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Information Systems Research in the 21st Century: A Bibliometric Study

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Abstract:

The present study focuses on the bibliometric analysis of the renowned journal Information Systems Research in the Library and Information Science field. The study reveals that most number of articles (75) in the journal was published in Volume 23 i.e. year 2012. Multiple authorship has got the priority in this journal over single authorship. Degree of collaboration among the authors is 0.92. USA being the most productive country regarding the contributors and University of Maryland holds the maximum number of contributions as per the authors' affiliations. Regarding citation, time has an inverse relationship with the growth of citation. Information system is the subject on which the maximum number of contributions (i.e. 123) has been made in this journal. Articles are the predominant document type in this journal.

Keywords: *Information Systems Research, Scimago journal and country rank, Library and information science, Authorship pattern, Degree of collaboration, Geographical distribution*

1. Introduction

The first hand information on a specific subject area nowhere gets a more cogent reflection than the journal on that specific field. Journals are the primary source of information and are the torchbearers of the growth of literature in different areas of knowledge. A suitable way of measuring the growth of a specific field of knowledge is the thorough analysis of a renowned journal on that specific subject domain. In this regard the bibliometric study of a journal is the best possible way. Bibliometrics are a range of quantitative measures that assess the impact of research outputs and complement qualitative indicators of research impact mainly to assess the quality and impact of research (University of Leeds, n.d.).

Just like any other subject domain, Library and Information Science (LIS) is also developing with every passing day and this growth gets its flagrant reflection in the original outputs of the journal Information Systems Research. But to limit the journal's compass within the short boundaries of a specific discipline like Library and Information Science does not do justice to its calibre. Business, Management and Accounting, Management Information Systems, Computer Science, Computer Networks and Communications, Information Systems, Decision Sciences, Information Systems and Management all are the areas which fall under the purview of this journal. This particular bibliometric study on this journal will not only be helpful to judge the merit of this journal and the growth trend of its subject coverage but at the same time will be helpful to the Library and Information Science professionals to draw a better plan regarding journal selection i.e. collection development in a library because escalating price of journals has made libraries very choosy in their selection of their resources.

2. Literature Review

Mahendra Kumar (2014) presented a bibliometric analysis of the journal Library Herald for the period 2011 to 2014. He focused on the number of articles, authorship pattern, subject wise distribution of articles, average number of references per articles, forms of documents cited, year wise distribution of cited journals and the like. The result reflected that out of 114 articles single author contributions are 65 (57.01%) while the rest 49 (42.98%) articles were contributed by joint authors. Study emphasized on the India with 89.47 % contributions. Sarwesh Pareek (2013) focused on bibliometric analysis on the various aspects of the IFLA Journal. Distribution of article by year, authorship patterns, distribution of contributions by institution, subject distributions, citation patterns, length of article, rank of cited authors, and geographical distributions of authors have been represented by this study. "The year 2001 shows the maximum number of contributions (34 articles; 12.01 percent) to the IFLA journal. This study reveals that the categories of article distributions are remarkable in this research journal. Almost 99 % articles are written in English language. The majority of the articles were contributed by single authors (214 articles; 75.62 percent); and most authors were

librarians, faculty members or researchers affiliated with academic or research institutions. Similarly most of the contributions are from USA with (71 articles; 18.35 percent), while Indian contribution is very less. The study revealed that maximum number of citations accounted in the period 2008 (12.01 percent). And maximum lengths of the citations are belonging to 11-20 citations." Nelson Edewor (2013) evaluated a Nigerian Library and Information Science journal in order to assess its performance and importance index, influence weight and popularity index. Citation analysis was carried out on the journal Information Impact: Journal of Information and Knowledge Management (IIJIKM) (ISSN: 2141-4297) over a four year period from 20110 to 2013. Library Philosophy and Practice (e-journal) topped the list of journals most cited in IIJIKM. Predominance of Internet resources among the scholars of Nigeria; Information Technology as the most researched subject; lack of international collaboration among authors of the journal; dominance of multiple authorship pattern were some of the findings of the study. Pal and Sarkar (2016) in their study focused on the year and volume wise distribution of contributions, authorship pattern, distribution of contributions by citation etc. of the three renowned LIS journals Annals of Library and Information Studies, DESIDOC Journal of Library and Information Technology and SRELS Journal of Information Management.

3. About Information Systems Research

"Information Systems Research (ISSN print: 1047-7047, web: 1526-5536) is a peer-reviewed academic journal that covers research in the areas of information systems and information technology, including cognitive psychology, economics, computer science, operations research, design science, organization theory and behavior, sociology, and strategic management. It is published by the Institute for Operations Research and the Management Sciences, USA and was recently selected as one of the top 20 professional/academic journals by BusinessWeek. Along with Management Information Systems Quarterly, Information Systems Research is regarded as one of the two most prestigious journals in the information systems discipline. The current editor-in-chief is Alok Gupta of University of Minnesota, Carlson School of Management." (Information Systems Research, n.d.). The 2017 Impact Factor of this journal is 2.301 and 5-year Impact Factor is 5.153. The journal publishes four issues every year (Information Systems Research, 2018). This journal holds the numero uno status in Scimago Journal and Country ranking site (SJR) with a SJR of 3.160 and h-index of 135 (Scimago Journal and Country Rank, n.d.). ResearchGate (RG) Journal Impact Factor for this journal is 4.45, which is calculated using ResearchGate data and is based on average citation counts from work published in this journal (ResearchGate, n.d.).

4 Objectives

The objectives of this study are to:

i. Make an analysis of articles published in Information Systems Research from 2001 to September, 2018.
ii. Find out the year wise distribution of articles.
iii. Trace the volume and issue wise distribution of contributions.
iv. Assess the authorship pattern.
v. Delineate the degree of collaboration among authors.
vi. Examine the geographical distribution of authors of the articles.
vii. Find out the top ten institutions as per the affiliations of the authors.
viii. Assess the chronological distribution of citations.
ix. Trace the most prominent subjects covered in this journal through keyword analysis.
x. Find out the number and forms of documents.

5. Scope of the Study

The scope is confined to the bibliometric analysis of peer reviewed American journal Information Systems Research in 21st century, i.e. from 2001 to September 2018. Throughout this coverage period the journal has published 18 volumes (Volume 12 to Volume 29) which contain 722 articles.

6. Methodology

For this study at first journal was selected from Scimago Journal & Country Rank (https://www.scimagojr.com/journalrank.php). First of all the search zone of SJR was opened and then search has been made by selecting subject area, *Social Science*, then selecting subject category *Library and Information Science* and then by selecting *all region/country*. From the search results number one journal **"**Information Systems Research" was selected for this study. The data were collected on source journal named Information Systems Research through Scopus.com. (Information Systems Research, 2018). Then the collected data were tabulated, organized and analysed by the use of MS-Excel and statistical techniques. The bibliometric study has been conducted by collecting the bibliographic properties (like number of authors, publication year, subject coverage etc.) of selected articles and finally citation counting of the articles has also been done. For the calculation of Degree of Collaboration (DC) which is determined by the ratio of number of collaborative publications and total number of publications during a certain period of time, Subramanyam's formula is used (Subramanyam, 1983). R statistical software has also been used for calculating Pearson's correlation formula.

7. Data analysis and Findings

7.1 Year wise distribution of contributions

The following figure represent the year wise distribution of articles published in the above mentioned journal from 2001-September 2018.

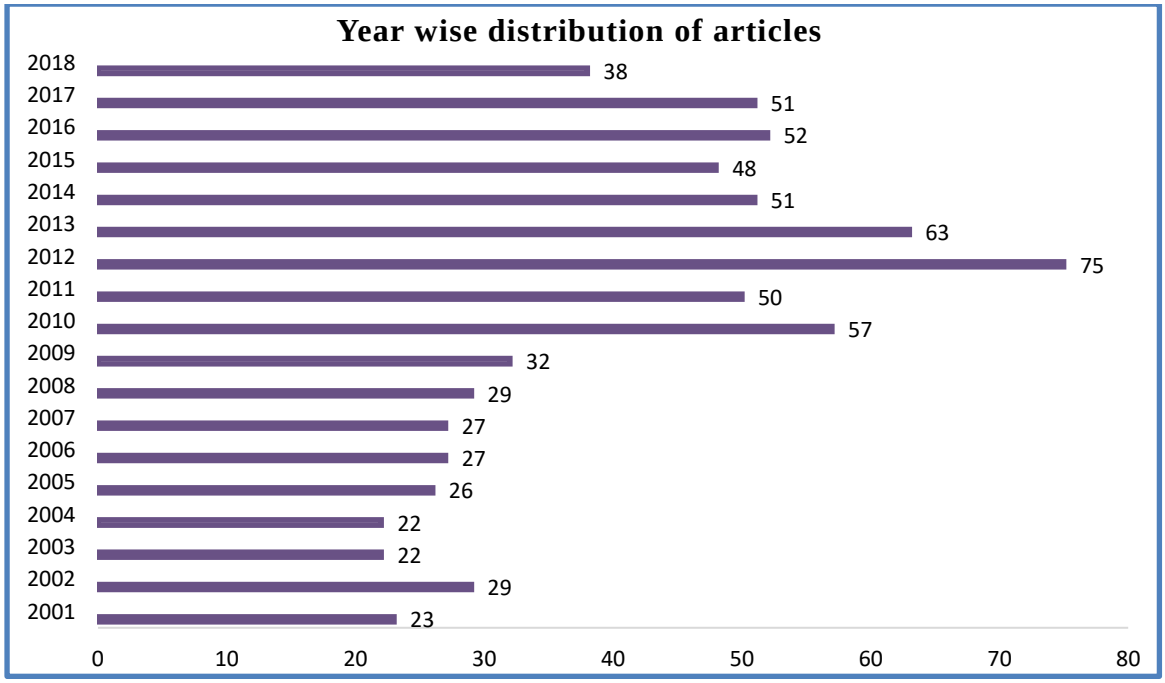

Figure 1: Year-wise distribution of articles

On the observation of figure-1 it has been found that total 722 number of research contributions are published in the journal Information System Research during the period from 2001 to September 2018. Also it has been found that most number of articles (75) published in Volume 23 i.e. year 2012. Then it is followed by 2013 (63 articles), 2010 (57 articles) and 2016 (52 articles). This figure also shows that lowest number of articles published in the year of 2003 and 2004 with only 22 articles. It is also observed that since 2010 the number of articles have been increased and frequently crossing 50 mark. This only hints at the growth of this journal.

7.2 Volume and issue wise distribution of contributions

The following table (Table-1) indicates that issue wise distribution of published articles within 12-29 volumes.

Table 1: Volume and Issue wise distribution of articles

Year	Volume No.	Issue No.				Total	Percentage (%)
		1	2	3	4		
2001	12	6	6	6	5	**23**	**3.18**
2002	13	8	7	7	7	**29**	**4.01**
2003	14	7	5	5	5	**22**	**3.04**
2004	15	6	5	5	6	**22**	**3.04**
2005	16	7	7	6	6	**26**	**3.6**
2006	17	6	6	8	7	**27**	**3.73**
2007	18	7	7	7	6	**27**	**3.73**

2008	19	7	7	8	7	**29**	**4.01**
2009	20	9	8	8	7	**32**	**4.43**
2010	21	11	10	11	25	**57**	**7.89**
2011	22	12	12	14	12	**50**	**6.92**
2012	23	16	17	26	16	**75**	**10.38**
2013	24	12	16	19	16	**63**	**8.72**
2014	25	10	12	13	16	**51**	**7.06**
2015	26	12	12	10	14	**48**	**6.64**
2016	27	12	13	11	16	**52**	**7.2**
2017	28	12	12	12	15	**51**	**7.06**
2018	29	13	13	12	**	**38**	**5.26**
TOTAL		173	175	188	186	**722**	**100 %**

Observing the above table it has been found that at the beginning of 21st century issue wise publication number is low like 6, 7, 8 number of articles per issue but after 2010 onwards issue wise number of articles have become almost double in comparison to the previous years' issues. 2012's 3rd issue hold the maximum number of articles i.e. 26.

7.3 Authorship pattern of contributions

Following table-2 shows the authorship pattern of research contributions published in the journal Information Systems Research from the period of 2011-September 2018.

Table-2: Distribution of authorship pattern

Year	Volume	Articles contributed by No. of Authors				Total Articles
		One Author	Two Author	Three Author	More than three Author	
2001	12	2	7	9	5	**23**
2002	13	1	10	12	6	**29**
2003	14	2	6	9	5	**22**
2004	15	3	2	9	8	**22**
2005	16	4	3	13	6	**26**
2006	17	2	6	16	3	**27**
2007	18	3	7	12	5	**27**
2008	19	2	2	18	7	**29**
2009	20	2	9	18	3	**32**
2010	21	4	15	31	7	**57**
2011	22	3	11	24	12	**50**
2012	23	4	23	26	22	**75**
2013	24	4	21	28	10	**63**
2014	25	3	16	20	12	**51**
2015	26	3	15	19	11	**48**
2016	27	5	7	25	15	**52**
2017	28	5	13	26	7	**51**

2018	29	3	3	24	8	**38**
Total		**52**	**179**	**338**	**153**	**722**
Percentage		**7.20%**	**24.79%**	**46.81%**	**21.19%**	**100%**

From the above table (Table-2) it becomes clear that only 7.20% articles were published by single author whereas 24.79% articles contributed by two authors. Also in case share authorship, 46.81% articles published by three authors and rest 21.19% articles are contributed by more than three authors. So, this table concluded that multiple authorship has become a prominent issue in the 21st century research regarding this journal and three authorship is mostly prominent in this journal.

7.4 Degree of collaboration among the authors

The following table and paragraph describes the degree of collaboration among the authors. In this study the Degree of Collaboration (C) of the contributors has been calculated using the Subramanyam formula. The formula is as follows:

Degree of Collaboration **(C) =** $DC = \frac{Nm}{Nm+Ns}$

Where,

C = Degree of Collaboration
Nm = Number of multiple authors
Ns = Number of single authors

Table-3: Degree of collaboration among the authors

Year	Volume	Single Authors (Ns)	Multiple Authors (Nm)	Total (Ns+Nm)	Degree of Collaboration (C)
2001	12	2	21	23	0.91
2002	13	1	28	29	0.96
2003	14	2	20	22	0.90
2004	15	3	19	22	0.86
2005	16	4	22	26	0.84
2006	17	2	25	27	0.92
2007	18	3	24	27	0.88
2008	19	2	27	29	0.93
2009	20	2	30	32	0.93
2010	21	4	53	57	0.92
2011	22	3	47	50	0.94
2012	23	4	71	75	0.94
2013	24	4	59	63	0.93
2014	25	3	48	51	0.94
2015	26	3	45	48	0.93
2016	27	5	47	52	0.90
2017	28	5	46	51	0.90

2018	29	3	35	38	0.92
Total		**55**	**667**	**722**	**0.92**

So, Degree of Collaboration (C) = Nm / Nm + Ns,
Here, Degree of Collaboration (C) = 667 / 55 + 667,
= 667/ 722
= 0.92

Above table shows the individual year wise Degree of Collaboration and as a whole (from the year 2001 to 2018) Degree of Collaboration. In this case Nm = 667 and Nm + Ns= 722 and Degree of Collaboration (C) = 0.92 that indicates large number of collaborative works among the journal authors.

7.5 Country wise distribution of authors

Top ten (10) countries as per contributors' geographical location have been mentioned below with the number of contributors.

Table-4: Top ten (10) countries as per contributors' geographical location

SL No.	Country	Number
1	USA	611
2	Canada	73
3	Hong Kong	56
4	Singapore	45
5	China	38
6	Germany	28
7	South Korea	25
8	Australia	23
9	United Kingdom	21
10	India	18

Above table depicts the country wise distribution of authors, where USA holds the top most position with 611number of contributors and is followed by Canada (73), Hong Kong (56), Singapore (45), China (38) and so on.

7.6 Distribution of institutions as per author's affiliation

The following table reveals the list of top ten institutions with their number of affiliations (number of authors).

Table-5: Top ten (10) institutions as per authors' affiliations

SL No.	Name of Institution	Number
1	University of Maryland	61
2	University of Texas at Dallas	47
3	Georgia State University	36
4	New York University	35
5	Carnegie Mellon University	35
6	Leonard N. Stern School of Business	35
7	University of Minnesota Twin Cities	34
8	University of Texas at Austin	33
9	Georgia Institute of Technology	31
10	National University of Singapore	29

From above table (Table-5) it can be concluded that University of Maryland holds the top position with 61 number of affiliations and the followed by University of Texas at Dallas (47), Georgia State University (36) etc.

7.7 Year wise / Chronological distribution of citations

Table-6: Chronological distribution of citation

Year	Volume	No. of Citation	Percentage (%)
2001	12	6085	9.95
2002	13	11069	18.10
2003	14	5852	9.56
2004	15	4958	8.10
2005	16	4166	6.81
2006	17	4773	7.80
2007	18	2504	4.09
2008	19	3389	5.54
2009	20	3210	5.24
2010	21	3991	6.52
2011	22	2521	4.12
2012	23	2702	4.41
2013	24	3235	5.29
2014	25	1381	2.25
2015	26	707	1.15
2016	27	451	0.73
2017	28	119	0.19
2018	29	40	0.06
TOTAL		**61,153**	**100 %**

The above table demonstrates that volume 13 (2002) has received maximum number of citations i.e. 11069 (18.10%). In this regard a hypothesis can be drawn.

Hypothesis A: Time has an inverse relationship with the growth of citation.

Using Pearson correlation formula the above hypothesis can be tested. Pearson correlation is a test used to know the correlation (degree of association) between two variables. In this study correlation has been observed between time (year) and growth of citation (number of citation).

Pearson correlation as per R-Statistical Software:

> Year<- c (2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018)

> Citation<- c (6085, 11069, 5852, 4958, 4166, 4773, 2504, 3389, 3210, 3991, 2521, 2702, 3235, 1381, 707, 451, 119, 40)

>cor (year, citation, method="pearson")

[1] -0.8669179

There is a significant negative relationship between time and growth of citation. In this case Pearson's **r =-0.8669179**. Therefore, above mentioned hypothesis (Hypothesis A) is accepted. Following figure also shows the negative correlation between two variables.

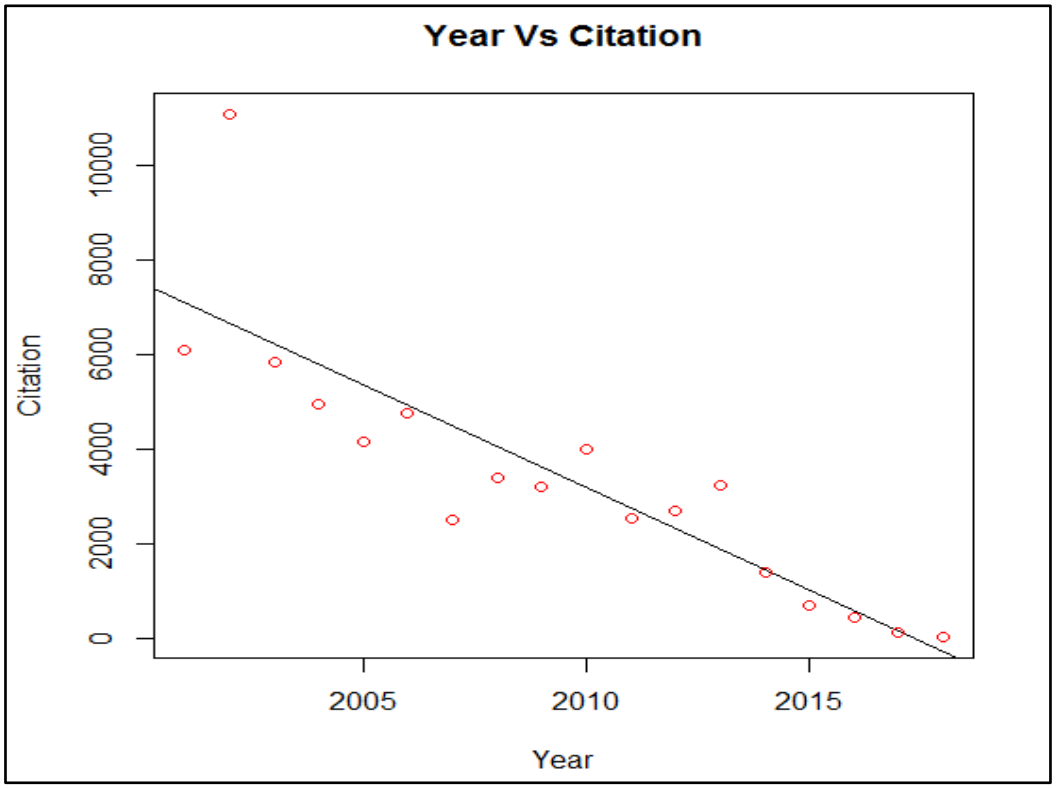

Figure-2: Relationship between Year Vs Citation (Using R Statistical Software)

7.8 Distribution of prominent keywords

Now, the following table- 7 depicts the top ten keywords with their numbers in the contributions of the journal.

Table-7: Distribution of prominent keywords

SL No.	Keywords	Number
1	Information system	123
2	Commerce	110
3	Economics	84
4	Electronic commerce	82
5	Costs	78
6	Sales	74
7	Social networking (online)	74
8	Hardware	60
9	Investment	51
10	Decision making	50

Table- 7 reveals that the keyword Information system is used mostly (123) in this journal within the selected period. Then, next keywords are Commerce (110), Economics (84), Electronic commerce (82) and so on.

7.9 Distribution of document types

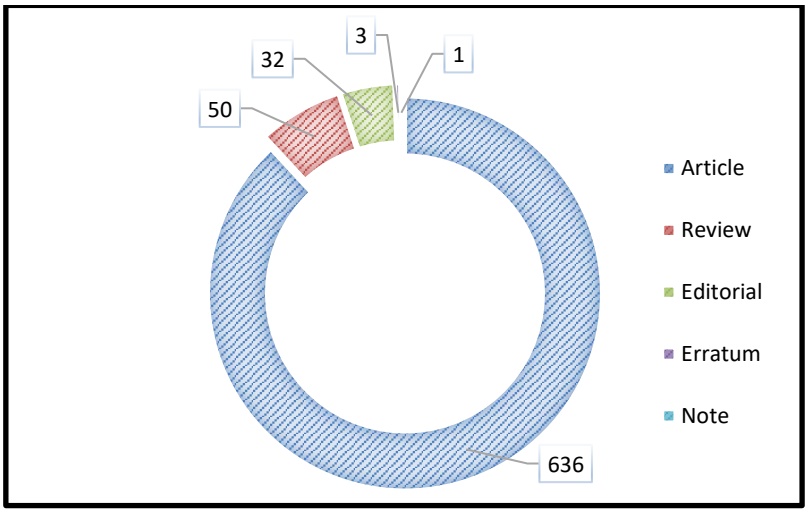

Figure-3: Distribution of document types

Above figure shows the distribution of document types among the selected literature. This figure depicts that most number of contributions are articles (636) and then it is followed by Review (50), Editorial (32), Erratum (3) and Note (1).

8. Conclusions and Recommendations

Analysing the journal Information Systems Research it has been found that most number of articles (75) in the journal was published in Volume 23 i.e. year 2012. Multiple authorship has got the priority in this journal over single authorship. Degree of collaboration among the authors is 0.92. USA being the most productive country regarding the contributors and University of Maryland holds the maximum number of contributions as per the authors' affiliations. Regarding citation time has an inverse relationship with the growth of citation. Information system is the subject on which the maximum number of contributions (i.e. 123) has been made in this journal. Articles are the predominant document type in this journal. Thus this bibliometric study also hints at the ways of analysing other journals in different fields of knowledge. The analysis of citation patterns, linguistic analysis, altmetrics evaluation, tracking of collaboration network and such other studies on this journal could also be pursued.

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