

A Scientometrics Analysis of Research Productivity: A Case Study of National Institute of Technology, Kurukshetra

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Abstract

The present paper presents a Scientometric analysis of publications of National Institute of Technology, Kurukshetra (NIT Kurukshetra) from 2012 to 2016 as reflected in Web of Science database. It attempts to analyse the growth and development of research activity of NIT Kurukshetra as reflected in publications output. Data for a total of 352 publications have been downloaded and analysed according to objectives. The study reveals that the growth of literature follows the year-wise growth pattern; conference proceeding papers are the most published form of literature (68.18%); Indian Institute of Technology Roorkee is top collaborating institution/ university with National Institute of Technology, Kurukshetra (NIT Kurukshetra). The highly productive subject areas are engineering, computer science, energy fuels, telecommunication, and materials science. Malaysia, USA, and Japan are the most favoured countries for collaborations; top prolific authors are Kumar, A and Singh, A K; authorship pattern analysis shows that most preferred authorship pattern is two authors (59.09%).

Keywords: Research Productivity, Research Output, Scientometrics Analysis

Introduction

National Institute of Technology, Kurukshetra is located in Haryana state which provides education and research in the fields of engineering and technology. The institute started working as Regional Engineering College, Kurukshetra in 1963. This institute was conferred upon status of deemed university on June 26, 2002 and at same time it has been renamed as National Institute of Technology, Kurukshetra. NIT Kurukshetra has been branded as an institute of excellence and considered

as the most prestigious engineering and technology institution of region. There are a number of factors that contribute to their being the most sought after institute both for the students as well as the faculty. Almost all the faculty members in NIT Kurukshetra have PhD degrees. The quality of faculty is a major strength enjoyed by this institute. The performance of this institute is directly related to the research interests of their faculty members as it impacts their teaching, govern their consultancy preferences and enable their continuing education.

As per a report published in National Institutional Ranking Framework, Ministry of Human Resource Development, and Government of India in 2016 & 2017, NIT Kurukshetra has been dominating the slots in top hundred engineering colleges in India. NIT Kurukshetra is 48th ranked engineering institute in 2016 and 60th ranked in 2017. Research productivity is one important factor that has traditionally been used by rating agencies internationally to rank institutes of higher learning. In fact, research productivity is one such attribute that has been documented the most and somehow efficiently. The purpose of this study is to examine the research productivity of this institute of technology as evidenced by the number of research papers published during the period under investigation. In addition, this study also intends to examine the growth pattern, authorship patterns, co-authorships, etc. from the publications data of this institute.

Review of Literature

Few quantitative studies have been carried in the past analysing the engineering and technology institutions of India. Banshal, Singh, Basu, and Muhuri (2017) analysed the research performance of 16 older Indian Institutes

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of Technology of India. The study shows that there is a substantial difference in research performance levels of old IITs vis-à-vis the new IITs.

Hasan and Singh (2015) attempts to evaluate the trend of research output of five top ranked Indian Institutes of Technology (IITs) on the basis of research papers/ articles indexed in Web of Science online database for the five years' period of 2009-13. A total of 215,019 records were retrieved for India which are 2.72% of the global records for the period 2009-13.

Singh (2015) analyses the research output of Indian Institute of Technology Mandi (IIT Mandi) and focuses on collaboration at different levels such as author, institution and status of collaboration at national/ international level".

Bid (2016) makes an analysis of publications of Indian Institute of Technology Kharagpur for the period from 2000 to 2015. The result emphasizes on growth and development of research activities of the institution.

Jeevan and Gupta (2002) analyse the performance and impact of research produced in each department, and the comparison of the impact of research in various departments.

Arif (2015) analyses the research productivity of faculty members of computer science & engineering departments of four IITs. The study finds that there are much differences in research productivities of different IITs in terms of number of publications, growth of literature, per capita productivity, etc. IIT Madras has outperformed the other IITs.

Objectives of the Study

1. To analyse year-wise research productivity in terms of total papers.
2. To find out the top ten most productive authors and authorship pattern.

3. To know research area-wise distribution of publications.
4. To find out the top collaborative institutions at national and international levels.
5. To identify the collaboration with other countries.
6. To determine the types of documents preferred, in which maximum research findings have been published.

Data Collection

For collection of the publication data, the source Web of Science (WoS), a bibliographic and citation database was used which covers a selected group of journals and conferences. The data was collected for the period 2012-2016. The five-year period is a good period to know research productivity. The search criterion made for the collection of data was: [OG = "National Institute of Technology Kurukshetra" Timespan=2012 2016]. The data was obtained in April 2017. The full record was downloaded in the excel format i.e. article, proceedings paper, editorial material, titles, author records, affiliation etc.

Methodology

For Scientometric analysis of publication data of NIT Kurukshetra, the standard form of methodologies were used to analysis of various parameters like year-wise growth rate of papers, highly prolific authors, collaborated papers, authorship pattern, collaborative authors etc. The top productive authors were found out and their performances were analysed based on their publications' productivity. The most collaborating institutions and countries have been recognised using extraction of information from affiliation text. Finally, the major research areas were examined by mapping them in top major areas of research.

Data Analysis and Interpretation

Growth of Literature

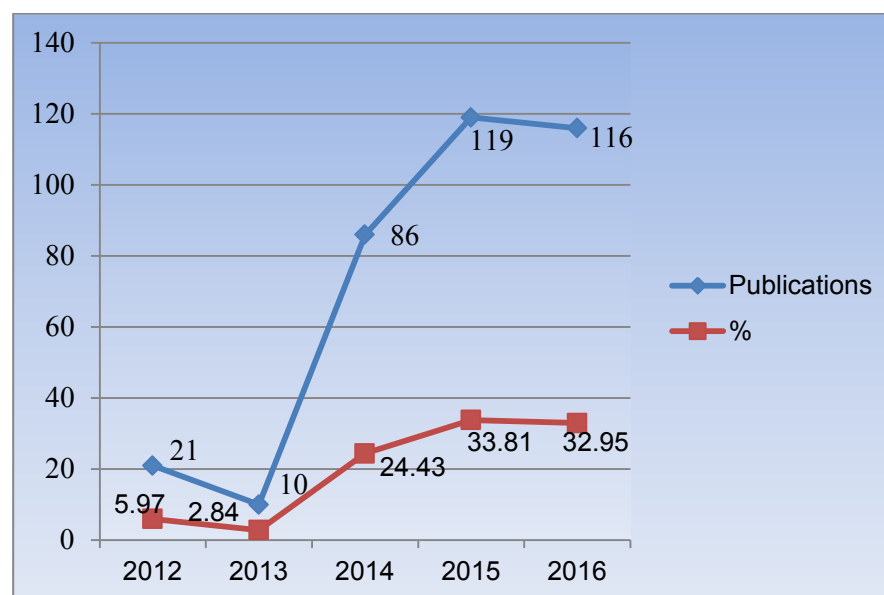


Fig. 1: Year-Wise Research Growth in Terms of Total Papers

The year-wise research growth in terms of TP (total papers) is shown in Fig. 1. It is shown that number of research paper is increasing year-wise from 2012 to 2016.

It reveals that maximum number of papers were published in 2015 (no. of papers 119; 33.81%) and minimum in 2013 (no. of papers 10, 2.84%).

Authors Pattern of Papers Published

Table 1: Authorship Pattern of Papers Published

Year	One Author	Two Authors	Three Authors	Four Authors	Five Authors	Six Authors	Seven Authors	Eight Authors	Total
2012	0	10	7	2	0	2	0	0	21
2013	0	5	4	0	1	0	0	0	10
2014	2	51	24	5	4	0	0	0	86
2015	5	67	26	14	0	2	4	1	119
2016	3	75	31	5	2	0	0	0	116
Total in 5 years	10	208	92	26	7	4	4	1	352
%>	2.84	59.09	26.14	7.39	1.99	1.14	1.14	0.28	100.00

Table 1 shows the authorship pattern of papers. Out of 352 papers, the maximum number of papers were 208 (59.09 %) from two authors followed by 92 paper from three authors (26.14 %), 26 papers from four authors (7.39), 10 papers from one author (2.84%), seven papers

from five authors (1.99) and so on. Data reveals that most of the authors like to publish papers in collaboration and the most preferred authorship pattern is co-authorship by two authors.

Degree of Collaboration (DC)

Table 2: Degree of Collaboration Measures (DC)

	<i>Number of of publications</i>	<i>Percentage (%) of total publications</i>	<i>Nm+Ns</i>	<i>DC</i>
Total number of Single/ Multi-Authored Publications	352	100		
No. of co-author publication (NM)	342	97.16	352	0.97
No. of single-author publication (NS)	10	2.84		
No. of two-author publication (NM)	208	59.09	218	0.95
No. of three-author publication (NM)	92	26.14	102	0.90
No. of four-author publication (NM)	26	7.39	36	0.72
No. of five-author publication (NM)	7	1.99	17	0.41
No. of six-author publication (NM)	4	1.14	14	0.29
No. of seven-author publication (NM)	4	1.14	14	0.29
No. of eight-author publication (NM)	1	0.28	11	0.09

In order to understand the degree of collaboration, the formula suggested by Subramanyam and Stephens (1982) and used by Bid (2016) has been applied for this study. The results are presented in Table 2. The DC calculates the proportion of co-author publications among total publications. The formula of DC is as follows:

$$DC = Nm / (Nm + Ns)$$

where C is degree of collaboration in a discipline,

Nm is number of multi-authored papers during specific period in some discipline,

Ns is number of single authored papers in a discipline during the same period of time.

The data given in Table 2 shows 0.97 as the overall degree of collaboration (2012-16), followed by 0.95% (two- authored publications) and 0.90% (three-author publications). The value of DC is lowest for eight-author publications, which is 0.09, indicating the trend towards multi-authorship papers.

Calculation:

$$DC = Nm / (Nm + Ns)$$

Based on the data in Table 2, for two-author publications,

$$Nm = 208 \text{ \& } Ns = 10$$

hence, $DC = 208 / (208 + 10) = 0.95$

Most Productive/ Highly Prolific Authors and their Publications

Table 3: Top Ten Highly Prolific Authors and their Publications

<i>S. No.</i>	<i>Authors</i>	<i>Publications</i>	<i>Percentage %</i>
1	Kumar, A	62	17.6
2	Singh, A K	29	8.2
3	Kumar, P	15	4.3
4	Gupta, B B	15	4.3
5	Dave, M	13	3.7
6	Kumar, S	11	3.1
7	Kumar, R	11	3.1
8	Kumar, J	11	3.1
9	Sharma, R K	10	2.8
10	Sandhu, K S	10	2.8

Table 2 shows the list of most productive/ prolific authors of NIT Kurukshetra. It is revealed that Kumar, A., of NIT Kurukshetra published highest numbers of papers, i.e. 62 followed by Singh, A K (29 papers) at second position and Kumar, P with 15 papers at third position.

Type of Publications

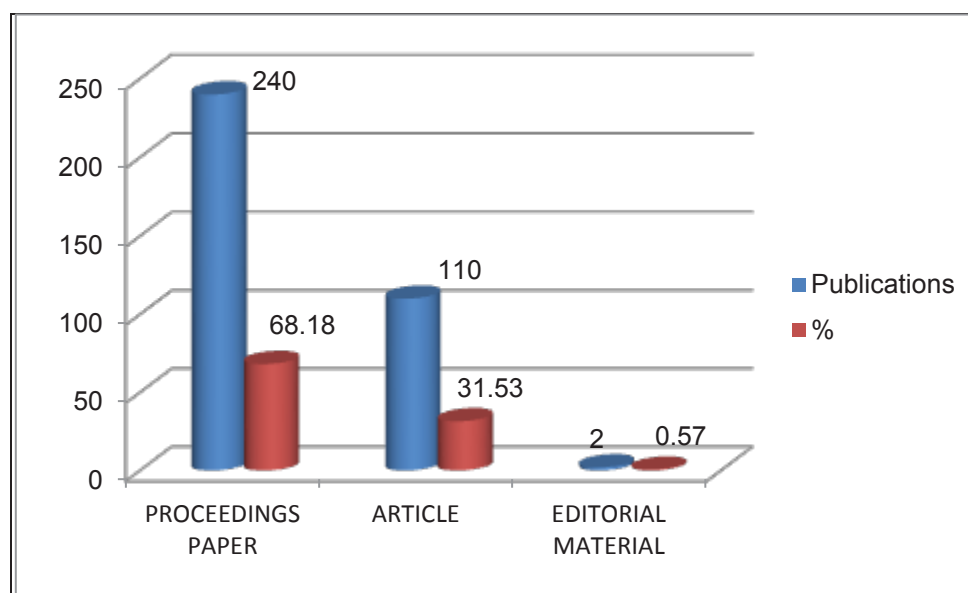


Fig. 2: Distribution of Publications According to Type

Fig. 2 shows distribution of publications according to type. It shows that number of proceeding papers was the highest, i.e. 240 (68.18%) followed by that of articles (110,

31.53%). It is revealed that research productivity in term of proceeding papers was highest in NIT Kurukshetra.

Research area-wise Distribution of Publications

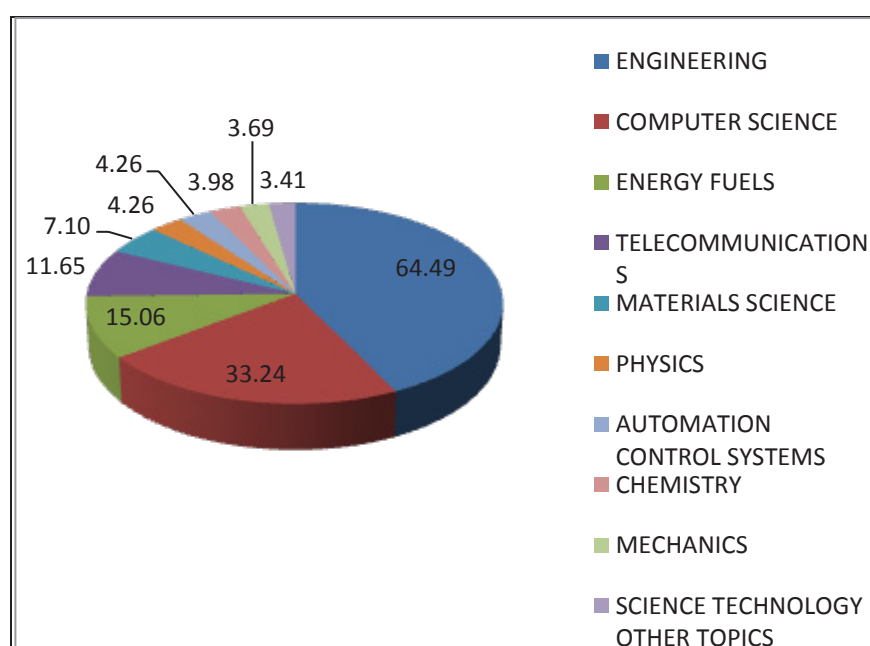


Fig. 3: Research Area-Wise Distribution of Publications

Fig. 3 shows the research output for various subjects covered in this study during 2012-2016 as defined by WoS. It shows the list of top subjects for which the authors of NIT Kurukshetra mostly contributed papers. It is evident that engineering is the most favoured area of research among the contributors with 64.49%, followed by computer science with 33.24%, energy fuels with 15.06%, telecommunication with 11.65%, materials science with 7.10 %, physics with 4.26%, automation control systems with 4.26%, chemistry with 3.98%, mechanics with 3.69%, science technology & other topics with 3.41%.

Collaboration with Other Countries

Table 4: Collaboration of Papers with Other Countries

S. No.	Countries/ Territories	Publications	Percentage %
1.	Malaysia	7	1.98
2.	USA	6	1.70
3.	Japan	5	1.42
4.	South Korea	2	0.56
5.	Singapore	2	0.56
6.	Serbia	2	0.56
7.	England	2	0.56
8.	Brazil	2	0.56

Table 3 shows collaboration of papers by author of NIT Kurukshetra with authors from other countries. It is revealed that Malaysia is at the top with number of publications 7 (1.9%), followed by USA with 6 papers (1.70%) at second position and Japan with 5 publications (1.42%) at third position.

Top Participating Institutions in Collaboration with NIT Kurukshetra

Table 5: Top Participating Institutions in Collaboration with NIT Kurukshetra

S. No.	Top participating institutions in collaboration with NIT Kurukshetra	Publications	Percentage %
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1	National Institute of Technology, Kurukshetra	355	100
2	Indian Institute of Technology, Roorkee	10	2.84
3	Sant Longowal Institute of Engineering Technology Punjab	7	1.99
4	Motilal Nehru National Institute of Technology Allahabad	7	1.99
5	Gautam Buddha University, Noida	6	1.70
6	Yamaguchi University Japan	5	1.42
7	Indian Institute of Technology Kanpur	4	1.14
8	Indian Institute of Technology, Delhi	4	1.14
9	Virginia Polytechnic Institute State University, Blacksburg, USA	4	1.14
10	Curtin University, Bentley, Perth, Western Australia	4	1.14

Table 5 shows top participating institutions in collaboration with NIT Kurukshetra. It is found that authors/contributors of NIT Kurukshetra were collaborating with many institutions to publish their papers. Among top 10 institutions, Indian Institute of Technology, Roorkee was found at top position with 10 publications (2.84%), followed by Sant Longowal Institute of Engineering Technology, Punjab and Motilal Nehru National Institute of Technology, Allahabad with 7 publications each (1.99%) jointly at second position and Gautam Buddha University, Noida with 6 publications (1.70%) at third position.

Findings & Conclusion

The study finds that NIT Kurukshetra has contributed 352 papers from 2012 to 2016. The contributors of NIT Kurukshetra have a tendency to publish their work with two or more authors which indicates multi-author pattern and shows that the contributors of NIT Kurukshetra are collaborative in nature. The overall degree of

collaboration amongst author is 0.97% (2012-16). The degree of collaboration for two-author publications is 0.95%, followed by three-author publications with 0.90%. The most productive author based on their publications was found to be Kumar, A. with 62 papers (17.06%). Contributors from NIT Kurukshetra have a tendency to publish their papers more in conference proceedings, followed by journal articles. Engineering is the top priority subject followed by computer science, energy fuels, telecommunication, and materials science in which the contributors contribute their paper. Malaysia was at the top position with 7 publications in the list of collaborating countries with NIT Kurukshetra., followed by USA with 6 publications and Japan with 5 publications. In terms of top participating institutions in collaboration with NIT Kurukshetra, Indian Institute of Technology, Roorkee ranked first with 10 documents (2.84%). It is suggested that such studies should be carried out periodically that will be helpful to review the progress in terms of research productivity of particular institution/ university.

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