# Bibliometric Analysis of IP&M Journal (1980–2015)

**Asad Abdi[1], Norisma Idris[2], Rasim M Alguliyev[3], Ramiz M Aliguliyev[3*]**

[1]UTM Big Data Centre, Universiti Teknologi Malaysia, Skudai 81310 Johor, MALAYSIA.
[2]Department of Artificial Intelligence, Faculty of Computer Science and Information Technology, University of Malaya, 50603, Kuala Lumpur, MALAYSIA.
[3]Institute of Information Technology, Azerbaijan National Academy of Sciences. 9A, B. Vahabzade Street. AZ1141 Baku. AZERBAIJAN.

## ABSTRACT

This study aims to present a bibliometric analysis of the journal titled "Information Processing & Management (IP & M)" for the period from 1980 to 2015. The present study was conducted with an aim to provide a summary of research activity in current journal and characterize its most important aspects. The analysis covers mainly the year-wise distribution of articles, category-wise classification of papers, authorship patterns of papers, degree of collaboration, most prolific contributions of papers, institutions-wise distribution of contributions, geographical distribution of papers, and citation analysis of the IP&M journal. The analysis showed that 2,913 papers were published in journal of IP&M from 1980 to 2015. The highest percentage was articles (67.15%) among the published document types. In this study, we have identified top 10 prolific authors, top 10 institutions and top 24 prolific countries with number of papers. Researchers from USA have been made the most percentage of contributions (50.88%). We have also identified that from the period 1980-1985 to the period 2010-2015 degree of collaboration has been increased in 3 times. All the studies demonstrate the merits and weakness of the journal which will be helpful for its further development.

**Keywords:** Bibliometrics, Journal of IP&M, Authorship pattern, Degree of collaboration, Citation analysis.

## INTRODUCTION

Bibliometrics includes a set of methods employed to examine or measure texts and information (Hung, 2012). Bibliometrics is the discipline where quantitative approaches were used to apply mainly to scientific fields and are based principally on various aspects of written articles like subject, author, citations, title, etc. (Hussain, Fatima, and Kumar, 2011). This type of analysis would be useful to monitor growth of literature and patterns of research (JACOBS, 2001). It also provides beneficial indicators of scientific productivity and the emphasis of research in various aspects and researchers' preferences for publication. Bibliometrics is considered as a standard tool of science policy and research management in the last decades. All significant compilations of science indicators depend on publication and citation statistics and other, more complex bibliometric techniques (Roy and Basak, 2013; Sengupta, 1985). Bibliometrics is the quantitative explanation of literature that aids in

measuring the patterns of forms of recorded information and their producers (Shilbury, 2011). It uses quantitative analysis and statistics to define patterns of publication with a given field or body of literature. Researchers can use bibliometric methods of evaluation to identify the influence of a single writer or to define the relationship of two or more writers or works.

Scientists do not work in isolation, they are members of a worldwide community of researchers working together to provide new insights and inspiration using articles publishing in different journals, for new researchers to work on the same or related fields (Jain, 2015). Thus, bibliometrics is an important scientific tool to evaluate the standard of a journal. The subject of bibliometrics was first described by Pritchard (1969) as "the application of mathematical and statistical methods to books and other media". It involves the analysis of a set of publications characterized by specific variables such as the citations, the associated subject keywords, the place of publication and the authors. Historically bibliometric approaches were used to trace relationships amongst academic journal citations. Many research fields use bibliometric approaches to examine the impact of their field, the impact of a set of researchers or the impact of a particular paper (Thanuskodi, 2010; Tsay, 2011;

Wan, Anyi, Anuar, and Zainab, 2009; Zainab, Anyi, and Anuar, 2013).

The journals are the indicators of literature development in any field of knowledge. The journals are the main channel to transmit knowledge. Due to the escalating cost of the journals and lack of enough library budgets the selection of any journal for a library should be done more carefully. Therefore, the librarians and statisticians are forced to conduct the bibliometric studies and reduce the number of journal subscriptions. Hence, we are seeing large number of bibliometric studies for over last two decades.

This paper studies the bibliometric analysis of the literature published in the Journal of "Information Processing and Management (IP&M)" from volume 16 (1980) to volume 51(2015) to analyse various parameters in this regard. IP&M (ISSN: 0306-4573) is an international peer-reviewed academic journal published by the ELSEVIER SCI LTD. It published six issues per year. Since 1980, it continues to publish six issues per year.

IP&M focuses on publishing peer-reviewed original research concerning theory, methods, or application in the field of information science, including (http://www.journals.elsevier.com/information-processing-and-management/): 1) "Research in information science, information searching, or information retrieval and related areas that deals with the production, representation, organization, storage, retrieval, use, or evaluation of information, along with the tools and techniques associated with these processes"; 2) "Research in human information behaviour and related areas that deal with the nature, manifestations, behaviour, and effects of information or knowledge, along with the communication and distribution of that information or knowledge"; 3) "Research in domain specific areas involving information studies or design, including the areas of web searching, online advertising, public relations, communication, management information systems, computational economics, computational advertising, web analytics, online news, bibliometrics, scientometrics, health informatics, or similar areas"; 4) Research in system design dealing with experimental processes related to digital libraries, knowledge management systems, multimedia processing, human-computer interfaces, or system evaluation in the information systems field.

The present study has been undertaken with the objective of analysing the following aspects.

Analysis of articles:

- To examine year-wise distribution of papers;
- To examine categories-wise classification of papers;
- To examine the authorship pattern of papers;

- To calculate the degree of collaboration;
- To examine the most prolific contributions of papers;
- To examine institute-wise distribution of papers;
- To determine the geographical distributions of contributions in the journal;

Analysis of citations:

- To identify the year-wise distribution of citations, Average Citations Per Item (ACPI), Average Citations Per Year (ACPY);
- Age of journal cited
- To identify the number and forms of documents cited.

## Related Work

This article reviews a few studies conducted on bibliometric study. The following are some of the related studies worthy of examinations.

Neff and Corley (2009) used the bibliometric tool of co-word analysis to determine trends in the approaches and subjects of ecology during the period 1970-2005. The bibliometric characteristics of three leading information science journals have been examined and compared in (Tsay, 2008) and (Tsay and Shu, 2001) while the citation analysis of four sports management journals has been studied in (Shilbury, 2011).

Thanuskod (2010) discussed the research output performance of social scientists on social science issues. The study includes mainly the year wise distribution of cited journals, forms of documents cited, average number of references per articles, subject wise distribution of articles, authorship pattern and the number of articles etc.

Authors of the articles (Uzun, 2004; Tsay, 2011, 2013 and 2015) studied bibliometric analysis of IP and M. Hong Yeoh and Kaur (2008) explore the publication output of research in various scientific fields in higher education. As a result, study of 40 issues of journal exposed a varied utilization pattern bibliographic reference sources by contributing researchers. Consequently, analysis of 40 issues of journal exposed a diversified usage pattern of bibliographic reference sources by contributing researchers, having a cumulative overall being 8,347. A positive pattern in research collaboration of authors, a continuous growth throughout the use of reference sources, Journals and internet documents in the citations denote the tendency of scholarly communication of research works in the electronic age. Similar to other disciplines of research studies, journals and books were the most cited source materials for researchers.

Singh, Mittal, and Ahmad (2007) carried out a bibliometric analysis of publication on digital libraries. The significant

results were that the most of papers are single-authored; the productivity was not in agreement with Lotka (1926) Law, besides in one case where the number of articles is three; the total number of papers were published in 2003 with English language; most papers were published in the journal Digital Library (D-lib) Magazine; distribution of papers follows Bradford's (1934) Law; and USA ranked first for maximum number of journals.

Patra, Bhattacharya, and Verma (2006) explored the growth pattern, core journals and distribution of authors in the field of bibliometric using data collected from Library and Information Science Abstract. According to the result of study the growth of literature does not show any certain pattern. Dhiman (2000) has conducted ten year bibliometric study "Ethnobotany Journal" published from 1989 to 1998. This paper analysed authorship pattern, country-wise, institution-wise, year-wise, range of references cited and length of the articles.

Larivière, Sugimoto, and Cronin (2012) presented a century-long analysis of the Library and Information Science (LIS) field using a variety of standard bibliometric techniques. This study not only provides field-specific indicators of scholarly productivity and impact but also includes aggregate data on scholarly publication, authorship and citation trends in the social sciences and humanities in general.

In (Levitt and Thelwall, 2011), the authors introduced a new hybrid indicator that is the weighted sum of the article's total number of citations in a citation window and the Impact Factor of the journal in which the article was published. This study found that, for short citation windows (0 or 1 years) the new indicator: 1) highly correlates with long-term citation; and 2) is less skewed towards articles published early in the year.

Sun (2011) investigated the trend in LIS international coauthorship and established its relationship with citations. In particular, she attempted to reveal: (1) the trend in authorship types (international collaboration, national collaboration, and single authorship) over the years, and (2) relation between the number of citations received and the international coauthor-ship. For identification of coauthorship trends within LIS, Sun analyzed 7489 papers published in ARIST, IP&M, JAMIA, JASIST, MISQ , and Scientometrics.

There have been several studies of research productivity (publications) and impact (citations) at the level of countries in recent years. Fiala (2012) determined the most influential countries in computer science by analysing the free CiteSeer digital library data.

Cobo *et al.* (2015) presented a bibliometric analysis of the scientific content of the journal Knowledge-Based Systems (KnoSys) by analysing the articles, published between 1991 and 2014. The analysis showed that during these 25 years: 1) KnoSys has attracted the interest of the scientific community; 2) the impact factor of KnoSys has increased; 3) the publications of KnoSys are focused mainly on eight great thematic areas (Classification, Data mining, Rough-sets, Decision-support-systems, Agent-systems, Information-retrieval, Group-decision making and Semantic-web).

Bornmann and Mutz (2015) analysed the number of publications and cited references since the mid-1600s up to 2012 to re-examine the question of the growth of science. They identified three growth phases in the development of science, which each led to growth rates tripling in comparison with the previous phase: from less than 1% up to the middle of the 18th century, to 2 to 3% up to the period between the two world wars and 8 to 9% to 2012.

By analysing the number of papers published in the software-engineering-related venues and indexed in the Scopus until year 2014 Garousi (2015) presented bibliometric analysis of the Turkish software engineering community. The analysis identified top-ranked institution and top-ranked scholar.

Heradio *et al.* (2015) analysed the literature on software product lines from 1995 to 2014. Using the science mapping technique, they identified the main research topics. Using the performance analysis technique, they also identified the most influential publications and the most researched topics on software product lines.

In (Kalita, 2016), a scientometric analysis of the articles published in Science during the period of 2006-2015 has been made based on the citation data available in the Web of Science database. In this study it was found that average authorship of the research papers has seen an increasing trend and the researches published in Science are highly collaborative (degree of collaboration always ≥0.96). Based on the cited references study, it also was found that each year Science generates an average of 10% self-citations from the outgoing citations through its research articles.

The study (Meera and Sahu, 2015), based on a bibliometric analysis of scientific research output, depicted the research performance of University College of Medical Science (UCMS) in different areas or subfields of medical and health sciences. To illustrate the research performance of researchers in this study some bibliometric indicators such as authorship pattern, degree of collaboration, author productivity, rank distribution etc. have been used.

Muthumari and Raja (2016) presented bibliometric analysis of 783 papers published in Defence Science Journal during 2005-2014. In this study, authors analysed different aspects

like types of communication, growth pattern, authorship pattern, prolific contributors, collaboration trend, etc.

Based on the data collected from the articles listed in Web of Science during the period of 1993-2012, the paper (Sangam and Arali, 2016) studied the relative growth rate of research publications versus the collaboration and authorship pattern of Genetics subject of the world and India. Study showed the higher the growth of literature and higher the scientific collaboration.

## Analysis

The analysis was done in two parts: 1) Analysis of articles 2) Analysis of citations.

## Data analysis and interpretation
### Year-wise distribution of papers

During the period of study 1980 to 2015 scientists all over the world have produced a total of 2913 articles in IP&M, as shown in Table 1. The journal on an average has published 81 papers per year. The fluctuations in publication pattern of literature were considered throughout the period of study. However, out of total 2,913 articles, the maximum number of publication was recorded in 2007 (141 articles, 4.84%) while the minimum was in the year 1980 (34 articles, 1.17%). The cumulative publications and cumulative percentage each year is also shown in Table 1.

### Category-wise classification of papers

Table 2 presents the category-wise classification of the articles published during period from 1980 to 2015. The study shows that the maximum number of papers published as under the category of article i.e. 1956 (67.15%), whereas 818 (28.08%) papers published under the book review category. There were a small number of articles published as under the Meeting Abstract category, i.e., 1 (0.03%).

### Authorship pattern of papers

The authorship pattern was studied to determine the percentage of single and multiple authorships. As shown in Table 3, our author sample consists of 5446 authors for 2913 papers. Table 3 exposes that during 1980-2015 the highest proportion of papers were by single authors (51.01%), followed by papers with 2 authors (22.04%), 3 authors (15.93%), and more than 3 authors (11.02%). The average number of authors per paper is 1.87, i.e. 5446 authors written 2913 articles. Table 3 displayed that out of 2913 papers single author contributed 1486 (51.01%) papers while the rest 1427 (48.99%) papers were contributed by joint authors.

### Degree of collaboration

To calculate the degree of collaboration in quantitative terms, Subramanyam (1983) proposed a formula as follows.

**Table 1: Year-wise distribution of papers.**

| Year | Volume and Issue No. | No. of Articles | % | Cumulative | % |
|------|------|------|------|------|------|
| 1980 | 16 and (1-6) | 34 | 1.17 | 34 | 1.17 |
| 1981 | 17 and (1-6) | 46 | 1.58 | 80 | 2.75 |
| 1982 | 18 and (1-6) | 54 | 1.85 | 134 | 4.60 |
| 1983 | 19 and (1-6) | 72 | 2.47 | 206 | 7.07 |
| 1984 | 20 and (1-6) | 67 | 2.30 | 273 | 9.37 |
| 1985 | 21 and (1-6) | 108 | 3.71 | 381 | 13.08 |
| 1986 | 22 and (1-6) | 116 | 3.98 | 497 | 17.06 |
| 1987 | 23 and (1-6) | 89 | 3.06 | 586 | 20.12 |
| 1988 | 24 and (1-6) | 112 | 3.84 | 698 | 23.96 |
| 1989 | 25 and (1-6) | 106 | 3.64 | 804 | 27.60 |
| 1990 | 26 and (1-6) | 100 | 3.43 | 904 | 31.03 |
| 1991 | 27 and (1-6) | 95 | 3.26 | 999 | 34.29 |
| 1992 | 28 and (1-6) | 94 | 3.23 | 1093 | 37.52 |
| 1993 | 29 and (1-6) | 110 | 3.78 | 1203 | 41.30 |
| 1994 | 30 and (1-6) | 80 | 2.75 | 1283 | 44.04 |
| 1995 | 31 and (1-6) | 110 | 3.78 | 1393 | 47.82 |
| 1996 | 32 and (1-6) | 89 | 3.06 | 1482 | 50.88 |
| 1997 | 33 and (1-6) | 77 | 2.64 | 1559 | 53.52 |
| 1998 | 34 and (1-6) | 66 | 2.27 | 1625 | 55.78 |
| 1999 | 35 and (1-6) | 56 | 1.92 | 1681 | 57.71 |
| 2000 | 36 and (1-6) | 46 | 1.58 | 1727 | 59.29 |
| 2001 | 37 and (1-6) | 51 | 1.75 | 1778 | 61.04 |
| 2002 | 38 and (1-6) | 45 | 1.54 | 1823 | 62.58 |
| 2003 | 39 and (1-6) | 55 | 1.89 | 1878 | 64.47 |
| 2004 | 40 and (1-6) | 58 | 1.99 | 1936 | 66.46 |
| 2005 | 41 and (1-6) | 102 | 3.50 | 2038 | 69.96 |
| 2006 | 42 and (1-6) | 119 | 4.09 | 2157 | 74.05 |
| 2007 | 43 and (1-6) | 141 | 4.84 | 2298 | 78.89 |
| 2008 | 44 and (1-6) | 132 | 4.53 | 2430 | 83.42 |
| 2009 | 45 and (1-6) | 61 | 2.09 | 2491 | 85.51 |
| 2010 | 46 and (1-6) | 60 | 2.06 | 2551 | 87.57 |
| 2011 | 47 and (1-6) | 68 | 2.33 | 2619 | 89.91 |
| 2012 | 48 and (1-6) | 82 | 2.81 | 2701 | 92.72 |
| 2013 | 49 and (1-6) | 92 | 3.16 | 2793 | 95.88 |
| 2014 | 50 and (1-6) | 52 | 1.79 | 2845 | 97.67 |
| 2015 | 51 and (1-6) | 68 | 2.33 | 2913 | 100.00 |

$$\text{Degree of collaboration (DC)} = \frac{\text{\# of multi authored papers}}{\text{\# of single authored papers} + \text{\# of multi authored papers}} \quad (1)$$

As a result, the degree of collaboration is: 1427/2913=0.49. As shown in Table 4 the value of DC varies from the study period. DC was 0.26 during 1980-1985, 0.22 during 1986-1991, 0.33 during 1992-1997, 0.62 during 1998-2003, 0.72 during 2004-2009 and 0.88 during 2010-2015. It indicates that there is significant increase in DC for the study period.

**Table 2: Category-wise classification of papers.**

| Category | Year | | | | | | No. of articles | % |
|---|---|---|---|---|---|---|---|---|
| | 1980-1985 | 1986-1991 | 1992-1997 | 1998-2003 | 2004-2009 | 2010-2015 | | |
| Article | 205 | 275 | 310 | 250 | 511 | 406 | 1956 | 67.15 |
| Book Review | 163 | 309 | 223 | 49 | 71 | 3 | 818 | 28.08 |
| Editorial material | 10 | 14 | 14 | 10 | 18 | 8 | 74 | 2.54 |
| Review | 0 | 7 | 6 | 6 | 5 | 3 | 27 | 0.93 |
| Note | 0 | 6 | 2 | 0 | 0 | 0 | 8 | 0.27 |
| Correction | 0 | 0 | 2 | 2 | 5 | 1 | 8 | 0.27 |
| Letter | 0 | 1 | 2 | 2 | 0 | 0 | 5 | 0.17 |
| Software Review | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 0.10 |
| Item about an Individual | 0 | 2 | 1 | 0 | 0 | 0 | 3 | 0.10 |
| Correction Addition | 1 | 0 | 2 | 0 | 0 | 0 | 3 | 0.10 |
| Biographical Item | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 0.10 |
| Discussion | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0.07 |
| Reprint | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0.07 |
| Meeting Abstract | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0.03 |

**Table 3: Authorship patterns.**

| Authorship | Year | | | | | | No. of Articles | % | Total Authors |
|---|---|---|---|---|---|---|---|---|---|
| | 1980-1985 | 1986-1991 | 1992-1997 | 1998-2003 | 2004-2009 | 2010-2015 | | | |
| Single | 282 | 484 | 375 | 122 | 174 | 49 | 1486 | 51.01 | 1486 |
| 2 authors | 74 | 81 | 104 | 94 | 189 | 100 | 642 | 22.04 | 1284 |
| 3 authors | 21 | 34 | 59 | 68 | 141 | 141 | 464 | 15.93 | 1392 |
| more than three | 4 | 19 | 22 | 35 | 109 | 132 | 321 | 11.02 | 1284 |
| Total articles | 381 | 618 | 560 | 319 | 613 | 422 | 2913 | 100.0 | -- |
| Total authors | 509 | 824 | 848 | 654 | 1411 | 1200 | -- | -- | 5446 |
| Average authors per article | 1.34 | 1.33 | 1.51 | 2.05 | 2.30 | 2.84 | -- | -- | -- |
| Single % | 74.02 | 78.32 | 66.96 | 38.24 | 28.38 | 11.61 | 51.01 | -- | -- |
| Joint % | 25.98 | 21.68 | 33.04 | 61.76 | 71.62 | 88.39 | 48.99 | -- | -- |

**Table 4: Year-wise degree of collaboration.**

| Authorship | Year | | | | | | No. of Authors |
|---|---|---|---|---|---|---|---|
| | 1980-1985 | 1986-1991 | 1992-1997 | 1998-2003 | 2004-2009 | 2010-2015 | |
| Single authored papers | 282 | 484 | 375 | 122 | 174 | 49 | 1486 |
| Multi authored papers | 99 | 134 | 185 | 197 | 439 | 373 | 1427 |
| Degree of collaboration | 0.26 | 0.22 | 0.33 | 0.62 | 0.72 | 0.88 | 0.49 |

We identify that from the period 1980–1985 to the period 2010–2015 DC has been increased in 3 times. The results reveal the prevalence of team research in information and library science field.

*The most prolific contributions of papers in IP&M*

From 1980 to 2015 articles were published by 5446 authors, as shown in Table 5. Table 5 presents the most publishing author SPINK A (28 articles; 292 citations), followed by EGGHE L (28 articles; 1449 citations), BORKO H (27 articles; 38 citations),

BOOKSTEIN A (23 articles; 60 citations), JANSEN BJ (20 articles; 1066 citations) and others. Table 5 also includes information on the number of articles, average citation value and h–index as found from the citation tool of the web of knowledge database, concerning all the articles published in the journal of IP and M for the study period. EGGHE L, JANSEN BJ and SARACEVIC T have received highest citation and h–index, suggesting that they have been senior researcher working in relevant fields.

**Table 5: Prolific authors with number of papers (first 10 authors).**

| Authors | No. of articles | % of articles | Total citations | Average citations per item | h-index |
|---------|-----------------|----------------|------------------|-----------------------------|---------|
| SPINK A | 28 | 0.96 | 292 | 10.43 | 10 |
| EGGHE L | 28 | 0.96 | 1449 | 51.75 | 17 |
| BORKO H | 27 | 0.93 | 38 | 1.41 | 5 |
| BOOKSTEIN A | 23 | 0.79 | 60 | 2.61 | 4 |
| JANSEN BJ | 20 | 0.69 | 1066 | 53.3 | 11 |
| LOSEE RM | 18 | 0.62 | 133 | 7.39 | 8 |
| SARACEVIC T | 17 | 0.58 | 28962 | 10.06 | 66 |
| COLE C | 17 | 0.58 | 505 | 29.71 | 3 |
| ROUSSEAU R | 16 | 0.55 | 472 | 29.5 | 8 |
| JARVELIN K | 16 | 0.55 | 186 | 11.62 | 7 |

**Table 6: Top ten prolific institutions with number of papers.**

| Institutions | No. of articles | % |
|--------------|-----------------|---|
| UNIVERSITY OF CALIFORNIA SYSTEM (UCS) | 118 | 4.05 |
| PENNSYLVANIA COMMONWEALTH SYSTEM OF HIGHER EDUCATION PCSHE (PCSHEP) | 84 | 2.88 |
| UNIVERSITY OF NORTH CAROLINA (UNC) | 79 | 2.71 |
| UNIVERSITY OF NORTH CAROLINA CHAPEL HILL (UNCCH) | 74 | 2.54 |
| UNIVERSITY OF CALIFORNIA LOS ANGELES (UCL) | 73 | 2.51 |
| CATHOLIC UNIVERSITY OF AMERICA (CUA) | 62 | 2.13 |
| RUTGERS STATE UNIVERSITY (RSU) | 56 | 1.92 |
| PENN STATE UNIVERSITY (PSU) | 56 | 1.92 |
| UNIVERSITY OF CHICAGO (UC) | 55 | 1.89 |
| UNIVERSITY OF WESTERN ONTARIO (UWO) | 46 | 1.58 |

*Institutions-wise distribution of papers*

This section presents institution-wise distribution of papers published the journal of IP&M during the period under study. Table 6 shows the most publishing institutions UCS (118 articles), followed by PCSHEP (84 articles), UNC (79 articles), UNCCH (74 articles), UCL (73 articles) and others.

*The geographical distributions of contributions*

Table 7 shows the geographical distribution of papers of the journal of IP&M under study. The highest number i.e. 1482 (50.88%) has been contributed by USA followed by ENGLAND, CANADA, PEOPLES R CHINA and SOUTH KOREA are on second, third, fourth and fifth place having 207 (7.11%), 183 (6.28%), 110 (3.78%) and 98 (3.36%) contributions respectively.

## Analysis of citations

The references supplied by the authors at the end of their papers considers as the basis of citation analysis. Citation traces a connection between two papers, one which cites and the other which is cited. Citation analysis is one of the popular methods applied to derive the following benefits.

*To identify the year-wise distribution of citations, Average Citations per Item (ACPI), Average Citations per Year (ACPY)*

As shown in Table 8, there are 29117 citations provided over thirty-six years for the total contributions of 2913 papers. Table 8 shows that maximum number of citations 2730 produced in 1988 followed by 1826 citations in 2006, 1571 citations in 2000, and 1538 citations in 2005, and 1508 citations in the year 2007.

*Age of journal cited*

Table 9 shows that the maximum number of citations accounted in the period 2004-2009, 8014 followed by 6457 in 1998-2003, 6323 in the year 1986-1991.

*Forms of documents cited*

Table 10 shows that maximum number of citations 27306 (93.78%) of the total 29117 citations produced by article followed by review with 1125 (4.17%) citations, editorial material with 527 (1.81%) citations, book review with 29 (0.10%) citations, note with 28 (0.10%) citations, item about an individual with 5 (0.02%) citations, letter with 4 (0.01%) citations, reprint with 2 (0.01%) citations and correction with 1 (0.00%) citation. The results show that the researchers

**Table 7: Top twenty-four prolific countries with number of papers.**

| Countries | No. of articles | % | Countries | No. of articles | % |
|---|---|---|---|---|---|
| USA | 1482 | 50.88 | FINLAND | 48 | 1.65 |
| ENGLAND | 207 | 7.11 | SCOTLAND | 46 | 1.58 |
| CANADA | 183 | 6.28 | SINGAPORE | 35 | 1.20 |
| PEOPLES R CHINA | 110 | 3.78 | GERMANY | 34 | 1.17 |
| SOUTH KOREA | 98 | 3.36 | NETHERLANDS | 32 | 1.10 |
| SPAIN | 90 | 3.09 | ISRAEL | 29 | 1.00 |
| JAPAN | 82 | 2.81 | TURKEY | 27 | 0.93 |
| TAIWAN | 71 | 2.44 | INDIA | 27 | 0.93 |
| ITALY | 70 | 2.40 | POLAND | 25 | 0.86 |
| FRANCE | 67 | 2.30 | DENMARK | 25 | 0.86 |

**Table 8: Citations in each year.**

| Year | No. of articles | No. of citations | ACPI | Year | No. of articles | No. of citations | ACPI |
|---|---|---|---|---|---|---|---|
| 1980 | 34 | 142 | 4.18 | 1998 | 66 | 881 | 13.35 |
| 1981 | 46 | 466 | 10.13 | 1999 | 56 | 1426 | 25.46 |
| 1982 | 54 | 267 | 4.94 | 2000 | 46 | 1571 | 34.15 |
| 1983 | 72 | 343 | 4.76 | 2001 | 51 | 843 | 16.53 |
| 1984 | 67 | 372 | 5.55 | 2002 | 45 | 881 | 19.58 |
| 1985 | 108 | 313 | 2.90 | 2003 | 55 | 855 | 15.55 |
| 1986 | 116 | 475 | 4.09 | 2004 | 58 | 1135 | 19.57 |
| 1987 | 89 | 741 | 8.33 | 2005 | 102 | 1538 | 15.08 |
| 1988 | 112 | 2730 | 24.38 | 2006 | 119 | 1826 | 15.34 |
| 1989 | 106 | 718 | 6.77 | 2007 | 141 | 1508 | 10.70 |
| 1990 | 100 | 1061 | 10.61 | 2008 | 132 | 1349 | 10.22 |
| 1991 | 95 | 598 | 6.29 | 2009 | 61 | 658 | 10.79 |
| 1992 | 94 | 941 | 10.01 | 2010 | 60 | 296 | 4.93 |
| 1993 | 110 | 771 | 7.01 | 2011 | 68 | 299 | 4.40 |
| 1994 | 80 | 621 | 7.76 | 2012 | 82 | 322 | 3.93 |
| 1995 | 110 | 1089 | 9.90 | 2013 | 92 | 196 | 2.13 |
| 1996 | 89 | 614 | 6.90 | 2014 | 52 | 44 | 0.85 |
| 1997 | 77 | 1204 | 15.64 | 2015 | 68 | 23 | 0.34 |

preferred journal papers more frequently for their research work, than any other types of communication channels.

## Findings of study

The followings are several useful facts discovered from the analysis of the journal IP&M.

* The analysis displays a trend of growth in contributions published during 2004 to 2009 and average number of contributions per year is 12.

* The DC is 0.49. It shows that during the study period from 1980 to 2015 the most authors contributed their papers single.

* The mean number of author per article was 1.87.

* The aim of the authorship pattern study was to identify the percentage of single and multiple authorships. The results showed that the number of multi–authored articles increases very fast. From the period 1980–1985 to

**Table 9: Age of journal cited.**

| Year | No. of articles | No. of citations | ACPY | ACPI |
|---|---|---|---|---|
| 1980-1985 | 381 | 1903 | 317.17 | 4.99 |
| 1986-1991 | 618 | 6323 | 1053.83 | 10.23 |
| 1992-1997 | 560 | 5240 | 873.33 | 9.36 |
| 1998-2003 | 319 | 6457 | 1076.17 | 20.24 |
| 2004-2009 | 613 | 8014 | 1335.67 | 13.07 |
| 2010-2015 | 422 | 1180 | 196.67 | 2.80 |

**Table 10: Forms of documents cited.**

| Forms of document | No. of articles | No. of citations | % of citations | ACPI |
|---|---|---|---|---|
| Article | 1956 | 27306 | 93.78 | 13.96 |
| Review | 27 | 1215 | 4.17 | 45.00 |
| Editorial material | 74 | 527 | 1.81 | 7.12 |
| Book Review | 818 | 29 | 0.10 | 0.04 |
| Note | 8 | 28 | 0.10 | 3.50 |
| Letter | 5 | 4 | 0.01 | 0.80 |
| Item about an Individual | 3 | 5 | 0.02 | 1.67 |
| Reprint | 2 | 2 | 0.01 | 1.00 |
| Correction | 8 | 1 | 0.00 | 0.13 |
| Correction Addition | 3 | 0 | 0.00 | 0.00 |
| Biographical Item | 3 | 0 | 0.00 | 0.00 |
| Discussion | 2 | 0 | 0.00 | 0.00 |
| Software Review | 3 | 0 | 0.00 | 0.00 |
| Meeting Abstract | 1 | 0 | 0.00 | 0.00 |

of scientific results and predicting the potential of a field. This work presents an analysis of IP&M literature over a thirty-six-year period (1980-2015). The journal has published 2,913 papers during the period of study. The analysis exposed that maximum number of citations (8014 out of 29117; 13.07%) accounted in the period 2004-2009. Majority of the authors preferred papers as the source of information providing the highest number of citations (27,306). The study displayed that the highest contributions were from universities with 1,866 (64.06%). Similarly, most of the contributions are from USA with 50.88 %, while DENMARK contribution is very less, 0.86%.

In future we plan investigate the influence of the collaboration degree, the number of co-authors and the forms of documents to the citations and therefore, on the impact factor of journal.

## REFERENCES

1. Bradford S. Sources of information on specific subjects. Engineering. 1934;137:85-6.
2. Bornmann L, Mutz R. Growth rates of modern science: a bibliometric analysis based on the number of publications and cited references. Journal of the Association for Information Science and Technology. 2015;66(11):2215-22.
3. Cobo MJ, Martínez MA, Gutiérrez-Salcedo M, Fujita H, Herrera-Viedma E. 25 years at Knowledge-Based Systems: a bibliometric analysis, Knowledge-Based Systems. 2015;80:3-13.
4. Dhiman A. Ethnobotany journal: a ten year bibliometric study. IASLIC Bulletin. 2000;45(4):177-82.
5. Fiala D. Bibliometric analysis of CiteSeer data for countries. Information Processing and Management. 2012;48(2):242-53.
6. Garousi V. A bibliometric analysis of the Turkish software engineering research community. Scientometrics. 2015;105(1):23-49.
7. Heradio R, Perez-Morago H, Fernandez-Amoros D, Javier Cabrerizo F, Herrera-Viedma E. "A bibliometric analysis of 20 years of research on software product lines", Information and Sofware Technology. 2015;72:1-15.
8. Hung JI. Trends of e-learning research from 2000 to 2008: use of text mining and bibliometrics. British Journal of Educational Technology. 2012;43(1):5-16.
9. Hussain A, Fatima N, Kumar D. Bibliometric analysis of the'Electronic Library'journal (2000-2010). Webology. 2011;8(1):87. http://www.webology.org/2011/v8n1/a87.html.
10. Jacobs D. A bibliometric study of the publication patterns of scientists in South Africa 1992-96, with special reference to gender difference. In: Proceedings of the 8th International Conference on Scientometrics and Informetrics. 2001; 275-85).
11. Jain S, Basavaraj P, Singla A, Singh K, Kundu H, Vashishtha V. Bibliometric analysis of Journal of Clinical and Diagnostic Research (Dentistry Section; 2007-2014). Journal of Clinical and Diagnostic Research. 2015;9(4):ZC47-51.
12. Kalita, D. (2016). Citation analysis of Science. COLLNET Journal of Scientometrics and Information Management. 2016;10(2):237-54.
13. Kim HY, Kaur K. Subject support in collection development: using the bibliometric tool. Collection Building. 2008;27(4):157-66.
14. Larivière V, Sugimoto CR, Cronin B. A bibliometric chronicling of library and information science's first hundred years. Journal of the American Society for Information Science and Technology. 2012;63(5):997-1016.
15. Levitt JM, Thelwall M. A combined bibliometric indicator to predict article impact. Information Processing and Management. 2011;47(2):300-8.
16. Lotka AJ. The frequency distribution of scientific productivity. Journal of Washington Academy Sciences. 1926;16(12):317-24.
17. Meera, Sahu SK. Research output of University College of Medical Science, University of Delhi: a bibliometric study. COLLNET Journal of Scientometrics and Information Management. 2015;8(2):401-18.
18. Muthumari S, Raja S. Bibliometric Analysis of Defence Science Journal during 2005–2014: A study based on Scopus Database. COLLNET Journal of Scientometrics and Information Management. 2016;10(2):273-87.
19. Neff MW, Corley EA. 35 years and 160,000 articles: a bibliometric exploration of the evolution of ecology. Scientometrics. 2009;80(3):657-82.
20. Patra SK, Bhattacharya P, Verma N. Bibliometric study of literature on bibliometrics. DESIDOC Journal of Library and Information Technology. 2006;26(1):27-32.
21. Pritchard A. Statistical bibliography or bibliometrics?. Journal of Documentation,

the period 2010-2015 degree of collaboration has been increased in 3 times.

- Most of the contributions are on articles (67.15%) followed by book review (28.08%), editorial material with (2.54%), review (0.93%) and note (0.27%).

- Most of the contributions in journal of IP&M are from USA (50.8%) followed by ENGLAND (7.11%), CANADA (6.28%), PEOPLES R CHINA (3.78%) and SOUTH KOREA (3.36%).

- The results of research institution wise articles of articles displayed that the most contribution were from USC (4.05%) followed by PCSHEP (2.88%), UNC (2.71%), UNCCH (2.54%), etc. respectively.

- The findings of year-wise distribution of citations showed that a good number of citations was in 1988 (2730 citations) followed by 2006 with (1826 citations), 2005 with the (1538 citations) etc. respectively.

- The results of forms of documents cited showed that the most citations produced by articles (27306 citations) followed by review (1215), editorial material (527), book review (29), note (28), item about an individual (5) and reprint (2).

## CONCLUSION

It should be highlighted that the articles are the key method of communication by researchers, supplying a primary indication on the quantum associated with work carried out in different. Bibliometric method is used for various purposes such as identification of different scientific indicators, analysis

1969;25(4):348-9.

22. Roy SB, Basak M. Journal of Documentation: a bibliometric study. Library Philosophy and Practice (e-journal). 2013;1-10.

23. Sangam SL, Arali U. Growth versus scientific collaboration in the field of genetics: a scientometrics analysis. COLLNET Journal of Scientometrics and Information Management. 2016;10(1):9-19.

24. Sengupta I. Bibliometrics: a bird's eye view. IASLIC Bulletin. 1985;30(4):167-74.

25. Shilbury D. A bibliometric analysis of four sport management journals. Sport Management Review. 2011;14(4):434-52.

26. Sin SCJ. International coauthorship and citation impact: a bibliometric study of six LIS journals, 1980-2008. Journal of the American Society for Information Science and Technology. 2011;62(9):1770-83.

27. Singh G, Mittal R, Ahmad M. A bibliometric study of literature on digital libraries. The Electronic Library. 2007;25(3):342-8.

28. Subramanyam K. Bibliometric studies of research collaboration: a review. Journal of Information Science. 1983;6(1):33-8.

29. Thanuskod S. Journal of Social Sciences: A Bibliometric Study. Journal of Social Sciences. 2010;24(2):77-80.

30. Thanuskodi S. Bibliometric analysis of the journal Library Philosophy and Practice from 2005-2009. Library Philosophy and Practice (e-journal). 2010;1-7.

31. Tsay M. Journal bibliometric analysis: a case study on the JASIST. Malaysian Journal of Library and Information Science. 2008;13(2):121-39.

32. Tsay M. A bibliometric analysis and comparison on three information science journals: JASIST, IPM, JOD, 1998-2008.Scientometrics. 2011;89(2):591-606.

33. Tsay M, Shu Z. Journal bibliometric analysis: a case study on the Journal of Documentation. Journal of Documentation. 2011;67(5):806-22.

34. Tsay M. Knowledge input for the domain of information science: a bibliometric and citation analysis study. ASLIB Proceedings. 2013;65(2):203-20.

35. Tsay M. Knowledge flow out of the domain of information science: a bibliometric and citation analysis study.Scientometrics. 2015;102(1):487-502.

36. Uzun A. Assessing internationality of scholarly journals through foreign authorship patterns: the case of major journals in information science, and scientometrics. Scientometrics. 2004;61(3):457-65.

37. Wan K, Anyi U, Anuar N, Zainab A. Bibliometric studies on single journals: a review. Malaysian Journal of Library and Information Science. 2009;14(1):17-55.

38. Zainab A, Anyi KWU, Anuar NB. A single journal study: Malaysian Journal of Computer Science.arXiv preprint arXiv:1301.5375.2013.