SCIENTOMETRIC ANALYSIS OF SPACE TRAFFIC LITERATURE

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ABSTRACT

{The paper describes the results of Scientometric study of Space traffic Literature. The purpose of the study is evaluates the research output of Space traffic as per SCI (Web of Knowledge). The findings indicated that there are 2195 research papers on space traffic, out of which 2149 (97.58%) were in English. The highest number of articles were produced in the year 2012 with 310(14.12%) and USA is top among countries with 760 (34.62%). The collaboration of authors increased year by year with highest collaboration co-efficient in 2012 (0.9%).}

Keywords: *Scientometric, Space traffic, Authorship pattern, Collaboration*

1. INTRODUCTION

A well equipped and well managed library is the foundation of modern educational structure. A library is strength of any education institution and without proper library there can be no real progress in education. A library is the water of knowledge. An ideal library provider valuable supports to education at the same time sound library. Any form of educationalworkwithout libraries become meaningless. It is through the right and proper use of libraries that students learn the techniques of finding facts for themselves and simply out truth from false hold in unbiased manner.

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"Scientometrics" is the English translation of the title word of Nalimov's classic Monograph Naukometriy in 1969, which was relatively unknown to western scholars even after it was translated into English. Without access to the internet and limited distribution, it was rarely cited. However, the term became better known once the journal Scientometrics appeared in 1978 (Garfield, 2007).There is many definitions for the term "Scientometrics" in the literature;

Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research (Glossary of Thompson…, 2008).

Satellites now form an essential part of everyday life on Earth and many important services are provided by them, so it is crucial that we don't have satellites being damaged or destroyed. What we need is a way for countries to share data about what they have up there and establish some rules of the road for space, like which satellites have to give way to others and those which don't have the ability to move. "The term we are using for this is Space Traffic, which is a bit like an air traffic control for outer space."

Losing a satellite is accidental on-orbit collision is no longer hypothetical but real and increasingly likely. As a result, the space faring nations of the world, especially the United States, need to address a global space-traffic-control service. The fiscal and national security ramifications are too significant to ignore. The replacement cost of a satellite, perhaps hundreds of millions of dollars, is the most obvious impact. But this may be the most trivial consideration. The greatest concern is the potential catastrophic loss of vital communications, navigation, weather, and other services we depend on for daily global commerce and defense. Space experts from around the world will discuss ways of tackling the growing

problem of space debris in orbit around the Earth. It comes just a year after an American satellite collided with a Russian satellite. The present study is confined to only "Space traffic" literature of global publication.

2. OBJECTIVES OF THE STUDY

The following are the objectives of the study

- To Study the year wise and Language wise distribution of space traffic literature.
- To identify country wise distribution of research articles.
- To assess subject wise distribution of Space traffic research articles.
- To identify active authors of Space traffic literature research articles.
- To examine authorship pattern of articles.
- To observe the contributing funding agencies for research.
- To study the form wise distribution of article.

3. METHODOLOGY

Science Citation Index (Web of Knowledge) was utilized to collect the data of Space traffic literature research articles by using single key term "Space traffic". The period constraint of study is 2003-2012(10 Years), 2,904 research articles were retrieved. The obtained result were further filtered to get only space traffic literature excluding categories like Transportation science technology, Transportation, Architecture, Cell Biology, Engineering Civil, Urban studies, and Construction building technology. These categories were excluded due to their non – relevance to the space traffic subject. The obtained data was then analyzed using Scientometrics formulas with the help of Ms-Excel.

4. DATA ANALYSIS AND INTERPRETATION

The retrieved data was analyzed and presented in the form of tables and graphs.

Year wise distribution of literature

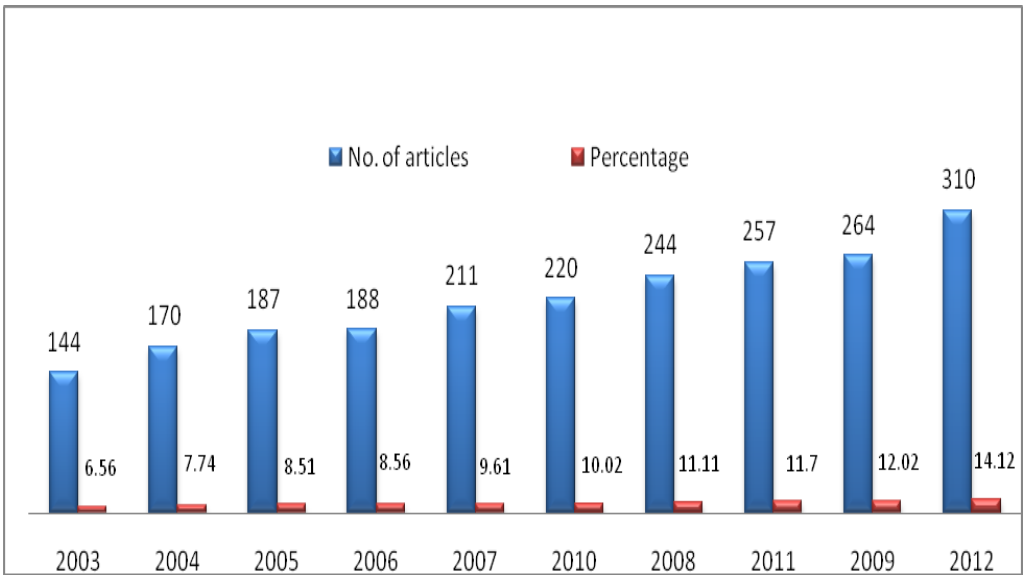


Fig .1

Figure – 1 indicates year wise distribution of articles on Space traffic literature. It provides data on the total output of article for the period of 2003 to 2012. Based on number of articles ten year publications were taken. . There is significant growth in number of articles from year to year. Among ten years publication, 2012 position with highest number of articles 310 (14.12%) articles were published and 2003 least number of articles i.e. 144 (6.56%) were published.

Language Wise Distribution

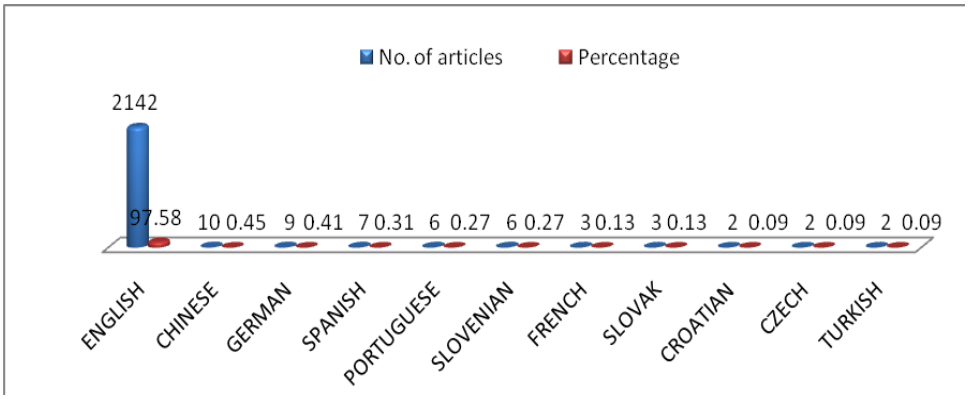


Fig. 2

Figure-2 represents language wise distribution of Space traffic articles. English was the language used highly to communicate the research articles i.e. 2149 (97.58%), Chinese with 10(0.45%), followed by German 9(0.41%) and Turkish as a least 2 (0.09%) articles.

Form Wise Distribution

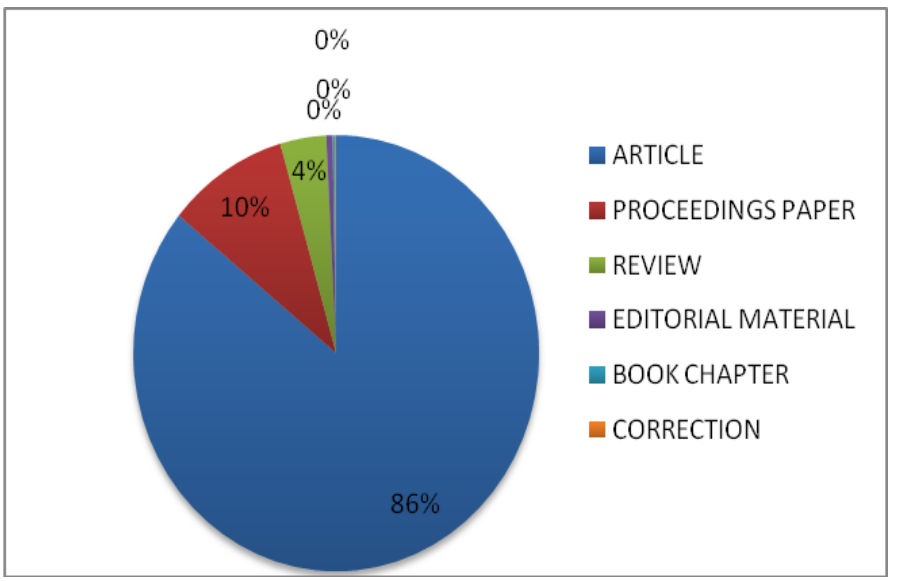


Fig. 3

Figure-3 shows form wise distribution of Space traffic literature. Among them research Articles locates first with 2085 (94.98%) and least was corrections 3 (0.13%).

Table-1
Country Wise Distribution of Articles

Sl. No.	Field: Countries/Territories	Record count	% of 2195	Cumulative Frequency
1	USA	760	34.62	3462
2	PEOPLES R CHINA	266	12.11	46.73
3	GERMAN	187	8.51	55.24
4	ENGLAND	161	7.33	6257
5	FRANCE	115	5.23	67.8
6	JAPAN	106	4.82	72.62
7	ITALY	105	4.78	77.4
8	CANADA	102	4.64	82.04
9	SPAIN	71	3.23	85.27
10	TAIWAN	65	2.96	88.23
11	AUSTRALIA	64	2.91	91.14
12	NETHERLANDS	58	2.64	93.78
13	SOUTH KOREA	57	2.59	96.37
14	SWITZERLAND	45	2.05	98.42
15	BELGIUM	38	1.73	100.15
16	BRAZIL	37	1.68	101.83
17	GREECE	37	1.68	103.51
18	SWEDEN	33	1.50	105.01
19	INDIA	32	1.45	106.46
20	SINGAPORE	28	1.27	107.73

Table-1 shows geographical distribution of articles Space traffic literature. Based on number of articles top twenty countries were taken. Among top twenty countries, USA stands first with 760 (34.62%) articles, Peoples R China stands second with 266 (12.11%) articles and Germany holds third with 187 (8.51 %) articles and last on list with twentieth rank is Singapore 28 (1.27%).

Table-2
Subject Wise Distribution

Sl. No.	Research areas	Record count	% of 2195	Cumulative Frequency
1	COMPUTER SCIENCE	579	26.37	26.37
2	ENGINEERING	565	25.74	52.11
3	TELECOMMUNICATIONS	347	15.80	67.91
4	MATHEMATICS	174	7.92	75.83
5	PHYSICS	159	7.24	83.07
6	ENVIRONMENTAL SCIENCES ECOLOGY	150	6.83	89.9
7	BIOCHEMISTRY MOLECULAR BIOLOGY	116	5.28	95.18
8	OPERATIONS RESEARCH MANAGEMENT SCIENCE	106	4.82	100
9	NEUROSCIENCES NEUROLOGY	69	3.14	103.14
10	SCIENCE TECHNOLOGY OTHER TOPICS	62	2.82	105.96
11	OPTICS	59	2.68	108.64
12	METHOROLOGY ATMOSPHERIC SCIENCES	55	2.50	111.14
13	GEOLOGY	52	2.36	113.5
14	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	51	2.32	115.82
15	GEOGRAPHY	48	2.18	118
16	AUTOMATION CONTROL SYSTEMS	46	2.09	120.09
17	BUSINESS	42	1.91	122
18	MECHANICS	40	1.82	123.82
19	AGRICLTURE	34	1.54	125.36
20	IMMUNOLOGY	34	1.54	126.9

Table-2 depicts subject wise distribution of articles Space traffic literature. Among top twenty subjects, the highest number of articles was produced in Computer Science places first with 579 (26.37%), followed by Engineering 565 (25.74%) and Immunology with 34 (1.54%) articles.

Table-3 Authorship Pattern Year Wise

Year	Single author	Two author	Three author	Four author	Five & above	Total	Percentage	Cumulative Frequency
2003	21	50	35	18	20	144	6.56	6.56
2004	35	44	40	22	29	170	7.74	14.3
2005	27	38	52	31	39	187	8.51	22.81
2006	30	52	53	26	27	188	8.56	31.37
2007	29	58	47	27	50	211	9.61	40.98
2008	42	65	60	23	54	244	11.11	52.09
2009	35	50	55	59	65	264	12.02	64.11
2010	25	55	54	43	43	220	10.02	74.13
2011	23	51	62	43	78	257	11.70	85.83
2012	31	72	68	60	79	310	14.12	99.95
Total	**298**	**535**	**526**	**352**	**484**	**2195**	**100**	

Table-4 indicates authorship pattern of Space traffic literature. There is steady growth in the number of multi authored from year to year. 2012 places at the highest on the list with 310 (14.12%) articles.

Table-5

Single V/S Multi Authored Papers

Year	Single author	Multi authored	Collaboration Co-efficient	Cumulative Frequency
2003	21	123	0.85	0.85
2004	35	135	0.79	1.64
2005	27	160	0.85	2.49
2006	30	158	0.84	3.33
2007	29	182	0.86	4.19
2008	42	202	0.82	5.01
2009	35	229	0.86	5.87
2010	25	195	0.88	6.75
2011	23	234	0.91	7.66
2012	31	279	0.9	8.56
Total	**298**	**1897**	**0.86**	

Table-5 explains single v/s multi authored articles of Space traffic literature. There is significant steady growth in the number of multi authored article from year to year in 2003 stands with123 (0.85%) article and the 20012 stands at the highest on the list with 279 (0.9%) articles. The table also shows the collaboration co-efficient by using Subramanyam formula i.e.

$$C = \frac{\mathrm{Nm}}{\mathrm{Nm} + \mathrm{Ns}}$$

Where,
C = degree of collaboration in a discipline,
N_m = number of multiple-authored research papers in the discipline published during a year,
N_s = number of single-authored research papers in the discipline published during the same year.

Table-6 Author Wise Distribution of Articles

Sl. No.	Field: Authors	Record Count	% of 2195	Cumulative Frequency
1	DEGRANDE G	11	0.50	0.5
2	GAO ZY	11	0.50	1
3	LI KP	10	0.45	1.45
4	HUANG HJ	9	0.41	1.86
5	WHITT W	9	0.41	2.27
6	WILLIAMS RJ	9	0.41	2.68
7	JIANG R	8	0.36	3.04
8	LOMBAERT G	8	0.36	3.4
9	ZHANG Y	8	0.36	3.76
10	LOHMEYER J	7	0.31	4.07
11	REUTERSHAN J	7	0.31	4.38
12	SEEGER W	7	0.31	4.69
13	DAI JG	6	0.27	4.96
14	DAI SQ	6	0.27	5.23
15	KHANH PQ	6	0.27	5.5
16	LI M	6	0.27	5.77
17	LIU Y	6	0.27	6.04
18	MAUS UA	6	0.27	6.31
19	MULDER M	6	0.27	6.58
20	TANG TQ	6	0.27	6.85

Table-6 represents author wise distribution of articles Space traffic literature. Among top twenty authors, Degrande G and Gao ZY is highly productive authors with 11(0.50%) articles, Li KP has produced10 (0.45%) articles and last on the list is Tang TQ with 6 (0.27%).

5. FINDINGS:

Following are some of the important findings evaluated from the study.

1. Among ten years publication highest number of articles are published in the year 2012 with 14.12% there is significant growth in articles published from year to year.
2. USA has published maximum number of articles 34.62% about space traffic between 2003 to2012. India stands at nineteenth position with 1.45%.
3. Currently the US is the only country with the ability to track satellites and debris in space, so other countries and satellite operators are reliant on the Americans alerting them to an impending threat.
4. Highest number of articles was published in English 97.58%.
5. Among top fifty research areas Computer sciences is on top with 26.37%, in the main stream of Space traffic literature.
6. Majority of the documents published about Space traffic are articles 94.98%.
7. There is study growth in multi authored articles from year to year 2012 stands first with highest number of multi authored articles 14.12%.
8. Among the top fifty authors Degrande G has published maximum number of articles 11.

6. CONCLUSION

The Quantitative analysis of literature always helps in policy and decision making. In library and information science the applications of metrics such as Bibliometrics, scientometrics and webometrics is not new and it is followed to help the institutions in decision making. The Scientometric study of literature is one of the major areas of research. The upcoming and up growing interest in specific field of research can be easily identified through application of analysis. Space traffic is one of the growing research area of physics discipline the present study of Scientometric analysis of space traffic literature from the web of knowledge for the period of 2003 -2012 gives a clear view that the space traffic literature is growing year by year and there is increase in multi authored increased articles similar to other studies of Scientometric analysis of literature.

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