A Scientometrics Analysis of Research Productivity: A Case Study

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Abstract

The paper presents a Scientometric analysis of publications of National Institute of Technology Kurukshetra (NIT Kurukshetra) during 2012 to 2016 as reflected in Web of Science database. It attempts to analyze the growth and development of research activity of NIT Kurukshetra as reflected in publications output. Data for a total of 352 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 author are Kumar, A, 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 at 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 same time it has been renamed as National Institute of Technology, Kurukshetra.

National Institute of Technology Kurukshetra has been branded as institutes 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 institutes both for the students as well as the faculty. Almost all the faculty members in NIT Kurukshetra have Ph.Ds. 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 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 analyzing the Engineering and Technology Institution of India. Sumit Kumar Banshal¹ (at...al.) (2017) “analyzed the research performance of 16 older Indian Institutes of Technology of India, shows that there is a substantial difference in research performance levels of old IITs vis-à-vis the new IITs”.

Nabi Hasan² (2015) “The paper 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”.

Vivek Kumar Singh³ (2015) “analyze the Research output of Indian Institute of Technology Mandi (IIT Mandi) and focusing on the collaboration at different levels such as author, institution and status of collaboration at National/international level”.

Subhodip Bid⁴ (2016) “analysis of publications of Indian Institute of Technology Kharagpur for the period 2000 to 2015 emphasize the growth and development of research activity of this institution”.

V. K. J. Jeevan⁵ (at...al.) (2002) “analyze the performance and impact of research produced in each department, and the comparison of the impact of research in various departments”.

Tasleem Arif⁶, (2015) “analyze the Research Productivity of Indian Institutes of Technology, faculty member of computer science Engineering departments of four IITs Study find that there are much differences in research productivity in terms number of publications, growth of literature, per capita productivity, etc. IIT Madras has outperformed in amongst of them”.

Objectives of the Study

- To analyse year wise research productivity in terms of total paper.
- To find out the top ten most productive authors and authorship pattern.
- To know Research area -wise distribution of publications.
- To find out the top collaborative institutions national and international levels.
- To identify the collaboration with other countries
• 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 5 years period is a good period to know research productivity. The search has been 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 downloaded in the excel format i.e. article, proceedings paper, editorial material, titles, author records, affiliation and citation references 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, Internationally Collaborated Papers (ICP), authorship pattern, collaborative authors. The top productive authors were find out and their performances were analysis based on their publications productivity. The most collaborating institutions and countries have been recognized using extraction of information from affiliation text. Finally the major research areas were examined and mapping them in ten major areas of research.

Data Analysis and Interpretation

Growth of Literature

![Figure 1: Year-wise research growth in terms of Total papers](image-url)
The year wise research growth in terms of TP (Total papers) are given in figure 1, it is shows that no. of research paper are increasing year wise form 2012 to 2016. It revel that highest no. papers published in 2015, No. of Papers: 119 (33.81%) and lowest in 2013 total No. of papers: 10 (2.84%).

Authors Pattern of Papers Published

<table>
<thead>
<tr>
<th>Years</th>
<th>One Author</th>
<th>Two Author</th>
<th>Three Author</th>
<th>Four Author</th>
<th>Five Author</th>
<th>Six Author</th>
<th>Seven Author</th>
<th>Eight Author</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
<td>10</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>2014</td>
<td>2</td>
<td>51</td>
<td>24</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>86</td>
</tr>
<tr>
<td>2015</td>
<td>5</td>
<td>67</td>
<td>26</td>
<td>14</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>119</td>
</tr>
<tr>
<td>2016</td>
<td>3</td>
<td>75</td>
<td>31</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>116</td>
</tr>
<tr>
<td>5 year</td>
<td>10</td>
<td>208</td>
<td>92</td>
<td>26</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>352</td>
</tr>
<tr>
<td>%&gt;</td>
<td>2.84</td>
<td>59.09</td>
<td>26.14</td>
<td>1.99</td>
<td>1.14</td>
<td>1.14</td>
<td>0.28</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Table-1: Authorship Pattern of Papers Published

Table 1 shows the authorship pattern of papers in Out of 352 papers, the maximum number of papers were 208 (59.09 %) from two authors followed by three authors 92 (26.14 %), four authors 26 (7.39), one authors 10 (2.84%), four author 7 (1.99) and so on. Data reveals that most of the authors like to publish papers in collaborations and most preferred authorship pattern is two authors.

Degree of Collaboration (DC)

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

Table-2: Degree of Collaboration Measures (DC)
In order to understand the degree of collaboration, the formula suggested by Subramanyam\(^7\) (1982) has been applied for this study and results are formulated in above table-2. The formula of DC is as follows: 

\[
DC = \frac{Nm}{Nm + Ns}
\]

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

\[
DC = \frac{Nm}{Nm + Ns} = \frac{208}{208+10} = 0.95
\]

**Most Productive/Highly Prolific Authors and their Publications**

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

**Table 3: Top Ten Highly Prolific Authors and their Publications**

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

**Type of Publications**

![Graph showing type of publications](image-url)
Figure 2: Distribution of publications according to type

Figure 2 shows that Distribution of publications according to type it is shows that research productivity in form of no. of proceeding paper was 240 (68.18%) followed by no. of article 110 (31.53%), etc. It is reveal that research productivity in term of proceeding papers find highest in NIT Kurukshetra.

Research area -wise Distribution of Publications:

Figure 3: Research area -wise Distribution of Publications

Figure 3 shows that the research output covered in this study during 2012-2016 as various subjects as defined by WoS. The list of Top subjects for which the authors of NIT Kurukshetra, mostly contributed papers. It is clarify 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 11.65%, Material Science with 7.10 % Physics 4.26%, Automation Control Systems 4.26%, Chemistry 3.98%, Mechanics 3.69% Science Technology Other topics 3.41% and others.

Collaboration with other Countries

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Countries/Territories</th>
<th>Publications</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Malaysia</td>
<td>7</td>
<td>1.98</td>
</tr>
<tr>
<td>2.</td>
<td>USA</td>
<td>6</td>
<td>1.70</td>
</tr>
<tr>
<td>3.</td>
<td>Japan</td>
<td>5</td>
<td>1.42</td>
</tr>
<tr>
<td>4.</td>
<td>South Korea</td>
<td>2</td>
<td>0.56</td>
</tr>
<tr>
<td>5.</td>
<td>Singapore</td>
<td>2</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Table-4 Collaboration of papers with other countries

Table-3 shows that collaboration of papers with other countries with author of NIT Kurukshetra. It is reveal that Malaysia is at the top with no. of publications is 7 (1.9%), followed by USA 6 (1.70) as a second position and Japan with no. of publication is 5 (1.42%) in third position.

Top participating institutions in collaboration with NIT Kurukshetra

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

Table-5: Top participating institutions in collaboration with NIT Kurukshetra

Table -5 shows the top participating institutions in collaboration with NIT Kurukshetra. It is find that authors/contributors of NIT Kurukshetra were collaborating with many institutions to publish their papers, It has been found that within top 10 institutions Indian Institute of Technology, Roorkee found in in Top Position with 10 Publications(2.84%), followed by Sant Longowal Institute of Engineering Technology Punjab with 07 Publications (1.99%) & Motilal Nehru National Institute of Technology Allahabad with 07 Publications (1.99%) found in second position and Gautam Buddha Univ Noida with publications 6 (1.70%) & found in third position.

Findings & Conclusion

The study find that NIT Kurukshetra has contributed 352 papers from 2012 to 2016 The contributors of NIT Kurukshetra have tendency to publish their work with two or more authors which indicates the multi author pattern and shows that the contributors of NIT Kurukshetra is collaborative in nature. The overall degree of collaboration amongst author is 0.97% (2012-16) and followed by is
two-authored publications is 0.95%; followed by three-author publications is 0.90%. The Most Productive author based on their publication find that Kumar, A. ranked first with 62 papers (17.06%). Contributors from IIT Kurukshetra have a tendency to publish their papers in conference proceeding followed by Journal Articles. Engineering is the top priority subject followed by Computer Science, Energy Fuels, Telecommunication, and Material Science in which the contributors contribute their paper. The 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, the Indian Institute of Technology, Roorkee ranked first with 10 documents (2.84%). It is suggested that such types of studies should be carried out periodically that will be helpful to review the progress in terms of research productivity of particular institution/University.

References


