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A Scientometric Assessment of Research Output in Textile Technology

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Abstract – **This paper attempts to highlight quantitatively the growth and development of world literature on Textile Technology in terms of publication output as reflected in Scopus database. During 1988-2012 (25 years) a total of 79757 papers were published by the scholars in the field of Textile technology. This study analyses the research output in Textile technology during 1988-2012 on several parameters including its growth, ranking of authors, and global publication share, overall share of international collaborative papers and share of major collaborative partners.**

Keywords: **Textile Technology, Scientometrics, Authorship Pattern**

I. Introduction

The international Encyclopedia of the social & behavioral sciences defines "Scientometrics" as the " study of the quantitative aspects of scientific communication, R&D practices, and science and technology (S&T) policies" (Leydesdorff, 2001).

In 1969, Vassily V. Nalimov & Z. M. Mulchenko coined the Russian equivalent of the term 'scientometrics' ('naukometriya') (Nalimov & Mulchenko, 1969). As the name would imply, this term is mainly used for the study of all aspects of the literature of science and technology. The term had gained wide recognition by the foundation in 1978 of the journal Scientometrics by Tibor Braun in Hungary. According to its subtitle, Scientometrics includes all quantitative aspects of the science of science, communication in science, and science policy (Wilson, 2001).

Anil Sagar, Kademani, B.S.(2011) analysed the scientific contribution from Madhya Pradesh (India) as per the Web of Science expanded version during 2000-2009. The parameters studied include growth of publications and citations, international collaborations, national collaborations, subject-wise distribution of publications, citations, activity index and collaboration rate, ranking of research and academic institutions, authorship and collaboration patterns, channels of communications, and major journals preferred by scientists of Madhya Pradesh for publishing their research works.

Gupta & Dhavan (2006) found that publication output in S & T, as compared to 2.51% annually during 1985-2005, has almost doubled to 5.4% annually during 1995-2005. India's publications as indexed in Web of Science (WoS) have grown from 14,405 papers in 1990 to 28,603 papers in 2005. The institutional participation in research has broadened from 1,734 institutions in 1985-86 to 3,443 in 2001-02. However, there were only 24 institutions which published 300 or more papers during 1985-86 and 2001-02.

II. Objectives of The Study

The main objective of the study is to analyze the research performance on textile technology in global context, as reflected in its publication output during 1988-2012. In particular, the study focuses on the following objectives:

1. To study the world research output and its Growth on textile technology;
2. To measure the geographical distribution of research output;
3. To measure the authorship pattern in the publications;
4. To study the nature of collaboration;
5. To study the ranking of authors and global publication share.

III. Scope and Methodology

The present study attempts to find out the publication pattern of world researchers in the field of textile technology. The study is based on the references and aims to analyze quantitative growth and development of textile technology in terms of research output as reflected in Scopus database during the years 1988-2012.

A. Scopus

In 2004, a leading company in scientific, technical and medical information services production, named Elsevier, announced the launch of commercial database Scopus. Scopus has gained high interest in a short time period and has become a competitor of Thomson Reuter‘s Web of Science.

B. Method

The data in this study has been retrieved from Scopus database (www.scopus.com) for the studied period (25 years ie.1988-2012). The scopus is one of the world’s largest databases of peer reviewed literature. The search string “Textile technology” in title, abstract and keywords fields were used to download the records on the subject. A total of 79757 records were downloaded and analyzed as per the objectives of the study. The present study aims to analyze the research output of researchers in the field of Textile technology.

IV. Analysis and Discussions

Table 1 Frequency Distribution of Research Literature on Textile Technology – Year Wise Distribution

Year	No. of Publications	%
1988	935	1.17
1989	1103	1.38
1990	1629	2.04
1991	1563	1.96
1992	1659	2.08
1993	1782	2.23
1994	2281	2.86
1995	2083	2.61
1996	2834	3.55
1997	2606	3.27
1998	4923	6.17
1999	3391	4.25
2000	3640	4.56
2001	4443	5.57
2002	4530	5.68
2003	4758	5.97
2004	5203	6.52
2005	3128	3.92
2006	3765	4.72
2007	5233	6.56
2008	2858	3.58
2009	4558	5.71
2010	3990	5.00
2011	3758	4.71
2012	3104	3.89
	79757	100

The research productivity in textile technology do not show any uniformity in growth or decline. During the period before millennium the maximum output is in the year 1998 and in 1999 there is sudden fall. From 1988 till 1997 there is increase in the productivity which is gradual except in certain years like 1991, 1993 and 1997 there is slight decrease. Here it is interesting to note that before millennium there is decline in the odd years. After the millennium there is increase in the productivity up to the year 2004. In 2005 and 2008 the decrement is vast and hence it is found essential to analyze the rate of growth during the period of study.

Table II Growth Rate of Research in Textile Technology

Year	Count	Growth Rate
1988	935	
1989	1103	0.18
1990	1629	0.48
1991	1563	-0.04
1992	1659	0.06
1993	1782	0.07
1994	2281	0.28
1995	2083	-0.09
1996	2834	0.36
1997	2606	-0.08
1998	4923	0.89
1999	3391	-0.31
2000	3640	0.07
2001	4443	0.22
2002	4530	0.02
2003	4758	0.05
2004	5203	0.09
2005	3128	-0.40
2006	3765	0.20
2007	5233	0.39
2008	2858	-0.45
2009	4558	0.59
2010	3990	-0.12
2011	3758	-0.06
2012	3104	-0.17
	79757	

The growth rate in the year of 2009 (0.59%), 1989 (0.48%) and in the year 1994 (0.28%) are abnormal. Due to this abnormal growth rate the average growth rate works out 0.09%. The inference is that every year the research productivity in textile technology will grow by nearly 1 percent.

Table III Authorship Pattern

Sl.No.	Authorship Pattern	No. of Publications	Percentage
1	Single Author (Ns)	28082	35.21
2	Multiple Authors(Nm)	51675	64.79
Total		79757	100.00

Degree of Collaboration

To determine degree of collaboration in quantitative terms, the formula given by K. Subramanyam (1983) was used.

The formula is

$$C = \frac{N_M}{N_M + N_S}$$

Where

C = Degree of collaboration

N_M= Number of multi authored papers

N_S= Number of single authored papers

$$C = \frac{51675}{51675 + 28082}$$

C= 0.6479

So, in this study the degree of collaboration is 0.6479.

During the study period (1988-2012), overall the average degree of collaboration is of 0.64. Further it is identified that 64.79% of authors were contributing their research output worked as a team or joint venture. Based on this study, the result of the degree of collaboration C = 0.64. i.e, 84% of collaborative authors' articles are published during the study periods. Overall the average degree of collaboration of the whole sample year is 0.64. Further it is identified that 64.79% of authors were contributing their research output by working as a team or joint venture.

In a collaborative publication, it can be said all the authors have put equal effort in the research. Hence, in a three authored publication each author has one third share, in a four authored publication each has one fourth share and so on. If the authors are given weight age according to their share in their publication, there is change in the ranked list of authors. Schollmeyer, E. who ranks first according to the total publication count (283) is moved to the 7th place. Similarly Fisher, G. who is in the 8th rank is moved up to 3rd place. In this ranking, those authors with less number of publications, but having greater share in each contribution is given more weight age.

Table IV Prolific Authors - Equal Share Method

Author	Count	Share	Rank
Holme I.	238	237.25	3
De Coster J.	142	142.00	6
Fisher G.	128	127.20	8
Wilson A.	123	121.67	9
Rupp J.	123	115.78	9
Tait N.	116	114.50	11
Schollmeyer E.	283	98.44	1
Nair G.P.	138	93.50	7
McCurry J.W.	100	89.63	14
Owen P.	91	85.90	20
Swedberg J.	86	85.20	22
Gries T.	242	85.01	2
Lennox-Kerr P.	84	82.20	24
Thiry M.C.	76	75.50	29
Watkins P.	70	70.00	33
Galli A.	65	64.50	39
Tagliabue A.	60	59.50	44
Sung V.	58	58.00	46
Anson R.	78	57.17	27
Sterk B.	58	57.00	46
Subhan M.	57	57.00	47
Gupta S.	62	56.39	42
Li Y.	179	55.19	5
Butler N.	57	54.70	47
Ward D.	58	52.79	46
Bullio P.G.	54	52.50	50
Memon N.A.	52	52.00	52
Wang X.	184	51.46	4
Dempsey E.	53	51.33	51
Watzl A.	57	50.67	47
Taylor G.	61	50.37	43
Lal R.A.	54	50.00	50
Bottcher P.	60	49.42	44

Table V Prolific Authors - Positional Share Method

Author	Count	Potency	Rank
Holme I.	238	237.10	3
De Coster J.	142	142.00	6
Fisher G.	128	127.20	8
Wilson A.	123	121.67	9
Rupp J.	123	116.40	9
Tait N.	116	114.67	11
Nair G.P.	138	104.67	7
McCurry J.W.	100	91.04	14
Owen P.	91	86.07	20
Swedberg J.	86	85.13	22
Lennox-Kerr P.	84	82.47	24
Thiry M.C.	76	75.33	29
Watkins P.	70	70.00	33
Gries T.	242	67.63	2
Galli A.	65	64.67	39
Anson R.	78	61.24	27
Schollmeyer E.	283	59.97	1
Tagliabue A.	60	59.33	44
Sung V.	58	58.00	46
Sterk B.	58	57.33	46
Subhan M.	57	57.00	47
Li Y.	179	56.85	5
Gupta S.	62	56.46	42
Butler N.	57	54.33	47
Bullio P.G.	54	52.67	50
Memon N.A.	52	52.00	52
Dempsey E.	53	51.83	51
Ward D.	58	51.78	46
Watzl A.	57	51.67	47
Lal R.A.	54	51.33	50
Bottcher P.	60	49.43	44
Knittel D.	120	49.38	10
Taylor G.	61	49.28	43
Hemmings J.	50	49.17	54

An application of this principle to the list of authors ranked according to the publication count, changes the entire ranking given in the Table V. It shows the ranked list of authors according to their potency. There is a difference in the rank while the authors are arranged according to publication and according to potency. Here it is interesting to note Schollmeyer, E. who has contributed 283 publications and 1st rank in the publication count, is now in the 17th place when arranged according to the weightage based on author's position. Watkins, P who was in the 33rd rank was contributed 70 papers is now in the 13th position. Hence it can be generalized that the authors in collaborative research in Textile technology are primarily responsible for their publications in one of fifth of their publications.

Table VI Correlation Between Contributions and Contributors

Year	Publication Count	No. of Authors
1988	935	1765
1989	1103	2060
1990	1629	2497
1991	1563	2323
1992	1659	2637
1993	1782	2629
1994	2281	2939
1995	2083	2632
1996	2834	3389
1997	2606	3344
1998	4923	3760
1999	3391	4144
2000	3640	4569
2001	4443	5428
2002	4530	5272
2003	4758	5541
2004	5203	6245
2005	3128	5851
2006	3765	4694
2007	5233	7458
2008	2858	6402
2009	4558	8756
2010	3990	8699
2011	3758	8867
2012	3104	8292
	79757	0.701081

Table VI shows the number of contributions every year and the number of contributors in that year. The correlation coefficient of these two variables is 0.70 having that as the number of publications increase, there will be increase in the number of authors also. But here it is to be noted that the correlation is not so strong.

Table VII shows the continent-wise distribution of authors in Textile technology. Asian countries take lead forming 24.21% of the total output and European continent is in the next place with 24.07% of authors. Africa, Oceania and South America continents take less than 2% of authors.

Table VII Region-Wise Distribution of Authors

Continent	Count	Percent
NA	30101	37.74
Asia	19308	24.21
Europe	19200	24.07
North America	7852	9.84
Africa	1225	1.54
Oceania	1103	1.38
South America	968	1.21
	79757	100

Table VIII Country of Publication

S.No.	Country of Publication	Count	Percent
1.	USA	10078	59.90
2.	ENGLAND	3254	19.34
3.	NETHERLANDS	451	2.68
4.	GERMANY	439	2.61
5.	ITALY	375	2.23
6.	FRANCE	354	2.10
7.	CANADA	246	1.46
8.	SWITZERLAND	244	1.45
9.	DENMARK	186	1.11
10.	BRAZIL	154	0.92
11.	JAPAN	134	0.80
12.	AUSTRALIA	124	0.74
13.	INDIA	84	0.50
14.	IRELAND	75	0.45
15.	PEOPLES R CHINA	75	0.45
16.	NEW ZEALAND	70	0.42
17.	SPAIN	62	0.37
18.	CROATIA	55	0.33
19.	U ARAB EMIRATES	51	0.30
20.	SCOTLAND	39	0.23
21.	SINGAPORE	37	0.22
22.	POLAND	22	0.13
23.	SOUTH KOREA	22	0.13
24.	IRAN	18	0.11
25.	AUSTRIA	14	0.08

S.No.	Country of Publication	Count	Percent
26.	SERBIA	13	0.08
27.	ISRAEL	13	0.08
28.	SAUDI ARABIA	12	0.07
29.	THAILAND	10	0.06
30.	TURKEY	10	0.06
31.	NORWAY	9	0.05
32.	GREECE	9	0.05
33.	PAKISTAN	8	0.05
34.	TAIWAN	8	0.05
35.	SLOVENIA	7	0.04
36.	NIGERIA	7	0.04
37.	ROMANIA	6	0.04
38.	NA	5	0.03
39.	CZECH REPUBLIC	4	0.02
40.	MEXICO	4	0.02
41.	BELGIUM	4	0.02
42.	CHILE	3	0.02
43.	HONG KONG	3	0.02
44.	LITHUANIA	3	0.02
45.	RUSSIA	3	0.02
46.	SWEDEN	3	0.02
47.	COSTA RICA	2	0.01
48.	COLOMBIA	2	0.01
49.	SLOVAKIA	2	0.01
50.	UGANDA	2	0.01
51.	ARGENTINA	2	0.01
52.	BAHRAIN	1	0.01
53.	BENIN	1	0.01
54.	BULGARIA	1	0.01
55.	ETHIOPIA	1	0.01
56.	FINLAND	1	0.01
57.	KUWAIT	1	0.01
58.	MALAYSIA	1	0.01
59.	JAMAICA	1	0.01
		16825	100

Scholarly communication by authors from 93 countries of the world is published in journals emanating from 58 countries. USA stands first forming 59.9 % of the total output. The second ranked country is England (19.34%) and the third ranked country is Netherlands (2.68%). India is in the 13th place while China is in the 15th place. Of the total 58 countries, there are 49 countries that have a negligible per cent of publications. Hence it can be understood that journals are emanating more from developed countries.

Table IX Core Journals

Sl.No.	Journal	Count
1	Textile Research Journal	1619
2	Melliand Textilberichte	1476
3	Textile Asia	1411
4	Journal of the Textile Institute	1198
5	Colourage	1150
6	Journal of Applied Polymer Science	1130
7	Textile Month	1008
8	Asian Textile Journal	886
9	Medical Textiles	872
10	Chemical Fibers International	751
11	Fibre Chemistry	724
12	Wool Record	714
13	Tinctoria	712
14	Technical Textiles International	687
15	Textile World	633
16	Textile Magazine	620
17	Khimicheskie Volokna	618
18	International Dyer	610
19	Industrial Fabric Products Review	538
20	Technische Textilien	522
21	Melliand International	519
22	Man-Made Textiles in India	509
23	Fibres and Textiles in Eastern Europe	509
24	Revista de la Industria Textil	506
25	Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti	503
26	American Dyestuff Reporter	477
27	Composites Science and Technology	460
28	Textile Outlook International	444
29	Industrie Textile	435
30	ATA Journal	433

31	TUT Textiles a Usages Techniques	425
32	JTN Weekly	417
33	Kettenwirk-Praxis	414
34	International Textile Bulletin	405
35	Pakistan Textile Journal	401
36	AVR Allgemeiner Vliesstoff-Report	396
37	Knitting International	392
38	Nonwovens Industry	383
39	Tekstil	382
40	Textiles Panamericanos	375

Table X Correlation Between Number of Publications qnd Number of Journals

Year	Publication Count	Number of Journals
1988	935	265
1989	1103	336
1990	1629	327
1991	1563	332
1992	1659	357
1993	1782	355
1994	2281	478
1995	2083	428
1996	2834	593
1997	2606	554
1998	4923	588
1999	3391	649
2000	3640	686
2001	4443	721
2002	4530	717
2003	4758	719
2004	5203	755
2005	3128	708
2006	3765	638
2007	5233	976
2008	2858	907
2009	4558	1101
2010	3990	1100
2011	3758	1211
2012	3104	1039
	79757	0.706723

The total core journals identified in Textile technology research is 40 of which Textile Research Journal ranks first and Melliand Textilberichte ranks second. The 3rd ranked journal is Textile Asia.

Table X shows, the publication count increases, the total number of Journals publishing them also increases. The correlation coefficient works out to 0.70 showing a strong and positive correlation between the number of journals and the number of publications.

V. Conclusion

In this study we investigated the publication productivity of researchers in Textile technology during 1998 - 2012. The aim of the present study was to discover a better understanding of what is actually taking place in research on Textile technology and Scientometric studies help the researchers and scientists to know the growth, development and research impact of particular field of research to know countries, institution and scientist individually. Science is no longer a pursuit of an individual. Governments in different countries have taken initiatives to enhance contacts among scientists in science through collaborative research programs, both at the national and international levels. Such initiatives have resulted in increased collaborations at national and international levels.

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