CONFERENCE PAPERS OF BARC SCIENTISTS AND ENGINEERS: A CITATION BASED STUDY

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Abstract

This paper highlights the importance of conference papers in the scientific communication process. Carried out a citation analysis of 474 (8.52%) conference papers of BARC Scientists and Engineers published during 1999-2007 as per *Scopus* database. The highest number of papers (117) were published in 2004 and these papers have received the highest (183) number of citations. The average number of papers published per year was 52.66 and the average number of citations per paper was 1.81. Identified highly cited authors and highly cited conference papers. Concludes that conference literature has to be integrated with the databases so as to avoid the missing link in the knowledge development process.

Keywords: Conference Papers, BARC, Citation Study, Bibliometrics, Scientometrics, Conference Proceedings

1. INTRODUCTION

Conference papers, no doubt are invaluable source of knowledge for scientists and Engineers. Conferences provide a battle ground to argue, sharpen, modify, refine ones own ideas. Once conferences are held, the conference proceedings become a neglected source of information and becomes a missing link in the process of scientific communication as many of the abstracting and indexing databases have not fully covered the conference literature, although some databases attempt to cover the conference papers selectively. Scientific meetings are important channels for communicating research results and proceedings literature may usefully supplement journal literature as a measurable object of documented scholarly communication in basic and applied sciences Glänzel et al. (2006). Drott (1995) showed that the function of proceedings in the scholarly communication system is much more complex than what the standard evolutionary model has suggested, and that they are more than just "preliminary material that will latter turn into rigorous, finished works and formally published has journal articles". According to Drott conference proceedings has three specific functions. First, they can help researchers improve their papers by allowing the latter to gather feedback from other researchers before submitting to a journal. Second, they can stimulate discussion within a field by, for example, allowing researchers to exchange ideas on emerging questions and paradigmatic positioning or to seek peer expertise. Third, they can vehicle for information that would otherwise difficult to include in an article, such as application reports or theories and are either too broadly presented, difficult to confirm, or too short to be published in article form. A Montesi and Mackenzie Owen (2008) concluded that conference proceedings can "measure the ability to innovate and propose new ideas, whereas

journal publication can more strongly contribute to building a knowledge bases…"Lisee, Larivaere and Archambault (2008) have examined the scientific impact and ageing of conference proceedings compared to those of scientific literature in general and found that proceedings age faster become obsolete quickly than the cited scientific literature in general**.** Anil Sagar, Kademani and Vijai Kumar (2009) have study the growth of conference proceedings in the field of Neutron Activation Analysis in Nuclear Science and Technology.

2. OBJECTIVES

The main objective of the study is to present the growth of conference literature of Bhabha Atomic Research Centre published during 1999-2007, extent of coverage of conference literature in comparison with journals in *scopus* database and make the quantitative and qualitative assessment by way of analyzing various features of research output such as growth of publications and Citations, Authorship pattern vs Citations, highly cited Scientists, and highly cited Conferences, highly cited conference papers and keywords.

3. MATERIALS AND METHODS

Data was collected from the *Scopus* database (1999-2007). The *Scopus* database was launched in autumn 2004 by Elsevier is one of the most comprehensive databases covering all subjects. The search string 'Bhabha Atomic Research Centre or BARC or B.A.R.C. in the Affiliation field and Conference papers in the Document Type field' was used to extract conference papers of BARC scientists and engineers. A total of 474 conference papers and 860 citations to these papers were received. The data was downloaded and analysed by using the spread sheet application as per the objectives of the study.

4. RESULTS AND DISCUSSION

4.1 Year-wise Distribution of Journal Articles and Conference Papers

Figure-1 gives year-wise distribution of journal articles and conference papers. BARC Scientists and Engineers have published 5561 publications during 1999-2007as per *Scopus* database out of which 5087 (91.48%) were journal articles and only 474 (8.52%) were conference papers.

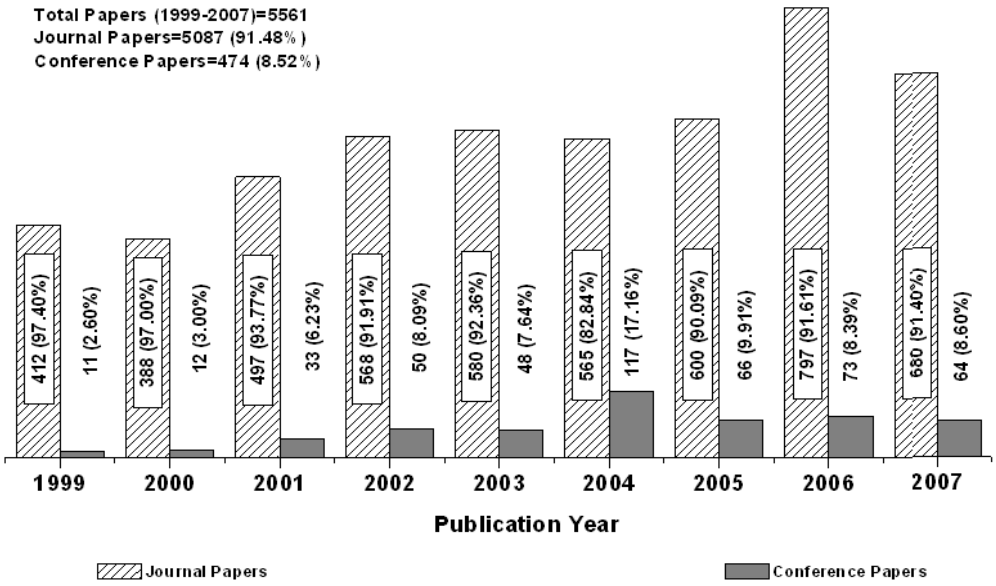


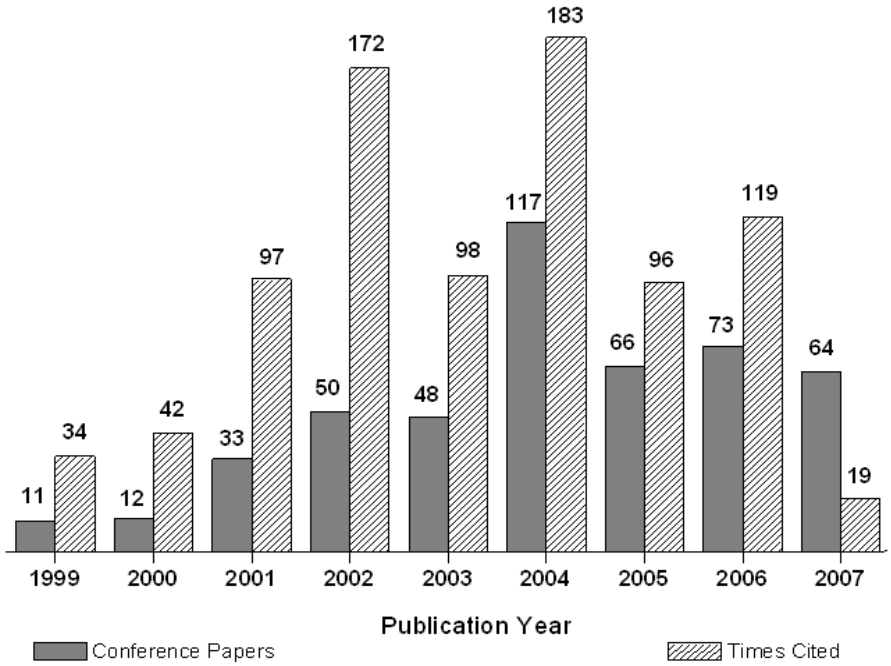
Fig. 1. Year-wise distribution of journal papers and conference papers published by BARC Scientists and Engineers during 1999-2007 as per *Scopus* database

4.2 Year-wise Growth of Conference Papers and Citations

Scientists and Engineers of Bhabha Atomic Research Centre published a total of 474 conference papers during 1999-2007 which have received 860 citations. The highest number of papers (117) were published in 2004 and these papers have received the highest (183) number of citations. The average number of papers published per year was 52.66 and the average number of citations per paper was 1.81. Table-1 and Figure-2 give the year-wise growth of conference papers and their citations. It was observed that more number of papers in a particular year received more number of citations indicates that quality and quantity of research always go hand in hand. The older papers tend to received more citations than the most recent papers.

Table 1. Growth of Conference papers during 1999-2007 as per *Scopus* database

Publication Year	Total Papers	Citations	Average Citations/Paper	Single-Authored	Multi-Authored	Collaboration Rate
1999	11	34	3.09	3	8	0.73
2000	12	42	3.50	1	11	0.92
2001	33	97	2.94	9	24	0.73
2002	50	172	3.44	7	43	0.86
2003	48	98	2.04	2	46	0.96
2004	117	183	1.56	8	109	0.93
2005	66	96	1.45	8	58	0.88
2006	73	119	1.63	9	64	0.88
2007	64	19	0.30	2	62	0.97
Total	474	860	1.81	49	425	0.90



4.3 Citations Vs Authorships

Jointly authored papers tend to be cited more than others. In fact, the more authors a paper has, the more likely it is to be cited. For the field of cancer research, Lawani (1980) has shown clearly that citation rate and quality of paper (as judged by a forum of peer review) both correlate positively with the number of authors per paper. Smart and Bayer (1986) stated that the acceptance rate of articles which are collaboratively authored tends to be higher than that for single authored papers, thereby suggesting a generally positive relationship between collaboration and quality. The analysis of ten year citation rates of 270 randomly selected articles in three applied fields likewise shows a similar relationship, with somewhat higher citation frequencies for multi-authored papers than for single authored ones. The relationship persists whether self-citations are included or excluded. However, those differences are not statistically significant for articles in clinical psychology or educational measurement. Only multi-authored articles in management science show a statistically significant higher citation rate.

The number of Citations received in relation to authorship pattern is given in Table-2. Single-authored 49 (10.34%) papers have received 113 (13.14%) citations and multi-authored 425 (89.66%) papers 747 (86.86%) citations. Maximum 169 (19.65%) citations were for four authored papers followed by six authored papers with 168 (19.53%) citations and two authored publications with 134 (15.58%) citations.

Table 2. Authorship trend in Conference papers and Citations

Author (s) in byline	Publication Year									Papers	Papers (%)	Citations	Citations (%)
	99	00	01	02	03	04	05	06	07				
1	3	1	9	7	2	8	8	9	2	49	10.34	113	13.14
2	1	1	7	5	7	18	7	6	9	61	12.87	134	15.58
3	2	1	6	3	12	19	13	9	15	80	16.88	107	12.44
4	4	4	5	9	5	24	15	17	11	94	19.83	169	19.65
5	1	2	2	4	5	25	13	11	10	73	15.40	89	10.35
6		2		12	9	15	6	9	7	60	12.66	168	19.53
7		1	2	2	3	2	2	4	2	18	3.80	47	5.47
8					1	4		1	2	8	1.69	7	0.81
9				5					1	6	1.27	6	0.70
10					1		1	2		4	0.84	3	0.35
12						1		1	1	3	0.63	6	0.70
14				1						1	0.21	1	0.12
16				1					1	2	0.42	1	0.12
18				1						1	0.21	1	0.12
22								1		1	0.21	1	0.12
23						1				1	0.21		0.00
26							1			1	0.21	2	0.23
30					2					2	0.42	2	0.23
32									1	1	0.21	1	0.12
33									1	1	0.21		0.00
34			1					1		2	0.42	1	0.12
38								1	1	2	0.42		0.00
99					1					1	0.21		0.00
307			1							1	0.21	1	0.12
465								1		1	0.21		0.00
Total	11	12	33	50	48	117	66	73	64	474	100.00	860	100.00
CR	0.73	0.92	0.73	0.86	0.96	0.93	0.88	0.88	0.97	0.90	-	-	-

(CR=Collaboration rate)

4.4 Highly Cited Authors

Table-3 gives the highly cited authors in conference papers of BARC Scientists and Engineers. J. V. Yakhmi (Technical Physics and Prototype Engineering Division) has received 78 citations for his 22 papers followed by N. M. Gupta (Applied Chemistry Division) has received 48 citations for his 6 papers, A. Das (Solid State Physics Division) has received 36 citations for his 18 papers, V. K. Aswal (Solid State Physics Division) has received 33 citations for his 13 papers, S. M. Yusuf (Solid State Physics Division) has received 31 citations for his 8 papers, K. R. Chakraborty (Solid State Physics Division) has received 23 citations for his 7 papers, and V. C. Sahni (Physics Group) has received 19 citations for his 8 papers.

Table3. Highly Cited BARC Scientists and Engineers in Conference Papers as per *Scopus* Database during 1999-2007

Rank	Author (s)	Divisions	Citations	Papers	Average Citations/ Papers
1	Yakhmi, J. V.	Technical Physics and Prototype Engineering Division	78	22	3.55
2	Gupta, N. M.	Applied Chemistry Division	48	6	8.00
3	Das, A.	Solid State Physics Division	36	18	2.00
4	Aswal, V. K.	Solid State Physics Division	33	13	2.54
5	Yusuf, S. M.	Solid State Physics Division	31	8	3.88
6	Chakraborty, K. R.	Solid State Physics Division	23	7	3.29
7	Sahni, V. C.	Physics Group	19	8	2.38
8	Godwal, B. K.	High Pressure Physics Division	18	11	1.64
9	Manchanda, V. K.	Radiochemistry Division	18	8	2.25
10	Paranjpe, S. K.	Solid State Physics Division	17	6	2.83
11	Ramanadham, M.	Solid State Physics Division	16	7	2.29
12	Krishna, P. S. R.	Solid State Physics Division	15	8	1.88
13	Gupta, S. K	Technical Physics and Prototype Engineering Division	13	14	0.93
14	Aswal, D. K.	Technical Physics and Prototype Engineering Division	12	9	1.33
15	Kulshreshtha, S. K.	Chemistry Division	11	5	2.20
16	Banerjee, S.	Materials Group	10	12	0.83
16	Chaplot, S. L.	Solid State Physics Division	10	7	1.43
16	Mukherjee, T.	Chemistry Group	10	6	1.67
17	Chatterjee, A.	Nuclear Physics Division	9	9	1.00
17	Pant, H. C.	High Pressure Physics Division	9	6	1.50
17	Roy, B. J.	Nuclear Physics Division	9	8	1.13
18	Tomar, B. S.	Radiochemistry Division	8	6	1.33
18	Wagh, A. G.	Solid State Physics Division	8	7	1.14
19	Dey, G. K.	Materials Science Division	7	5	1.40
20	Jha, V.	Nuclear Physics Division	6	5	1.20
20	Kothiyal, G. P.	Technical Physics and Prototype Engineering Division	6	6	1.00
20	Patra, A. K.	Solid State Physics Division	6	6	1.00
20	Shrikhande, V. K.	Technical Physics and Prototype Engineering Division	6	5	1.20
22	Kailas, S.	Nuclear Physics Division	4	5	0.80
22	Kushwaha, H. S.	Health, Safety and Environment Group	4	22	0.18
22	Mazumder, S.	Solid State Physics Division	4	5	0.80
22	Sen, D.	Solid State Physics Division	4	6	0.67
23	Choudhury, R. K.	Nuclear Physics Division	3	10	0.30
23	Ghosh, A. K.	Reactor Safety Division	3	15	0.20
23	Jain, V. K.	Chemistry Division	3	5	0.60
23	Sen, S.	Technical Physics and Prototype Engineering Division	3	5	0.60
24	Biswas, D.	Nuclear Physics Division	2	5	0.40
24	Sharma, S. M.	Synchrotron Radiation Section	2	5	0.40
24	Sundararaman, M.	Materials Science Division	2	7	0.29
25	Bandyopadhyay, B.	Reactor Control Division	1	5	0.20
25	Gupta, S. K.	Reactor Safety Division	1	7	0.14
25	Mohanty, A. K.	Nuclear Physics Division	1	5	0.20
25	Tiwari, A. P.	Reactor Control Division	1	5	0.20
25	Verma, V	Reactor Safety Division	1	6	0.17
-	Dutta, B. K.	Reactor Safety Division	-	10	0.00
-	Lele, H. G.	Reactor Safety Division	-	5	0.00
-	Mukhopadhyay, D.	Reactor Safety Division	-	5	0.00
-	Muthe, K. P.	Technical Physics and Prototype Engineering Division	-	5	0.00

-	Samal, M. K.	Reactor Safety Division	-	5	0.00
-	Vaze, K. K.	Reactor Safety Division	-	6	0.00

4.5. *Domain-wise Distribution of Conference Papers and Citations*

The major areas of Conference Papers during 1999-2007 were: Physical Sciences (246) with 391 citations, Engineering Sciences (106) with 85 citations, Chemical Sciences (83) with 232 citations, Biological Sciences (31) with 145 citations and Multidisciplinary Sciences (8) with 7 citations as shown in Table-4 and Table-5.

Table 4. Domain-wise distribution of Conference Papers of BARC Scientists and Engineers

Domains	Year									Papers	Papers (%)
	99	00	01	02	03	04	05	06	07		
Physical Sciences	6	1	10	25	30	69	37	29	39	246	51.90
Engineering Sciences	2	4	3	10	10	32	14	26	5	106	22.36
Chemical Sciences	2	6	13	12	2	9	12	14	13	83	17.51
Biological Sciences	1	1	7	3	5	3	2	3	6	31	6.54
Multidisciplinary Sciences					1	4	1	1	1	8	1.69
Total	11	12	33	50	48	117	66	73	64	474	100.00

Table 5. Domain-wise distribution of citations of Conference Papers of BARC Scientists and Engineers

Domains	Year									Citations	Citations (%)
	99	00	01	02	03	04	05	06	07		
Physical Sciences	15	21	15	53	71	115	41	52	8	391	45.47
Chemical Sciences	3	21	35	50	5	20	34	55	9	232	26.98
Biological Sciences	10		12	67	17	25	10	2	2	145	16.86
Engineering Sciences	6		35	2	5	23	4	10		85	9.88
Multidisciplinary Sciences							7			7	0.81
Total	34	42	97	172	98	183	96	119	19	860	100.00

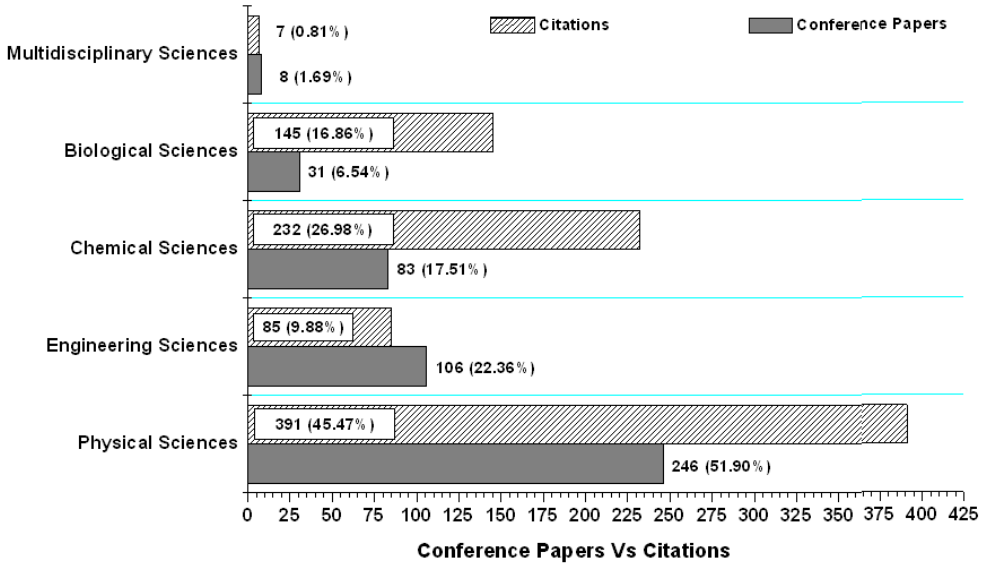


Fig. 3. Domain-wise Conference papers and their Citations of BARC Scientists and Engineers during 1999-20007 as per *Scopus* database

4.5 Most Cited Conferences

Table-6 lists the most cited conferences. The *Proceedings of the International on Magnetic Materials, 17-19 October 2000, Calcutta* has received the highest number (16) of citations followed by *Second Moscow International Symposium on Magnetism (MISM), 20-24 June 2001, Moscow* with 15 citations, *International Symposium on Advances in Superconductivity and Magnetism: Materials, Mechanisms and Devices, 25-28 September 2001, Mangalagangothri* with 14 citations, *International Symposium on Nuclear Physics, 18-22 December 2000, Mumbai* and *Proceedings of the Second Regional Conference on Magnetic and (MSS-01), 9-13 September 2001, Irbid* with 13 citations each. Table-7 lists the most cited conference papers of BARC Scientists and engineers.

Table 6. Most Cited top ten Conferences as per *Scopus* database

Rank	Conference Name	Number of Citations
1	Proceedings of the International on Magnetic Materials, 17-19 October 2000, Calcutta	16
2	Second Moscow International Symposium on Magnetism (MISM), 20-24 June 2001, Moscow	15

3	International Symposium on Advances in Superconductivity and Magnetism: Materials, Mechanisms and Devices, 25-28 September 2001, Mangalagangothri	14
4	International Symposium on Nuclear Physics, 18-22 December 2000, Mumbai	13
4	Proceedings of the Second Regional Conference on Magnetic and (MSS-01), 9-13 September 2001, Irbid	13
5	The 5th International Conference on Nano-Molecular Electronics, 10-12 December 2002, Kobe	7
6	Proceedings of the 1999 IEEE/SICE/RSJ International Conference on Multisensor Fusion and Integration for Intelligent Systems, MFI'99, 15-18 August 1999, Taipei, Taiwan	6
6	Selections from the Presentations of the 3rd Asia-Pacific Congress, 12 October 2003, Dalian	6
8	9th International Workshop on Slow Positron Beam Techniques, 16-22 September 2001, Dresden	5
8	International Conference on Strongly Correlated Electrons, 6-6 August 2002, Ann Arbor, MI	3

Table 7. Highly Cited Conference papers of BARC Scientists and Engineers during 1999-2007 as per *Scopus* database

Rank	Conference Papers	Citations
1	Devasagayam, T.P.A.; Sainis, K.B. 2002. Immune system and antioxidants, especially those derived from Indian medicinal plants. *Indian Journal of Experimental Biology*. Vol. 40 (6): pp. 639-655	42
2	D'Souza, S.F. 2001. Immobilization and stabilization of biomaterials for biosensor applications. *Applied Biochemistry and Biotechnology - Part A Enzyme Engineering and Biotechnology*. Vol. 96: pp. 225-238. DOI: 10.1385/ABAB:96:1-3:225	30
3	Vidya, K.; Dapurkar, S.E.; Selvam, P.; Badamali, S.K.; Kumar, D.; Gupta, N.M. 2002. Encapsulation, characterization and catalytic properties of uranyl ions in mesoporous molecular sieves. *Journal of Molecular Catalysis A: Chemical.* Vol. 181: pp. 91-97. DOI: 10.1016/S1381-1169(01)00350-8	27
4	Sar, P.; K. Kazy, S.; D'Souza, S.F. 2004. Radionuclide remediation using a bacterial biosorbent. *International Biodeterioration and Biodegradation.* Vol. 54: pp. 193-202. DOI: 10.1016/j.ibiod.2004.05.004	22
5	Pressl, S.; Romm, H.; Ganguly, B.B.; Stephan, G. 2000. Experience with FISH-detected translocations as an indicator in retrospective dose reconstructions. *Radiation Protection Dosimetry*. Vol. 88 (1): pp. 45-49	21
6	Mishra, U.C. 2004. Environmental impact of coal industry and thermal power plants in India. *Journal of Environmental Radioactivity*. Vol. 72: pp. 35-40. DOI: 10.1016/S0265-931X(03)00183-8	17
6	Devasagayam, T.P.A.; Kamat, J.P. 2002. Biological significance of singlet oxygen. *Indian Journal of Experimental Biology.* Vol. 40 (6): pp. 680-692	17
7	Kawamura, H.; Parr, R.M.; Dang, H.S.; Tian, W.; Barnes, R.M.; Iyengar, G.V. 2000. Analytical quality assurance procedures developed for the IAEA's Reference Asian Man Project (Phase 2). *Journal of Radioanalytical and Nuclear Chemistry.* Vol. 245 (1): pp. 123-126. DOI: 10.1023/A:1006712813369	16
8	Singh, B.N.; Maiti, B. 2006. Separation and preconcentration of U(VI) on XAD-4 modified with 8-hydroxy quinoline. *Talanta.* Vol. 69 (2): pp. 393-396. DOI: 10.1016/j.talanta.2005.06.072	15
9	Krishna, M.V.B.; Karunasagar, D.; Rao, S.V.; Arunachalam, J. 2005. Preconcentration and speciation of inorganic and methyl mercury in waters using polyaniline and gold trap-CVAAS. *Talanta*. Vol. 68 (2): pp. 329-335. DOI: 10.1016/j.talanta.2005.08.066	14

10	Yusuf, S.M.; Ganguly, R.; Chakraborty, K.R.; Mishra, P.K.; Paranjpe, S.K.; Yakhmi, J.V.; Sahni, V.C. 2001. Effect of Dy substitution for La in La0.7Ca0.3MnO3 perovskite. *Journal of Alloys and Compounds*. Vol. 326: pp. 89-93. DOI: 10.1016/S0925-8388(01)01218-X	13
10	Yakhmi, J.V. 2002. Magnetism as a functionality at the molecular level. *Physica B: Condensed Matter*. Vol. 321: pp. 204-212. DOI: 10.1016/S0921-4526(02)00851-7	13
11	Murthy, T.S.R.Ch.; Basu, B.; Balasubramaniam, R.; Suri, A.K.; Subramanian, C.; Fotedar, R.K. 2006. Processing and properties of TiB2 with MoSi2 sinter-additive: A first report. *Journal of the American Ceramic Society*. Vol. 89 (1): pp. 131-138. DOI: 10.1111/j.1551-2916.2005.00652.x	12
12	Choudhury, N.; Pettitt, B.M. 2005. Local density profiles are coupled to solute size and attractive potential for nanoscopic hydrophobic solutes. *Molecular Simulation*. Vol. 31: pp. 457-463. DOI: 10.1080/08927020500035457	10
12	Chattopadhyay, S.; Das, M.K, Sarkar, S.K, Saraswathy, P.; Ramamoorthy, N. 2002. A novel 99mTc delivery system using (n,Î³)99Mo adsorbed on a large alumina column in tandem with Dowex-1 and AgCl columns. *Applied Radiation and Isotopes*. Vol. 57 (1): pp. 7-16. DOI: 10.1016/S0969-8043(02)00080-5	10
12	Aswal, V.K.; Goyal, P.S. 2004. Small-angle neutron scattering from micellar solutions. *Pramana - Journal of Physics*. Vol. 63 (1): pp. 65-72	10
12	Misra, A.N.; Sahu, S.M.; Misra, M.; Ramaswamy, N.K.; Desai, T.S. 1999. Sodium chloride salt stress induced changes in thylakoid pigment-protein complexes, photosystem II activity and thermoluminescence glow peaks. *Zeitschrift fur Naturforschung - Section C Journal of Biosciences*. Vol. 54: pp. 640-644	10

4.6 Conference Papers covered by Journals

A paper presented at a conference may eventually appear in the literature in number of ways: in a proceedings volume, in a book form, as a conference serial and as a special issue of a particular journal. There are some journals devoted particularly to publish the conference papers (e.g. Journal of Physics: Conference Series). Table-8 provides the most cited conference papers of BARC Scientists and Engineers published in journals.

Table 8. Most Cited Conference papers published in Journals as per *Scopus* database

Rank	Journal	IF 2007	Citations	Papers	Citations (%)	Papers (%)
1	*Pramana-Journal of Physics*	0.42	136	100	15.81	21.10
2	*Indian Journal of Experimental Biology*	-	67	4	7.79	0.84
3	*Journal of Radioanalytical and Nuclear Chemistry*	0.51	41	22	4.77	4.64
4	*Journal of Molecular Catalysis-A*	2.51	37	3	4.30	0.63
5	*Radiation Protection Dosimetry*	0.45	34	4	3.95	0.84
6	*Applied Biochemistry and Biotechnology-A*	1.10	30	1	3.49	0.21
7	*Talanta*	2.81	29	2	3.37	0.42
8	*Radiochimica Acta*	1.07	28	11	3.26	2.32
9	*Journal of Environmental Radioactivity*	1.07	23	3	2.67	0.63
9	*Physica-B*	0.87	23	6	2.67	1.27
10	*International Biodeterioration and Biodegradation*	1.62	22	1	2.56	0.21
10	*Proceedings of the Indian Academy of Sciences: Chemical Sciences*	-	22	9	2.56	1.90
11	*Environment International*	2.63	18	4	2.09	0.84
11	*Journal of Magnetism and Magnetic Materials*	1.21	18	3	2.09	0.63
12	*Radiation Measurements*	0.92	17	8	1.98	1.69
13	*Journal of Alloys and Compounds*	1.25	16	2	1.86	0.42

14	*Journal of Thermal Analysis and Calorimetry*	1.44	15	9	1.74	1.90
15	*Laser and Particle Beams*	3.96	14	5	1.63	1.05
16	*Journal of Environmental Pathology, Toxicology and Oncology*	1.11	12	6	1.40	1.27
16	*Journal of the American Ceramic Society*	1.40	12	1	1.40	0.21
17	*Applied Radiation and Isotopes*	0.92	10	1	1.16	0.21
17	*Applied Surface Science*	1.44	10	2	1.16	0.42
17	*Molecular Simulation*	1.08	10	1	1.16	0.21
17	*Physica Status Solidi-A*	1.22	10	2	1.16	0.42
17	*Zeitschrift fur Naturforschung-C*	0.72	10	1	1.16	0.21

4.7 Keyword Analysis

Keywords are one of the best scientometric indicators to understand and grasp instantaneously the thought content of the papers and to find out the growth of the subject field. By analyzing the keywords appeared either on the title or assigned by the indexer or the author himself will help in knowing in which direction the knowledge grows. The keywords appeared in the Index Keywords field in *Scopus* database of conference papers were analysed to assess the impact of the conference papers of BARC Scientists and Engineers. The highly Cited keywords were conference papers (71) with 324 citations, India (24) with 178 citations, Antioxidants (10) with 158 citations, Human (11) with 96 citations, Catalysis (7) with 95 citations, Oxygen (11) with 95 citations, Adsorption (12) with 87 citations, Immune system (2) with 84 citations, Oxidative stress (2) with 84 citations, Oxidation (10) with 82 citations, Uranium (9) with 77 citations, Neutron scattering (40) with 77 citations, Antioxidant (4) with 74 citations, Nitrogen (4) with 73 citations, DNA damage (5) with 72 citations, Methanol (9) with 72 citations, Magnetization (25) with 70 citations. Table-9 lists the keywords frequency and their citations.

Table 9. Keywords frequency and their citations appeared in conference papers in the 'Index Keywords' field as per *Scopus* database

Keyword	**TC**	**KF**	**ACK**	**Keyword**	**TC**	**KF**	**ACK**
Immune System	84	2	42.00	Hydrophobicity	57	6	9.50
Oxidative Stress	84	2	42.00	pH Effects	38	4	9.50
Adjuvants, Immunologic	42	1	42.00	Fourier Transform Infrared Spectroscopy	46	5	9.20
Herbs	42	1	42.00	Free Radicals	46	5	9.20
Immunological Adjuvant	42	1	42.00	Dispersion	36	4	9.00
Medicinal Plant	42	1	42.00	Environmental Impact	35	4	8.75
Plants, Medicinal	42	1	42.00	Human	96	11	8.73
Reactive Oxygen Metabolite	42	1	42.00	Oxygen	95	11	8.64
Reactive Oxygen Species	42	1	42.00	Uranium	77	9	8.56
Ion Exchange	54	2	27.00	Adult	34	4	8.50
Carbon Monoxide	59	3	19.67	Oxidation	82	10	8.20
Antioxidant	74	4	18.50	Methanol	72	9	8.00

Nitrogen	73	4	18.25	Unclassified Drug	54	7	7.71
Coal	34	2	17.00	Carbon	53	7	7.57
Ecology	34	2	17.00	India	178	24	7.42
Lipid Metabolism	34	2	17.00	Adsorption	87	12	7.25
Mutagenesis	34	2	17.00	Analytic Method	64	9	7.11
Photochemotherapy	34	2	17.00	Infrared Spectroscopy	35	5	7.00
Singlet Oxygen	34	2	17.00	Animals	32	5	6.40
Transportation	34	2	17.00	Lipid Peroxidation	32	5	6.40
Metabolism	67	4	16.75	Male	48	8	6.00
Surface Property	32	2	16.00	Cesium	34	6	5.67
Uranium Oxide	32	2	16.00	Quality Control	40	8	5.00
Antioxidants	158	10	15.80	Seawater	40	8	5.00
Free Radical	44	3	14.67	Radioactivity	35	7	5.00
Immunology	58	4	14.50	Temperature	63	13	4.85
Plants (Botany)	58	4	14.50	Radiation Exposure	38	8	4.75
DNA Damage	72	5	14.40	Conference Paper	324	71	4.56
Animalia	56	4	14.00	Chemical Analysis	39	9	4.33
DNA	55	4	13.75	Lead	39	10	3.90
Catalysis	95	7	13.57	Priority Journal	49	13	3.77
Radioisotopes	49	4	12.25	X-ray Diffraction	60	17	3.53
Drug Effect	61	5	12.20	Micelles	36	11	3.27
Ultraviolet Spectroscopy	36	3	12.00	Concentration (process)	38	12	3.17
Proteins	47	4	11.75	Interfaces (materials)	32	11	2.91
Molecular Interaction	35	3	11.67	Magnetization	70	25	2.80
Calcination	34	3	11.33	X-ray Diffraction Analysis	56	20	2.80
Electricity	34	3	11.33	Crystallization	32	12	2.67
Photochemistry	34	3	11.33	Neutron Scattering	77	40	1.93
Concentration (Parameters)	41	4	10.25	Neutron Diffraction	34	19	1.79
Humans	67	7	9.57	Phase Transitions	32	19	1.68

TC=Total Citations; KF=Keyword Frequency; ACK=Average Citations per Keyword)

5 CONCLUSION

This study was conducted to know the extent of coverage of conference papers of BARC scientists and engineers in *Scopus* database during 1999-2007. BARC publishes large number of conference papers as well as journal articles encompassing various fields of knowledge. It was surprising to note that only a fraction 474 (8.52%) of conference papers have been covered in the *Scopus* database during 1999-2007.

The main findings of the study were: Conference papers also receive citations like other sources of information; Multi-authored papers receive more citations compared to single-authored papers; Older papers (2-3 year old) tend to receive more citations ; more number of conference papers in a particular period receive more number of citations indicates that quantity and quality go hand in hand; accessibility of full conference papers is the main obstacle in receiving citations to these papers.

The results would be altogether different if databases like *INIS* and *INSPEC* are considered as these databases cover more number of conference papers falling within their subject scope when compared to *Scopus* and *Web of Science*.

In many areas conference papers are the only source of information but often overlooked. Therefore, it is suggested that databases *like Web of Science* and *Scopus* make concerted efforts to cover more conference papers to integrate conference literature into common stock of knowledge. The obsolescence studies may be initiated in different fields to know the importance of conference literature.

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