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Mapping the Research Publications of IIT Delhi: A Scientometric Analysis

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ABSTRACT

This paper provides a scientometric analysis of the research productivity of Indian Institute of Technology Delhi (IITD) to access the progress in research output. To perform the study, the bibliographic data of the publications, indexed in Web of Science (WoS), of the period 2013 to 2022 were considered for the analysis. The standard scientometric indicators/metrics are used to obtain a proper insight of the research performance of IITD. Publication growth, Collaboration pattern, citation analysis and many other indicators are used to analyse the performance of IITD in terms of publications. The Study reveals that total 16604 documents have been published during 2013-2022. 6895 records have been received citation ranging 51-100. RGR & Doubling time of the publication growth is 0.10 and 15.96 respectively. A total 12017 documents co authored by 5 or more author while 4219 documents have been published by 1-4 co authors in collaboration.

KEYWORDS: IIT Delhi, Scientometric Analysis, NIRF, Research Productivity, Citation Analysis.

1. INTRODUCTION

The Indian Institute of Technology Delhi (abbreviated IIT Delhi or IITD) is a first generation IITs located in Delhi, India. It was declared to be an Institute of National Importance by Government of India under IIT Act. IITD is the premiere institutions of national importance.IIT Delhi offers undergraduate, postgraduate, and doctoral programs across various disciplines. It is known for its rigorous academic curriculum and world-class faculty. The institute is a hub for cutting-edge research and has numerous research centres and laboratories. It collaborates with industries and other academic institutions globally[1]. IIT Delhi consistently ranks among the top engineering institutions worldwide and is recognized for its contributions to technology and innovation.

IIT Delhi is playing a significant role in country's quality research in terms of publications. The research productivity of IITD makes a substantial contribution in the field of Science and technology.

The present Scientometric analysis is conducted to understand the research analysis, research trends and its impact, produced by IITD. It deals with the study of measuring and analysing science, technology, and innovation. The objective of the study is to obtain an analytical view of overall research status of IITD using standard scientometric indicators. Some previous similar studies (Jeevan & Gupta, 2002; Uddin & Singh, 2014, 2015) and (Singh, V.K., 2015) have also been carried out to analyse the IITD research output.

2. LITERATURE REVIEW

To obtain the insight in to the subject, the following literature have been reviewed covering similar research published in the past on the selected topic,

Uddin & Singh (2014) conducted a comprehensive scientometric and keyword-based analysis of computer science research in the SAARC region over the past 25 years. Using bibliographic and textual data from publications indexed in Scopus, the study evaluates the total research output of SAARC countries, their global status, growth trends, and impact.

It also examines collaboration patterns within the region and internationally, identifies leading institutions and researchers, and highlights preferred journals. Additionally, a text-based analysis of research topic trends is included. The findings not only reflect the landscape of computer science research in the SAARC region, but also correlate with demographic and economic indicators, providing insights for funding strategies and policy development in the field of scientific research.
Pradhan, B. and Ramesh, D.B., 2018investigated the research productivity of IITs using comprehensive analysis of bibliographic data from 72,940 research papers published by six Indian Institutes of Technology (IIT Delhi, IIT Kharagpur, IIT Madras, IIT Bombay, IIT Kanpur, and IIT Roorkee) and indexed in the Scopus database between 2006 and 2015. The findings reveal that IIT Roorkee and IIT Bombay exhibit a higher relative citation impact compared to their counterparts, while research outputs from IIT Kharagpur receive the highest citation frequency. Additionally, the analysis identifies the most prevalent journals utilized by researchers across these institutions, highlighting the Physics of Plasma, Journal of Applied Polymer Science, and Journal of Applied Physics as key venues for scholarly communication. This study provides insights into the research performance and publication trends of leading IITs, contributing to the understanding of academic output and impact in the Indian higher education context.

Chaurasia, N.K. and Chavan, S.B., 2014 highlighted various output pattern of Indian Institute of Technology Delhi (IIT Delhi), the study portraits the usage of a number of facets of bibliometrics with the data collected. The study describes the growth, contribution and impact of research carried out by the faculty members and researchers of IIT Delhi. It also attempts to analyze the growth and development of research activity of IIT Delhi as reflected in publications output covered by ISI Web of Science during the year 2001 to 2010.
Veer, C.D. and Kulkarni, J.N., 2020reveled that international research collaboration of IITD faculties with 61711 citations published by IIT, Delhi faculties during 2015-2019. The research output of IIT Delhi faculty was 88.58% followed by articles in proceeding papers (3.14%), Review (2.82%), Editorial (2.92%), and Review (3.82%). The degree of collaboration among IIT faculties was 58.68%. The number of collaborative authors was 1360 articles. The total number of collaborators was 68.67%. It was found that the number of collaboration between IIT and IIT was 66.78%. Research productivity of the top six universities of Tamil Nadu during 2006-2015 is A. This study aims to find out research productivity among the four IITs faculty.

3. OBJECTIVE OF THE STUDY

i. To find out author productivity of IITD
ii. To identify citations received
iii. To know collaborative pattern;
iv. To find out research areas chosen for the research
v. To find out the authorship pattern of publications;
vi. To assess publications chronologically.

4. SCOPE OF THE STUDY

The present study is limited to the IIT Delhi publications indexed in Web of Science database from 2013 to 2022. The publication data may differ the data retrieved from the other databases.

5. METHODOLOGY

This research paper presents a comprehensive analysis of the publication records of the Indian Institute of Technology (IIT) Delhi, utilizing verified data extracted from the Web of Science database. The study encompasses a total of 16604 research papers and other forms of literature authored by IIT Delhi researcher between the years 2013 and 2022. Employing quantitative methodologies using software tools such as Rstudio, Microsoft Excel and VOS viewer, HistCite. The findings aim to elucidate publication trends, collaboration patterns, and the overall research impact of IIT Delhi in the academic landscape, thereby contributing valuable insights into the institute's scholarly output during the specified period.

6. SEARCH QUERY

Following search query employed to extract the desired data from WoS.
Indian Institute of Technology (IIT) - Delhi (Affiliation) or **IIT Delhi** (Affiliation) and **2022** or **2021** or **2020** or **2019** or **2018** or **2016** or **2017** or **2014** or **2013** or **2015** (Publication Years).

7. DATA ANALYSIS AND INTERPRETATION

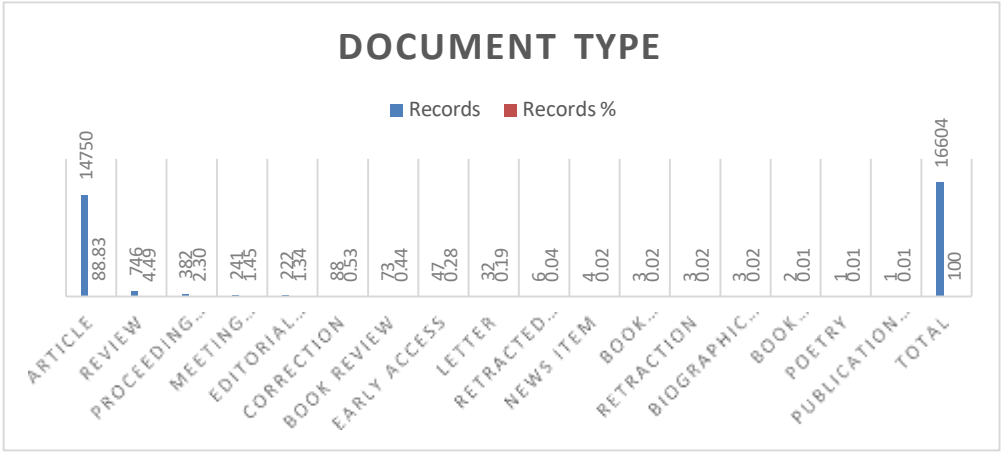
7.1 Document Type of research output from IIT, Delhi

IIT Delhi published 16604 research articles in seventeen forms of publications. The highest records were found in research articles, with 114750 records with 88.83% of the total. The second and third highest publications were found in the form of review and proceeding papers articles, with 746 records (4.49%) and 382 records (2.30%). The remaining form of publication of this Institution was a Meeting Abstract (241 records), Editorial Material (222 records), and Correction (88 records).

Table 1: Document Type of research output from IIT, Delhi

Sl. No.	Document Type	Records	Records %
1	Article	14750	88.83
2	Review	746	4.49
3	Proceedings Paper	382	2.30
4	Meeting Abstract	241	1.45
5	Editorial Material	222	1.34
6	Correction	88	0.53
7	Book Review	73	0.44
8	Early Access	47	0.28
9	Letter	32	0.19
10	Retracted Publication	6	0.04
11	News Item	4	0.02
12	Book Chapter	3	0.02
13	Retraction	3	0.02
14	Biographical-Item	3	0.02
15	Book Chapter	2	0.01
16	Poetry	1	0.01
17	Publication with Expression of Concern	1	0.01
Total		**16604**	**100**

Figure 1: Document Type of research output from IIT, Delhi



7.2 Citation Distribution of Publication of IIT, Delhi

The IIT Delhi shows that 1065 articles received zero citations. 829 articles received 1 citation, 838 articles received 2 and 3 citations, 810 articles received 4 citations, 776 articles received 5 citations, 3068 articles received 6-10 citations, 6895

articles received 11-50 citations, for more than 100 citations received by 238 articles, more than 200 citations received by 34 articles and more than 300 citations received by 35 articles.

Table 2: Citation Distribution of Publication of IIT, Delhi

Range of Citation	Records	Records %
Zero	1065	6.41
1	829	4.99
2	838	5.05
3	838	5.05
4	810	4.88
5	776	4.67
6—10	3068	18.48
11—50	6895	41.53
51—100	1081	6.51
101—150	238	1.43
151—200	85	0.51
201—250	34	0.20
251—300	12	0.07
> 300	35	0.21
Total	**16604**	**100**

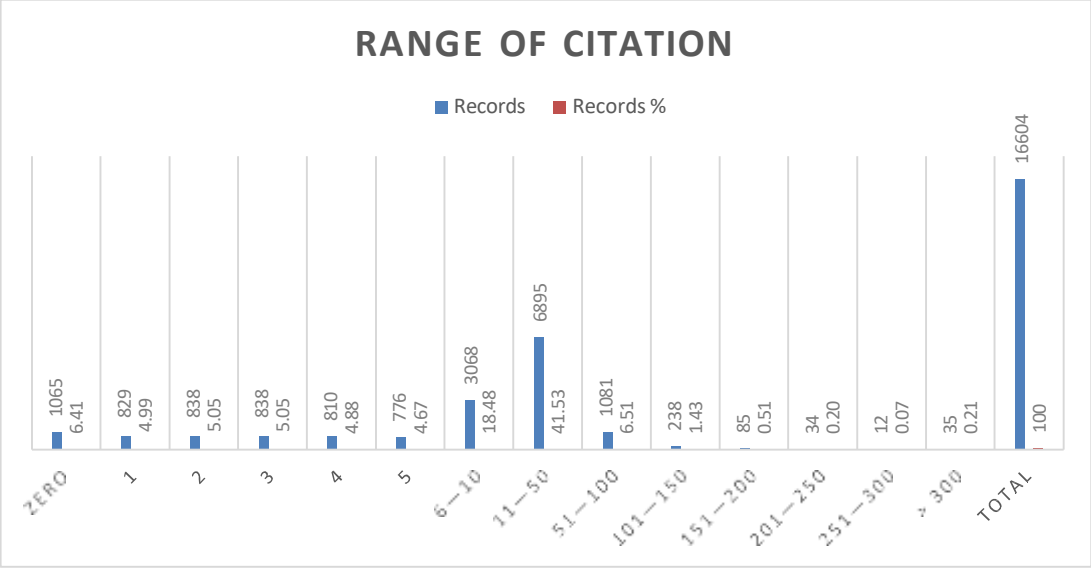


Figure 2: Citation Distribution of Publication of IIT, Delhi

7.3 Year-wise growth of research output of IIT, Delhi

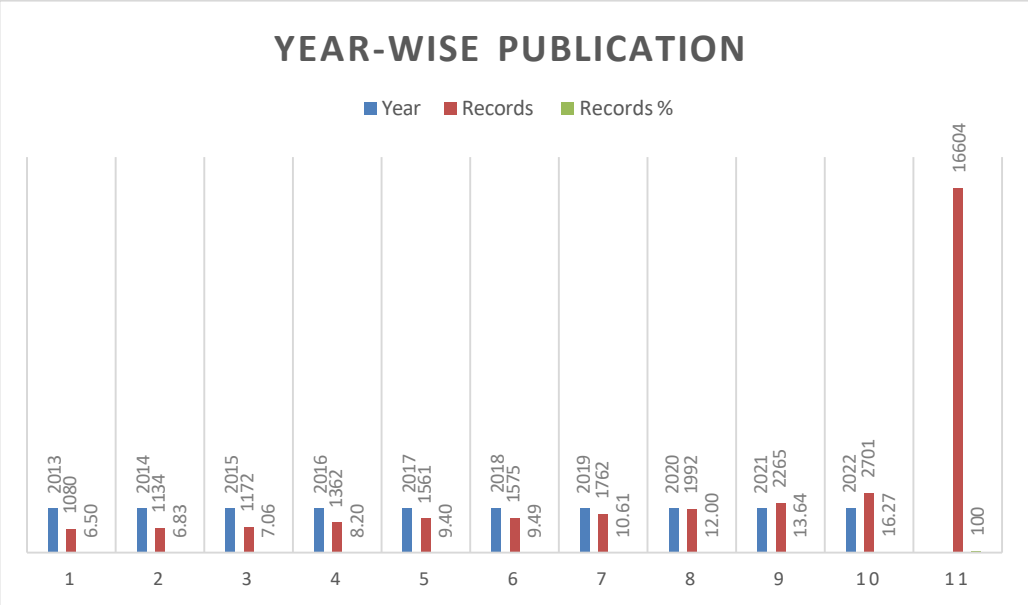
During 2013 to 2022 (totally ten years) periods, 16604 records were downloaded from the web of knowledge database for this analysis of IIT, Delhi literature output. There are variations in the number of publications of articles during this sample period taken for the study. According to Table year wise distribution of IIT, Delhi research output, the year of 2022 has highest number of publications, 2701 (16.27 %) being a first position among the 10 years output. The year of 2021 has 2265 (13.64 %) records and it stood in second position of publishing records of IIT, Delhi. Followed by the year 2020 has 1992 (12.00 %) of records. The above-mentioned years were having above 1000 records.

Table 3: Year-wise growth of research output of IIT, Delhi

Sl. No.	Year	Records	Records %
1	2013	1080	6.50

2	2014	1134	6.83
3	2015	1172	7.06
4	2016	1362	8.20
5	2017	1561	9.40
6	2018	1575	9.49
7	2019	1762	10.61
8	2020	1992	12.00
9	2021	2265	13.64
10	2022	2701	16.27
Total		**16604**	**100**

Figure- 3 Year Wise Publications



7.4 Time Series Analysis of research output in IIT, Delhi

Straight Line equation Yc = a+bX
a= ∑y/N = 1660.4
b= ∑XY/∑X 2 = 144.57
Estimated literature in 2030 is when X = 2030-2017 = 13 = 3540
Estimated literature in 2035 is when X = 2035– 2017 = 18 = 4263
Estimated literature in 2040 is when X = 2040– 2017 = 23 = 4986

Table 4: Time Series Analysis of research output in IIT, Delhi

Year	Articles (Y)	X	X2	X*Y	Trend Value
2013	1080	-5	25	-5400	938
2014	1134	-4	16	-4536	1082
2015	1172	-3	9	-3516	1227
2016	1362	-2	4	-2724	1371
2017	1561	-1	1	-1561	1516
2018	1575	1	1	1575	1805
2019	1762	2	4	3524	1950
2020	1992	3	9	5976	2094

2021	2265	4	16	9060	2239
2022	2701	5	25	13505	2383
2030		13			3540
2035		18			4263
2040		23			4986
	16604		110	15903	

With the help of the time series analysis formula, it calculates the future productivity of the IIT, Delhi. The predicted value of the IIT, Delhi research output for 2030 is 3540, 2035 is 4263, and 2040 is 4986. There is a positive growth in the research output of IIT, Delhi publications.

7.5 Relative Growth Rate and Doubling Time of research output in IIT, Delhi

Table-.5 predicts data of relative growth rate and doubling time for total research output of IIT, Delhi. The analysis of IIT, Delhi research output visualize the following facts: It is observed that its relative growth rates have contracted progressively from 0.05 at 2013 to 0.18 in the year of 2022. Contrary to this, the Doubling Time for publication of all sources of IIT, Delhi research output has decreased from 14.20 years at 2013 to 3.94 years at 2022.

Table 5: Relative Growth Rate and Doubling Time of research output in IIT, Delhi

Sl. No.	Year	Records	Cum.	log W1	log W2	RGR	DT
1	2013	1080	1080	-	6.98	-	-
2	2014	1134	2214	6.98	7.03	0.05	14.20
3	2015	1172	3386	7.03	7.07	0.03	21.03
4	2016	1362	4748	7.07	7.22	0.15	4.61
5	2017	1561	6309	7.22	7.35	0.14	5.08
6	2018	1575	7884	7.35	7.36	0.01	77.62
7	2019	1762	9646	7.36	7.47	0.11	6.18
8	2020	1992	11638	7.47	7.60	0.12	5.65
9	2021	2265	13903	7.60	7.73	0.13	5.40
10	2022	2701	16604	7.73	7.90	0.18	3.94

7.6 Exponential Growth Rate found in the published Literature fromIIT, Delhi

It was found from table that the EGR of the IIT, Delhi published research output was at a maximum in 2022 and a minimum in 2015.

Table 6: Exponential Growth Rate found in the published Literature

Sl. No.	Year	Records	EGR
1	2013	1080	-
2	2014	1134	0.05
3	2015	1172	0.03
4	2016	1362	0.15
5	2017	1561	0.14
6	2018	1575	0.01
7	2019	1762	0.11
8	2020	1992	0.12
9	2021	2265	0.13

10	2022	2701	0.18

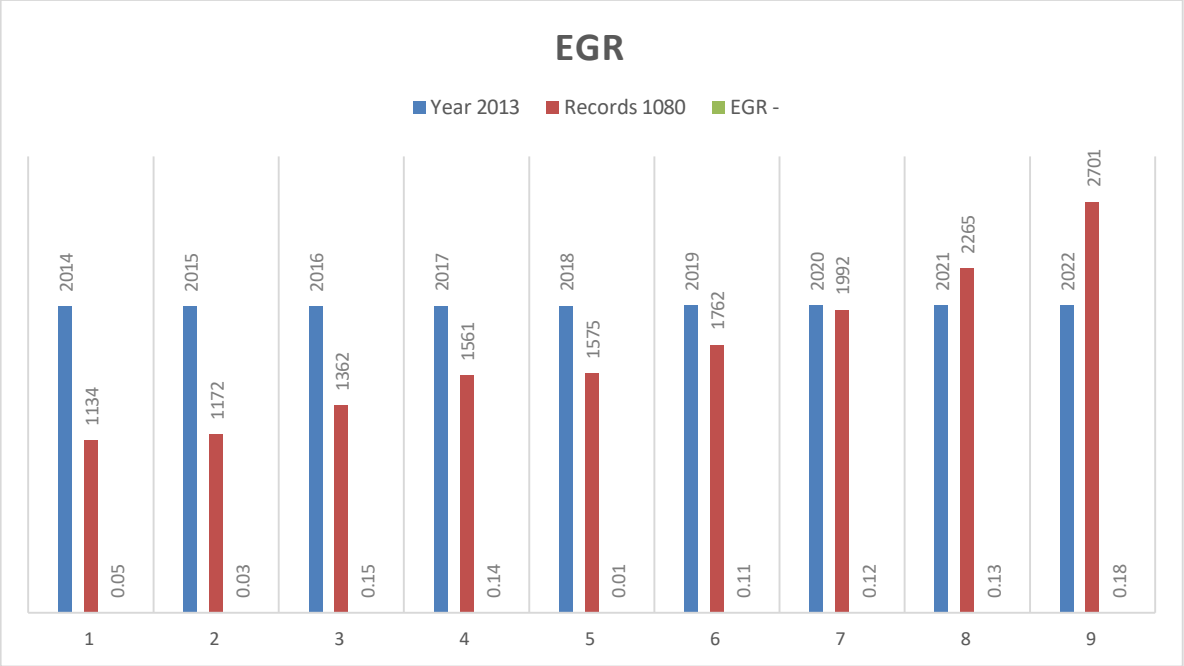


Figure 2: Exponential Growth Rate found in the published Literature fromIIT, Delhi

7.7 Year-wise Annual Growth Rate found in the published Literature from IIT, Delhi

Table shows that IIT, Delhi had the highest Annual growth rate in 2022 with a 19.25 AGR value and the lowest found in 2018 with a 0.90 AGR value.

Table 7: Year-wise Annual Growth Rate found in the published

Sl. No.	Year	Records	AGR
1	2013	1080	-
2	2014	1134	5.00
3	2015	1172	3.35
4	2016	1362	16.21
5	2017	1561	14.61
6	2018	1575	0.90
7	2019	1762	11.87
8	2020	1992	13.05
9	2021	2265	13.70
10	2022	2701	19.25

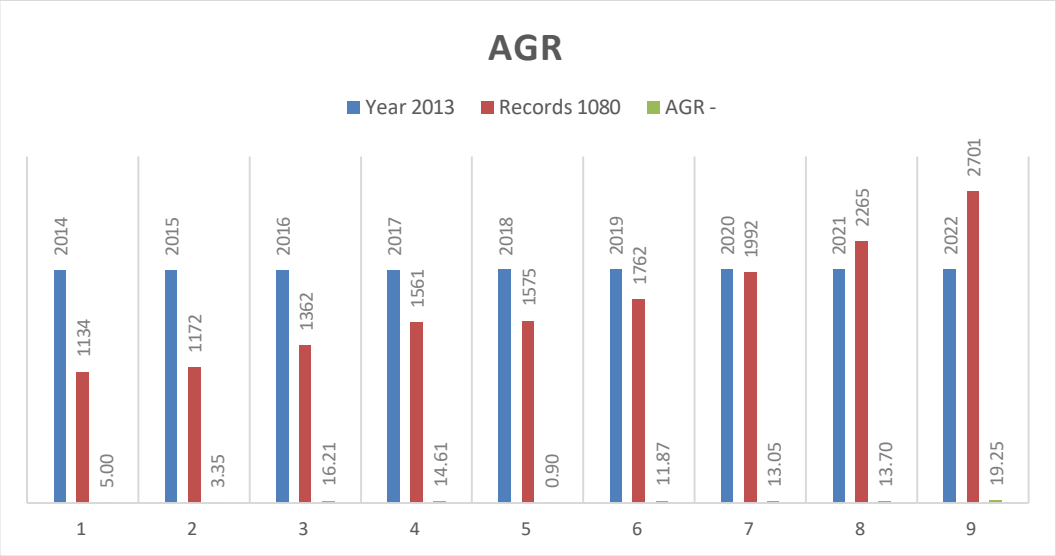


Figure 3: Year-wise Annual Growth Rate found in the published Literature from IIT, Delhi

7.8 Authorship Pattern found in Published Literature from IIT, Delhi

The IIT, Delhi published 16604 research articles during the study period, out of which 4613 have three authored authorships, which is the highest in this institute, followed by 3930(23.67%) papers publisher by two authored (Table 4.4.8). Ten authored papers found in this institute are only 153, which is 0.92% of the total published research of IIT Delhi.

Table 7.8: Authorship Pattern found in Published Literature from IIT, Delhi

Sl. No.	Pattern	Records	Records %
1	1 Author	516	3.11
2	2 Authors	3930	23.67
3	3 Authors	4613	27.78
4	4 Authors	2958	17.81
5	5 Authors	1694	10.20
6	6 Authors	1085	6.53
7	7 Authors	631	3.80
8	8 Authors	394	2.37
9	9 Authors	262	1.58
10	10 Authors	153	0.92
11	More than 10 Authors	368	2.22
Grand Total		**16604**	**100**

7.9 Most Prolific Authors found in IIT, Delhi

Table 4.4.9 gives the five most prolific authors from IIT, Delhi. The data convey that Kumar, A published the highest 672 records from the IIT, Delhi study year. His publications received 13068 citations. It is found that Singh, B has ranked 2nd in IIT, Delhi with 634 publications but he received 14279 citations. This author has a higher impact than other authors from IIT, Delhi. The author's impact indicators show that Singh, B received the highest h-index with 57, respectively. Panigrahi, BK is the second highest author who received a 54 h-index. The highest m-index from IIT, Delhi was obtained by Singh, B with a 4.75 m-index value.

Table 9: Most Prolific Authors found in IIT, Delhi

SN	Author	Records	Citation	h_index	g_index	m_index
1	Kumar A	672	13068	51	70	4.25
2	Singh B	634	14279	57	77	4.75
3	Kumar S	471	12079	46	90	3.833
4	Sharma S	372	7948	41	65	3.417
5	Kumar V	352	8140	47	67	3.917
6	Singh A	293	5528	37	53	3.083
7	Ghosh S	285	8225	45	77	3.75
8	Singh S	270	6556	43	65	3.583
9	Rathore As	265	3809	34	44	2.833
10	Panigrahi Bk	256	8716	54	78	4.5
11	Mishra S	237	5807	39	62	3.25
12	Singh R	233	4161	34	48	2.833
13	Kumar R	231	4753	39	54	3.25
14	Kumar D	219	3086	28	36	2.333
15	Gupta A	201	3866	34	50	2.833
16	Sharma A	196	3938	30	55	2.5
17	Das A	195	2733	25	41	2.083
18	Kumar M	193	4192	34	53	2.833
19	Kumar P	181	5362	36	66	3
20	Das S	171	3921	32	54	2.667
21	Sharma Rp	165	1089	16	23	1.333
22	Pant Kk	164	6124	43	69	3.583
23	Gupta S	164	2760	28	42	2.333
24	Ganguli Ak	158	4078	34	57	2.833
25	Basu S	155	4226	34	56	2.833

7.10 Distribution of articles in the leading Journals by IIT, Delhi

Table 4.4.10 reveals the top 25 journals preferred by researcher/ scientists of IIT, Delhi. It reveals that the Indian Scientists preferred IEEE Transactions on Industry Applications (236 publications), followed by, RSC Advances(153 publications),

Scientific Reports(115 publications) respectively. The Citations per Paper is the highest one for the journal, Bioresource Technology(with 58.04 CPP), followed by, Journal of Cleaner Production(with 48.90 CPP), Solar Energy(with 4.89 CCP) ranked first to third respectively.

Table.10: Distribution of articles in the leading Journals by IIT, Delhi

Sl. No.	Source	Recs.	Citation	CPP
1	IEEE Transactions on Industry Applications	236	5221	22.12
2	RSC Advances	153	4078	26.65
3	Scientific Reports	115	2831	24.62
4	Journal of the Textile Institute	108	1035	9.58
5	Physics of Plasmas	108	841	7.79
6	Journal of Applied Physics	106	1629	15.37
7	Abstracts of Papers of The American Chemical Society	106	1	0.01
8	IEEE Transactions on Industrial Electronics	92	3175	34.51
9	Applied Physics Letters	92	1816	19.74
10	Journal of Alloys and Compounds	91	2013	22.12
11	Journal of Cleaner Production	89	4352	48.90
12	International Journal of Hydrogen Energy	89	2843	31.94
13	Solar Energy	87	3644	41.89
14	Indian Journal of Fibre & Textile Research	87	577	6.63
15	Ieee Transactions on Electron Devices	84	2456	29.24
16	Bioresource Technology	81	4701	58.04
17	Iet Generation Transmission & Distribution	77	1403	18.22
18	Iet Power Electronics	73	1041	14.26
19	Iete Technical Review	73	169	2.32
20	International Journal of Biological Macromolecules	72	1899	26.38
21	Industrial & Engineering Chemistry Research	71	1359	19.14
22	IEEE Communications Letters	67	1483	22.13
23	Iete Journal of Research	67	134	2.00
24	Applied Surface Science	65	1448	22.28
25	Chemical Engineering Science	65	1147	17.65

7. 11 Research Collaboration with top Twenty Countries

Table-11 was prepared to know India's collaboration with other country authors/scientists. The table indicates that Indian authors are working with the authors of USA (404 publications), followed by, 188 publications collaborated with United Kingdom, 156 publications have collaborated with Germany, followed by China with 140 publications. The collaboration helps the researchers to focus on key issues of their research areas and allows each other to share reasonable suggestions for making policies and providing scientific results effectively.

Table -11 Research Collaboration with top Twenty Countries

Sl. No	Country	Articles	Articles %
1	India	14419	86.8
2	USA	404	2.4
3	United Kingdom	188	1.1
4	Germany	156	0.9

5	China	140	0.8
6	Canada	94	0.6
7	Korea	94	0.6
8	France	89	0.5
9	Australia	77	0.5
10	Singapore	51	0.3
11	Japan	47	0.3
12	Sweden	38	0.2
13	Czech Republic	37	0.2
14	South Africa	32	0.2
15	Mexico	30	0.2
16	Italy	29	0.2
17	Netherlands	28	0.2
18	Iran	26	0.2
19	Saudi Arabia	26	0.2
20	Malaysia	25	0.2

7.12 Year-wise Co-Author Index of IIT, Delhi

Table-12 indicates the year-wise Co-Authorship Index of IIT, Delhi publications from 2013 to 2022. For this analysis, the CAI values for publications have a single author, two authors, three authors, and more than three authors. There are five years above the Co-authorship Index found in the single author. In the two authors, five years are found above the Co-Authorship Index. In more than three authors, six years are found above the Co-Authorship Index.

Table 4.4.12: Year-wise Co-Author Index of IIT, Delhi

Year	1	CAI	2	CAI	3	CAI	> 4	CAI	Grand Total
2013	35	104.28	325	127.14	334	111.31	386	78.65	1080
2014	44	124.85	312	116.24	319	101.25	459	89.07	1134
2015	46	126.30	314	113.19	370	113.63	442	82.99	1172
2016	44	103.95	322	99.88	423	111.79	573	92.58	1362
2017	39	80.39	354	95.81	472	108.83	696	98.12	1561
2018	47	96.02	390	104.62	458	104.67	680	95.01	1575
2019	51	93.14	435	104.30	472	96.42	804	100.42	1762
2020	67	108.23	457	96.93	536	96.85	932	102.96	1992
2021	68	96.61	469	87.48	584	92.81	1144	111.15	2265
2022	75	89.35	552	86.34	645	85.95	1429	116.43	2701
Total	**516**		**3930**		**4613**		**7545**		16604

7.13 Showing word Frequency Occurrence of Author's Keywords

Table-13 reveals that the word frequency occurred of the whole sample of 16604 documents; the available word list is 26482, word count is 93994 from the selected data. For this analysis the researcher has taken top twenty frequent occurrence words from the sample data. The word of "performance" has occurred from the sample data at 1087 times by the IIT, Delhi researchers. "design" word has occurred from the sample data at 789 times; "behavior" word has occurred from the sample data at 696 times, "model" word has occurred 694 times. The remaining words are occurred below 500 times in the total records of IIT, Delhi research output

Table-13: Showing word Frequency Occurrence of Author's Keywordsof IIT, Delhi Research Output

Sl. No.	Words	Occurrences
1	Performance	1087
2	Design	789
3	Behavior	696
4	Model	694
5	Nanoparticles	459
6	System	437
7	Temperature	436
8	Optimization	427
9	Mechanical-Properties	350
10	Water	308
11	Simulation	304
12	Systems	304
13	Growth	301
14	Impact	268
15	Stability	263
16	Fabrication	262
17	Energy	260
18	Dynamics	249
19	Generation	234
20	Surface	228

7.14 Research output on subject area of IIT Delhi research

IIT Delhi's research productivity, as evidenced by its 16,604 total records, shows a significant focus on engineering, with 5,382 records accounting for the biggest share (32.41%) of the institution's output is shown in Table 4. Chemistry (16.71%) and Materials Science (19.05%) come next, suggesting an emphasis on fundamental scientific and technical domains. The significance of fundamental sciences in IIT Delhi's research environment is highlighted by the fact that physics accounts for 13.87% of the total records. Significant contributions are also made by other fields like computer science (6.10%), energy fuels (7.00%), and science technology (9.22%), indicating a holistic approach to solving modern problems. IIT Delhi's efforts in sustainability, digital innovation, and mechanical sciences are further demonstrated by its research in environmental sciences, ecology (5.61%), telecommunications (4.36%), and mechanics (4.18%), which upholds the university's standing as one of India's top universities for scientific and technological research.

Table-14: Research output on subject area of IIT Delhi research

Sl. No.	SubjectArea	Records	%
1	Engineering	5,382	32.41%
2	Materials Science	3,163	19.05%
3	Chemistry	2,774	16.71%
4	Physics	2,302	13.87%
5	Science Technology	1,531	9.22%
6	Energy Fuels	1,162	7.00%
7	Computer Science	1,013	6.10%
8	Environmental Sciences Ecology	932	5.61%
9	Telecommunications	724	4.36%
10	Mechanics	694	4.18%

8. MAJOR FINDINGS AND CONCLUSION

Research is becoming a key element in the overall advancement of various academic disciplines. IIT Delhi is promoting research and related activities to enhance the overall quality of scholarship. The study has led to the following conclusions:

- **Document Type Distribution**: IIT Delhi's research output primarily consists of articles, which account for 88.83% (14,750 records) of the total 16,604 publications. Reviews and proceedings papers are the second and third most common forms of research output, representing 4.49% (746 records) and 2.30% (382 records) respectively. Other publication types, such as meeting abstracts, editorial materials, and corrections, make up smaller portions of the total output.
- **Citation Distribution**: Out of 16,604 publications, 41.53% (6,895 records) received between 11 and 50 citations, indicating a strong impact in academic literature. However, 1,065 publications (6.41%) received zero citations. A notable 35 publications received more than 300 citations, highlighting their significant academic influence.
- **Year-wise Growth**: There has been a consistent growth in IIT Delhi's research output from 2013 to 2022. The year 2022 recorded the highest number of publications (2,701), making up 16.27% of the total output, followed by 2021 (2,265 publications, 13.64%) and 2020 (1,992 publications, 12%).
- **Future Predictions**: Time series analysis indicates a positive growth trend in IIT Delhi's research output. The projected number of publications is expected to reach 3,540 by 2030, 4,263 by 2035, and 4,986 by 2040, showing a continued increase in research productivity.
- **Relative Growth Rate (RGR) and Doubling Time (DT)**: The Relative Growth Rate of IIT Delhi's publications increased from 0.05 in 2014 to 0.18 in 2022, demonstrating faster growth in recent years. The Doubling Time for publications has decreased from 14.20 years in 2014 to 3.94 years in 2022, signifying quicker accumulation of research outputs.
- **Exponential Growth Rate (EGR)**: The Exponential Growth Rate (EGR) of IIT Delhi's research output was highest in 2022 at 0.18 and lowest in 2015 at 0.03. This illustrates an overall increasing trend, with notable growth in recent years.
- **Annual Growth Rate (AGR)**: The highest Annual Growth Rate was observed in 2022 with 19.25%, while the lowest AGR was in 2018, with a minimal increase of 0.90%. The overall trend shows substantial growth in research output over the past decade.
- **Authorship Pattern**: The majority of IIT Delhi's publications are authored by three authors (27.78%, 4,613 records), followed by two-author papers (23.67%, 3,930 records). Single-author papers account for only 3.11% (516 records) of the total output. Collaborative research with more than 10 authors makes up just 2.22% (368 records).
- **Co-Authorship Index (CAI)**: The analysis of Co-Authorship Index reveals that the highest co-authorship in terms of single-author publications was found in 2015, while 2022 saw a higher co-authorship with more than four authors. The trend reflects increasing collaboration among researchers, with more multi-authored papers in recent years.
- **Growth and Impact of Research**: IIT Delhi has shown remarkable progress in its research output, with both qualitative and quantitative improvements. The doubling time of publications has decreased significantly, reflecting accelerated academic activity and impact.

These findings underscore the strategic emphasis on fundamental and applied sciences at IIT Delhi demonstrating significant productivity in engineering, chemistry, and materials science. The publications of IIT Delhi reflects the majority of national collaboration (86.4%) and international collaboration (13.6%), there is scope for IITD researchers for more international collaboration for optimum visibility of them.

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