CHAPTER 3

RESEARCH DESIGN

3.1 INTRODUCTION

This chapter designs the complete research of the present scientometric study on Nano Thin Films, which consists of the objectives, statement of the problem, hypotheses, methodology applied, data collection, applied statistical tool, and the limitations of the study.

3.2 STATEMENT OF THE PROBLEM

The increasing growth of knowledge together with the fission and fusion of interdisciplinary subjects paves way to Nano Thin Films from the vast area of Nano Technology. There is a vast difference in the growth of technology at almost all the phases of the routine life of the society in the contemporary age comparing to the last few decades in general. Many new innovative discoveries in the field of Nano Technology using Nano Thin Films are emerging. A considerable number of publications were published throughout the world on Nano Thin Films. Due to worldwide scattered publications on Nano Thin films, the findings of this area research work is undertaken with an intention to bring out the reality towards visibility to the policy makers, researchers and scientists who are the prime personalities balancing the goodness of the society from perishing. If there is no visibility about the scattered research publications, there won’t be innovative researches in any discipline. So, In order to determine the growth of the modern
technology on Nano Thin Films the hidden research findings are brought to the light on one side towards consolidating the research output process and the visibility of the publications are facilitated on the other side, by means of scientometric techniques.

With regard to the above stated problems, this research attempts to analyze the research publications on Nano Thin Films from the secondary database Web of Science.

3.3 OBJECTIVES OF THE STUDY

The major objectives are framed with the unique principle of the present study as mentioned below:

1. To identify the year-wise distribution of research output on Nano Thin Films from 1999 to 2012 with TLCS and TGCS

2. To find out the relationship between the number of publications of the first half of the years and the second half of the during the process of publishing research publications on Nano Thin Films from 1999 to 2012

3. To examine the growth rate, doubling time and exponential growth rate of Nano Thin Films research output during the period of 1999 to 2012

4. To determine the moving average of the Research Growth by every year research on Nano Thin Films
5. To ascertain the forecast of the research publications on Nano Thin Films

6. To find out the Source wise and year wise v/s source wise research publications on Nano Thin Films

7. To find out the language wise and year wise v/s language wise publications on Nano Thin Films

8. To find out year wise v/s Number of Authors, degree of collaboration and Journals on the research publications on Nano Thin Films

9. To find out the authorship pattern, author productivity and to test the Lotka’s Law

10. To retrieve the top hundred authors on the basis of maximum number of publications on Nano Thin Films

11. To do further scientometric analysis on the top three productive authors towards year wise, source wise, language wise and to find out core journals by the application of Bradford’s Law

12. To find out country wise and year wise v/s country wise publications on Nano Thin Films

13. To find out continent wise and year wise v/s continent wise publications on Nano Thin Films

14. To find out the Priority and Specialization Index for the continent wise publications on Nano Thin Films

15. To find out the year wise cited references analysis towards the publications on Nano Thin Films
16. To find out the relationship between the first half of the cited references and the second half of the cited references during the publications on Nano Thin Films from 1999 to 2012

17. To find out the year wise v/s authorship pattern of the cited references

18. To find out top three authors on the basis of the more cited references on year wise cited records, source wise cited records and language wise cited records towards publishing research publications on Nano Thin Films

3.4 HYPOTHESES

On the basis of the objectives framed the following hypotheses were formulated and tested with appropriate statistical tools:

- H0 There is no relationship between the number of publications of the first half of the years and the second half from the data selected for the research work.
  
  H1 There is relationship between the number of publications of the first half of the years and the second half from the data selected for the research work.

- H0 There is no significant regular growth rate in the research publications published on Nano Thin Films
  
  H1 There is a significant regular growth rate in the growth of the research publications published on Nano Thin Films.

- H0 There is no significant constant doubling time throughout the research publications published on Nano Thin Films
H₁ There is a significant constant doubling time throughout the research publications published on Nano Thin Films

➢ H₀ There is no significant individual domination of a particular source among the sources of records published on Nano Thin Films

H₁ There is a significant individual domination of a particular source among the sources of records published on Nano Thin Films

➢ H₀ “There is no significant individual domination of a particular language among the records published on Nano Thin Films”

H₁ “There is a significant individual domination of a particular language among the records published on Nano Thin Films”

➢ H₀ “There is no significant domination of the single authored papers among the records published on Nano Thin Films”

H₁ “There is a significant domination of the single authored papers among the records published on Nano Thin Films”

➢ H₀ There is no significant relationship between the actual number of authors and the prediction of the Lotka’s Law of productivity

H₁ There is a significant relationship between the actual number of authors and the prediction of the Lotka’s Law of productivity

➢ H₀ There is no priority and specialization in the Asian Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the Asian Continent towards the research publications published on Nano Thin Films
H₀ There is no priority and specialization in the Europe Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the Europe Continent towards the research publications published on Nano Thin Films

H₀ There is no priority and specialization in the North American Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the North American Continent towards the research publications published on Nano Thin Films

H₀ There is no priority and specialization in the Oceanic Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the Oceanic Continent towards the research publications published on Nano Thin Films

H₀ There is no priority and specialization in the African Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the African Continent towards the research publications published on Nano Thin Films

H₀ There is no priority and specialization in the South American Continent towards the research publications published on Nano Thin Films.

H₁ There is priority and specialization in the South American Continent towards the research publications published on Nano Thin Films
H0 There is no relationship between the number of publications cited in the first half of the seven years and the second half of seven years from the year 1999 to 2008.

H1 There is relationship between the number of publications cited in the first half of the seven years and the second half of the seven years from the year 1999 to 2008.

3.5 DATA COLLECTION

Data related to the publications on Nano Thin Films were downloaded from the secondary database Web of Science from the year 1999 to 2012 toward the implementation of the various scientometric techniques. A total data of 8386 research publications were utilized for the research work.

3.6 METHODOLOGY

The data collected from the Web of Science on Nano Thin Films were uploaded in a open source software “Hist Cite” and processed into difference desirable tables before testing and finding the inferences. It is analytically descriptive research in design. Proper hypotheses were framed and worked accordingly with relevant scientometric techniques and statistical tools. Relevant test were conducted to identify the distribution of research output on Nano Thin Films. Lotka’s author productivity law was tested through a Lotka programme. Country wise analysis and continent wise analysis were retrieved to analyse the priority and specialization index. The authorship pattern were identified. Core
Journals were retrieved through the application of Bradford’s Law. Cited references were analysed with proper scientometric tools.

3.7 **STATISTICAL TOOLS**

3.7.1 **REGRESSION TEST AND CORRELATION:**

Regression Test and Correlation test were utilized with the help of Microsoft Excel to test the hypotheses framed towards the completion of the research work.

3.7.2 **RELATIVE GROWTH RATE (RGR)**

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,
\[ R (a) = \text{Relative growth rate per unit of publications per unit of time (year)} \]

\[ R (p) = \text{Relative growth rate per unit of pages per unit of time (year)} \]

### 3.7.3 EXPONENTIAL GROWTH RATE

Exponential growth rate is utilized to find out the relative growth rate of population on the basis of the available population. It is also utilized in the demographical research. The formula for calculating exponential growth is as follows:

\[ N(t) = N(0) e^{rt} \]

Where,

- \( N(0) \) is the population when the time elapsed is “t” years
- \( N(0) \) is the initial population
- “r” is the growth rate
- “t” is number of years
- “e” is the natural base of logarithms whose value is 2.711828.

### 3.7.4. DOUBLING TIME

The doubling time is nothing but the number of publications 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 publications can be calculated with the following formula:
Doubling time \((Dt) = \frac{0.693}{R}\)

Therefore,

Doubling time for publication \(Dt(a) = \frac{0.693}{R(a)}\)

3.7.5 DEGREE OF COLLABORATION

The degree of collaboration may be 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 (1983) is used. It is expressed as

\[
C = \frac{N_m}{N_m + N_s}
\]

where, \(C\) is the collaboration coefficient 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.

The collaboration coefficient is determined by using the above stated formula.

3.7.6 PRIORITY AND SPECIALIZATION INDEX

The Priority and Specialization Index is to identify the priority of the publications during the specific period of time. In this research it is utilized to find the priority of the continental countries towards the research publication on Nano Thin Films. The value of \(PI = 100\) indicates that research priority of a country or continent 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, the reality can be observed. Priority Index is computed by the following formula:

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

where,

- \(N_{ij}\) = the number of publications of country i in subfield j
- \(N_{io}\) = the number of publications of country i is in all subfields of the major fields
- \(N_{oj}\) = the number of publications of all countries viz., the total world output in subfield j
- \(N_{oo}\) = the number of publications in all sub fields of those major fields

3.7.7. LOTKA’S LAW

The author productivity of Lotka’s Law has been applied and tested with a Lotka Programme. Lotka’s law is one of the three major laws of Bibliometrics. This is also called as Inverse square law. It mainly focus on the author productivity. The reveals that more number of articles are being contributed by a very few number of researchers with a large proportion of
researchers contributes just one number of publication. Therefore, Lotka propounded the logarithmic relation between researchers and publication quantities. It is also called "The Frequency Distribution of Scientific Productivity". It’s a key law in bibliometrics which predicts the productivity of scientific researchers. Lotka's Law describes the frequency of publication by authors in a given field and states that the number of authors making $n$ contributions is about $1/n^2$ of those making one; and the proportion of all contributors who make a single contribution is about 60 percent. This means that out of all the authors in a given field, 60 percent will have just one publication and 15 percent will have two publications ($1/2^2 \times .60$). 7 percent of authors will have three publications ($1/3^2 \times .60$) and so on. The formula is as follows:

$$N = \frac{N \sum XY - \sum X \sum Y}{N \sum X^2 - (\sum X)^2}$$

3.8.8 BRADFORD’S LAW OF SCATTERING JOURNALS

Bradford's law is to explain that a mass of journals could be managed in an order of decreasing productivity to show the journals which has most productive articles rank first and the most unproductive tail in the end. According to this law the journals may be grouped into three zones each producing a similar number of articles. However the number of journals in each zone will increase rapidly. Then the relationship between the zones is $1: a: n^2$. Accordingly the relationship between the zones are $1: a: n^2$. 

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4. LIMITATIONS

- The data utilized for the study is downloaded only from Web of Science.
- The period of study is only from 1999 to 2012, as the remaining years were taken for the purpose of analysis.
- As the scientometric analysis is a vast area, therefore the techniques applied in this research work is limited to the techniques mentioned in the research design.

REFERENCES:


