METHODOLOGY

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CHAPTER IV

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India has the second largest number of scientific and technical manpower of the world after the U.S.A. However the scientific information productivity of India is very low compared to some of the small countries like Japan, Sweden, Switzerland and England measured in terms of the Nobel prizes and other international recognitions. The economic and social backwardness of India to a very great extend could be attributed to the low scientific information productivity of the country.

On these backgrounds it is highly essential to make proper attempt to assess the scientific information productivity of India on the basis of the set of sound theoretical framework so as to formulate correct strategies and policies by realising the practical constraints. It has been decided to limit the study in physical scientists working in four major Universities in Kerala. It is a fact that Universities are the greatest consumers and producers of scientific information through training and education programme, on the one hand and the theoretical and experimental research programme on the other hand (Mathew, 1989).

4.1 Basic assumptions of the study

Regarding the low scientific information productivity of physical scientists of Universities in Kerala, the following basic assumptions have been made.

1. The higher education system is not adequate to train the post graduate students in acquiring the skill of high level scientific information consumption – production and there by develop scientific expertise.

2. The research scholars, even after completing the doctoral work are not attaining high level scientific information consumption- production.

3. The scientific information productivity is not taken as basic criteria for the future placement and promotion of the scientists.

4. Most of the scientists are not getting enough facility to make use of modern technologies for easy access and consumption of high level scientific information.

5. The authorities are not giving appropriate importance for scientific research and their applications.

4.2 Propositions of the study

Scientific information productivity of physical scientists in the Universities in Kerala could be enhanced-augmented by:

1. Proper re-designing of higher education with new and innovative programmes of instruction and research.

2. The higher education curricula should be re-designed to develop or train the post graduate students to acquire the skill of high level scientific information consumption and production.

3. Research scholars must be made methodologically sound in acquiring the skill of high level information consumption-production during their period of doctoral research.

4. The Scientific Information Productivity must be made as the criteria for the placement and promotion of the scientists in Universities.

5. The existing IT facilities must properly be utilised and more facilities must be provided for the scientists.

4.3 Variables of the study

The study has been designed with seventeen independent variables, which can be grouped to three namely, personal characteristics, use of information sources and information consumption of the scientists. Scientific productivity has been taken as the dependent variable.

a. Personal Characteristics.

1. Sex

2. Age

3. Subject area of specialisation.

4. Designation

5. Experience

6. Doctoral theses produced

b) Use of information sources

7. Primary journals

8. Abstracting/Indexing journals

9. Conference proceedings

10. Review articles

11. Research Reports

12. Books/Monographs

13. Reprints/Preprints

14. Consultation with others

15. Attending Seminars/Conference

16. Membership in learned bodies/professional organisations

c) Information consumption

17. Hours spend per week

The significance of these variables on the dependent variable namely scientific productivity of physical scientists in the universities in Kerala is worked out.

4.4 Hypotheses of the study

The hypotheses set for the study are the following

1) There exist differences with regard to information consumption and information production for different categories of physical scientists in the Universities of Kerala.

2) There exist similarities in the pattern of information use among the different category of physical scientists.

3) The proper application of information technology could augment the information consumption production processes of the physical scientists in the Universities in Kerala considerably.

4.5 Methodology

The methodology of the study has been presented under the following major heads

i) Population selected
ii) Tools employed
iii) Data collection procedures
iv) Processing of the data and
v) Analysis of the data

4.5.1 Population for the study

The population selected for the presented study has been drawn from the physical scientists of four Universities in Kerala. They are

1. Calicut University
2. Cochin University of Science and Technology

3. Mahatma Gandhi University
4. Kerala University

The scientists from the following physical science disciplines/ departments have been selected for the present study.

1. Physics
2. Chemistry
3. Electronics
4. Computer science
5. Mathematics
6. Statistics

Stratified sampling technique giving representation to all desirable strata in the proposed sample has been employed. The strata of the population are research scholars, postdoctoral fellows and teachers of the above physical science departments of all the four major Universities. These departments are well established with experienced teachers. In addition, all relevant characteristics such as sex, age, designation, experience, area of specialisation etc have provided a basis for choosing the stratified sample. The characteristics of entire population have carefully been considered together with the purpose of the study before stratified sample is decided upon.

While selecting the sample for the present study a number of decisions have to be taken. Three major decisions taken for the present study are

1. What should be the size of the sample.

2. Which should be the basal variables for which stratification needs to be attempted and proportionate representation to be given to such stratum.

3. Which geographic areas should be covered for obtaining the final sample.

The major consideration used for answering these questions are discussed below under the respective headings.

1. Size of the sample

The study proposed has been conducted among the scientists of the physical science departments of the four major universities in Kerala. They consist of research scholars, postdoctoral fellows and teachers. Some of these research scholars have published works. The total number of physical science teachers working in the four universities in Kerala has been limited to 105 at the time of conducting the present study. The total sample constitutes a sample population of 97. An interview followed by administering questionnaire has been employed for the collection of data.

The break up of the population in terms of sex, age group, subjects, designation and experience are given in Table 4.1 – 4.5.

Table 4.1

Break up of the sample in terms of sex

Sex	No. of Scientists
Male	71
Female	26
Total	97

Table 4.2

Break up of the sample in terms of age group

Age group	No. of Scientists
25 or less	3
26-30	16
61-40	29
41-50	32
Above 50	16
Not given	1
Total	97

Table 4.3

Break up of the sample in terms of disciplines/departments

Disciplines/Departments	No. of Scientists
Physics	30
Chemistry	35
Electronics	3
Computer science	2
Mathematics	20
Statistics	7
Total	97

Table 4.4

Break up of the sample in terms of designation

Designation	No. of Scientists
Lecturer	16
Reader/Lecturer Sr.	29
Professor	26
Research Scholar initial stage	6
Research Scholar final stage	16
Post Doctoral Fellow	4
Total	97

Table 4.5

Break up of the sample in terms of experience in years

Experience	No. of Scientists
3 years or less	10
3-5	15
6-10	16
11-15	18
16-20	20
21-25	10
26 and above	7
Not given	1
Total	97

4.5.2 Data Collection

The investigator, besides, administering the well prepared and detailed questionnaire, also conducted direct interview and discussion for data collection. The investigator spent more than three hours for each scientist to get the data. Most of the questions could not be answered by mere tick marking, as it involves detailed discussion. The scientists have even to spend time foregoing through their bio-data and personal records to provide relevant information. Hence there is a need for approaching the scientists two or three times to get the required data. The investigator also collected list of publications and their bio-data of the scientists to

ascertain their scientific productivity. Hence the investigator spent more than 4 weeks in each university to complete the data collection. The productivity is measured in terms of the research output of the scientists up to the period in which the study is conducted.

4.5.3 Statistical Treatment of Data

The data collected through questionnaires, interviews and discussions from the physical scientists has been analysed. The scientific productivity, information consumption time etc, values are taken by average and percentages wherever necessary.

To find the factors that affect the information productivity of Scientists, Y, the variables are selected from the questionnaire. Seventeen variables had been taken, as x_1, x_2, x_3, ...x_{17}. The multiplicative cause of independent variables (x_1, x_2, x_3, ...x_{17}) on the dependent variable Y, a relation for Y is established.

$$Y = a+b_1x_1+b_2x_2+.....+b_{17}x_{17}$$

The multiple correlation is the simple correlation between Y and $\hat{Y}$ where $\hat{Y}$ is the estimate of Y using the above relation.

Multiple correlation R is given by

$$R = \frac{\sum_{i=1}^{n}(y_i - \bar{y})(\hat{y} - \bar{y})}{\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2 \sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2}}$$

Where $\bar{y}$ is the mean of Y's Yi is the productivity of i^{th} scientist, $\hat{Y}_i$ is the estimate of Yi using the above relationship.

Where R = 1, means Y = $\hat{Y}$ which is the maximum correlation. To find the significance of each of the 17 variables, the value of R is found by eliminating each variable.

4.6 SCOPE AND LIMITATIONS OF THE STUDY

The present study concentrates on the information or knowledge consumption and production of the scientific community. The present study is intended to provide a basic methodical and theoretical framework for giving an explanation for the process of knowledge/information consumption and production, especially of the physical scientists. The approach of the study is a multi disciplinary as it integrates the basic theories knowledge, epistemology, metaphysics, philosophy of science, cognitive sciences, cybernetics etc. The present study aims at validating the theories of information consumption production correlation and the stage theory of information/knowledge growth. It also aims at examining the application of information technologies in augmenting the process of consumption production.

The scientific productivity of the scientists of Universities in Kerala, compared to their counterparts elsewhere is not at the desired level, inspite of long traditions and investing a lot of resources for acquiring different systems and components of modern technologies. This

is more evident with regard to the various physical sciences departments in the universities such as Physics, Chemistry, Mathematics, Statistics, Electronics and Computer Sciences. The study has been conducted in the four main Universities in Kerala, namely, the Kerala University, the Mahatma Gandhi University, the Calicut University and the Cochin University of Science and Technology. The scientists include, the teachers and research scholars of these Universities. Here scientific information productivity is measured in terms of published research work. The productivity in terms of teaching, under taking research projects, etc could not easily be measured and hence they have not been included in the present study.

The findings of the study may be useful to higher educational planners at national, state and university level, for formulating correct policies and strategies with regard to scientific research and post graduate studies and introduction and application of Information technology in higher education. This will be useful for library and information systems and network experts and managers in designing and implementing highly efficient and effective library and information systems. The study provides a theoretical explanation for the complex processes of information consumption and production of scientists and thereby augmenting the scientific information productivity of a country, especially a developing country like India.