Tsunami Research Output in India and Sri Lanka: a Scientometric Analysis

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Tsunami research in India, Sri Lanka, over the years 2005–2011 is analysed and compared with that in USA and Japan. Its growth, rank and global publications share, citation impact, share of international collaborative papers, contribution of major collaborative partner countries, and patterns of research communication in most productive journals. Tsunami research in India and Sri Lanka are analyzed based on papers abstracted in ISI Science Citation Index, Social Science Citation Index and Arts and Humanities Index. There were 3,624 publications all over the world; of which Indian has published 318 and Sri Lanka 88 papers in all, and these were published in more than 499 scholarly journals.

Keywords: *Tsunami, Scientometrics, Citations, India, Sri Lanka*

Introduction

The present study pointing out of analyzing the research output performance of Tsunami in India and Sri Lanka. Tsunami is a series of waves usually generated by movement of the seafloor. These movements are caused by different types of geophysical phenomena such as earthquakes, landslides, volcanic eruptions, slumps and meteorites. But 90% of the Tsunamis are initiated with earthquakes. They all repress a enormous mass of water, which become special waves, the ratio between the water depth and the length of these waves is very small. They move at a speed equals to the square root of the product of gravity (9,8m/s/s) and the depth of the water. Because they lose energy reciprocally related to their length, they can travel with high speed over long distances without losing much energy. Therefore, the tsunami reaches the coast with a destructive and devastating force.

Literature Analysis

Karki and Garg (1997) attempts quantitative assessment of alkaloid chemistry (a subgroup of organic chemistry) research in India as viewed through Chemical Abstracts, focusing on world

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versus citations of India's work. Fish research in India has been examined by Jayashree and Arunachalam (2000), about 460 papers, roughly 5.5% of the world output, came from India every year, of which 82% are journal articles. About 61% of publications are contributed by government laboratories in low impact and low visibility journals and academic institutions in journals of medium impact. Arunachalam and Gunasekaran (2002) undertaken diabetes research in India and China, during 1990–1999, indexed in PubMed, Science Citation Index (SCI) and Biochemistry and Biophysics Citation Index (BBCI). They identified institutions carrying out diabetes research, and these two countries account for 26% of the prevalence of diabetes, they contribute less than 2% of the world's research. Gunasekaran (2006) explored Chemical science research in India, data collected from Chemistry Citation Index in 2002. Roughly, 4.5% of the global R&D output in chemical sciences was contributed by Indian in 2002, about 16% of the papers had international collaboration.

Objectives

The main objective of this study is to present the growth of scientific output in the field of Tsunami research over the period of 2005-2011 using Scientometric analysis. In particular, the study focuses on the following objectives:

- To study the relative research effort in Tsunami by the scientists of the two countries
- To study the publications productivity and impact of leading institutions and authors of India and Sri Lanka,
- To find out the impact made by the research in Tsunami by the two countries using surrogate measures;
- To study the pattern of co-authorship of the two countries.
- To study the patterns of research communication in most productive journals of the two countries

Methodology

The data for the study has been sourced out from ISI Science Citation Index – Expanded edition of Web of Knowledge database. The study analyses literature growth trends, examines research activities in different higher education and research institutions across India and Sri Lanka. The study also identifies the active institutions in India and Sri Lanka, which published the productive Tsunami research.

The data contains all types of documents published during 2005 to 2011.The analysis is explored to reveal:

(1) Number of works published on the Tsunami,

(2) the top rated journals used to publish this research work and their position

(3) The top publishing research institutions of India and Sri Lanka.

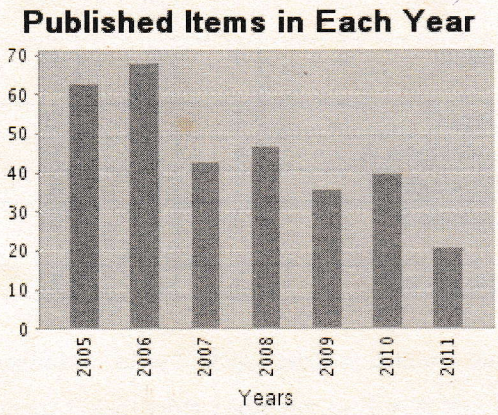
Results and Discussion

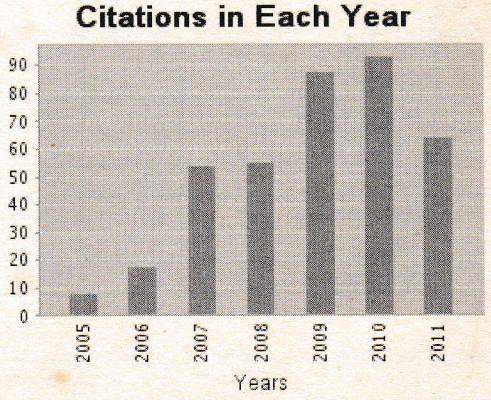
Table 1: Publication Output, Citations of Different Countries in Tsunami Research, 1999-2011

Year	India		Sri Lanka		Japan	USA	World
	TP	TC	TP	TC			
1999	---	---	---	---	13	29	78
2000	---	---	---	---	23	29	106
2001	---	---	---	---	12	23	80
2002	---	---	---	---	11	33	79
2003	---	---	---	---	17	53	114
2004	---	---	---	---	12	48	113
2005	63	715	10	42	24	96	492
2006	68	348	20	103	46	29	501
2007	43	207	10	48	48	122	421
2008	47	192	16	68	41	147	462
2009	36	68	17	34	54	118	497
2010	40	32	12	13	42	109	469
2011	21	0	3	0	20	41	198
Total	318		88		363	877	3610

The productivity of Publication of four countries involved in Tsunami during 1999-2011 is given in Fig. 1. The US is the undoubted leader, followed by Japan, India, and Sri Lanka .Among these countries, the US topped the list with 877 publications, followed by Japan (363), India (318), and Sri Lanka (88). India Ranked 3rd and Sri Lanka ranked 15th in terms of publications output during 1999-2011.

India





Sri Lanka

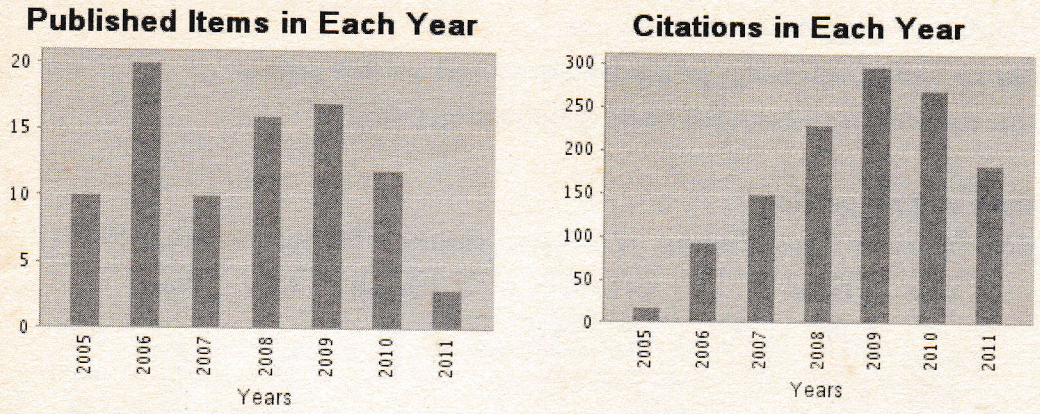


Figure 1: Graph showing the trend in Tsunami research publication and citations in India and Sri Lanka

The publication of India and Sri Lanka researchers involved in Tsunami during 2005-2011 is given in Fig. 1. During these 7 years (2005-2011), India produced 318 publications with highest 68 publications, in 2006; average number of publications per year was 45. Sri Lanka produced 88 papers with highest 20 papers, 2006; average number of publication per year was 12.

Table 2: Productivity & Impact of 10 Most Productive Indian and Sri Lankan authors on Tsunami, 1999-2011

S.No	India - Authors	Recs	TLCS	TGCS	Sri Lanka - Authors	Recs	TLCS	TGCS
1	Dimri VP	7	4	7	Wijetunge JJ	6	3	8
2	Kurian NP	7	12	18	Dahdouh-Guebas F	5	1	60
3	Jain SK	6	14	19	Jayatissa LP	5	1	60
4	Jambulingam P	6	8	31	Koedam N	4	1	59
5	Murthy MVR	6	2	4	Kunii O	4	2	18
6	Murty CVR	6	14	20	Perera C	4	1	20
7	Murty TS	6	4	5	Sumathipala A	4	3	18
8	Rai DC	6	14	20	Abeysinghe N	3	0	6
9	Rajendran CP	6	13	131	Fernando S	3	1	21
10	Srinivasalu S	6	20	40	Konradsen F	3	0	22

Among the prominent authors contributing to Tsunami research in India and Sri Lanka, 10 Indians and Sri Lanka were identified as most productivity and they have published more than 3 papers

during 2005 -2011. Of these 10 Most Productivity Indian authors are Dimri VP and Kurian NP with 7 papers, Jain, SK, Jambulingam P, Murthy MVR, Murty CVR, Rai DC, Rajendran CP, and Srinivasalu with 6 papers. Most Productivity Sri Lankan authors are Wijetunge JJ topped the list with 6 papers and other Sri Lankan authors are below 5 papers.

Table 3: Productivity & Impact of 10 Major Indian & Sri Lankan Institutions on Tsunami, 1999-2011

S.No	**Indian - Institution**	TP	LCS	TCS	**Sri Lanka Institution**	TP	LCS	TCS
1	Indian Institute Technology	22	30	163	University Peradeniya	11	9	32
2	National Geophys Res Inst	19	36	67	University Ruhuna	6	2	73
3	National Inst Oceanog	16	24	67	Int Water Management Inst	5	0	39
4	Anna University	9	30	60	University Copenhagen	4	0	31
5	Ctr Earth Sci Studies	7	23	139	University Moratuwa	4	4	18
6	MS Swaminathan Res Fdn	6	22	140	Anti Malaria Campaign Head Off	3	0	22
7	Univ Madras	6	13	32	Kenya Marine & Fisheries Res Inst	3	1	55
8	Natl Inst Ocean Technol	5	27	66	University Colombo	3	3	20
9	Vector Control Res Ctr	5	6	27	Columbia University	2	0	3
10	Annamalai Univ	4	13	89	Ctr Conservat & Res	2	0	2

Table 3 provides data on the contribution made by Indian and Sri Lanka institutions. Indian Institute of technology, tops the list (for India) with 22 papers which were cited 193 times. National Geophysics Research Institute (19 Papers) , National Institute Ocean graphic (16 Papers) and Anna University (9 Papers) , have also published moderately in this field. No other Indian laboratory has published more than 22 papers during 2005–2011. The University Peradeniya leads the field in Sri Lanka with 11 papers during 2005–2011, followed by University Ruhuna (6 papers), and Institute of Water Management Institute(5 Papers).

Table 4: Research Communication in High Productive Journals

#	**Indian author Published - Journal**	**TP**	**TLCS**	**TGCS**	**Sri Lankan Author Published Journal**	**Recs**	**TLCS**	**TGCS**
1	CURRENT SCIENCE	74	136	252	DISASTERS	4	1	16
2	JOURNAL OF THE GEOLOGICAL SOCIETY OF INDIA	20	21	29	INTERNATIONAL REVIEW OF PSYCHIATRY	4	1	8
3	MARINE GEODESY	12	3	8	AQUATIC CONSERVATION-MARINE AND FRESHWATER ECOSYSTEMS	3	2	10
4	INTERNATIONAL JOURNAL OF	10	6	25	EARTHQUAKE SPECTRA	3	0	20

	REMOTE SENSING							
5	EARTHQUAKE SPECTRA	9	0	15	EMERGENCY MEDICINE AUSTRALASIA	3	3	12
6	INDIAN JOURNAL OF MARINE SCIENCES	8	4	6	JOURNAL OF THE NATIONAL SCIENCE FOUNDATION OF SRI LANKA	3	0	0
7	INTERNATIONAL REVIEW OF PSYCHIATRY	8	7	43	MALARIA JOURNAL	3	0	24
8	ENVIRONMENTAL MONITORING AND ASSESSMENT	7	6	10	BMC PSYCHIATRY	2	0	15
9	JOURNAL OF ENVIRONMENTAL MANAGEMENT	7	10	26	CIVIL ENGINEERING AND ENVIRONMENTAL SYSTEMS	2	1	2
10	ENVIRONMENTAL GEOLOGY	6	14	26	COASTAL ENGINEERING JOURNAL	2	0	6

Table 4 gives the list of top 10 productive journals preferred by the Indian and Sri Lankan scientists for publication. These 10 top journals together contributed 153 papers, which constitute 48.11 per cent of the total Indian publications output and Sri Lankan researchers contributed 29 papers, which constitute 32.95 percent of the total Sri Lankan publication output in Tsunami during 2005-2011.

Table 5: Extent of international collaboration in the field of Tsunami cells

#	**India Collaboration - Country**	**Recs**	**TLCS**	**TGCS**	**Srilanka Collaboration Country**	**Recs**	**TLCS**
1	USA	**23**	43	297	USA	15	2
2	Canada	**13**	7	18	UK	12	5
3	UK	**10**	20	138	Japan	11	7
4	Japan	**9**	39	262	Australia	9	3
5	Malaysia	**8**	20	142	Denmark	6	0
6	Belgium	**7**	8	67	Belgium	5	1
7	Indonesia	**7**	21	234	France	4	1
8	Denmark	**4**	20	128	Kenya	4	1
9	France	**4**	1	5	India	3	1

The extent of international collaboration as seen from coauthored papers is presented in Table 5. India has collaborated often with USA (23), Canada (13) and UK (10). Sri Lanka researchers have co-authored papers with mainly researchers from USA (15), UK (12) and Japan (11). Overall, the share of papers resulting from international collaboration is much less for India and Sri Lanka than all other countries considered here.

Conclusion

In India a total of 318 papers were published in the field of Tsunami during the seven year period 2005-2011. There were only 391 publications produced from India, which is approximately 8.08 percentage of the world output. In Sri Lanka 88 papers were published, which is approximately 2.43 percentage of the world output. Out of top 10 journals where Indian research output is published, Current Science and Journal of the geological society of India are India-based journals, rest of the journals are international. It reflects the tendency of the authors to publish in top journals having high impact factor and wide circulation. Compared to the share of Tsunami publications, Sri Lanka's publications output is very small as compared to USA, Japan and India. Sri Lanka has to substantially increase its investments in R&D and train much more scientists to work in Tsunami area. International collaboration can also be substantially increased to boost the output and enhance the quality of research.

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