication than during the periods 2011-2020 University of Delhi.

Table 4: Subject Wise

Subject	Total Number of Publication
Medicine	8095
Physics and Astronomy	4658
Biochemistry, Genetics and Molecular Biology	3753
Chemistry	3053
Engineering	2865
Engineering	2515
Social Sciences	2406
Computer Science	1962
Mathematics	1835
Agricultural and Biological Sciences	1754
Pharmacology, Toxicology and Pharmaceutics	1333
Chemical Engineering	1313
Environmental Science	1172
Immunology and Microbiology	1046
Economics, Econometrics and Finance	1041
Business, Management and Accounting	894
Arts and Humanities	725
Earth and Planetary Sciences	716
Multidisciplinary	585
Energy	542
Decision Sciences	427
Neuroscience	360
Psychology	303
Dentistry	295
Health Professions	167
Nursing	152
Veterinary	54

Table 4 represents the subject wise document contributed by the authors of Delhi University during the period of study. After observation Table 6, it has been found that the highest 8095 (86.79%) records were research articles, followed by short communication with 16 (6.04%) records, editorial with 8 (3.02%) records, research note with 4 (1.51%) records, case study and review articles with 3 (1.13%) records both an opinion paper with 1 (0.38%) record. This shows that the maximum contribution was researched articles contributed by the authors of Delhi University with 86.79 per cent articles. Research articles were the priority of the authors other were very few in the comparison of research articles which was only 13.21 per cent.

Top 5: Collaboration with National Institute or University

Institute/University	Total Number of Collaboration
Maulana Azad Medical College	2910
University College of Medical Sciences	2477
Lady Hardinge Medical College	2034
Guru Teg Bahadur Hospital	1849
Punjab University	1322
Tata Institute of Fundamental Research, Mumbai	1208

Table 5 represents the Collaboration with national institute or university wise document contributed by the National Institute and university during the period of study. After observation Table 5, it has been found that the highest Maulana Azad medical college top rank in collaboration 2910 (86.79%) records were research articles, followed by University college of medical sciences with 2477 (6.04%) records, Lady Hardinge medical college with 2034 (3.02%) records, Guru Teg Badadur hospital with 1849 (1.51%) records, Punjab university and TMC Mumbai institution with 1322 (1.13%) and 1208 collaboration found.

Table 6: Top 10 Collaboration with International Institute or University

Name of Foreign University	Collaboration
Imperial College London	1199
Korea University	1196
Rheinisch-Westfälische Technische Hochschule Aachen	1194
Northwestern University	1185
University of Virginia	1182
Joint Institute for Nuclear Research, Dubna	1180
University of Mississippi	1177
Fermi National Accelerator Laboratory	1177
Uniklinik RWTH Aachen	1174
University at Buffalo, The State University of New York	1174

Table 6 represents the Collaboration with national institute or university wise document contributed by the National Institute and university during the period of study. After observation Table 6, it has been found that the highest

Imperial college London top rank in collaboration 1199 (86.79%) records were research articles, followed by Korea University with 1196 (6.04%) records, Rheinisch-Westfälische Technische Hochschule Aachen with 2034 (3.02%) records Northwestern University with 1849 (1.51%) records, University of Virginia and Joint Institute for Nuclear Research, Dubna with 1322 (1.13%) and 1208 collaboration found. Uniklinik RWTH Aachen and University at Buffalo, The State University of New York 1174 (2.50).

Table 7: Top 10 Country Wise Collaboration

Country Name	Publication	Citation	H-Index	Publication Minimum 1 Citation
United States	2892	127119	137	2670
United Kingdom	1779	104033	129	1673

Country Name	Publication	Citation	H-Index	Publication Minimum 1 Citation
Germany	1681	98468	124	1596
China	1479	93970	121	1422
South Korea	1472	92027	119	1425
France	1432	92341	121	1392
Italy	1331	89674	120	1267
Spain	1323	92161	122	1290
Russian Federation	1320	97989	119	1289
Brazil	1300	87114	118	1273
Total	16009			

Table 7 the top 10 Country wise Collaboration USA 2892 was top ranked in top 10 country and second rank found the United Kingdom 1779, third rank 1681 collaboration Germany, 4th rank china 1479, 5th rank contribution south Korea 1472 and 6th rank France 1432.

Table 8: Top 10 Cited Paper

Paper Name	Author	Year	Journal	Citation	Journal Impact Factor
Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC	Chatrchyan, S., Khachatryan, V., Sirunyan, A.M., (...), Swanson, J., Wenman, D.	2012	Physics Letters, Section B	6344	4.384
Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015	Vos, T., Allen, C., Arora, M., (...), Zeeb, H., Zuhlke, L.J.	2016	The Lancet	3417	79.321
Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015	Wang, H., Naghavi, M., Allen, C., (...), Zonies, D., Zuhlke, L.J.	2016	The Lancet	3231	79.321
Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016	Vos, T., Abajobir, A.A., Abbafati, C., (...), Zuhlke, L.J., Murray, C.J.L.	2017	The Lancet	2769	79.321
Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: A systematic analysis for the Global Burden of Disease Study 2016	Naghavi, M., Abajobir, A.A., Abbafati, C., (...), Lopez, A.D., Murray, C.J.L.	2017	The Lancet	2167	79.321
The tomato genome sequence provides insights into fleshy fruit evolution	Sato, S., Tabata, S., Hirakawa, H., (...), Riddle, C., Gianese, G.	2012	Nature	1903	49.962
Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016	Gakidou, E., Afshin, A., Abajobir, A.A., (...), Lim, S.S., Murray, C.J.L.	2017	The Lancet	1252	79.321

Paper Name	Author	Year	Journal	Citation	Journal Impact Factor
Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015	Kassebaum, N.J., Arora, M., Barber, R.M., (...), Zeeb, H., Zuhlke, L.J.	2016	The Lancet	1172	79.321
Shifting the limits in wheat research and breeding using a fully annotated reference genome	Appels, R., Eversole, K., Feuillet, C., (...), Tong, W., Wang, L.	2018	Science	1078	41.845
A chromosome-based draft sequence of the hexaploid bread wheat (<i>Triticum aestivum</i>) genome	Lukaszewski, A.J., Alberti, A., Sharpe, A., (...), Ogiwara, Y., Dubska, Z.	2014	Science	1016	41.845

Table 8 represents the Top 10 Cited paper in this study. We found that Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC (6344) top cited paper in research output of University of Delhi during this periods 2011-2020. And 2nd position Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: A systematic analysis for the Global Burden of Disease Study 2015 (3417) Cited. Third rank is Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: A systematic analysis for the Global Burden of Disease Study 2015 (3221) Cited. And Ten rank A chromosome-based draft sequence of the hexaploid bread wheat (*Triticum aestivum*) genome 2014 (1016) Cited.

CONCLUSION

The current study attempted to examine the publication trends of Delhi University based on the SCOPUS. The result of the current study has directed A total, 27290 publications were published during the study. It is seen that only 3291 publication published in the year 2020 from the university. During 2011-2020, a maximum number of articles were included in ICI i.e. 3291 (12.05%) followed the year 2020 with 12.96 (11.61%) open access publication publications and year 2011 with 2232 (8.17%) articles published during the period of study. Hence the highest publication came in the year 2015 and the lowest publication was in the year 2011 represents the top ten ranked publication name which published most of the articles contributed by the authors of Delhi University. From the observation of a particular table, it has been found that Journal of High Energy Physics was a top-ranked selected journal for publication of articles with 16 (6.04%) articles during the study period followed by Indian Pediatrics and Economic and Political Weekly with 10 (3.77%) articles each publication consuming 2nd and 3rd rank respectively. It has been also found that three publications Environment and Ecology, The Indian Forester, Journal of the Paleontological Society of India with 8 (3.02%) articles and next three publications Indian Journal of Tropical Biodiversity, Journal of Geological Society of India, and

Journal of Tropical Forestry 6 (2.26%) articles each. While Asian Journal of Chemistry with 7 (2.64%) articles taking 7th rank during the study period. Journal of High Energy Physics highest number of name of sources and top citation and mass of 125 GeV with the CMS experiment at the LHC (6344) top cited paper in research output of University of Delhi during this periods 2011-2020.

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