

Mapping the Research Productivity of Top Nirf-ranked Universities in Delhi



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ABSTRACT: This study investigates the research productivity of prominent Delhi-based universities ranked in the National Institutional Ranking Framework (NIRF) 2023, utilizing scientometric and bibliometric techniques to assess various dimensions of academic output. By analyzing published literature from Delhi Technological University, Jamia Hamdard, Jamia Millia Islamia, Jawaharlal Nehru University, and the University of Delhi, collected from the Scopus database over the last five years (2019-2023), we aim to understand publication patterns, collaborative performance, and citations, productivity and efficiency by applying bibliometric and econometric indicators. Data was processed using Microsoft Excel, with visual representations generated via VOSviewer software. Additionally, faculty size, annual expenditure, and other relevant scores were obtained from NIRF 2023.

While Delhi Technological University excels in publication growth (CAGR 26.02%), it faces low citation rates. On the other hand, Jamia Millia Islamia is in fourth place in growth rate and leads in impactful research output with a CPP of 13.31 and an h-index of 111. More than 70% of the papers gained citations irrespective of the university. Per capita and per crore spending exergy reveal that increased spending or a larger faculty size does not correlate with enhanced efficiency. Notably, the econometric results derived from NIRF scores do not accurately represent the efficiency and productivity of the universities. The universities have adopted the open access initiative to varying extents for publishing their research papers. Except for Jawaharlal Nehru University, all other universities have high author collaboration rates, with more than 90% of the works being collaborative. The key terms like "synthesis," "covid," "property," and "control" appear across multiple universities, indicating common research themes and a collaborative focus on specific areas of study across multiple institutions. Computer science is a focal area across several institutions; engineering fields show substantial collaboration, and chemistry, physics, and astronomy demonstrate moderate inter-institutional collaboration. Medicine is a prominent collaborative subject, especially at Jamia Hamdard.

Keywords: Inclusive And Equitable Access, Academic Libraries, Democracies, E-Governance, Open Access, Open Data, Open Educational Resources

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1. Introduction

The global academic competition has prompted educational institutions worldwide to adopt diverse strategies for enhanced performance (Cakir et al., 2015). Notably, Asian universities have made significant strides in global rankings over recent decades (Zeng, 2024), driven by various evaluative parameters such as teaching quality, learning resources, professional practice, outreach and inclusivity, stakeholder perceptions, research output, citations, international outlook, student and faculty ratio, academic reputation, employer reputation, etc. Research has emerged as a fundamental component of university operations, with institutions leveraging their established infrastructure to foster knowledge creation and address diverse societal needs. As universities have engaged in research for over a century, their role remains pivotal in advancing academic research and innovation globally.

Technological innovation and knowledge generation are pivotal to economic success, enabling regions to enhance productivity and improve living standards (Broughel and Thierer, 2019; Khan, 2023). The future of science, technology, and innovation will significantly influence the resolution of critical global challenges, such as survival, freedom from fear, and the alleviation of poverty (Vessuri, 2008). National economic growth is closely linked to the volume of research conducted and the corresponding research publications, which also play a key role in ranking higher education institutions (Deka and Sarmah, 2021). Consequently, governments, universities, and funding bodies allocate substantial resources to research endeavours. Continuous assessment of research productivity in higher education institutions and research centres is imperative for optimizing financial resources and enhancing the research landscape (Franceschini and Maisano, 2011; Ponomarev and Boardman, 2010). Scientometric studies are essential for evaluating research effectiveness, thereby facilitating resource allocation and supporting underperforming centres (Yazdani et al., 2015).

2. Related Works

Bibliometric and scientometric studies serve as critical tools for assessing the scientific output of institutions, disciplines, and journals, focusing on various aspects such as publication patterns, collaborative research, and citation analysis (Mitchel, Rose, & Asare, 2020). Highlighting the need for a comprehensive national assessment of research productivity, Khanali, Malekpour, and Kolahi (2023) emphasize the importance of increased research and development funding, support for underperforming research institutions, and enhancement of cross-border collaborations in Iran. In a comparative analysis, Nadi-Ravandi and Batooli (2022) found that Iranian researchers surpassed their Turkish counterparts across several metrics, underscoring the region's dynamic landscape of research output.

Various databases, including Web of Science, Scopus, PubMed, Dimensions, and Lens, facilitate scientometric studies by providing essential data. Many countries, including India, have initiated the development of national databases to maintain their own research data, as exemplified by the Indian Science Reports. Singh et al. (2023) analyzed Science and Technology Innovation data from this repository. An evaluative study by Krishnan et al. (2023) on the research outputs of 19 animal science research institutions under the Indian Council of Agricultural Research (ICAR) highlighted the prevalence of multi-authorship, with significant collaboration from the USA. In Latin America, Tocora, Gracia-Ramos, and Forero (2024) found that most collaborative papers emerged from the USA and Europe, with highly cited publications being predominantly open access. Moreover, Valentine and Williams (2024) compared research outputs in engineering education across European countries, revealing that Spain and the UK excelled in this field, while France, Germany, and Italy led in general engineering and science research. Finally, Thelwall and Maflihi (2022) explored co-authorship trends over two decades using Scopus data, indicating a continuous increase in the average number of authors per paper.

In recent years, several scientometric studies have been conducted across India to evaluate the research performance of higher educational institutions. For instance, Maurya et al. (2018) analyzed the research outputs of Mizoram University, revealing that approximately 93% of its publications were journal articles, with a notable emphasis on papers in the *Current Science Journal*. Similarly, Bapte and Gedam (2018) found that 21% of Sant Gadge Baba Amravati University's publications involved international collaboration, which correlated with higher citation rates. Patel (2019) highlighted a 2.14-fold growth in research output from Gujarat University over a decade, recommending increased international partnerships. Keshava (2020) noted a rising trend in paper production at Tumkur University, while Gnanasekaran (2021) indicated that 98.4% of Kalasalingam Academy of Research and Education's papers were produced in collaboration, with 25% receiving funding. Mamdapur (2021) at Karnatak University further corroborates the trend of rising research output, identifying the U.S. and South Korea as primary collaborators. Mahala and Singh (2021) also analyzed the science publications of five prominent Indian universities, confirming continuous growth between 2015 and 2019. Research by Mondal (2022) on the Indian Institutes of Science Education and Research showed that 18.52% of papers were produced collaboratively. Nishavathi and

Jeyshankar (2022) reported that Alagappa University achieved 99.45% of its research through collaborations, with 88.45% of these being international. Sokolova et al. (2023) categorized Ural State University's faculty research using advanced data mining technologies, illustrating the importance of structured analysis. Akbar, Arif, and Rafiq (2024) examined the Pakistan Agricultural Research Council, revealing a dominance of internal collaboration.

Research gap and new avenues for research

While most studies seem to focus on specific fields and comparing research output between countries, there is a notable absence of comparative analysis of research patterns among the top universities in specific regions, such as Delhi, that indicates a need for focused studies on regional research performance. The studies focus on research output and research quality based on citations and h-index, and there is a need to assess the balance between the number of research outputs and their quality to gain a comprehensive understanding by employing a broader range of indicators. The influence of open-access journals on citation rates and overall research impact is mentioned but not deeply analysed. While some studies provide insights into trends over several years, the study could be conducted to assess productivity and efficiency based on input to outcome indicators, exploring how faculty strength and budget influence research productivity. The co-authorship linkages need to be studied to analyse the collaboration networks that could yield insights into the dynamics of research partnerships. Also, the institutions' subject excellence and collaboration profile need to be addressed.

By addressing these gaps and exploring new avenues, future research can contribute significantly to understanding and enhancing the landscape of scientific inquiry.

3. Objectives

The primary objective of this study is to analyze the publication patterns of universities in Delhi over the period from 2019 to 2023. By examining various metrics, the research aims to quantify the growth rate of academic publications, assess overall productivity and efficiency, and evaluate research quality. Additionally, the study will explore authorship collaboration and co-authorship linkages, which are critical for identifying potential networking and collaborative opportunities for future research endeavours. It will also investigate the adoption of open-access publishing practices and shifting trends, pinpoint gaps and opportunities for improvement based on the usage of key terms, and create a comprehensive mapping of subject excellence and collaboration profiles within the university landscape. This multifaceted approach aspires to enhance the understanding of academic output and foster a more connected and productive research environment in Delhi.

4. Methodology

Many databases provide bibliographic details of research publications, including Scopus, Web of Science, Lens, Dimensions, PubMed, Indian Science Abstracts, etc. This study uses the Scopus database to analyze the bibliographic details of research publications from selected universities in Delhi over the past five years (2019-2023). Following the introduction of the National Institutional Ranking Framework (NIRF) in India, there has been a marked increase in research output among higher educational institutions (Deka and Sarmah, 2021). Hence, the selection process for participant universities involved a two-phase methodology: initially, seven institutions were identified from the NIRF 2023 ranking, and subsequently, verification against University Grants Commission (UGC) records resulted in the exclusion of the Indian Institute of Technology Delhi and All India Institute of Medical Sciences, Delhi since they were not listed under the university category by UGC (UGC, 2024). The final selection comprised five institutions: Delhi Technological University (DTU), Jamia Hamdard (JH), Jamia Millia Islamia (JMI), Jawaharlal Nehru University (JNU), and University of Delhi (DU). Data were extracted in CSV format and analyzed using MS Excel, while VOSviewer software facilitated the visualization of co-authorship networks and term occurrence maps, as recommended by Romero-Duque and Anzola Montero (2023).

5. Results and Discussion

Table 1 outlines the characteristics of five universities, including one state university, one deemed university, and three central universities. Notably, DTU, JMI, and the DU were established prior to India's independence.

Table 2 provides the details of the universities that are involved in the NIRF. Regarding the NIRF, the central universities rank highest, followed by the state and deemed universities. JH, which is the youngest of the group and a deemed university, occupies the lowest position at rank 49, reflecting its comparatively limited faculty and research scholar strength. The disparity in the faculty-to-research scholar ratio among these institutions is significant. The annual expenditure of universities, with the exception of DU, demonstrates a correlation with their NIRF rankings. DU's higher financial outlay does not appear to align with its ranking, indicating that factors beyond financial investment may influence academic standing. This anomaly suggests a need for further investigation into the determinants of university performance and their interplay with fiscal resources.

Table 1. Details of Universities on the UGC Website

University	Year of Estd.	Type	UGC Status
DTU	1941	State University	2(f) & 12(B)
JH	1989	Deemed to be University (Institute of Eminence)	Sect. III & 12(B)
JMI	1920	Central University	2(f) & 12(B)
JNU	1969	Central University	2(f) & 12(B)
DU	1922	Central University	2(f) & 12(B)

Table 2. Details of Universities in NIRF Ranking

University	NIRF Ranking (University)	Faculty Strength	Research Scholars	Faculty Strength	Faculty Strength	Faculty Strength	Faculty Strength
DTU	40	901	1417	1.57	164	26.04	741.90
JH	49	531	816	1.54	315	70.70	619.01
JMI	3	738	1512	2.05	520	192.39	1560.80
JNU	2	598	3845	6.43	907	81.07	1774.76
DU	11	1226	3702	3.02	1328	161.54	3030.09
Total		3994	11292	2.83	3234	531.74	7726.56

Publication Growth

Table 3 presents the publication production data of various universities over the past five years, revealing a consistent annual increase with a compound annual growth rate (CAGR) of 13%. While the DU ranked highest in total publications, it was outperformed in growth rate by DTU, leading to substantial increases. JH, although the least producer, demonstrated a noteworthy 15.66% CAGR, securing the second position in the growth rate. Conversely, JH and JNU experienced a slight decrease in publications in 2023. This trend suggests that publication output may be more closely tied to the number of faculty members rather than the size of research scholar cohorts or the extent of sponsored projects.

Citations and Research Quality

Overall, 74.24% of the papers examined were cited at least once, with more than 70% receiving an average of 10.56 citations each, regardless of the institution. JMI achieved a commendable average of 13.31 citations per paper and an h-index of 111, highlighting its significant impact on the academic community. Table 4 depicts the values of different metrics.

The analysis indicates a mixed performance in research output between older and younger universities, with older institutions outperforming their younger counterparts. The h-index, introduced by Hirsch in 2005, is a widely acknowledged metric for assessing the quantity and citation impact of researchers' publications. However, its reliance on the number of papers over their citation prominence suggests a bias towards institutions with a longer history. To address this limitation, Egghe

Table 3. Growth of publications

University	Publication Count						
	2019	2020	2021	2022	2023	Total	CAGR
DTU	803	1179	1725	1911	2025	7643	0.2602
JH	494	690	743	953	885	3765	0.1566
JMI	1227	1423	1584	1736	1783	7753	0.0979
JNU	1277	1364	1429	1603	1557	7230	0.0508
DU	2428	2710	3328	3607	3906	15979	0.1262
Total	6229	7366	8809	9810	10156	42370	0.1300

Table 4. Citations and Research Quality based on Scientometric indicators

University	Cited Pub	Citations	CPP	h-index	g-index	hg-index	p-index
DTU	5428 (71.02%)	73088	9.56	86	170	120.91	99.47
JH	3074 (81.85%)	47981	12.74	76	116	93.89	90.81
JMI	6049 (78.02%)	103180	13.31	111	172	138.17	120.74
JNU	5168 (71.48%)	76088	10.52	86	172	121.62	103.86
DU	11736 (73.45%)	147188	9.21	107	172	135.66	122.67
Total	31455 (74.24%)	447525	10.56	157	270	205.89	179.69

developed the g-index in 2006, the number of top articles (g) that gain together at least g^2 citations, which places greater emphasis on highly cited works but does not account for the total number of publications and citations over time. The hg-index was subsequently proposed as a geometric mean of the h and g indices to merge their strengths while mitigating their weaknesses. Despite variations in the values of these metrics, the overall university rankings derived from each index are the same, indicating that the differences in research impact may not be as pronounced as suggested by individual metrics.

Quantity-Quality Mapping

A comparative evaluation of university research performance was conducted utilizing the Exergy (X) indicator, as proposed by Prathap (2011). This analysis employed total publication count as a quantitative proxy and the best paper rate (BPR) as a qualitative proxy to assess the universities' performance in the quantity-quality spectrum. The BPR, defined as 10% of the most cited publications or 1% of total cited papers, is a field-normalized, size-independent metric. The Exergy indicator was derived from these measurements, calculated as $X = i^2P$, where 'i' is the BPR adjusted for scale. The findings indicate that DU exhibited a superior performance, achieving the highest Exergy value, followed by JMI, DTU, JNU, and JH. This ranking effectively reflects the universities' research output.

The universities' faculty strength and overall expenditure data were sourced from the NIRF and analyzed in conjunction with the Exergy indicator to assess efficiency and productivity. Consequently, econometric measures such as per capita exergy (X/F) and per crore spending exergy (X/S) were computed, as detailed in Table 5. The findings indicate that increased spending or a larger faculty size does not correlate with enhanced efficiency. Notably, aside from DU, the econometric results derived from NIRF scores do not accurately represent the efficiency and productivity of the other four universities examined.

Table 5. Bibliometric and Econometric Indicators for Quantity-Quality Mapping

University	Total Publication	Best Paper Rate	Exergy (X)	Spent per Faculty (S/F)	Spent per Faculty (S/F)	Spent per Faculty (S/F)
DTU	7643	54.28	225187.12	0.823	249.93	303.53
JH	3765	30.74	35577.28	1.166	67.00	57.47
JMI	7753	60.49	283685.38	2.115	384.40	181.76
JNU	7230	51.68	193100.46	2.968	322.91	108.80
DU	15979	117.36	2200846.73	2.472	1795.14	726.33

Adoption to Open Access

The analysis reveals the varying degrees of commitment to open-access publishing across different universities, with implications for research visibility and accessibility. All five universities have adopted the open access initiative to varying extents for publishing their research papers, reflecting a commitment to enhancing the visibility of academic research. According to Table 6, these institutions collectively published 29.11% of their papers in an open-access format. Notably, DTU diverges from its peers, with only 16.35% of its publications available as open access, while the other universities maintain open access rates of approximately 30% or higher. Interestingly, JH, the youngest group, stands out by publishing the highest proportion of its papers in open access mode at 36.53%, illustrating the shifting trends in academic norms and the increasing adoption of accessible research models.

Table 6. Open Access Publications

University	2019	2020	2021	2022	2023	Total	% in Total
DTU	148	200	269	334	299	1250	16.35%
JH	164	242	272	360	337	1375	36.53%
JMI	361	467	490	616	515	2449	31.59%
JNU	358	450	475	479	396	2158	29.85%
DU	947	834	1035	1165	1120	5101	31.92%
Total	1978	2193	2541	2954	2667	12333	29.11%

Author Collaboration and Co-authorship linkages

Analyzing the trends in co-authorship is essential for understanding the evolving dynamics of research collaboration across various disciplines. Over the past century, co-authorship in research has increasingly gained prominence across various domains (Thelwall and Maflahi, 2022). Publications from external collaborations tend to receive more citations (Deka and Sarmah, 2021). As indicated in Table 7, only 8.93% of publications resulted from solo efforts, while approximately 91.07% were produced through collaborative work. This aligns with the findings of Nishavathi and Jeyshankar (2022) at Alagappa University, where 99.45% of papers stemmed from collaboration, and 88.41% involved cross-border partnerships. Notably, papers with 3-5 authors constituted 47.01%, followed by two-authored and 6-10 authored papers. In contrast, Das and Verma (2021) observed a different authorship pattern, noting that two-authored papers comprised 12.57% of their study's total. The analysis suggests varying collaboration norms across institutions.

Table 7. Co-Authorship Pattern

University	Authorship Pattern							Total Publication
	1 Author	2 Author	3-5 Author	6-10 Author	11-20 Author	21-50 Author	50+ Author	
DTU	161	2348	4537	540	34	3	20	7643
JH	69	278	1633	1541	221	14	9	3765
JMI	459	1253	3924	1858	237	11	11	7753
JNU	1422	1394	2777	1332	230	33	42	7230
DU	1674	3121	7049	3073	466	79	517	15979
Total	3785	8394	19920	8344	1188	140	599	42370

Kumar, A. stands out as the most productive author with an impressive portfolio of 1,667 documents, 18,810 citations, and a linkage strength of 3,279. He is followed by Kumar, S., who has contributed 1,502 documents and garnered 16,993 citations, with a linkage strength of 2,705. Kumar, R. has produced 908 publications and received 10,598 citations, alongside 1,862 linkages. These authors have collaborated extensively with various universities, showcasing their significant impact in their respective fields.

Using the VOSviewer visualization software, linkage maps were generated based on the top 1,000 authors, identifying 19 distinct co-authorship clusters. Cluster 1 comprises 128 authors, while Cluster 2 includes 98 authors, with the prominent author Kumar, A. positioned within the latter. In contrast, Kumar, S. is associated with cluster 17, which comprises 21 authors. The results point to the potential for enhanced networking and collaborative opportunities within specific clusters, which may inspire future research endeavours. The co-authorship linkage map is given in Fig.1.

Key Term Co-occurrence Mapping

The analysis identifies gaps and opportunities for further exploration, particularly where keyword usage diverges among institutions. The co-occurrence maps derived from the titles of various academic documents given in Fig.2 reveal significant trends in terminology usage across several universities. Notably, the term "synthesis" emerges as the most prevalent, with 988 occurrences, followed by "classification" (382) and "production" (371), indicating their significance in current research. Each institution exhibits distinct yet overlapping keyword trends: DTU frequently employs terms such as "effect" and "control," while JH focuses on "covid," "optimization," and "detection". The emphasis on "COVID" at JH underscores the ongoing relevance of pandemic-related studies in academic discourse. JMI emphasizes "characterisation" and "nanocomposite,". The repeated appearance of "nanocomposite" and "characterization" indicates a strong focus on materials science and engineering. JNU highlights "protein", "property" and "activity." The DU predominantly features "search" and "solution." Importantly, key terms like "synthesis," "covid," "property," and "control" appear across multiple universities, indicating common research themes and a collaborative focus on specific areas of study across multiple institutions.

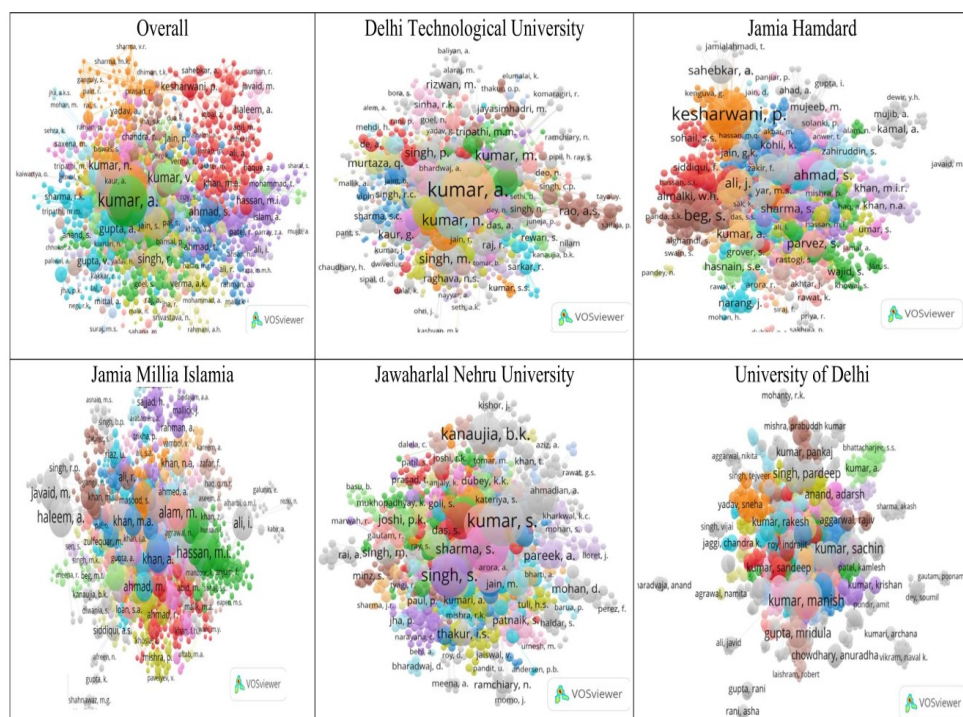


Figure 1. Co-authorship Linkage

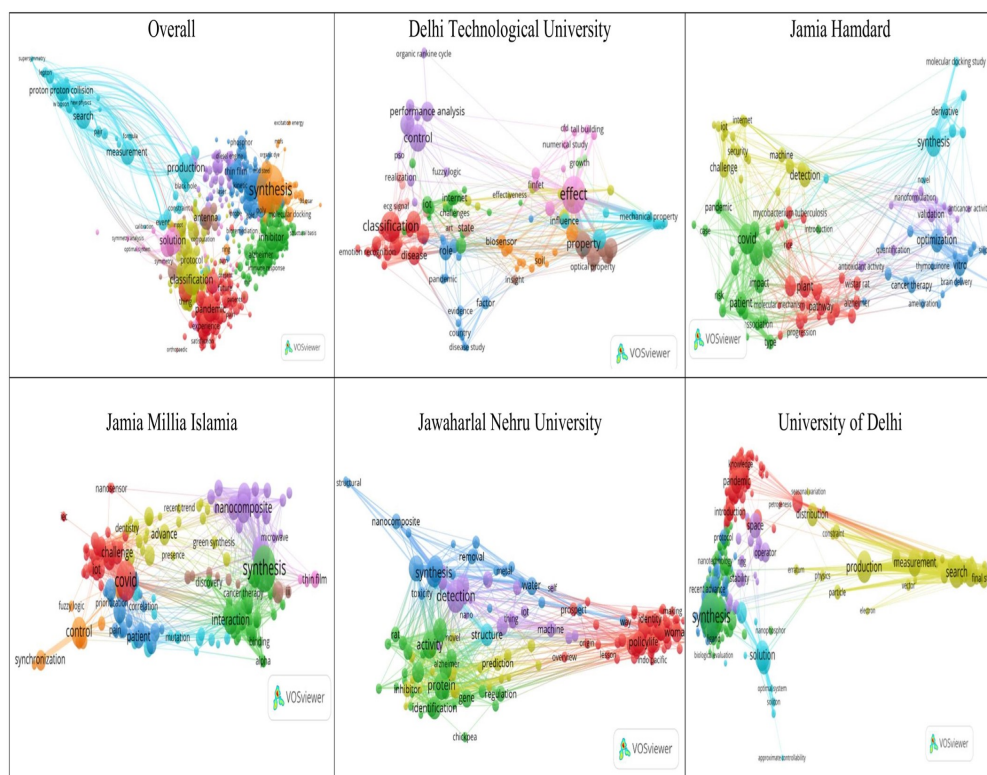


Figure 2. Key Term Co-occurrence

Subject Excellence and Collaboration Profile

To visualise the subject excellence and collaboration profile, we used the web application *Mapping Scientific Excellence* (<https://www.excellencemapping.net>). It uses the publication and citation data collected for *SCImago* Institutions Ranking from Scopus. The application is restricted to institutions that have at least 500 papers in the study period and all the subject areas with at least 500 papers individually. Table 8 indicates the distinguished level of excellence across various academic disciplines among the institutions. Specifically, DTU stands out in Physical Sciences, while JH excels in Health Sciences and Life Sciences. JMI, JNU, and DU also demonstrate notable achievements in Physical Sciences, Health Sciences, and Life Sciences. Furthermore, JNU and DU also portray excellence in Social Sciences and Humanities.

Table 8. Subject Excellence and Collaboration Profile

Subjects	DTU		JH		JMI		JNU		UD	
	Pub	Col.	Pub	Col.	Pub	Col.	Pub	Col.	Pub	Col.
Physical Sciences										
Chemical Engineering	-	-	-	-	-	-	-	-	732	7.7%
Chemistry	-	-	-	-	591	15.8%	-	-	1522	6.3%
Computer Science	1608	12.7%	-	-	792	15.5%	665	13.6%	1045	12.5%
Energy	620	5.0%	-	-	-	-	-	-	-	-
Engineering	1742	11.6%	-	-	1234	16.4%	626	13.5%	1501	15.6%
Environmental Science	-	-	-	-	-	-	549	17.6%	510	15.1%
Mathematics	714	8.9%	-	-	545	13.6%	-	-	1087	11.6%
Materials Science	751	10.8%	-	-	739	16.8%	-	-	1399	10.7%
Physics and Astronomy	808	10.8%	-	-	791	18.2%	627	7.4%	2565	16.8%
Health Sciences Medicine	-	-	921	15.6%	697	22.6%	832	15.8%	2341	10.4%
Life Sciences										
Agricultural and Biological Sciences	-	-	-	-	-	-	-	-	694	15.6%
Biochemistry, Genetics and Molecular Biology	-	-	549	11.9%	603	13.7%	807	8.4%	1437	7.1%
Pharmacology, Toxicology and Pharmaceutics	-	-	800	19.2%	-	-	-	-	-	-
Social Sciences and Humanities										
Social Science	-	-	-	-	-	-	896	7.1%	797	7.5%

The excellent mapping of subjects across various institutions is shown in Fig.3. The horizontal axis (X) shows the subject areas and vertical axis (Y) shows the publication quantity for each subject area. Each subject demonstrates distinct performance indicators, highlighting the strengths of different universities. For instance, Computer Science shows commendable engagement across institutions, particularly at DTU with 1,608, while Physics and Astronomy at JNU stands out with an impressive 2,565. Engineering remains a core strength across all institutions, with prominent scores such as 1,742 at DTU. Additionally, disciplines like Medicine and Environmental Science display significant contributions, showcasing a diverse academic landscape.

The collaboration profile of subjects reveals varied engagement across the participating institutions: DTU, JH, JMI, JNU, and DU. Notably, Computer Science is a focal area, with contributions ranging from 12.50% to 15.70% across several institutions. Engineering fields also show substantial collaboration, particularly at JH (16.40%) and UD (15.60%). Chemistry, Physics, and Astronomy demonstrate moderate inter-institutional collaboration, with JH leading in both fields. Environmental Science stands out at JNU with a significant 17.60% share. The data indicates that Medicine is a prominent collaborative subject, especially at JH (22.60%). While some subjects foster strong partnerships, others reflect a more fragmented collaboration landscape. In Fig. 4, the horizontal axis (X) shows the subject areas and the vertical axis (Y) shows the percentage of collaboration in the particular subject area.

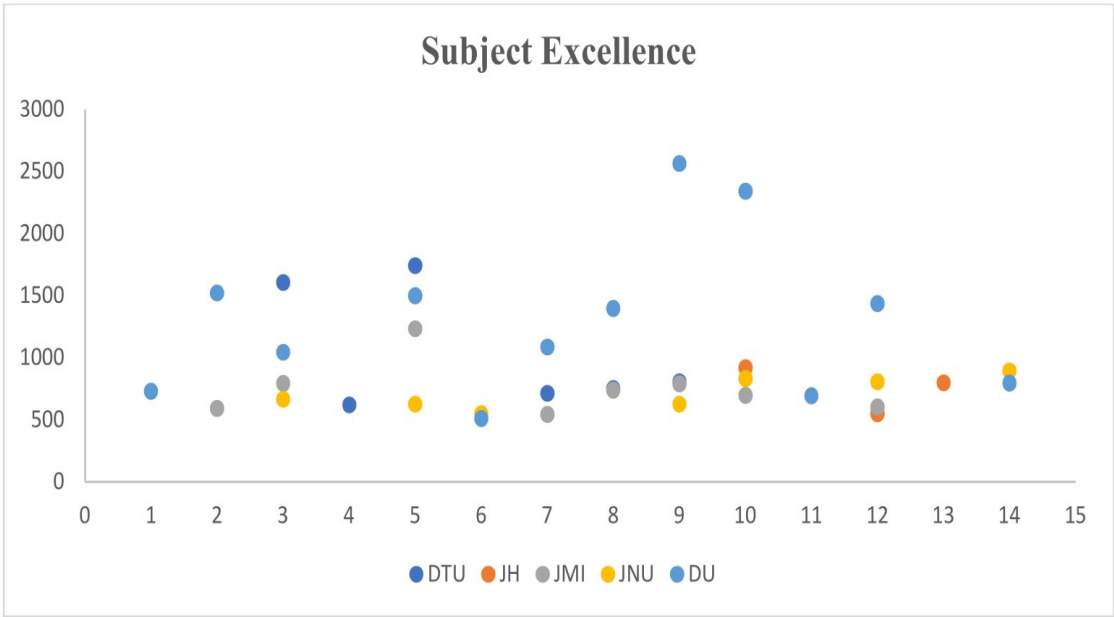


Figure 3. Excellence Mapping of subjects

The collaboration profile of subjects reveals varied engagement across the participating institutions: DTU, JH, JMI, JNU, and DU. Notably, Computer Science is a focal area, with contributions ranging from 12.50% to 15.70% across several institutions. Engineering fields also show substantial collaboration, particularly at JH (16.40%) and UD (15.60%). Chemistry, Physics, and Astronomy demonstrate moderate inter-institutional collaboration, with JH leading in both fields. Environmental Science stands out at JNU with a significant 17.60% share. The data indicates that Medicine is a prominent collaborative subject, especially at JH (22.60%). While some subjects foster strong partnerships, others reflect a more fragmented collaboration landscape. In Figure 4, the horizontal axis (X) shows the subject areas and the vertical axis (Y) shows the percentage of collaboration in the particular subject area.

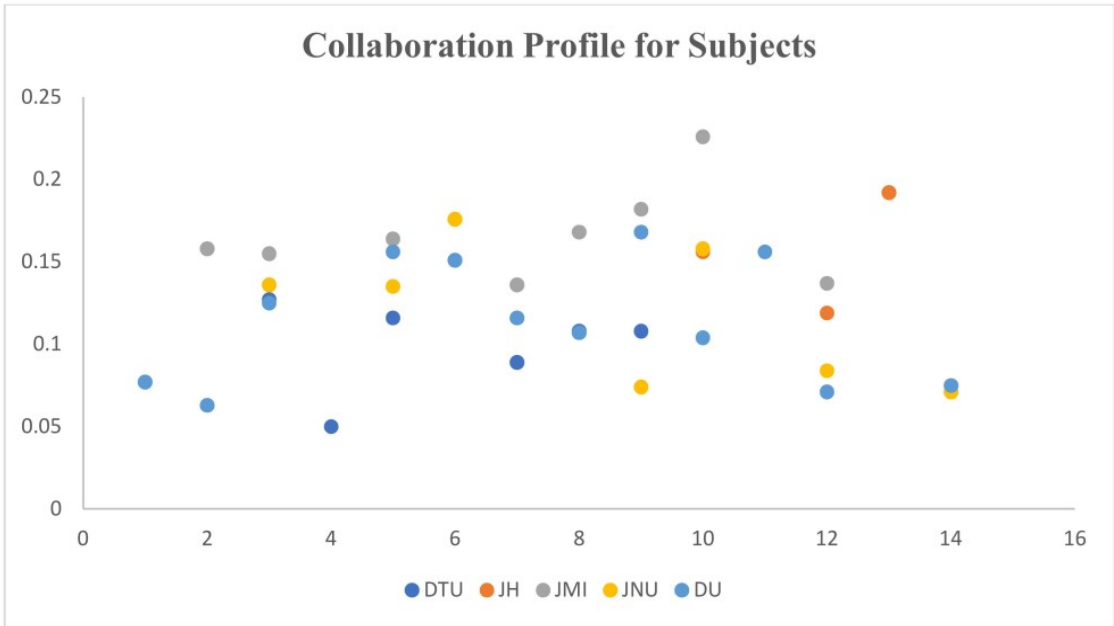


Figure 4. Collaboration Profile for Subjects

6. Conclusion

The study was conducted to map the research outputs of Delhi-based universities that get higher rankings in NIRF 2023 under the university category. Five universities were taken up for the study, among them three central universities, one state university and one deemed to be a university. Producing more publications does not mean that there is a high growth rate. Paper production highly depends on the number of faculty members working at the university. The funded projects and sanctioned amounts do not positively reflect in the paper production. The finding reveals that increased spending or a larger faculty size does not correlate with enhanced efficiency. Notably, the econometric results derived from NIRF scores do not accurately represent the efficiency and productivity of the universities.

Attracting citations to publications does not relate to the age and history of the university. JMI and JH gained more citations. The hybrid scientometric indices (h, g, hg) differ in showing the results. The P-index shows a difference from other indices. Around 30% and more articles are produced by the universities in open access mode, except DTU, which produces only 16.35% in open access mode.

The multi-authored papers are dominating. 91.07% of the papers were produced with multi-author collaboration. The papers with 3-5 authors are dominating, which shows a continuous increase in the multi-authored papers. As collaborative efforts continue to shape the research landscape, a balanced approach that fosters both quantity and quality of publications will be essential for Indian universities to enhance their global standing in academia. The co-authorship occurred with 19 clusters, and the top authors have a collaboration with all universities. While some subjects, such as computer science, engineering, chemistry, physics and astronomy, foster strong partnerships, others reflect a more fragmented collaboration landscape. The key terms synthesis, COVID, property, and control are present in the papers of more than one university. It shows that interdisciplinary approaches or cross-disciplinary collaborations are emerging in recent research. The performance of any organisation in all aspects is highly dependent on the infrastructure support. The authors do not study the infrastructure facility of the universities for conducting research. This study would be helpful to the policymakers to extend financial support, and the researchers' previous research track record may be considered for funding decisions since the funded projects and sanctioned amounts do not yield more research as well. The authors believe that the findings of this study would assist policymakers in taking sound decisions to achieve better research activities.

Abbreviations Used

CAGR	-	Compound Annual Growth Rate
CPP	-	Citations Per Publication
DTU	-	Delhi Technological University
DU	-	University of Delhi
ICAR	-	Indian Council of Agricultural Research
IISER	-	Indian Institutes of Science Education and Research
JH	-	Jamia Hamdard
JMI	-	Jamia Millia Islamia
JNU	-	Jawaharlal Nehru University
NIRF	-	National Institutional Ranking Framework
UGC	-	University Grants Commission

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