Research Productivity of College of Engineering Technological University Pune, India: A Scientometric Study

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Abstract:

The Study focussed on a systematic mapping of the research productivity of the College of Engineering Technological University, Pune(COEP), India, from 1989 to 2022. The publications were indexed in Web of Science database. 475 documents were retrieved as a primary data from respective database. The publications were increased constantly year-wise. Goyal R. K. has the top most cited author with 39 articles and 13.44% fractionalized; Price-Whelan AM has the most global cited paper with 1355 citations in terms of the top twenty papers. India has strong collaborations with the USA in terms of the most relevant countries by corresponding authors. India has a greater number of productions with 444 articles, followed by the USA (71), Germany (17), UK (16), South Korea (6), and India has got strong collaborations with USA in-terms of most relevant countries by corresponding authors. Design (10%) is the most used keyword, followed by behaviour (7%). Transactions of the Indian Institute of Metals have most preferable journal or source. 8.33% growth rate was found with 1017 total authors.

Keywords- Scientometric, Engineering, Web of Science, Biblioshiny, VOS viewer

Introduction:

In recent years, assessments of scientific literature produced at the individual or institution level have been done to map the impact of the literature produced. These assessments enable the rating of the contribution of research papers by the evaluation of various statistical indicators. It also helps allocating funds for policymaking and international benchmarking (Diem & Wolter,2013). Researchers are producing qualitative and quantitative research in every domain of the subject. Today, information seekers are searching for reliable and accurate information in a timely manner. Therefore, the obligation of libraries and information professionals has increased for the analysis of the productivity of research publications by applying various metrics and formulas that have been formulated by information scientists. For example Alfred J. Lotka (1926), Ranganathan, S. R. (1930), Broadford (1934), Derek John De Solla Price (1961), and Pitchard (1969)(Fd et al.,

2022). In the present study, the researchers have used a Scientometric study to analyse the research work.

Institute Profile:

College of Engineering Technological University, Pune was opened in July 1854. It was situated in Bhawani Peth, Pune. In 1879 the college was known as a "The Poona Civil Engineering College" and afterwards "The College of Science". The academic legacy of the college has been widening ever since. Bharat Ratna Sir M. Visvesvarayya is the alumni of this institution.

The college got autonomous status in 2003 and in June 2022 the college has been granted with the status of a university; now it is known as COEP University of Technology. Thus, considering the importance of the institute as it has completed 168 years after its inception, the involvement of the institute in nation-building is high; therefore, the authors thought to carry out research on the productivity of the COEP to measure the value of the institute (https://www.coep.org.in/), retrieved on November 27, 2022.

Literature Review:

When analysed the research output by NITs faculty, it shows that NIT Rurkela and Trichy were the top institutions in terms of research productivity in the overall scholarly content in the field of engineering and technology (Shettar & Hadagali, 2020).

After analysing the comparative research productivity of respective

Madhukar Togam & Chandrashekhar Khairnar

institutions, it has been seen that their research works have been cited globally consistently, therefore it is relatively significant for scholars (Pradhan & Ramesh, 2018).

Author investigated the research papers were published on library automation. The study analysed the bibliometric evaluation of the research published between 2002 to 2019 (Jadhav & Togam, 2020).

Study was conducted for science and engineering, of research organizations in India, extracted data from the Web of Science. Researchers have compared research performance in science and engineering, across countries, among Indian research organizations and subject-level comparisons(Kumar & Pandit, 2018).

Study found the research works of the faculties published in highly impact journals and reputed publications in social sciences and humanities. These faculties were affiliated to IIT Kharagpur. Observed that most of research works jointly published got more citations (Bhui & Sahu, 2018).

The Study found that the authors' research works are made in the field of medical sciences. This work was carried out with the affiliation of foreign countries. It applied the various quantitative patterns, methods for sorting the published research articles. The collected data examines through SPSS 20(Haq, 2017).

Author analyses the research publications among the Central Universities in India. The author suggested the research gaps and various constraints

for policy making authorities (Marisha et al., 2017).

Author analyses the contribution of research publications in the field of engineering sciences(Pradhan & Ramesh, 2017, pp. 2006–2015).
Evaluated the research publications of the faculties, in terms of Scientometric study. Study found the specific sub-domain where publication ratio is high i.e. Physical Chemistry (Nagarkar, 2014, pp. 1999–2012).

Study found most of the publications were made in participation with other subjects. More articles were published abroad in the scholarly journals. The primary data was assembled in physical mode. (Khaparde, 2013b).

Study found that, the publications were gradually increased with participation of more faculty members in the same discipline (Baskaran, 2013, pp. 1999–2011).

Presented the mapping of the research productivity of scientists. Study found that in the year 2017.The scientific production was with 611 articles with 25.76% and then degradation of scientific production was observed (Togam & Jadhav, 2022).

After browsing the available literature, it was found that there was no Scientometric study conducted on production of scientific literature published by faculty members of College of Engineering Technological University Pune, India.

Objectives:

1. To reveal the annual scientific production of College of Engineering Technological University, Pune(COEP)
2. To identify the average citation per year and author productivity through Lotka's law.
3. To find out influential researchers and their citations.
4. To trace the most relevant countries by corresponding authors.
5. To identify the country-wise scientific productions.
6. To reveal the most frequent words and top twenty most relevant sources preferred by authors.

Methodology:

The Scientometric study has been conducted for research publication produced by College of Engineering Technological University, Pune(COEP), India. Researchers have tried to retrieve all data from web of science which are associated with College of Technological University (COEP), Pune and the data were found since1989 to 2021. The documents were retrieved with search string as (OG=(College of Engineering)) AND (DT==("ARTICLE") AND LA==("ENGLISH")) on 15th June, 2022. The 475 records generated through search strategy, were used for further scrutiny. The entire bibliographic data was retrieved in plain text (.txt) file format and further analysis was done through Biblioshiny (Version. 2022.02.1+461) and VOS viewer (1.6.17) software.

Madhukar Togam & Chandrashekhar Khairnar

Data Analysis and Interpretation:

Source Information:

Table 1: Descriptive analysis: Source
Information

Description	Results
Information about Data	
Timespan	1989:2022
Sources (Journals, Books, etc)	272
Documents	475
Average years from publication	5.46
Average citations per document	14.9
Average citations per year per doc	2.353
References	14050
Document Types	
Article	421
article; early access	15
article; proceedings paper	7
Correction	3
correction; early access	1
Discussion	3
editorial material	5
Letter	1
Review	18
review; early access	1
Document Contents	
Keywords Plus (ID)	1116
Author's Keywords (DE)	1796
Authors	
Authors	1017
Author Appearances	1711
Authors of single-authored documents	6
Authors of multi-authored documents	1011
Authors Collaboration	
Single-authored documents	8
Documents per Author	0.467
Authors per Document	2.14
Co-Authors per Documents	3.6
Collaboration Index	2.16

Year-wise Research Productivity:

Fig No. 1 depicted the year-wise research progress during the period 1989-2022. During the initial years from 1989 only two articles were produced then downtrend observed with single article in each year till the year 2000. Afterward slightly increased the production in the year 2004, then again in 2005 and 2007 only one article was produced. But from 2008 onwards uptrend observed with 4 articles, in the year 2009 – 5, 2010-15, 2011-21, 2012-14, 2013-24, 2014-21, 2015-33, 2016-34, 2017-41, 2018-40, 2019-59, 2020-46, 2021-59, 2022-28.
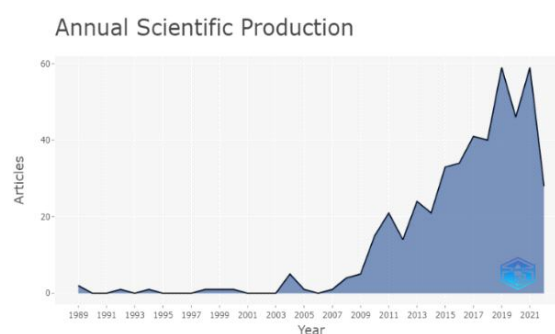

Fig.1 -Year-wise Research Productivity

Average Citations per Year:

Table No. 2 show the scientific production and average citation during a period of (1989-2022) 33 years of study. In the initial years, we see a downtrend beginning with 2articles published in 1989.

Table. 2 Average Citations per Year

Year	N	Mean TC per Art	Mean TC per Year	Citable Years
1989	2	0.00	0.00	33
1990	0	0.00	0.00	0
1991	0	0.00	0.00	0
1992	1	0.00	0.00	30
1993	0	0.00	0.00	0
1994	1	1.00	0.04	28
1995	0	0.00	0.00	0
1996	0	0.00	0.00	0
1997	0	0.00	0.00	0
1998	1	3.00	0.13	24
1999	1	1.00	0.04	23
2000	1	1.00	0.05	22
2001	0	0.00	0.00	0
2002	0	0.00	0.00	0
2003	0	0.00	0.00	0
2004	5	7.80	0.43	18
2005	1	10.00	0.59	17
2006	0	0.00	0.00	0
2007	1	6.00	0.40	15
2008	4	7.25	0.52	14
2009	5	73.40	5.65	13
2010	15	34.07	2.84	12
2011	21	18.71	1.70	11
2012	14	22.86	2.29	10
2013	24	17.79	1.98	9
2014	21	46.57	5.82	8
2015	33	16.82	2.40	7
2016	34	16.15	2.69	6
2017	41	13.05	2.61	5
2018	40	41.25	10.31	4
2019	59	5.80	1.93	3
2020	46	5.48	2.74	2
2021	59	1.68	1.68	1
2022	28	0.29		0
*TC – Total Citations				

Authorship Productivity: Lotka's Law:
(Researchers has applied Lotka's Law to find out the relativity of the law)

Lotka's Law of Scientific Productivity has been applied for collected data and result is shown in the Table No. 3 and Fig. No. 2 given below; A total

number 755 authors contributed articles during the period of 1989 to 2022. Here, Lotka's law reveals that 0.742% of the authors (755 authors) has one publication, and 0.137 % of the authors (139 authors) has two publications.

Table. 3 Authorship Productivity: Lotka's Law

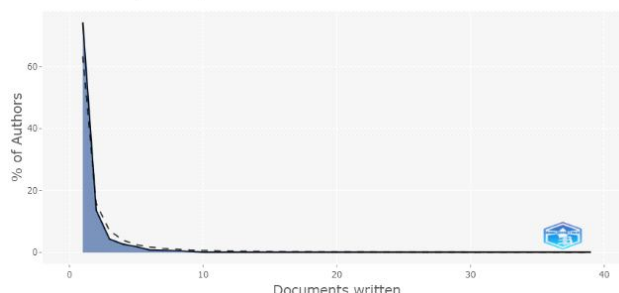| Documents written	Number of Authors	Proportion of Authors
1	755	0.742
2	139	0.137
3	44	0.043
4	27	0.027
5	19	0.019
6	8	0.008
7	7	0.007
8	6	0.006
9	3	0.003
10	1	0.001
11	1	0.001
13	1	0.001
14	1	0.001
16	1	0.001
18	1	0.001
20	1	0.001
30	1	0.001
39	1	0.001

Fig. 2 Authorship Productivity: Lotka's Law

Prominent Cited Authors:

Table No. 4 reflects the prominent researchers during the period of study. Goyal R. K. has the top most cited author

Madhukar Togam & Chandrashekhar Khairnar

with 39 article and (13.44) fractionalized. Phadke S.B. has second rank with 30 articles and (9.28) fractionalized.

Table. 3 Most Relevant Cited Authors

Authors	Articles	Articles Fractionalized
Goyal RK	39	13.44
Phadke SB	30	9.28
Shendge PD	20	6.08
Dhokey NB	18	6.16
Deshpande PP	16	4.80
Rege PP	14	6.37
Dadge JW	13	2.11
Bogle KA	11	1.79
GinoyaD	10	2.87
Butee SP	9	2.09
Kumar P	9	2.32
Patil SL	9	2.87
Chaudhari BN	8	2.87
Halge DI	8	1.22
Narwade VN	8	1.22
Sahasrabudhe AD	8	3.75
Tiwari AN	8	2.50
Vyas V	8	2.67
Kambale KR	7	1.53
Khairnar RS	7	1.18

Most Cited Papers Globally:

Table No. 5 stretches the overview of top twenty most global cited papers with its digital object identifier (DOI), total citations, total citation per year and normalized total citations.PRICE-WHELAN AM is the most global cited paper (DOI -10.3847/1538-3881/aabc4f) with 1355 citations and GINOYA D has received the second rank with 376 citations for (DOI-10.1109/TIE.2013.2271597) paper.

Table. 5 Most Global Cited Papers

Sr. No.	Paper	DOI	Total Citations	TC per Year	Normalized TC
1	PRICE-WHELAN AM, 2018, ASTRON J	10.3847/1538-3881/aabc4f	1355	271	32.8485
2	GINOYA D, 2014, IEEE T IND ELECTRON	10.1109/TIE.2013.2271597	376	41.7778	8.0736
3	TALOLE SE, 2010, IEEE T IND ELECTRON	10.1109/TIE.2009.2029528	316	24.3077	9.2759
4	SHAH P, 2016, MECHATRONICS	10.1016/j.mechatronics.2016.06.005	273	39	16.9071
5	SHARMA YC, 2009, ENVIRON TECHNOL	10.1080/09593330902838080	253	18.0714	3.4469
6	DESHPANDE PP, 2014, J COAT TECHNOL RES	10.1007/s11998-014-9586-7	221	24.5556	4.7454
7	DESHPANDE VS, 2014, J SOUND VIB	10.1016/j.jsv.2014.01.023	103	11.4444	2.2117
8	PHADKE SB, 2012, IEEE T	10.1109/TAES.2012.6324711	77	7	3.3687

	AERO ELEC SYS				
9	GINOYA D, 2015, COMMUN NONLINEAR SCI	10.1016/j.cnsns.2015.02.008	76	9.5	4.5189
10	GOYAL RK, 2013, COMPOS PART B-ENG	10.1016/j.compositesb.2012.06.019	71	7.1	3.9906
11	DAFTARDAR-GEJJI V, 2014, APPL MATH COMPUT	10.1016/j.amc.2014.06.097	63	7	1.3528
12	PATOWARI PK, 2010, INT J ADV MANUF TECH	10.1007/s00170-010-2653-z	63	4.8462	1.8493
13	PATOWARI PK, 2011, MATER MANUF PROCESS	10.1080/10426914.2010.512652	59	4.9167	3.1527
14	GOYAL RK, 2009, J APPL POLYM SCI	10.1002/app.29042	58	4.1429	0.7902
15	UGALE RT, 2017, IEEE T IND ELECTRON	10.1109/TIE.2016.2606587	54	9	4.1383
16	PATOWARI PK, 2011, INT J ADV MANUF TECH	10.1007/s00170-010-2966-y	54	4.5	2.8855
17	GOGATE NG, 2017, J CLEAN PROD	10.1016/j.jclepro.2016.11.079	54	9	4.1383
18	SEWATKAR CM, 2012, J FLUID MECH	10.1017/jfm.2012.359	51	4.6364	2.2312
19	DAFTARDAR-GEJJI V, 2015, FRACT CALC APPL ANAL	10.1515/fca-2015-0026	51	6.375	3.0324
20	CHAVAN SL, 2017, ENERGY	10.1016/j.energy.2017.07.070	50	8.3333	3.8318
(*DOI – Digital Object Identifier; TC – Total Citation)					

Most Relevant Countries by Corresponding Author:

Table No. 6 reveals the most relevant countries of the concerned authors. It depicts the growth rate of articles produced by researchers of various countries. India has led the publications with 444published articles, however, many are in co-authorship with another author of at least one other country. Subsequently, USA authors have produced 11 articles, followed by Korea (3), however, it is observed that single country publication for India is 420 and for USA reflects only

Madhukar Togam & Chandrashekhar Khairnar

one article. Addition to that India has 24 and USA has 10 Multiple Countries Publications followed by Korea with 3

numbers. It means the study reveals that India has strong collaborations with USA during the period.

Country-wise Scientific Production:

Table. 6 Most Relevant Countries by Corresponding Authors

Country	Articles	Freq	SCP	MCP	MCP_Ratio
India	444	0.93869	420	24	0.0541
USA	11	0.02326	1	10	0.9091
Korea	3	0.00634	0	3	1
Denmark	2	0.00423	0	2	1
Canada	1	0.00211	0	1	1
China	1	0.00211	0	1	1
Czech Republic	1	0.00211	0	1	1
Ethiopia	1	0.00211	0	1	1
Finland	1	0.00211	0	1	1
Germany	1	0.00211	0	1	1
Greece	1	0.00211	0	1	1
Guinea	1	0.00211	0	1	1
Italy	1	0.00211	0	1	1
Malaysia	1	0.00211	0	1	1
Russia	1	0.00211	0	1	1
Saudi Arabia	1	0.00211	0	1	1
United Kingdom	1	0.00211	0	1	1
*(SCP: Single Country Publication; MCP: Multiple Country Publication; TC: Total Citations; AAC: Average Article Citation)					

Fig No. 3 reveals the country-wise scientific productions during the study period. India has produced of 958 articles followed by USA (71), Germany (17), UK (16), South Korea (6) whereas Canada, France and Saudi Arabia have produced 5 articles each; Australia, Czech Republic, Malaysia, Russia, Spain haveproduced4 articles each; Chile, China, Denmark, Guinea, Italy, Qatar, Vietnam have produced 3 articles each. The study concludes that India has greater number of articles in-term of scientific production as

studied Institute-COEP Technological University Pune. India is located at Indian Jurisdiction.

Country Scientific Production

Fig. 3. Country-wise Scientific Production

Madhukar Togam & Chandrashekhar Khairnar

Most Frequent Words:

The authors' keywords help for retrieval and indexing purpose. The purpose of these keywords is to find, to locate the research works, that save the researchers' time. It helps to direct the research community to find various areas where work is in progress. The present word-tree map shows 50 most used keywords. Design (10%) is the most used keywords, followed by Behavior (7%), Performance (6%), Composites (5%), Optimizations (21%) etc.
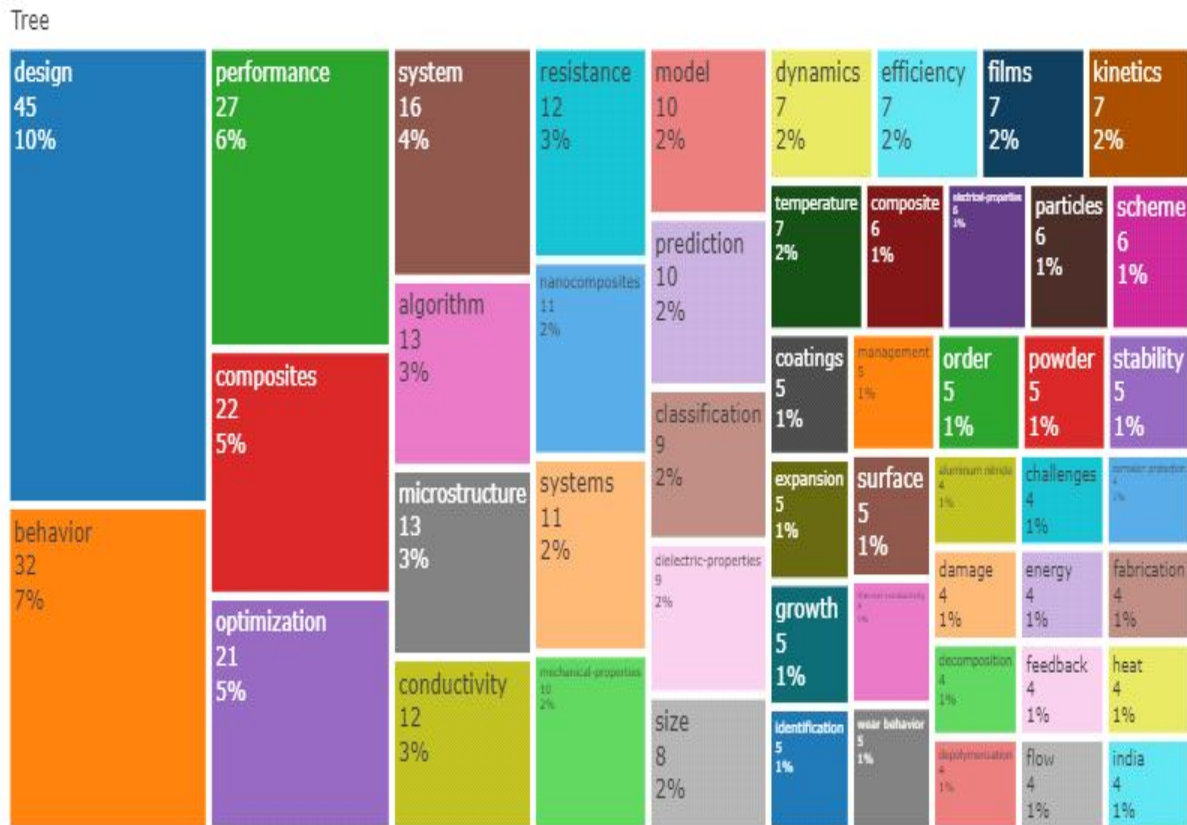

Fig. 4. Most Frequent Words: Tree Map

Top Twenty Most Relevant Sources:

Fig No. 5 and Table No. 7 have depicted the top twenty most relevant sources during the period of study. Transaction of the Indian Institute of Metals has got most preferable journal/source during the period followed by Journal of Applied Polymer Science then, Sadhana Academy Proceedings in Engineering Science. This list shall be useful for researcher scholars, faculty members and Library and Information Science Professionals working in Engineering and Technological Universities across the globe.

Fig.5 Top Twenty Most Relevant Sources

Madhukar Togam & Chandrashekhar Khairnar
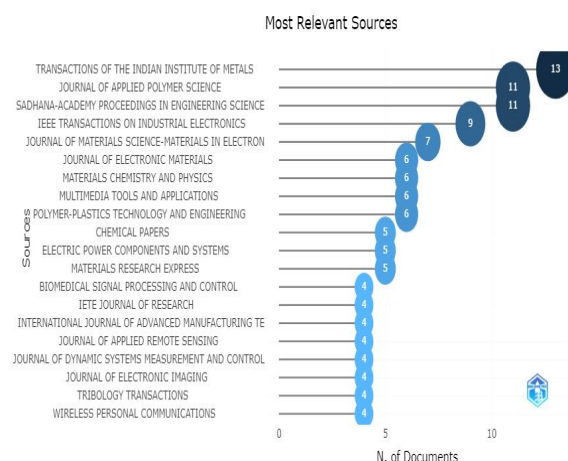
Table. 7 Top Twenty Most Relevant Sources

Sr.No.	Sources	Articles
1	Transactions of the Indian Institute of Metals	13
2	Journal of Applied Polymer Science	11
3	Sadhana-Academy Proceedings in Engineering Sciences	11
4	IEEE Transactions on Industrial Electronics	9
5	Journal of Materials Science-Materials in Electronics	7
6	Journal of Electronic Materials	6
7	Materials Chemistry and Physics	6
8	Multimedia Tools and Applications	6
9	Polymer-Plastics Technology and Engineering	6
10	Chemical Papers	5
11	Electric Power Components and Systems	5
12	Materials Research Express	5
13	Biomedical Signal Processing and Control	4
14	IETE Journal of Research	4
15	International Journal of Advanced Manufacturing Technology	4
16	Journal of Applied Remote Sensing	4
17	Journal of Dynamic Systems Measurement and Control-Transactions of the ASME	4
18	Journal of Electronic Imaging	4
19	Tribology Transactions	4
20	Wireless Personal Communications	4

Findings:

Results showsthe annual scientific production during the period of 1989-2022. During the initial years from 1989 only two articles produced then downtrend observed with single article in each year till the year 2000. Afterwards the production increased slightly in the year 2004, then again in 2005 and 2007 only one article was produced in each year. But from 2008 onwards uptrend was observed with 4 articles.

- Lotka's law reveals that 0.742% of the researchers (755 authors) has single publication, 0.137% of the authors (139 authors) has two publications.

- Goyal R. K. has the most cited author with 39 articles and 13.44% fractionalized. Phadke S.B. has a second rank with 30 articles and 9.28 fractionalized.

- PRICE-WHELAN AM has the most global cited paper (DOI - 10.3847/1538-3881/aabc4f) with 1355 citations, and GINOYA.D. has received the second rank with 376 citations for the (DOI 10.1109/TIE.2013.2271597).

- India has strong collaborations with the USA in terms of the most relevant countries of the concerned authors.

- According to country-wise scientific production India has

produced 958 articles, followed by the USA (71), Germany (17), the UK (16) and South Korea (6). Canada, France, and Saudi Arabia have produced 5 articles each.

- Design (10%) is the most used keyword, followed by behaviour (7%), performance (6%), composites (5%), optimizations (21%), etc.

- 'Transactions of the Indian Institute of Metals' has been the most preferred journal or source than the Journal of Applied Polymer Science as well as the Sadhana Academy Proceedings in Engineering Science.

Conclusions:

The study analysed the scientific productivity of COEP Technological University Pune, India, with Scientometric indicators. The Core Collection Data was extracted from the Web of Science between 1989 and 2022. 475 documents were found, and the same data was analysed with Biblioshiny software. The average rate of citation per year per document was 14.9; the average rate of year of publication was 5.46. In addition to that, Goyal R. K. is the most cited author with 39 articles, and Price-Whelan AM is the most global cited paper (DOI - 10.3847/1538-3881/aabc4f) with 1355 citations. India has strong collaborations with the USA in terms of the most relevant countries of the concerned authors. In terms of country-wise scientific production, India has produced 958

articles, followed by the USA (71), Germany (17), the UK (16), and South Korea (6). Design (10%) is the most used keyword, followed by behaviour (7%), and Transaction of the Indian Institute of Metals has been the most preferred journal or source.

Acknowledgement:

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Madhukar Togam & Chandrashekhar Khairnar

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