A Bibliometric Study of World Research Output on E-Resources during 2006-2016

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ABSTRACT

A bibliometric study is generally used to measure the literature output on any given subject. Bibliometric analysis uses data on numbers and authors of scientific publications and on articles and the citations therein (and in patents) to measure the “output” of individuals/research teams, institutions, and countries, to identify national and international networks, and to map the development of new (multi-disciplinary) fields. Similar approaches have been adopted in this paper to identify the global literature output on e-resources. The research data used for the study has been retrieved from ‘Scopus’ database source. The study in hand attempts to identify the bibliometric characteristics of the research publications from Scopus database during the study period 2006-2016 (11 years). A total of 137051 publications have been identified. Bibliometric techniques have been used to analyze the data. The collected data was classified by using Excel Spreadsheet. The results show that the total publication output (137051) shows a stable trend in citation on yearly basis, the articles (56.8%) are the most prominent publications, and the most prolific author is Bates, D.W with 159 articles and Denny, J.C. with 96 publications. The most productive institution is V.A. Medical Centre which produced 1349 publications, followed by University of Toronto which produced 1006 publications. 'Journal of The American Chemical Society' is highly productive journal with 2362 (1.72%) publications. United States of America tops the list of countries with publication output being 43121 (31.46%) publications. The majority of the e-resource publications are produced by the subject of Medicine with 43.3% publication output.

Key Terms: Bibliometrics, e-Resources, Scopus, Citation.

INTRODUCTION

The scholarly communication has been influenced by the advent and escalation of electronic resources and digital libraries. It has provoked an oscillation of literature for the preference of electronic resources for their information needs and research purposes. The concept of e-resources has transformed the education system and the methodology of seeking information by the scholars has been refashioned.

The information needs of the researchers can be fulfilled through primary, secondary and tertiary sources, which can be made available through a variety of formats like print and electronic. Formerly, the traditional sources of information in any specified discipline were cited as “literature” which included journals, encyclopedias, handbooks, textbooks, monographs, dissertations, etc. With the growth of other forms of dissemination of information especially in electronic media, the term information sources is increasingly being used in reference to the term “literature”. Furthermore, owing to the escalation in the cost of information resources, it has become difficult for the libraries and information centres and other research organizations in the world to meet the expenses for all the resources they necessitate for their library users. Therefore, there has been a launch of resource sharing throughout the world. The concept of resource sharing among libraries also necessitates the knowledge and use of electronic resources among information seekers and professionals. Thus, the contemporary electronic era is an expansion of the resources encountered by the users for research purposes.

LITERATURE REVIEW

IFLA ISBD (ER), defines electronic resources (as cited in Sethi & Panda) “as all those
materials that are computer-controlled, including materials that required the use of a peripheral (e.g., a CD-ROM player) attached to a computer; the items may or not be used in the interactive mode\textsuperscript{11}. On the other hand, Saye explains that “electronic resources are the resources that are generated through some electronic medium and made available to a wide range of viewers both on-site and off-site via some electronic transferring machine or Internet\textsuperscript{12}.”

Electronic resources encompass online and offline resources (Vasishta & Navijoti, Forms of EIR section, point 1 & 2)\textsuperscript{1}. Online resources consist of e-books, e-journals, e-encyclopedias, e-dictionaries, e-directories, e-handbooks, e-theses, e-databases, web OPACs, digital archives, virtual conferences, web exhibitions, virtual help desks, etc., and offline resources include CD-ROM’s, jukebox, audio visual aids, etc.

The considerable amount of information research output on e-resources has already taken place and accumulated in different literature databases which put forward the rationale of the bibliometric study. Yet, it has not yet received the international recognition it deserves because there has been very little research on the concept. Therefore, this paper is an attempt to assess the research progress in the area of e-resources research from 2006 to 2016. This paper is an attempt to identify, analyse and report outgrowth of e-resources literature in the world.

Sevukan & Sharma in their article examined the research output on Biotechnology faculty in selected Indian Central Universities from 1997-2006\textsuperscript{1}. They retrieved the data from two databases viz. PubMed, NCBI and ISI web of Science database – SCIE. They observed that there was increase in publications in Biotechnology from 15 articles in 1997 to 43 articles in 2006. Majority of the publications were two-authored. The contribution of BHU is more as compared to other Universities. It was revealed that 66.72% authors contribute one article and 1.79% contribute more than 10 articles.

Jasmine & Nithyanandam investigated the volume of earthquake research carried out from 1998 to 2007\textsuperscript{1}. The data related to earthquake was retrieved from Web of Science. The findings of the study revealed that English is the most preferred language of publication. USA tops the list of countries which have published literature on earthquake research. Among institutions, US Geological Survey published the majority of articles on earthquake research. Articles were preferred type of document to disseminate the research results during the study period. Bulletin of Seismology Society of America is the most productive source that has published the literature on earthquake.

Duff & Nikam examined the collaboration trend in solar cell research in India from 1991-2010, i.e. 20 years\textsuperscript{1}. The data was retrieved from Web of Science. They observed that almost half of the total publication output surfaced domestic and international collaboration. They found that the academic institutions had equal proportion of output emerging from domestic as well international collaboration. The findings of the study also revealed that National Physical Laboratory - Delhi of the Council of Scientific and Industrial Research had the highest number of publications as far as collaborative research is concerned. Indian researchers collaborated with 31 countries. The countries like South Korea, Japan, USA, Germany, England, France and Greece dominated the collaborative research.

Biradar & Tadasad in their paper attempted to map the reproduced economics literature of India and some selected countries across the world\textsuperscript{1}. The scientometric analysis of on-line articles in economics and related sub-fields from 2000-2014 was done through Web of Science database. They found that the mean relative growth for the first 6 years (2000-05) reveal a growth of 0.32742. From 2006-11, the growth rate was 0.12956. They further observed that the doubling time of publication of articles increased from 1.01519% to 8.43465% during the study period. It was further revealed that the average relative growth rate of articles of Indian distribution decreased from 0.76824 to 0.08216 over study period. The contribution of Management sub-field is found to be the highest in the world, i.e. 72.52% articles and as far as India is concerned, the contribution of Management sub-field is found to be the highest (42.89%).

The review reveals that the bibliometric analysis of literature on e-resources has not been dealt elaborately by the researchers in India as well as abroad till date. However, no systematic study has been undertaken for presenting the growth of literatures on e-resources. Keeping in view the above, an attempt has been made in this paper to analyse the research productivity of e-resources all over the globe. Therefore, the investigator has chosen the subject of e-resources research output covered in SCOPUS database for the purpose of studying and analyzing quantitatively by using bibliometric indicators and tools.

**OBJECTIVES**

- To examine the worldwide research production on e-resources
- To identify the journal distribution of research productivity
- To identify the most prolific authors producing more than sixty articles
- To identify and rank the organizations involved in research on e-resources
- To identify research productivity count of the publications on the basis of geographical distribution
- To identify the document type of publications
- To study the characteristics of highly cited papers

**METHODLOGY**

The study used Scopus International, a multidisciplinary online database, which is the world’s leading indexing and abstracting database. The relevant data on e-resources was extracted published in India and other most productive countries for the period 2006-2016 (11 years). The data has been retrieved from Scopus online database. The advanced search strategy involving the following search query was initiated \textquotedblleft TITLE-ABS-KEY(e-resources) OR TITLE-ABS-KEY(e-resources) OR TITLE-ABS-KEY(e-books) OR TITLE-ABS-KEY(e-journals) OR TITLE-ABS-KEY(e-databases) OR TITLE-ABS-KEY(e-thesis) OR TITLE-ABS-KEY(e-digial repositories) OR TITLE-ABS-KEY(e-repositories) OR TITLE-ABS-KEY(e-articles) OR TITLE-ABS-KEY(e-articles) OR TITLE-ABS-KEY(e-dissertations) OR TITLE-ABS-KEY(e-dissertations) OR TITLE-ABS-KEY(CD-ROM)) AND PUBYEAR > 2005 AND PUBYEAR < 2017\textquotedblright;.

The search query was given to search and download the data using Title, Abstract, and Keywords fields together, thereby resulting in downloading of 137051 records. Bibliometrics analysis method was used for the study in hand. The literature output was studied for the period from 2006 to 2016. The appropriate approach related to the literature produced, the bibliographic details for each record included author, authors affiliation, title, name of the journal,
type of document, source of publication, year of publication, and country of output have been collected. Subsequently, all the collected data was computed using a spreadsheet package. Statistical tools such as frequency distribution and percentage analysis and interpreted.

**DATA ANALYSIS**

- **Document Wise Distribution of Publications**

  The fig. 1 below shows the data about share of publication output of e-resources in different types of documents at the global level:

  ![Fig. 1: Document Wise Publications (%)](image)

  It has been observed that out of total 137051 documents on e-resources, articles are the most prominently found publication and it contains 94764 (69.14%) of total publications, followed by 20391 (14.87%) conference proceedings, 13716 (10%) reviews, 1605 (1.17%) books, and 1426 (1.04%) book chapters. The editorials, letters, short surveys, notes and other remaining document types scored the low numbers of output i.e., below 1% of output for e-resources literature.

- **Year Wise Distribution of Publications**

  Table 1 shows the year wise distribution of research output on e-resources literature at world level during the period 2006-2016.

  ![Table 1: Year Wise Distribution of Research Publications](image)

  It is clearly observed from table 1 that during the period 2006-2016 a total of 137051 publications were published at the global level on e-resources. Table 1 and fig. 2 shows that publication output on e-resources grew from 5.99% in 2006 to 11.40% in 2011. Thereafter, the publication output declined to 10.63% in 2012, gained momentum in 2013 (11.58%). It sharply declined to 7.70% after 2013. It is inferred from the said data that all these 137051 publications on e-resources show a see-saw trend in citation found among the researchers. It is observed from fig. 2 that the publication of research on e-resources shows a downturn which is not healthy in the era of digitization. There is need for the researchers to aggressively take up the research on e-resources in the digital era.

- **Most Prolific Authors**

  The top productive authors who have published more than 60 articles published across the world have been depicted in fig. 3 below:

  ![Fig. 3: Most Prolific Authors Contributing More Than 60 Articles](image)

  The results of the findings reveal that the most publishing author is D.W. Bates with 159 articles, followed by J.C. Denny with 96 articles, R. Kaushal with 88 articles and D. F. Sittig with 86 articles. The remaining authors have contributed less than 80 articles on e-resources. The trend shows a substantial and growing body of work in the field of e-resources in future.

- **Most Productive Institutions**

  The top 20 productive institutions wherein the number of articles published on e-resources across the world have been depicted in fig. 4 below:

  ![Fig. 4: Most Productive Institutions](image)

  Twenty high productive institutions together have published 14848 articles on e-resources, which account for 10.83% of the total output during 2006-2016. Although V.A. Medical Centre, Washington, DC (USA) has produced the highest number of publications (1349), fig. 4 shows that foreign institutes are the top 20 producers of e-resources literature. It is significant to observe that foreign institutes are more involved in research on e-resources as compared to Indian institutes. It is proposed that Indian Government should...
promote research on e-resources and push young scientists and scholars who have the potential for research to work on this subject area.

Most Prolific Journals

The top 20 most prolific journals wherein articles on e-resources got published across the world have been depicted in Table 2 below:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journal</th>
<th>TP</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Journal of the American Chemical Society</td>
<td>2362</td>
<td>1.72</td>
</tr>
<tr>
<td>2</td>
<td>Plos One</td>
<td>1227</td>
<td>0.90</td>
</tr>
<tr>
<td>3</td>
<td>Physical Chemistry Chemical Physics</td>
<td>1135</td>
<td>0.83</td>
</tr>
<tr>
<td>4</td>
<td>Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes in Bioinformatics</td>
<td>1049</td>
<td>0.77</td>
</tr>
<tr>
<td>5</td>
<td>Journal of Physical Chemistry A</td>
<td>995</td>
<td>0.73</td>
</tr>
<tr>
<td>6</td>
<td>Spectrochimica Acta Part A Molecular And Biomolecular Spectroscopy</td>
<td>959</td>
<td>0.70</td>
</tr>
<tr>
<td>7</td>
<td>Journal of Chemical Physics</td>
<td>779</td>
<td>0.57</td>
</tr>
<tr>
<td>8</td>
<td>Nature Communications</td>
<td>741</td>
<td>0.54</td>
</tr>
<tr>
<td>9</td>
<td>Studies in Health Technology And Informatics</td>
<td>719</td>
<td>0.52</td>
</tr>
<tr>
<td>10</td>
<td>Journal of the American Medical Informatics Association</td>
<td>706</td>
<td>0.52</td>
</tr>
<tr>
<td>11</td>
<td>Optics Express</td>
<td>684</td>
<td>0.50</td>
</tr>
<tr>
<td>12</td>
<td>Inorganic Chemistry</td>
<td>666</td>
<td>0.49</td>
</tr>
<tr>
<td>13</td>
<td>AMIA Annual Symposium Proceedings AMIA Symposium AMIA Symposium</td>
<td>583</td>
<td>0.43</td>
</tr>
<tr>
<td>14</td>
<td>Journals of Organic Chemistry</td>
<td>572</td>
<td>0.42</td>
</tr>
<tr>
<td>15</td>
<td>International Journal Medical Informatics</td>
<td>524</td>
<td>0.38</td>
</tr>
<tr>
<td>16</td>
<td>Journal of Molecular Modeling</td>
<td>510</td>
<td>0.37</td>
</tr>
<tr>
<td>17</td>
<td>Cochrane Database of Systematic Reviews</td>
<td>497</td>
<td>0.36</td>
</tr>
<tr>
<td>18</td>
<td>Nano Letters</td>
<td>492</td>
<td>0.36</td>
</tr>
<tr>
<td>19</td>
<td>Chemical Communications</td>
<td>480</td>
<td>0.35</td>
</tr>
<tr>
<td>20</td>
<td>Advanced Materials</td>
<td>444</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16124</td>
<td>11.76</td>
</tr>
</tbody>
</table>

It has been observed from Table 2 above that United States tops the list of countries producing publication output on e-resources literature with 43121 (31.46%) during the period 2006-2016 followed by China (12.86%) and United Kingdom (8.81%). Germany, which comes fourth on the list, produced a meagre 5.37% of total output on e-resources even though it is in close proximity with Canada (4.45%). It is clearly revealed that nearly 33% of the outputs are provided by five countries, Australia, India, France, Italy, Spain, Japan, Netherlands, Brazil, South Korea, Switzerland, Taiwan, Sweden, Poland and Belgium. Only Iran produced less than 1% publication output. It is observed that there are the only larger developed nation which have contributed towards publication output of e-resources literature. The smaller countries have very scanty output on the same during the period 2006-2017.

Subject Wise Distribution of Publications

Fig. 6 presents subject wise distribution of e-resources literature by the topmost 10 subjects.
The results of the findings revealed that subject of Medicine tops the list of subjects producing publication output on e-resources literature with 43.32% publications during the period 2006-2016 followed by Computer Science with 15.18% publications and Chemistry with 14.72% publications. Engineering, which comes fourth on the list, produced 14.21% of total output on e-resources and is in close proximity with Chemistry. It is observed that Biochemistry, Genetics and Molecular Biology, Social Sciences along with Physics, Astronomy, and other subjects produced less than 12% of the publications on e-resources. It is observed that there are only science subjects which have contributed largely towards publication output of e-resources literature. The Arts and Humanities subjects have very scanty output on the same during the period 2006-2017.

Highly Cited Papers

Table 4 analyses the top 5 most highly cited papers on e-resources during the period 2006-2017.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Year of Pub</th>
<th>Author</th>
<th>Title</th>
<th>Journal/Book Title</th>
<th>Citation Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2009</td>
<td>Huang, D.W., Sherman, B.T., Lempicki, R.A.</td>
<td>Systematic and integrative analysis of large gene lists using DAVID bioinformatics resources</td>
<td>Nature Protocols 4(1), 44-57</td>
<td>10924</td>
</tr>
<tr>
<td>3</td>
<td>2006</td>
<td>Stankovich, S., Dikin, D.A., Dommett, G.H.B., ...</td>
<td>Graphene-based composite materials</td>
<td>Nature 442(7100), 282-286</td>
<td>7084</td>
</tr>
</tbody>
</table>

It has been observed from table 4 that the highest citation work is “Systematic and integrative analysis of large gene lists using DAVID bioinformatics resources” by D.W. Huang, B.T. Sherman, and R.A. Lempicki published in Nature Protocols with 10924 citations, followed by “The electronic properties of graphene” by A.H. Castro Neto, F. Guinea, N.M.R. Peres, K.S. Novoselov and A.K. Geim published in Reviews of Modern Physics which is cited 10508 times. Rest of the publications received less than 8000 citations each. Of the highest cited publications all five are journal articles. The highly cited sources are observed to be from the period 2006-2011.

Findings

- There exist 137051 publications during the year 2006-2016.
- Publications in the form of articles are found to be the most prominent publication (69.14%).
- The publication output grew from 5.99% in 2006 to 11.40% publications in 2011.
- During the year 2012, the publication output declined to 10.63% which again gained momentum in 2013 with 11.58% publications, i.e. more than in 2011.
- The publication output sharply declined to 7.70% after 2013.
- The most publishing author is D.W. Bates with 159 articles, followed by J.C. Denny with 96 articles.
- V.A. Medical Centre, Washington, DC (USA) produced the highest number of publications (1349).
- It is observed that the foreign institutes are the top 20 producers of e-resources literature as they are more involved in research on e-resources as compared to Indian institutes.
- 20 high productive journals published 16124 research papers on e-resources, which accounts for nearly 11.76% of the total output during 2006-2016.
- It is observed that Journal of the American Chemical Society is the highly productive journal with 2362 (1.72%) publications.
- The journals with second and third highest output have less than 1% publications namely, Plos One with 1227 (0.90%) and Physical Chemistry Chemical Physics with 1135 (0.83%) publications.
- United States tops the list of countries producing publication output on e-resources literature with 43121 (31.46%) during the period 2006-2016 followed by China (12.86%) and United Kingdom (8.81%).
- Nearly 33% of the outputs are provided by 15 countries, Australia, India, France, Italy, Spain, Japan, Netherlands, Brazil, South Korea, Switzerland, Taiwan, Sweden, Poland and Belgium.
- Iran produced less than 1% publication output
- Subject of Medicine tops the list of subjects producing publication output on e-resources literature with 43.32% publications.
- Only science subjects which have contributed largely towards publication output of e-resources literature.
- The Arts and Humanities subjects have very scanty output on the same during the period 2006-2017.
- The most cited work is “Systematic and integrative analysis of large gene lists using DAVID bioinformatics resources”, a journal article by D.W. Huang, B.T. Sherman, and R.A. Lempicki published in Nature Protocols which has been cited 10924 times.

Conclusion

The country’s research performance in e-resources needs to gain momentum in the global context. However, the country
needs to intensify the quality and quantity of its research carried out by different organizations including government institutions, with international collaboration. It is suggested that significant efforts should be made for research on e-resources in arts and humanities subjects also with proper supervision and clearly defined goals.

REFERENCES


