CHAPTER III

METHODOLOGY

This investigation entitled “Scientometric analysis of the literature on textile technology based on bibliographic databases” is a case study encompassing the records output from the Science Citation Index (SCI) and Social Science Citation Index (SSCI) which is available via the Web of Science (WoS).

The present study efforts to analyze the research literature on Textile technology. It aims to identify the distribution of research output on the basis of research papers contributed by Scientists in the field of Textile technology. The study probes to examine the growth rate and relative growth level during the study period. The author productivity and degree of collaboration on Textile technology research output are also brought under the purview of the study. The study aims to analyze the thrust areas of research.

3.1 WEB OF SCIENCE (WOS)

Eugene Garfield’s studies led to foundation of Institute for Scientific Information (ISI) in 1960. After four years, the first multidisciplinary database, named Science Citation Index, was introduced by ISI (acquired by Thomson Reuter in 1992). By following it, Social Sciences and Arts & Humanities citation indexes were developed and all of them were combined as Web of Science in web environment (Yancey, 2005). Web of Science provides a single destination to access the most reliable, integrated, multidisciplinary research. Quality, curated content delivered alongside information on emerging trends, subject specific content and analysis, and program managers to pinpoint the most relevant research to inform their work.
3.2 SOURCE OF DATA

There are various sources contributing to the research output in the field of Textile Technology by global scientists. In this study the secondary sources are taken for analysis. The necessary data was collected from the Science Citation Index (SCI) and Social Science Citation Index (SSCI) which is available via the Web of Science (WoS). The Web of Science is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). SCI and SSCI database is one of the very comprehensive databases covering all aspects of science.

3.2.1 Database Size

Records for the Bibliometric analysis have been downloaded from Web of Science (WoS) database. The fields selected for the downloaded included Author, Title, Source, Language, Country, Year. The size of the data downloaded for the purpose is 32815. This is a case study involving the analysis of behavior of Textile technology literature output in its wholeness between a break free period of 1999-2012.

3.2.2 Data Collection

The necessary data were collected from the Science Citation Index (SCI) and Social Science Citation Index (SSCI) which is available via the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). SCI and SSCI database is one of the very comprehensive databases covering all aspects of science. The search string is “ti = "textile" or ti = "textiles" or ti = "spinning" or ti = "Fabrics" or ti = "dyeing" or ti = "weaving" or ti = "knitting" or ti = "twisting" or ti = "reeling" or ti = "yarn" or ti = "Rayon" or ti = "linen" or ti =
3.2.3 Sample Record

FN Thomson Reuters Web of Knowledge

VR 1.0

PT J
Degradation of reactive dyes by contact glow discharge electrolysis in the presence of Cl- ions: Kinetics and AOX formation

The plasma generated around the anode during contact glow discharge electrolysis (CGDE) is a rich source of hydroxyl ((OH)-center dot) radicals that can efficiently degrade organic contaminants in aqueous solutions. The degradation of textile azo dyestuffs, Reactive Yellow 176 (Y3RS), Reactive Red 239 (R3BS) and Reactive Black 5 (B5), by anodic CGDE was investigated in the presence of chloride (Cl-) ions. The degradation kinetics of the dyes was dependent on the concentration of Cl- ions and on the respective dye being treated. R3BS degradation was inhibited by Cl- ions in the range of 0-0.01 M. When the Cl- ion
concentration was less than 0.02 M, the dyes followed pseudo first-order
degradation kinetics. For concentrations greater than 0.02 M, the degradation of
Y3RS and B5 was significantly enhanced compared to the degradation of R3BS
and deviated from first-order reaction kinetics. The presence of Cl- ions (0.03 M)
did not appear to improve dye mineralization but resulted in the formation of
adsorbable organic halogens (AOX). The results indicated that the AOX could be
abated with prolonged electrolytic treatment. This observation is significant for the
assessment of the environmental impact of this technology for wastewater
treatment. (C) 2011 Elsevier Ltd. All rights reserved.

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FU Fundamental Research funds for Central Universities Central [2010B04-04-1];
Shanghai Leading Academic Discipline Project [B604]; Priming Scientific
Research Foundation for the junior teachers of Donghua University [113-10-
0044049]; PhD thesis innovation foundation of the Donghua University
[BC201026]

FX The authors graciously acknowledge the financial support from the Fundamental
Research funds for Central Universities Central (2010B04-04-1) and the Shanghai
Leading Academic Discipline Project (B604). This work was partially supported by
the Priming Scientific Research Foundation for the junior teachers of Donghua
University (No. 113-10-0044049) and the PhD thesis innovation foundation of the
Donghua University (BC201026). S.N.R. wishes to thank Dr. H. Xu, Dr. X. Xie
and MSc. P. Yang for their technical assistance and support.
Helsinki Commission, 1993, Baltic Sea Environmental Proceedings, V54
Liu YJ, 2010, J HAZARD MATER, V181, P1010, DOI 10.1016/j.jhazmat.2010.05.115
SENGUPTA SK, 1994, J ELECTROANAL CHEM, V369, P113, DOI 10.1016/0022-0728(94)87089-6
Tezuka M, 2002, THIN SOLID FILMS, V407, P169
Wang L, 2009, J HAZARD MATER, V171, P577, DOI 10.1016/j.jhazmat.2009.06.037

NR 48

TC 1

Z9 1

PU PERGAMON-ELSEVIER SCIENCE LTD

PI OXFORD

PA THE BOULEVARD, LANGFORD LANE, KIDLINGTON, OXFORD OX5 1GB, ENGLAND

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J9 ELECTROCHIM ACTA

JI Electrochim. Acta

PD DEC 30
3.3 STATISTICAL TOOLS

Keywords filtered and records were finally imported in to MS-ACCESS for statistical analysis. Laws and principles of Bradford, Lotka, Zipf and Narayanan have been applied for inferences. In addition, general statistical principles and formulae governing Regression Analysis, Trend Analysis have been applied wherever required.
3.3.1. Relative Growth Rate (RGR)

The relative growth rate is the increase in the number of publications/pages per unit of time. Here, one year is taken as the unit of time. The mean relative growth rate \( R (1-2) \) over a specified period of interval can be calculated from the following equation suggested by Mahapatra. 

\[
R (1-2) = \frac{w_2 - w_1}{T_2 - T_1}
\]

where,

\( R \) = Mean relative growth rate over the specific period of interval;
\( W_1 \) = \( \log w_1 \) (Natural log of initial number of publications/pages);
\( W_2 \) = \( \log w_2 \) (Natural log of initial number of publications/pages);
\( T_2 - T_1 \) = Unit difference between the initial time and final time. Therefore,
\( R (a) \) = Relative growth rate per unit of publications per unit of time (yr)
\( R (p) \) = Relative growth rate per unit of pages per unit of time (year)

3.3.2. Bradford’s Law of Scattering

The prominent work in Bibliometrics was of Bradford in 1934 on the distribution and in Lubrication research. This research found the backbone of the theoretical foundation of the “Bibliometrics” study known as the “Bradford’s Law of scattering”. In 1948, Bradford, based on his analytical approach arranged journals ranked according to the total publication count. He divided the journals into \( m \) zones each containing the same number \( r \) of publications. He found that

\[
m_1 r_1 = m_2 r_2 = m_3 r_3 \ldots = m_k r_k
\]

where \( m_i \) is the number of journals and \( r_i \) is the average number of articles per journal in the \( i \)th zone. Thus from the relation(A), we have if the journals are divided into
three zones, they will be in the order of 1: n: n²... This n is known as BRADFORD MULTIPLIER.

3.3.3. Author Productivity (Lotks’s Law)

The lotka’s Law of Author Productivity is tested with the applications of scientific productivity chi - square model, and it is applied in relation to number of authors contributing to the number of Authors contributing to the number of publications. Potter (1981) identified the Lotka’s fraction 1/n -4.65. On the basis of Euler – Maclaurin formula of summation.

The Lotka’s Law was also tested with application of scientific chi – square model in relation to a number of another who contributed “n” number of publications.

It can be expressed by the equation

\[ y_n = \frac{C}{n^a} \]

where \( y = \) number of authors ranking n publications

\( c = \) constant

(n=1…n)

In other words, for every 100 authors, making one contribution each, there would be 25 authors contributing two articles each \((100/2^2 = 25)\) about 11 contributing articles each \((100/ 3^2 = 11.1)\) and so on.

The formula of Lotka states that, the number of authors producing n publications is about \(1/n^a\) of those making one publication or

\[ Y_n = \frac{C}{n^a} \]
When \( y \) is the number of authors producing \( n \) publications \((n=1,2,3 \ldots n)\). \( C \) and the exponent \( a \) are contents depending upon the specific subject. Thus for \( n=1 \) (only one publication) \( C \) will be \( Y \) (the number of authors making only one publication). Lotka suggested that the value of \( a = 2 \). This means that the number of authors making 2 publication will be \( \frac{1}{2^2} \) of the number of authors making one publication. Similarly the number of authors making 3 publication will be \( \frac{1}{3^2} \) of the number of authors making one publication.

**In other words……**

Lotka's Law can be mathematically expressed as

\[
X^{a/y} = k
\]

Where \( x \) is the number of authors making \( y \) number of publications, \( k \) is a constant and the value of \( n \) can be derived by the method of interpolation.

**3.3.4. Zip’s Law of word occurrence**

Zipf developed and extended an empirical law, as observed by Estoup, governing a relation between the rank of a word and the frequency of its appearance in a long text. If “\( r \)” is the rank of a word and “\( f \)” is its frequency, then mathematically Zipf’s law can be stated as follows;

\[
rf = c
\]

where “\( c \)” is constant.

His law states that in a long textual matter if words are arranged in their decreasing order, then the rank of any given word of the text will be inversely proportional to the frequency occurrence of the text.
3.3.5 Doubling Time

A direct equivalence exists between the relative growth rate and doubling time. If the number of publications/pages of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. This difference has a value of 0.693. Thus, the corresponding doubling time for publication and pages can be calculated by the following formula:

$$\text{Doubling time (Dt)} = \frac{0.693}{R}$$

Therefore,

$$\text{Doubling time for publications Dt (a)} = \frac{0.693}{R (a)}$$

3.3.6. Degree of Collaboration

The degree of collaboration is defined as the ratio of the number of collaborative research papers to the total number of research papers in the discipline during a certain period of time. The formula suggested by Subramanyam\textsuperscript{2} is used. It is expressed as

$$C = \frac{N_m}{N_m + N_s}$$

where, \(C\) is the degree of collaboration in a discipline. \(N_m\) is the number of multi-authored research papers in the discipline published during a year.

\(N_s\) is the number of single authored papers in the discipline published during the same year. Using this formula, the degree of collaboration is determined.
3.3.7 Activity Index

Activity Index suggested by Frame (1977) and used among others by Schubert and Braun (1986), Garg (1999) and Nagpaul (1995) is used.

The activity Index (AI) is defined as

\[
AI = \frac{\text{the world share of the given country (region) in publications in the given field}}{\text{the overall world share of the given country (region) in publications}}
\]

or, equivalently

\[
AI = \frac{\text{the share of the given field in the publications of the given country (region)}}{\text{the share of the given field in the world total publications}}
\]

AI = 100 indicates that the country’s research effort in the given field corresponding precisely to the world’s average. AI > 100 reflects higher activity than the world’s average, and AI < 100 indicates lower than average effort dedicated to the field under study.

3.3.8 Priority Index

Priority Index (PI) has been calculated to properly normalize the size of a country and the size of the subject field so that cross national comparisons can be done for these “Frontier” areas of research computer communication.

Priority Index is computed by the following formula:

\[
\text{Priority Index} = \frac{(N_{ij} / N_{io})}{(N_{oj} / N_{oo})} \times 100
\]

where,

\[N_{ij} = \text{the number of publications of country i in subfield j}\]
\[ N_{io} = \text{the number of publications of country } i \text{ is in all subfields of the major fields} \]

\[ N_{oj} = \text{the number of publications of all countries viz., the total world output in subfield } j \]

\[ N_{o} = \text{the number of publications in all subfields of those major fields} \]

This index is identical to AI proposed (by Frame, 1977) and subsequently used among others by Schubert and Braun (Schubert, 1986 and Carpenter, et al. Carpenter, 1988). The value of PI = 100 indicates that research priority of a country for a given subfield corresponds precisely to the average of all countries. PI = 100 indicates average priority, PI > 100 indicates higher than average priority and PI < 100, lower than average priority. It should, however, be kept in mind that (by virtue of definition of PI), no country can have high or low priority in all subfields. From the values of PI, we can compare

(1) The priorities of a given country to different subfields in a given time span

(2) The priorities of different countries to a given subfield in a given time span

(3) The priority to a given subfield in different time spans.

3.3.9 Specialization Index

Using the specialization Index, a researcher can quickly identify the disciplines in which a country, region, institution or any other achieves greater research output than in all other disciplines.

The SI can be represented in two ways. First, as stated above, an aggregate is said to be specialized when it produces more in a specific discipline than in all other disciplines.
The second approach is to consider an aggregate as specialized when its percentage of output in a given discipline is higher than the other aggregates contributing to a system. In other words, the second approach indicates more precisely the specializing in which an aggregate’s output is larger or smaller than the average of a group. These two ways of representing the specialization index are equivalent and produce the same result, as shown below.

Each approach has a corresponding formula for calculating the specialization index. Thus specialization index of a group X relates to a reference group Y (IS$_{x/y}$) and it can be calculated in two ways:

\[
\text{IS}_{{x/y}} = \frac{(X_a / X_t)}{(Y_a / Y_t)} \rightarrow \frac{P_{xa}}{P_{ya}}
\]

(or)

\[
\text{IS}_{{x/y}} = \frac{(X_a / Y_a)}{(X_t / Y_t)} \rightarrow \frac{P_{ax}}{P_{ay}}
\]

where,

\[
X_a = \text{Number of articles published by group X in discipline } \alpha
\]

\[
Y_a = \text{Number of articles published by group Y in discipline } \alpha
\]

\[
X_t = \text{Total number of articles published by reference group X}
\]

\[
Y_t = \text{Total number of articles published by reference group Y}
\]

\[
P_{xa} = \text{Percentage of articles of group X belongs to discipline } \alpha
\]

\[
P_{ya} = \text{Percentage of articles of group Y belongs to discipline } \alpha
\]
\( P_{\alpha x} = \) Percentage of articles in discipline \( \alpha \) produced by group X

\( P_{\alpha y} = \) Percentage of articles in discipline \( \alpha \) produced by group Y

Group X is always a subset of group Y. An index \textbf{higher than 1.0} indicates that X is specialized in relation to Y, an index \textbf{lower than 1.0} indicates that group X has not specialized in discipline \( \alpha \).

The SI is in very widespread use, often being given a different name. It is often called the “revealed scientific advantage” in the Anglo-Saxon world (Soete and Wyatt, 1983), While trend researchers may use the term “Indice d’effort Specifique” (Filiatreans. et.al., 2003), Science metrix and the OST use the term “Specialization Index” in all their reports.

The SI is a relative indicator providing relatively complex, highly synthesized data. It is one of the best indicators for determining the areas, where research output of one group differs from that of the others. The advantage of using SI is relatively easy to calculate. The disadvantage is that it requires data on both specific disciplines and total output of a reference population. The bibliometrician therefore needs complete databases in order to be able to produce data by using this indicator.
REFERENCES


