

## Trends in Classification Literature: Analysis of Literature Published during 2000 to 2009

Rajendra Kumbhar

*Dept. of Library and Information Science, University of Pune, Pune-411 007*  
*E-mail: Kumbharrajendra@yahoo.co.in*

### ABSTRACT

This paper analyses the literature of classification published during 2000 to 2009 and finds that there is sustainability in the growth of literature on classification in the first decade of the 21<sup>st</sup> century. It traces the pattern in scattering of literature on classification in library and information science (LIS) journals and concludes that the literature adheres to the Bradford's law of scattering. It produces rank list of journals publishing the literature on classification and identifies authorship patterns and the prominent writers in classification. The research finds that the Indian LIS writers have shown sustained interest in classification domain.

**Keywords:** Classification, bibliometrics, rank list, authorship pattern, prominent authors in classification

### 1. INTRODUCTION

Classification is one of the oldest and prominent knowledge organisation (KO) tools. It is the foundation of librarianship and other KO tools. As such, a considerable literature is published on classification<sup>1</sup>. In spite of being used beneficially for years together, sometimes questions are raised about the usefulness of classification in the modern context. Particularly after the emergence of the so-called magic technology, i.e., the computer and telecommunication technology, the modern community is raising number of questions. For example, whether computer technology can be applied to the classification and cataloguing of natural language texts, whether human classification can be superseded by the powerful searching capabilities of computerisation, how far computers can be adopted in digital retrieval techniques, etc.

In 1999, Satyanarayana<sup>2</sup> answered these questions saying that as yet there are few signs that automatic procedures are sufficiently developed to completely replace manual ones. Gilchrist<sup>3</sup> argued that the new technology may have its own merits nevertheless the principles of classification and indexing may lead to much more accurate and targeted automatic searching and retrieval than is possible at present. Not just this but he further asserted that whichever system (knowledge organisation system) may prevail the role of human intellectual in grouping and labeling will remain very much

in demand. Thus, he emphasises that classification is important and even the human involvement in classification is equally important. Field<sup>4</sup> too has a similar observation to that of Satyanarayana, and indeed a very apt observation. Based on his observation, he provides a valuable piece of advice also. Field stated that the librarians might be developing a tendency to neglect their traditional skills in the rush to embrace the new icons of the information age, such as knowledge management, classification is an important technique of library and information science and should not be neglected by in a rush to embrace the modern technologies. Then what is the reality, has library automation undermined the role of classification? Slavic<sup>5</sup> answers this question negatively. According to Marcella<sup>6</sup> there are number of areas where there is scope for the application of classification. These, for example, are organisation and exploitation of a physical collection, archives, bibliographic records (electronic and printed), internet resources, and organisation's internal information resources.

Classification is surely important in modern electronic age, it is even more important in the ultramodern semantic web context<sup>3,7</sup>. Matveyeva<sup>8</sup> highlights the role of classification in the context of electronic resources who stated that, the traditional purpose of classification for locating physical objects on the shelves loses its function in the case of remote electronic resources. The other function of classification is categorisation. It is more

useful in the case of electronic resources, for it promotes the role of classification as a subject-organising tool. Attempts at using library classification schemes in order to organise electronic resources has moved beyond the realm of libraries and their catalogues. Information scientists, database developers, and specialists in information retrieval have explored library classification's potential in organising information on the internet, in order to improve browsing and subject searching.

Finally, how important is classification to librarianship? Can the various knowledge organisation tools and other related discoveries and inventions in LIS including classification be ranked to show their relative importance? Tyckoson<sup>9</sup> lists and describes top ten innovations in the history of librarianship and classification systems is one of the top ten innovations in librarianship. Considering the different opinions about the future of library classification, the present research is carried out to know the amount and nature of classification literature that has been published in the first decade of the 21<sup>st</sup> century.

## 2. RELATED LITERATURE

The search of literature on bibliometrics reveals that bibliometrics studies are carried out on the various topics of library and information science as well as on other than library science subjects. Hawkins<sup>10</sup> studied the bibliometric characteristics of electronic journals (e-journals) covering the field of information science. He identified twenty-eight e-journals and ranked them by number of articles on the subject they published. It was concluded that the 'core' as suggested by Bradford is yet to develop, but it may contain six journals. According to this study, common topics covered by e-journal articles in information science include electronic libraries, information search, retrieval, and use of the internet.

Singh, Mittal, & Ahmad<sup>11</sup> studied growth and characteristics of digital library literature. For this study, the authors collected data of over 1000 articles from *LISA Plus*. These articles were published during 1998-2004. The study analysed authorship patterns, authors' productivity and prominent contributors, language-wise and year-wise distribution of articles, country-wise distribution of journals, core journals in the subject area, and indexing term frequency. The study found that 61 per cent articles were written by single authors; author productivity was not in agreement with Lotka's Law, except in one case where number of articles is three; the maximum number of articles were published in 2003 with English being the most productive language; maximum articles were published in the *D-lib Magazine*.

Patra, Bhattacharya, & Verma<sup>12</sup> analysed growth pattern, core journals and authors' distribution in the field of bibliometrics using data from *LISA*. The authors

observed that growth of literature did not show any definite pattern. They adopted the Bradford's Law of Scattering to identify core journals and identified 'Scientometrics' as the core journal in this field. Authors' productivity patterns were studied by applying Lotka's Law and found that those authors' distributions do not follow original Lotka's law. This study also identified 12 most productive authors with more than 20 publications in this field. Chandrashekarai, Mulla, & Harinarayana<sup>13</sup> conducted bibliometric analysis of digital libraries in the Emerald database from April 1991 to March 2009. The study found that single authors contributed maximum numbers of articles (i.e., 67.62 %). Amongst countries producing literature on digital libraries, US was first with 31.94 per cent articles followed by UK with 27.09 per cent. *Electronic Library* journal ranked first among the published literature on digital library. This study helps in recognising the core journals in the field.

Guo<sup>14</sup> observed that due to the tremendous increase and variations in serial publications, the impact of every peer-reviewed paper on different subjects is varying continually. Domain experts or researchers want to keep track of those latest and highly cited peer-reviewed papers; however, they are finding it difficult to update or collect core paper's lists regularly and accurately. Evaluation of serial papers for generating and ranking core paper lists on different subjects becomes a very challenging task for scholars and librarians. Therefore, Guo developed a computer-aided bibliometric system (CABS) to generate a core article ranked list automatically. Four indicators—subject reference cited counts, subject total cited counts, subject reference period impact and subject reference cited history—were proposed to generate a subject core article-ranking list. Seven different subjects including e-commerce, data mining, supply chain, image processing, enterprise resource planning, microarray and expert systems were used as samples. The study provides experimental evidence to disprove three myths. Myth 1: the top papers on a subject (for instance, the top 10 papers) were all submitted to (*S*)*SCI* journals. Myth 2: the highly cited papers (cited counts >4) on interdisciplinary subjects were almost submitted to (*S*)*SCI* journals. Myth 3: the articles published in the top journals on a subject would be highly cited.

Chemoinformatics is one of the newly emerged subjects. It draws on techniques from a range of disciplines, most notably chemistry (particularly computational and medicinal chemistry), computer science and information science. Wallett<sup>15</sup> carried out bibliometric analysis of Chemoinformatics and discussed subject, author, and citation searches of the *Web of Knowledge* databases. The author found *Journal of Chemical Information and Modelling* as the core journal of the subject, but with many significant papers being

published in journals whose principal focus is molecular modelling, quantitative structure-activity relationships or more general aspects of chemistry. The discipline is international in scope, and many of the most cited papers describe software packages that play a key role in modern chemoinformatics research. Literature listed in the Medline database on diabetes is analysed by Krishnamoorthy, Ramkrishanan & Devi<sup>16</sup>. The authors found that maximum records were published in 2003 followed by 2002 and 2001. The research found that US is the largest contributor of literature on diabetes and the research productivity of diabetes confirms the Bradford's Law of Scattering. Palmer<sup>17</sup> analysed 12 tourism journals published within a 5-year period (1998–2002) and reviewed 1790 articles by means of a taxonomy with 24 statistical categories. The results showed the percentage of articles that apply statistical techniques as compared to those that do not, and a ranking of the techniques most often used and their distribution according to journal.

### 3. OBJECTIVES

The overall purpose of this study is to analyse the trends in the publication of articles on classification. Specific objectives of the study are to:

- (a) Identify year-wise trends in the publications of articles on classification;
- (b) Prepare rank list of journals publishing articles on classification and to find core journals dealing with it;
- (c) Study the pattern of collaboration amongst authors writing on classification;
- (d) Carry out quantitative analysis of the descriptors assigned to abstracts in the *Library and Information Science Abstracts (LISA)*; and
- (e) Identify the major contributors to the field of classification and to rank them.

### 4. SCOPE AND METHODOLOGY

The present study covers articles published on classification during a decade's time-span, i.e., during 2000 to 2009. The study analyses the literature listed in the *LISA*. The data required for the present study was retrieved in April 2010 from the *LISA* database (<http://www.csa.com/>). In the *LISA* database, literature was searched under the 'Classification' descriptor. *LISA* thesaurus recommends the term 'Classification' as a preferred descriptor. This descriptor was used to search the literature, as this is preferable to keywords. This to some extent helped in limiting the number of irrelevant items. Due to this, however, some researchers who have written on more specific areas of the field may have been excluded. Secondly, some well-known author's position

in the rank list of authors (Table 5) may have slightly changed. This limitation may have a minor implication on the list of core journals (Fig. 1). The implication may be minor because there is very insignificant difference in the productivity of 2<sup>nd</sup> to 5<sup>th</sup> ranked journals. The search retrieved total 2906 records. The bibliographic information including the descriptors given along with abstracts in the *LISA* were transferred in the MS-Excel sheet for quantitative analysis. The data was analysed by year of publication, journal-wise. The data was also analysed to find patterns of authorship collaboration. The numbers of descriptors were analysed, to find trends if any. Author's contributions were also counted.

The technique of bibliometrics has been adopted for the purpose of this study. Bibliometrics is the application of mathematical and statistical methods to books and other media of communication<sup>11</sup>. Bibliometric analysis is used for effective management of libraries, particularly for formulating collection development policies, and for making decisions related with inter library loan (ILL), collection maintenance, etc.

### 5. ANALYSIS AND INTERPRETATION

The collected data is analysed to accomplish the above stated objectives. MS-Excel is used to analyse the data and to display the results.

#### 5.1 Year-wise Publication Trend

Classification has been foundation of librarianship. It is used since the origin of libraries for marking and parking of documents. In due course of time, classification was used for other purposes also. For example, it was used in the organisation of entries in classified catalogue, deriving subject heading for cataloguing and indexing purpose, producing systematic display of thesaural entries, construction of thesaurofacets, etc. Increased use of computer and related developments such as artificial intelligence, natural language processing, semantic web and other developments created an apprehension about the value of library classification. What effect is there of such developments. The collected data was analysed year-wise so as to know if such thinking has any adverse effect on the number of articles published on the topic.

Table 1 indicates that on an average 290 articles were published per year during the decade covered by this study. This means about 10 per cent of the total articles are published per year. Highest number of articles were published in 2005 (i.e., 368, 12.66 %) followed by 2004 (i.e., 364, 12.52 %) and 2006 (i.e., 346, 11.90 %). Least numbers of articles were published in 2007 as well as in 2009 (i.e., 237, 8.15 %). However, it must be noted that there is no definite trend as far as the publication of articles on classification is concerned.

**Table 1. Year-wise analysis**

Year	No. of entries	%	Cumulative entries	%
2009	237	8.15	237	8.15
2008	256	8.80	493	16.95
2007	237	8.15	730	25.10
2006	346	11.90	1076	37.00
2005	368	12.66	1444	46.66
2004	364	12.52	1808	62.18
2003	274	9.42	2082	71.60
2002	289	9.94	2371	81.54
2001	259	8.91	2630	90.45
2000	276	9.49	2906	99.94

What is also noticeable is that the number of articles published on classification has not decreased. Probable reasons for the sustained interest of the LIS professionals in the classification could be that they (and other professionals, particularly information technology professionals) have found and are finding newer applications of classification. These newer applications include use of classification in text categorisation/automatic classification<sup>18-20</sup>; in the management web contents<sup>21-24</sup>; in organising resources in the institutional repositories<sup>25</sup>; in resource discovery from internet<sup>26</sup>. The other new areas where classification is applied are the creation and maintenance of semantic web tools such as taxonomy<sup>27</sup>, ontology<sup>28-29</sup>, folksonomy<sup>30</sup>.

### 5.2 Application of Bradford’s Law of Scattering

Total 2906 articles were published in 363 journals. These journals were arranged in the order of decreasing productivity of articles. Purpose of this arrangement was to know whether the ‘Scatter’ trend satisfies Bradford’s Law of Scatter<sup>31</sup>; and to get list of core journals in classification. Journals in the resultant rank list were grouped in three zones as shown in Table 2.

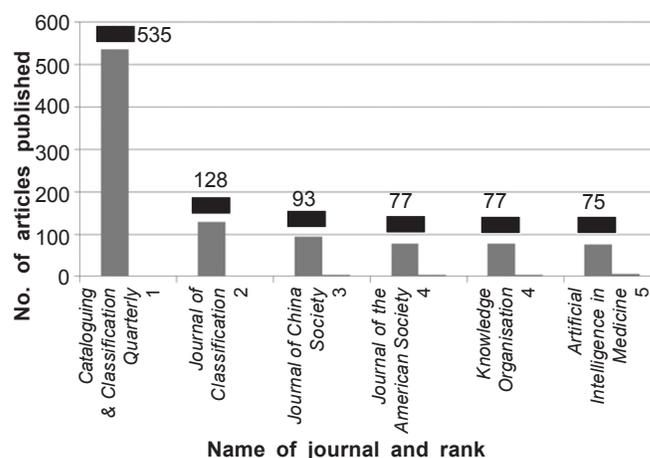
**Table 2. No. of zones and articles in each zone**

Zone no.	No. of journals	Number of articles
1	6	985
2	46	989
3	311	932
Total	363	2906

The data analysed in Table 2 satisfies Bradford’s Law. The data proves that very few, i.e., only six journals published one third (i.e., 985) of the total (2906) articles. These form part of the core journals. Whereas the same number of articles as that of the first zone were published in 46 and 311 journals of second and third zones, respectively.

### 5.3 Core Journals

According to Bradford’s Law of Scattering the journals forming part of the first zone are the core journals. This



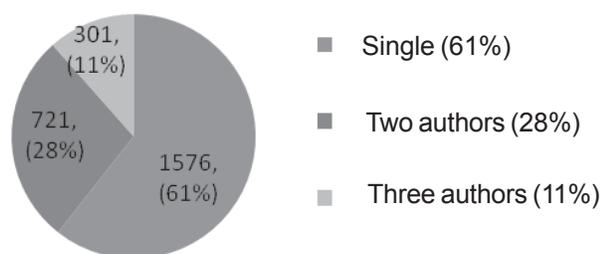
**Figure 1. List of core journals.**

study found that six journals (Table 2) form part of the core journals on classification. These are shown in Fig. 1. Six core journals listed in Fig. 1 produced one third (i.e., 985, approximately) of the total (2906) articles. Titles of the three journals forming part of core journals indicate that they are exclusively devoted to ‘classification’ and so they are rightly forming part of this core list. These three journals are *Cataloguing & Classification Quarterly*, *Journal of Classification* and *Knowledge Organisation*. *Cataloguing & Classification Quarterly* could be called as ‘super core journal’ as more than 50 per cent of the 985 articles are published by this journal. Patra, Bhattacharya, & Verma<sup>12</sup> in their study of literature on bibliometrics also found a single journal, i.e., *Scientometrics* as the core journal in this field. *Electronic Library* journal was identified as core journal in the bibliometrics study of digital library literature<sup>13</sup>.

It would have been ideal to have the ‘*Knowledge Organisation*’ journal within first three as against its present forth rank. The *Journal of the China Society for Scientific and Technical Information* and the *Journal of the American Society for Information Science and Technology* ranking third and fourth, respectively, indicate that these journals are producing a considerable amount of literature on classification. However, it should be also noticed that the journals ranking second to fifth are producing almost the same number of articles. Thus, the methodology adopted for searching the literature, has no adverse effect, as the difference in these journals’ productivity is very insignificant. The sixth journal, i.e., *Artificial Intelligence in Medicine* ranking fifth is probably an odd title in the list of core journals on classification. Whether this is because of *LISA*’s specific indexing policies, need to be investigated.

### 5.4 Pattern of Authorship Collaboration

To know whether the writers writing on ‘classification’ prefer to write individually or they write collaboratively was the purpose of this analysis. It is observed (Fig. 2) that single authors contributed more than 60 per cent articles.



**Figure 2. Authorship pattern.**

Similar results were found in other two studies on bibliometrics of digital libraries. For example, Singh, Mittal, & Ahmad<sup>11</sup> found that single authors wrote 61 per cent articles; whereas Chandrashekarai, Mulla, & Harinarayana<sup>13</sup> found that single authors wrote 67.62 per cent articles. At the same time trends in collaborative writing is encouraging as remaining 40 per cent authors are writing in collaboration. 25 per cent and 10 per cent authors have joined hand with other one and two authors respectively.

The pure and applied sciences are truly universal and are extreme generalised. In addition, the pure and applied scientists have excellent network of invisible college. Due to these reasons, it is generally observed that writers in these subjects tend to write jointly as against individually. Such trend is not much noticed in the social sciences may be due to their subjective nature. Nevertheless, the present analysis does indicate that a considerable number of articles, i.e., 40 per cent are written jointly. The writers on classification not only are joining hands with one or two other authors but even more than three authors also (Table 3).

In addition to those authors mentioned in Fig. 2 and Table 3, there are five articles, each one of which is written collaboratively by 11, 12, 13, 16 and 17 authors. These are example of extreme collaboration and these are noticed in the articles written in 2004 or later. This means collaboration amongst the writers on classification is increasing gradually. Whether there is similar trend in other LIS subjects or not is worth studying. Collaboration between four or more authors is mostly noticed in the articles of automatic classification/text categorisation.

**Table 3. Trends in collaboration (four or more authors)**

No. of authors joined	No. of articles written jointly	%
4	163	5.60
5	51	1.75
6	30	1.03
7	18	0.61
8	3	0.10
9	3	0.10

Note that the data given in Fig. 2 and Table 3 is to be considered together; 35 articles' entries in the *LISA* are without author's name; and all these together make 100 per cent.

### 5.5 Quantitative Analysis of Descriptors

The data for this research article was collected from *LISA*. Abstracts in *LISA* are supported with number of descriptors. These descriptors help in searching abstracts in the *LISA* use of precise descriptors is a key to have precision in retrieval. The 2906 articles analysed in this study had total 12,430 descriptors, i.e., approximately 4 (precisely 4.27) descriptors per article. The data about the number of descriptors was analysed to know if there are any patterns. The following Table 4 presents the analysis.

There is noticeable deviation from the average number of descriptors. For example, in 2004 the average number of descriptors used is five as against the overall average four. On the contrary in the year 2008 about three descriptors are used as against the overall average four descriptors. The analysis of the average number of descriptors from 2005 in the above table indicates that gradually the average number of descriptors is decreasing. To confirm the trend further study is needed.

Similarly, the maximum number of descriptors used seems to decreasing. The number of descriptors in the first half of the decade ranges from 11 to 19, whereas in the second half it ranges between 5 to 15. Abstracts in the last three years, i.e., 2007, 2008 and 2009 have

**Table 4. Analysis of descriptors**

Year of publication	Total articles published	Total descriptors used	Average No. of descriptors	Maximum descriptors used
2000	276	1163	4.21	11
2001	259	1293	4.99	14
2002	289	1352	4.67	13
2004	364	1847	5.07	19
2005	368	1505	4.08	12
2006	346	1646	4.75	15
2007	237	820	3.45	9
2008	256	743	2.90	5
2009	237	723	3.05	6
Total	2906	12,430	3.05	6

maximum nine, five, and six descriptors, respectively, which are very less compared to the maximum descriptors in the earlier years, i.e., 14 (2001), 15 (2006), and 19 (2004). Further study is needed in this context to know the reasons, if any for using less number of descriptors.

## 5.6 Prominent Contributors to Classification Literature

As in any field, in classification too it is noticed that there are few authors (i.e., 48 authors) who have written five or more articles. Table 5 lists and ranks the top ten authors who have contributed five or more articles to the field of classification. Inan Guler tops the list with 15 articles. Vanda Broughton and R.P. Smiraglia are sharing the second rank with 14 articles each. A. Neelamegha and Aida Slavic are ranking third and fourth with 13 and 11 articles, respectively. D. Vizine-Goetz and Arelene G. Taylor who have contributed 10 articles each share the fifth rank. The data about the writers was analysed to know how many of them have written as first authors in joint-authorship pattern and it was observed that almost all of them have written most of the articles as first author, and very few have written their most articles as second author. This means the major contributors to a subject field mostly keep their name as first author.

What is worth noticing is that in the 48 authors contributing five or more articles to classification there are five Indian authors at rank number three, seven, nine (two authors) and ten, respectively. These writers are continuing the legacy of Indian interest in classification inculcated S.R. Ranganathan.

Table 5. Rank list of authors

S. No.	Name of author	Number of articles contributed	Rank
1.	Guler, Inan	15	1
2.	Broughton, Vanda	14	2
3.	Smiraglia, R.P.	14	2
4.	Neelamegha, A.	13	3
5.	Slavic, Aida	11	4
6.	Vizine-Goetz, D.	10	5
7.	Taylor, Arelene G.	10	5
8.	Tillett, Barbara B.	9	6
9.	Williamson, Nancy	9	6
10.	Ubeyli, Elif Derya	8	7
11.	Hardalac, Firat	8	7
12.	Panigrahi, P.K.	8	7
13.	Beghtol, Clare	8	7
14.	Glanzel, W.	7	8
15.	Guerrini, Mauro	7	8
16.	Shiri, Ali	7	8
17.	McIlwaine, I.C.	7	8
18.	Thelwall, Mike	7	8

19.	Bowman, J.H.	7	8
20.	Intner, S.S.	7	8
21.	Joachim, Martin D.	7	8
22.	Roe, Sandra K.	7	8
23.	Weihs, Jean	6	9
24.	McCulloch, Emma	6	9
25.	Condron, L.	6	9
26.	Gilchrist, A.	6	9
27.	Gopinath, M.A.	6	9
28.	Hider, Philip	6	9
29.	Hill, Janet Swan	6	9
30.	Hjorland, Birger	6	9
31.	Landry, Patrice	6	9
32.	Olson, H.A.	6	9
33.	Satija, M.P.	6	9
34.	Dilevko, Juris	6	9
35.	Prasad, A.R.D.	5	10
36.	Ergun, Uzman	5	10
37.	Antoshkova, O.A.	5	10
38.	Bowker, G.C.	5	10
39.	Carter, R.C.	5	10
40.	Heiner-Freiling, M.	5	10
41.	Hunter, E.J.	5	10
42.	Kucianova, Anna	5	10
43.	Marcella, R.	5	10
44.	Tsai, Chih-Fong	5	10
45.	Cordeiro, Maria Ines	5	10
46.	Efremenkova, V.M.	5	10
47.	Star, S.L.	5	10
48.	Seo, Jungyun	5	10

## 6. CONCLUSIONS

Being a multi-functional tool, article literature on classification has a steady growth. About 300 articles are published per year, which is a satisfactory trend. The trend of collaboration among the writers of classification is increasing. The list of core journals will be useful to the LIS schools intending to build their journal collection.

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#### About the Author

**Dr Rajendra Kumbhar** is working as Professor at the Department of Library and Information Science, University of Pune. He has been in the teaching profession for last 25 years. His areas of interest are: LIS research, information retrieval, thesaurus, knowledge organisation systems, etc. He has published more than 40 articles and 15 books. 'His recent published book is 'Library Classification Trends in the 21<sup>st</sup> Century'.