

## Research Trend in the Field of Nanotechnology: A Bibliometric Study

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### Abstract

The paper presents a bibliometric study of research trends in the field of nanotechnology for the period 1999-2009, based on Web of Science. It deals with the growth of nanotechnology literature ; institutions' contribution; productivity of top ten countries of the world; language of the articles, and most productive authors. The present study may help library professionals in developing strategic plan for the management of science and technology libraries.

**Keywords:** Bibliometrics; Nanotechnology; Growth; Productive authors.

### Introduction

The term "nanotechnology" was coined in 1974 by Norio Taniguchi (1912-1999) at the University of Tokyo. It includes a number of technologies that deal with the miniaturization of existing technology down to the scale of a nanometer (one-billionth of a meter) in size, about the size of molecules and atoms. Potential effects of nanotechnology include microcomputers capable of storing trillion of bytes of information in the size of a sugar cube; portable fluids containing nanobots that are programmed to destroy cancer cells; and airborne nanobots that are programmed to rebuild the thinning ozone layer. A key understanding of nanotechnology is that it offers not just better products, but a vastly improved manufacturing *process*. A computer can make copies of data files – essentially as many copies as you want at little or no cost. It may be only a matter of time until the building of products becomes as

cheap as the copying of files. That's the real meaning of nanotechnology, and why it is sometimes seen as 'the next industrial revolution' [1]. Therefore, in the present paper an attempt has been made to know the research trend in the field of nanotechnology through bibliometrics.

Information managers have adopted a number of quantitative methods in recent years in order to evaluate library resources and services more objectively and effectively. Bibliometrics is one of the quantitative techniques applied by information managers to measure the records of human communication. It is used to identify the pattern of publication, authorship, citations used for a subject etc over a period of time and thereby offering insight into the dynamics of the area under a particular study [2]. Therefore, in the present paper an attempt has been made to know the research trend in the field of nanotechnology through bibliometrics

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### *Objective of the study*

The main objectives of the study are

- i. To investigate the nature of year-wise growth of articles;
- ii. To know the contribution of various institutions;

- iii. To observe productivity of top ten countries of the world;
- iv. To study the language of the articles;
- v. To investigate the most productive authors.

### Database and methodology

The data for the study were retrieved from the *Web of Science, Science Citation Index Expanded (SCIE)*, published by Thomson Reuters, by using relevant keywords related to Nanotechnology field. Records pertaining to Nanotechnology were collected from 1999-2009.

### Growth of Articles

The changes in the size of literature over a specific period may be termed as growth of literature (articles) [3]. Growth of has been identified by looking at the yearly distribution of the articles in a chosen field Nanotechnology.

Table 1 shows Year-wise distribution of articles in ISI Web Knowledge database in the

**Table 1: Year-wise growth of articles**

Years	No. of articles	Cumulative No. of articles	% of 4624	Cumulative %
1999	43	43	0.93	0.93
2000	67	110	1.44	2.37
2001	89	199	1.92	4.30
2002	170	369	3.67	7.97
2003	248	617	5.36	13.34
2004	339	956	7.33	20.67
2005	458	1414	9.90	30.57
2006	540	1954	11.67	42.25
2007	704	2638	15.22	57.48
2008	944	3602	20.41	77.89
2009	1022	4624	22.10	100
Total	4624		100	

**Table 2: Institutional Affiliation of the authors**

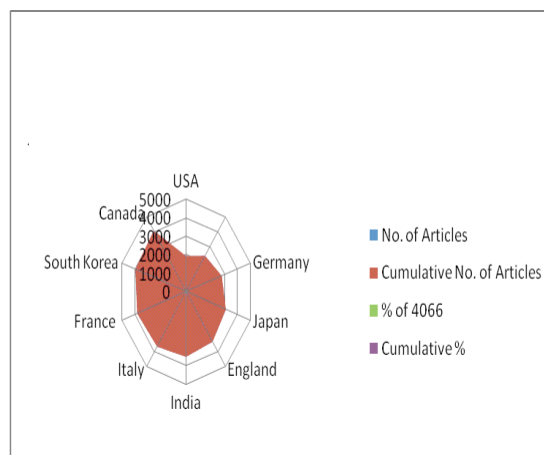
Institution(s)	No of Articles	%
Universities	3642	78.763
Research Institutions	722	15.61
Others	260	5.62
Total	4624	100

field of "Nanotechnology" .During the year 1999, 2000, 2001, 2002, 2003 and 2004 there were 43 (0.92%), 67 (1.44%), 89 (1.925), 170 (3.67%), 248 (5.36%) and 339 (7.33%) articles. From 2005 onwards, there is a steady increase in the number of articles. The year 2009 recorded the highest number of articles with 1022(22.10%).

**Table 3: Scientific productivity of top ten countries according to Number of publications**

Country/ Territory	No. of Articles	Cumulative No. of Articles	% of 4624	Cumulative %
USA	1917	1917	41.46	41.46
Peoples R China	473	2390	10.23	51.69
Germany	377	2767	8.15	59.84
Japan	321	3088	6.94	66.78
England	230	3318	4.97	71.75
India	177	3495	3.83	75.58
Italy	151	3646	3.26	78.84
France	148	3794	3.20	82.04
South Korea	144	3938	3.11	85.15
Canada	128	4066	2.77	87.92
Others	558	4624	12.07	100
Total	4624			

**Fig 1: Scientific productivity of top ten countries**



*Institutional Affiliation*

Table 2 from the above analysis could be deduced that Universities contributes 3642(78.76%) articles of the total 4624. The remaining are Research Institutions 722(15.61%) and others (includes colleges;

in the field. Peoples R China stands second in the table with 473(11.63%) articles, followed by Germany 377(9.27%), Japan 321(7.89%), England 230(5.65%), India 177(4.35%),Italy 151(3.71%), France 148(3.63%), South Korea

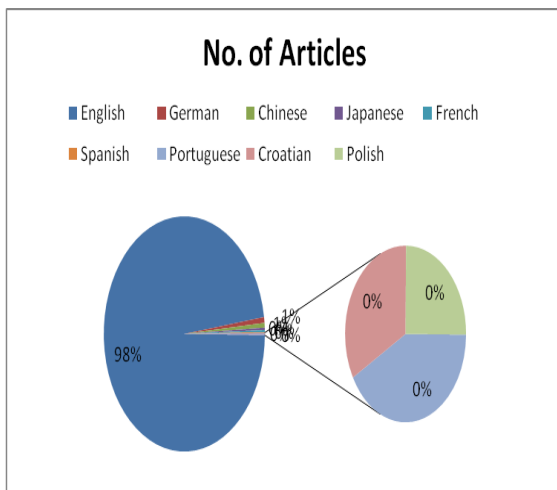
**Table 4: Language wise distribution of Articles**

Language	No. of Articles	Cumulative No. of Articles	% of Articles	Cumulative %
English	4512	4512	97.5778	97.5778
German	36	4548	0.7785	98.3563
Chinese	30	4578	0.6487	99.005
Japanese	15	4593	0.3243	99.3293
French	13	4606	0.2811	99.6104
Spanish	6	4612	0.1297	99.7401
Portuguese	5	4617	0.1081	99.8482
Croatian	4	4621	0.0865	99.9347
Polish	3	4624	0.0648	99.9995
Total	4624		99.9995	

**Table 5: Productivity top ten research Institutions according to Number of Articles**

Institutions	No. of Articles	Cumulative No. of Articles	% of 454	Cumulative %
Purdue Univ. (United Stats)	71	71	15.63	15.63
Univ. Illinois (Chicago)	57	128	12.55	28.19
Nat. Univ. Singapore	48	176	10.57	38.76
Harvard Univ. (United Stats)	46	222	10.13	48.90
Univ. Calif Los Angeles	44	266	9.6	58.59
Northwestern Univ. (Chicago)	39	305	8.95	67.18
Univ. Washington(USA)	39	344	8.59	75.73
Univ. Michigan	38	382	8.37	84.14
Univ. Cambridge	37	419	8.14	92.29
Arizona state Univ.	35	454	7.70	100
Total	454		100.	

**Fig 2: Language-wise distribution of articles**

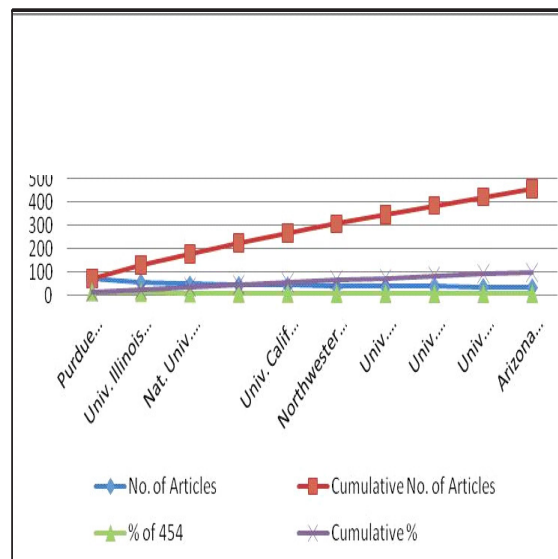


institute of technology; medical school etc) 260(5.62%) articles respectively.

*Cross National Assessment*

The above table shows the country wise distribution of articles in the field of “Nanotechnology”. Out of the total 4624 articles, 1917(47.14%) articles have been published from U.S.A. showing its dominance

**Fig 3: Scientific productivity of top ten research institutions**



**Table 6: Most productive authors**

Name of the authors	Rank	No. of articles	Cumulative no. of articles	% of articles	Cumulative %
Seeman N.C	1	29	29	26.8518	26.8518
Webster T.J	1	29	58	26.8518	53.7036
Feng S.S	2	17	75	15.7407	69.4443
Liu Y	2	17	92	15.7407	85.185
Anonymous	3	16	108	14.8148	99.9998
Total		108		99.9998	

144(3.54%) and Canada 128(3.14%) articles respectively.

#### *Language of the Articles*

4512(97.57%), out of 4624 articles are published in English language; 36(0.77%) articles in German language; 30(0.64%) articles in Chinese language; 15(0.32%) articles in Japanese language; 13(0.28%) articles in French language; 6(0.12%) articles in Spanish language; 5(0.10%) articles in Portuguese language; 4(0.08%) articles in Croatian language and 3(0.06%) articles in Polish language. This shows English language is the main language used by the scientists to communicate research output through different channels of communication.

#### *Institutional Assessment*

Table 5 shows the scientific productivity of top ten research institutions according to number of articles. Purdue University contributed 71(15.63%) articles ; University of Illinois(USA) 57(12.55%) articles; National University, Singapore 48(10.57%) articles; Harvard University 46(10.13%) articles; University Calif Los Angeles 44(9.69%) articles; Northwestern University 39(8.59%) articles; University of Washington (USA) 39(8.59%)articles; University Michigan 38(8.37%) articles; University of Cambridge 37(8.14%) articles and Arizona State University 35(7.70%) articles are contributed.

#### *Prolific Authors*

Table 6 gives ranked list of the most prolific authors. A total of 11,739 authors have been

contributed 4624 articles over the period of 11 years (1999 to 2009). It is observed that Seeman N.C and Webster T.J (USA) are contributed maximum numbers of articles i.e. 29(26.85%) articles followed by Feng S.S and Liu Y (Peoples R China) are contributed 17(15.74%) articles and 16(14.81%) articles do not have authors.

#### **Conclusion**

Bibliometrics as technique has extensive applications in identifying the research trends in a subject, trends in a authorship and collaboration in research, core periodicals; obsolescence and dispersion of scientific literature useful in estimating the comprehensiveness of the sources of information. It will help in formulation o need based collection development policy, weeding out of unused documents and make science policy for the libraries of the present era.

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