CHAPTER - I

INTRODUCTION
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1 Introduction

Knowledge is the most important asset and greatest competitive advantage of individuals as well as organizations. To Davenport, Thomas and Prusak, Lawrence [1], “Knowledge is fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment of framework for evaluating and incorporating new experiences and information”. Knowledge originates and is applied in the minds of the knower. Knowledge is the information stored or captured along with its context. This allows for making predictions, casual associations or predictive decisions about what to do, unlike information, which simply gives us the facts. Knowledge is intuitive, hard to communicate and difficult to express in words and chunk of it is not stored in database but in the minds of people. However ‘information’ and ‘knowledge’ are often used as if they are interchangeable or synonyms. When information has been utilised to achieve a specific purpose by an individual or organisation then it becomes knowledge. Information is considered as a fourth resource, which facilitates effective utilization of other essential resources. The conceptualisation of the fourth resource for effective management of the other resources can be considered as knowledge. Knowledge is a very difficult concept to be defined because
knowledge is formulated in the minds of individuals. Information can be the basis for expertise knowledge for one individual, but for another person it may not have any value. Knowledge has inherent value, which is formulated on the basis of the individual's conceptualisation and his/her ability to extract facts.

Before the invention of printing, the knowledge was in the form of personal knowledge and disseminated through talking. By the invention of printing 'documents' became the channel for communication of knowledge. Hence the universe of knowledge is expanding with the addition of documents. With the accumulation of documents of different types, the phenomenon of 'knowledge explosion' or 'knowledge fragmentation' occurred. Then steps towards organising the knowledge took place so that the various sources can be utilized in times of need. With 17th century onwards collaborative research starts and scientists began to communicate their research results to one another and the world at large. This put ways to the building up of the modern journals. The first journals published were 'Journal des Scavans' and 'The Philosophical Transactions', started in 1665 [2]. By the end of 17th century, about thirty scientific and medical journals were published. The specialised journals were become common in the next century. The proliferation of literature from traditional subjects to its narrower fields and research papers with the characteristic system of citation took shape in the 19th century.

Research is a diligent enquiry and careful search for knowledge through systematic, scientific and analytic approach in any branch of knowledge. With the emergence of global collaboration of research, scientists speak to the world through international conferences, symposia, seminar etc. The number of international conferences and participation of scientists in these programmes are increasing. Hence Science is advanced from "little science to big science" by "standing on the shoulders of giants" pointed out by Price [3]. Increase in the rate of collaborative research resulted in the exponential growth of scientific journals. The
professional societies which publish journals have to compete with professional publishers.

The exponential growth of Science and Technology literature during 20th century led to the phenomenon of 'information explosion' or 'information pollution'. In the field of Toxicology, the interdisciplinary research resulted in 'information fragmentation' of the basic subject to environmental, medical and economic toxicology. The interest in collaborative research resulted in the transdisciplinary growth of Toxicology which ultimately resulted in the scatter of literature. In scientific fields the research results published in journals are peripheral to the subject. Therefore there is a need for selection of literature by applying scientific methods. The rapid growth of scientific information has begun to pose serious problems for both scientists and librarians.

As well as offering greater functionality within journals, the Web offers possibilities for interactivity between journals. In medical field High Wire Press, run by Stanford University Libraries, Science Direct by Elsevier Science, Open Archives Initiative, Pub Med Central by US National Institute of Health, Cross Ref by Wiley and Academic Press, SPARC (Scholarly Publishing and Academic Resources Coalition) by the Association of Research Libraries are such journal communities.

The Internet offers rapid publication; 'live' cross-reference links; and greater interaction between journals and their readers. Most journals presently replicate some or all of their content into Web pages and add a search engine; others are using the Internet to improve traditional publishing practice, devising new ways of delivering content with additional features. The peer-review process is revolutionized by unlimited publication space; greater interactivity between editors, authors, and reviewers making peer review an ongoing process of comment and revision and the possibility of an openness that offers greater accountability and higher standards of ethical behaviour.
Easy and efficient access to the Toxicology journal literature is vital to the process of providing evidence-based health care. Advantages of retrieving information via the Web include its simple interface; currency of content; breadth of online resources; cost-effectiveness; and malleability of content to individual requirements. Many medically focused indexes and search engines have been developed. Manual indexes employ people to select and catalogue Web sites producing directories, whereas automated search engines use computer programs to generate searchable indexes. Manual directories are generally better at locating whole Web site relating to a particular topic, whereas computer-generated indices are generally better at locating individual Web pages or more specific information.

Open access, online peer review, e-prints, and online-only journals are changing the way we process and communicate Toxicology information. The Internet enables us to access databases of information that were previously either inaccessible or available solely in libraries. This enables these databases to evolve from a source of references and abstracts to a fully searchable and comprehensive set of online full-text articles, all at the click of a mouse.

Researchers can utilize the anonymity of the Internet to conduct qualitative research in Toxicology using techniques of passive observation, active participation, or interviews and surveys. The surveys are conducting via the Internet require an awareness of various methodological issues, selection bias, and technical issues. The Internet can help researches find information about laboratory or clinical protocols, or about statistical methods and instruments. The electronic 'pre-publication' of preliminary research results and conclusions facilitate an ongoing process of peer review and online collaboration. The automated current awareness services alert researchers to the ultimate publication of new work.

During the closing years of the twentieth century the Internet had become virtually ubiquitous, insinuating its way into almost all facets of life.
The transdisciplinary research resulted in the growth and scatter of Toxicology literature. Hence measuring of information becomes an essential need of toxicologists and as well as librarians working in the field. Information analysis is an efficient and accurate technique, can be applied to measure the information. This enables proper selection of literature for researchers and information managers.

1.1 Relevance of the study

Informetric research is undertaken by scholars from many disciplines including Library and Information Science, history of Science, Computer Science, Communications, Sociology and Linguistics. Studies examining the most popular search topics on Internet, search services or usage pattern of books within libraries are of interest to library managers are examples of research topics within scope of Informetrics.

According to Tague - Sutcliffe [4] Informetrics is "the study of the quantitative aspects of information in any form, not just records or bibliographic, and in any social group, not just scientists. Thus it looks at the quantitative aspects of informal or spoken communication, as well as recorded , and of information needs and uses of the disadvantaged, not just the intellectual elite. It can incorporate, utilise, and extend the many studies of the measurement of information that lie outside the boundaries of both 'Bibliometrics' and 'Scientometrics' “and she continues to say that, “Although in practice the scope of 'Informetrics' is very broad, two phenomena that have not, in the past, been seen as part of 'Bibliometrics' and 'Scientometrics', but fit within the scope of 'Informetrics' are

- definition and measurement of information and
- types of characteristics of retrieval performance measures”.

Retrieval performance measures have been studied by information retrieval theorists to 'Information and Computer Sciences', for both its theoretical and practical aspects. Thus, it can be said that the scope of
'Informetrics' is both practical and theoretical. However, the primary emphasis has been on the development of mathematical models, and a secondary emphasis on the derivation of measures for the diverse phenomena studies. The value of a model lies in its ability to summarize, in terms of a few parameters, the characteristics of many data sets; the overall shape, concentration, scatter, and the way the data sets change over time. Such models provide a basis for practical decision-making.

Brookes [5] is of opinion that "this new term is being used to cover both scientometrics and bibliometrics impartially. It has produced no distinctively new ideas of its own but as it implicitly covers both documentary and electronic forms of communication, it may have a future".

While tracing the origin of informetrics from 1979 by Otto Nacke of West Germany [6] to the 21st century it is evident that informetrics includes the application of informetric laws has led to two different types of studies; quantitative and qualitative. According to B.C. Brookes [7] quantitative studies have five general objectives:

i) "Design of more economic information systems and networks;"

ii) Improvement of efficiency rates of information handling process;

iii) Identification and measurement of deficiencies in bibliographical services;

iv) Prediction of publishing trends; and

v) Discovery and elucidation of empirical laws that can provide a basis for developing a theory of Information Science".

Whereas the qualitative studies direct to the following findings which can be intelligently used in library administration are [8]:

i) "Identification of core literature."
ii) Ranking of publications in zones of diminishing importance.

iii) Establishing a transition point between zones of higher and lower utility.

iv) Tracing the spread of ideas as a study of edidemics; and

v) Classifying segments of literature through interconnection of citations”.

To Susan Artandi [9] the application of informetric laws helps in the

i) determination of the impact value of a given document;

ii) location of criticisms, of published results of research and experiments.

Burton [10] is of the opinion that the product of bibliometric analysis or informetric analysis is meta information or information about information. This meta information can be used as:

i) a means to better understand the environment in which service and support are offered;

ii) a means to measure and evaluate productivity of his or her own staff and how it compares to other comparable units; and

iii) a new research project or compare his or her own progress to that of a broader spectrum such as other institutions, related disciplines, or other nationalities.

As citation analysis also comes under the perview of informetrics, it can be used to derive the following benefits in any subject field:
i) To study the use pattern of different types of documents

Based on the frequency of citations the relative use and the types of documents cited i.e. books, journals articles, reports, conference proceedings, Web sources etc can be determined.

ii) To study the use of literature

The country of origin can be identified in all types of documents like books, journal articles, reports etc. from the citations.

iii) For preparing subject bibliographies

Compilation of bibliographies is a difficult task in today's information flood. The citations gathered for analysis in different subjects can be used for the compilation of bibliographies.

iv) To study the use of different languages

Although English language dominates in all subject fields, the influence of other languages can be ascertain from analysing the citations.

v) To do further research in the subject

By analysing the citations in a given subject the reader get a sound subject background which lead him to further studies in the subject.

vi) To ascertain the subject scattering

Through citation analysis the dispersion of subject to different fields i.e. related or unrelated can be found out.

vii) To study the obsolescence rate of documents

Analysis of citations by age of documents show their 'half-life'. The time scales thus obtained are useful in planning of library holdings in future.
viii) To determine the interdependence and lineage of subjects

The interdependence of traditional and applied fields can be studied from citation analysis. By studying the lineage of subject, the mapping of the subject can be done. These two factors can be of use in the acquisition policy of libraries and information centre.

ix) To prepare ranked list of journals

By actual citation counting and by counting the number of entries in indexing and abstracting periodicals, the ranked list of periodicals can be prepared. These ranked lists are efficient and effective guidelines in the acquisition of periodicals in the library.

x) To study the rate of collaborative research

From the number of authors in papers, collaborative research can be measured. These studies reveal authorship pattern at the global, national and regional level in different subjects.

xi) To study the characteristics of scientific journals

The Institute for Scientific Information (ISI) [11] had developed five citation measures in the citation study of scientific periodicals:

i) Impact factor

Impact factor is the ratio between the citation rate of the journal and its citation potential

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\text{IF} = \frac{\text{the number of times a journal was cited}}{\text{the number of citable items of the journal published}}
\]

ii) Citation rate of a journal

The citation rate of a journal is the number of times a journal has been cited.
iii) Self-citing rate

Self-citing rate is a measurement of frequency with which journals cite themselves. It shows what percentage of a journal's reference cite articles it published.

iv) Self-cited rate

Self-cited rate shows what percentage of citations received by a journal originated in articles published by the journal. These self-citation rates serve as induces to the newness, size and isolation of the intellectual universe in which a journal operates.

v. Immediacy Index

Immediacy Index is a method of showing how rapidly the materials published by a journal are selected and used. Immediacy index is calculated by counting the number of citations received by articles in a journal during the year in which they were published.

In short the relevance of informetric study, according to Bjorneborn, E and Ingwersen, P [12] " the field of informetrics embracing the overlapping fields of bibliometrics and scientometrics following the widely adopted definitions by Brookes [13], Egghe and Rosseau [14] and Tague - Sutcliffe" [15]. Cybermetric studies of still fit in the generic field of informetrics as the study of the quantitative aspects of information "in any form" and "in any social group" as stated by Tague - Sutcliffe [16]. The ideas rooted in bibliometrics, scientometrics and informetrics contributed to the emergence of webometrics.

Today's digital and global age due to information overload users are in a confusion to retrieve the relevant information they need. Although the traditional role of librarian as a bookkeeper has changed to service provider and then to information manager, he has a vital role to play in directing the researchers to select suitable literature for their research.
Due to escalating price and constrained library budget the subscription of hard copy of journals become a difficult matter to deal with. The Internet and emergence of e-journals dominate today's journal literature. Therefore librarian must know about evaluative methods that can be applied to assess the particular needs of researchers in their organisation.

The acquisition of books and journals in many libraries are without following a definite pre-planned acquisition policy. As a result the amount spent on research and libraries become a real waste. Hence the acquisition and services are to be planned to meet the information requirements of the researchers to the maximum. Here comes the importance of informetric studies of the literature. The results obtained through informetric studies can be of great importance to librarians, researchers, faculty members and information scientists. The modified 'citation weights', 'impact factor' and 'immediacy index' put forward by Science Citation Index are of special mention here. The present study focuses on Toxicology literature.

1.2 Toxicology

People are exposed to a great variety of natural and man-made substances. Under certain conditions such exposures cause adverse health effects. These effects range from death to subtle biologic changes. Society's ever - increasing desire to identify and prevent these effects has prompted the dramatic evolution of Toxicology as a study of poisons to the present day complex science.

The assessment of health hazards of industrial chemicals, environmental pollutants, and other substances represents an important element in the protection of the health of the workers and members of communities. In-depth studies of the nature and mechanism of the effects of toxicants are invaluable in the invention of specific antidotes and other ameliorative measures. Thus Toxicology is the study of the nature and mechanism of toxic effects of substances on living organisms and other
biologic systems. Toxicology also deals with quantitative assessment of the severity and frequency of these effects in relation to the exposure of the organisms. The US Society of Toxicology has defined "Toxicology is both a scientific discipline and, like Medicine, an art that is practised. While toxicologists can differ on the exact definition of Toxicology, the central focus of Toxicology is a concern with the adverse effects of chemicals on living organisms and a commitment to assess the likelihood that such adverse effects will occur. Along with other sciences, Toxicology contributes to the development of safer chemicals used as drugs, food additives, and pesticides.

1.3 **Scope of Toxicology**

Toxicology has a broad scope. It deals with toxicity studies of chemicals used:

i) In medicine for diagnostic, preventive and therapeutic purposes.

ii) In food industry as direct and indirect additives.

iii) In agriculture as pesticides, growth regulators, artificial pollinators and animal feed additives.

iv) In chemical industry as solvents, components, and intermediates of plastics and many other types of chemicals.

v) In the health effects of metals, petroleum products, paper and pulp, toxic plants, and animal toxins.

The Bhopal MIC gas tragedy of December 3, 1994, Chernobyl nuclear reactor accident of April 25, 1986 and Gulf War 1990 are some of the man-made catastrophes that remind us to take stringent measures to control environmental pollution to save humanity from being put into jeopardy. Meuse Valley Incident, Belgium of December 1, 1930, Donora Smog Incident, Pennsylvania of October 26, 1948, Tokyo-Yokohana
Asthma developed in 1946, London Smog of December 5, 1952, Los Angeles Smog of 1953, Chlorine Accident of Chembur, Bombay in August 1985, Oleum Leakage in Delhi on December 4, 1985 are notable air pollution episodes. The decaying of marbles of Taj Mahal, leaning tower of Pisa, Italy among the wonders of the world is due to air pollution. In Kerala, people's march against Coco-Cola Company, Plachimada, Palakkad, spraying of endosulphan in the cashew nut estates of Kasargod cause pollution due to toxins. As the population increase, human impacts on environmental systems and technological hazards are not simply a matter of subject curiosity but threaten both the stability of industrialised and developing countries.

In the face of a growing population, modern society demands improvements of the health and living conditions. To meet this goal, a great variety of chemicals must be manufactured and used. It has been estimated that tens of thousands of different chemicals are in commercial production in industrialized countries. In one way or another, these chemicals come in contact with various segments of population; people are engaged in their manufacture, handling, use, consumption or misuse. Furthermore, people may be exposed to the more persistent chemicals through various environmental media. The depletion of ozone layer, disposal of hazardous wastes, burning of plastic materials are of special mention here.

The expansion of the various facets of Toxicology has been outcome of the need of an affluent society to protect itself from harmful chemicals, physical agents, and various industrial and consumer products. The need for Toxicology information on unlimited number of chemicals has had a profound effect upon the development of the Science and profession of Toxicology. Research in Toxicology is carried out in universities, in government and private research laboratories and in certain industrial laboratories. Today Toxicology research is increasingly being focussed on medical, environmental and industrial division as
people all around the world are more alert and aware about how widespread the toxins and more particularly over the last century. Many of the themes that are attracting widespread attention and interest are desertification, acid deposition, stratospheric ozone depletion, climatic changes, industrial wastes, drugs are of vital importance to the future of the planet and its people. As the scale of interest of Toxicology research has broadened i.e. from local and regional problems towards global problems, approaches have also progressed from subject-specific disciplinary emphasis towards increasingly multidisciplinary and interdisciplinary research programmes. Increase in research activities results increase in literature. To select relevant literature, the application of scientific techniques is essential. Informetric studies are the widely accepted methods, which enables meticulous selection of literature.

Lack of informetric studies in the field of Toxicology is a major disadvantage pointed out by researchers. Toxicology is a transdisciplinary field which is not only related to traditional subjects like Medicine, Chemistry, Biology, Pharmacology but also to newly emerging subjects like Biotechnology, Environmental Sciences, Food Sciences etc. Being a transdisciplinary subject the results based on Toxicology research may be coming out in a wide variety of documents. Therefore an informetric study of Toxicology literature is an effective tool that can be successfully and wisely used in any library attached to an organization specializing in Toxicology research.

1.4 Title of the study

The title of the study is “Toxicology Literature : An Informetric Analysis”.

1.5 Keyword definition

The keywords in the title are defined as follows for the purpose of study.
Toxicology

According to ‘Funk & Wagnalls New Encyclopaedia’ [17], “Toxicology is the science of poisons, embracing the physical and chemical history of all the known poisonous substances, as well as the methods of testing for them, their action on the living body, and the post mortem results they occur.”

To the ‘New Encyclopaedia Britannica’ [18], “Toxicology is the study of poisons and their effects, particularly on living systems, because many substance are known to be poisonous to life, Toxicology is a broad field, overlapping Biochemistry, Histology, Pharmacology, Pathology and many other disciplines.”

According to ‘Van Nostrand’s Scientific Encyclopaedia’ [19], “Toxicology is the technology of poisonous substances, their detection and counteractions. Basic to this branch of science is the realization that chemical compounds vary in their danger to humans and their environment. Sources of information pertaining to toxic substances include local and national health organisations in many countries. Several treaties on the subject have been prepared including the broad spectrum ‘Dangerous properties of Industrial materials.’

For the purpose of present study Toxicology is defined as the physical and chemical aspects of all poisons affecting environmental, economical and medical aspects of human life.

Literature

Literature is the body of writings produced in a particular country or period or in the world general or the body of books and writings that treat of a particular subject. In simple terms it means published materials on a specific topic.

Literature is also defined as “a literary productions as a whole” by the Oxford English Dictionary [20].
According to Reader's Digest Oxford Complete Word Finder [21], literature is defined as "the written works, those whose value lies in beauty of language or in emotional effect."

To Chambers 21st Century Dictionary [22], literature is defined as "written material, such as novels, poems and plays, that is valued for its language and content i.e. the whole body of written works of a particular country or period in time."

**Toxicology Literature**

The whole body of written materials, i.e. books, journal articles, information from Web etc, produced and available for use in the discipline Toxicology is known as Toxicology literature.

**Informetrics**

The 'International Encyclopaedia of Information and Library Science' [23] defines informetrics as "an emerging sub field in Information Science based on the combination of quantitative studies of information flows, advanced information retrieval and text, and data mining. It has a broader scope than bibliometrics, because it also covers non-scholarly communities in which information is produced, communicated and used."

Informetrics is "the use and development of a variety of measures to study and analyse several properties of information in general and documents in particular." It covers the mathematical and statistical applications on information and includes the quantitative and qualitative study of information. To certain extent it means a measure of information.

Informetrics is also defined as "the extensive use of quantitative and qualitative techniques used for studying the structure of literature or discipline. These techniques have been helpful in enabling the mapping of disciplines as also a study of any transition in the structure and composition of a discipline" [24].
Analysis

Analysis is the tracing of things to their source and the resolution of knowledge into its original principles, the discovery of general principles underlying concrete phenomena.

According to the ‘Oxford English Dictionary’ [25], “analysis is the investigation of any production of intellect, as a poem, tale argument, philosophical system; so as to exhibit its component elements in simple form.”

To ‘Reader's Digest Oxford Complete Word Finder’ [26], “analysis is the detailed examination of the elements or structure of a substance i.e. investigation, examination, study, scrutiny, enquiry, inquiry, dissection, assessment, interpretation, review etc.”

According to ‘Chambers 21st Century Dictionary’ [27], “analysis is the detailed examination of the structure and content of something” [27].

Informetric Analysis

The quantitative and qualitative techniques used for enquiring the elements or structure of information is known as informetric analysis.

1.6 Objectives of the study

The major objectives of the study are:

i) To assess the growth and development of toxicology literature.

ii) To analyse the literature scatter employing standard variables in informetrics.

iii) To identify prominent areas of research in Toxicology.

iv) To study the authorship pattern.
v) To analyse the type of language and documents cited.

vi) To examine how far the literature scatter satisfy the existing laws of informetrics.

vii) To examine the literature scatter in Toxicology in the light of laws of informetrics and suggests deviations if any.

1.7 Other Dimensions

The study focuses on the Toxicology literature produced during 1998 January to December 2003. Because of tremendous research output, the number of journals in Toxicology is increasing. Therefore from the core journal list, the first nine journals were selected and journal study was based on the above nine journals. The present study fled light on the main fields of Toxicology research as well as the important primary journals through which the results are being published. The authorship pattern, subject-wise scatter, country-wise, language-wise and growth pattern, self-citation, bibliographic coupling of the journals were studied. The study will be of great use in formulating the acquisition policy of documents in a library. The present study is useful in identifying obsolete journals so that they can be discarded from the collection.

From the Toxicology literature during 1998 to 2003, author collaboration, subject dispersion, language and types of documents, core books, core authors and their scientific productivity were analysed.

1.8 Hypothesis

The following hypotheses were formulated and tested in the course of study.

i) The toxicology literature will not satisfy the existing laws of informetrics.
ii) Obsolescence or aging of journals is quick in the field of Toxicology.

iii) 80/20 rule conform in the subject in which the percentage of articles receiving more citations.

iv) Input of the literature in Toxicology is mostly from developed countries.

1.9 Methodology

In order to get an idea about similar studies done in informetrics, an exhaustive search was carried out. For this many primary periodicals, secondary periodicals like LISA (Library and Information Science Abstract) and its CD-version LISA plus, bibliographies, UGC Infonet E - Journal Consortium, Internet etc were consulted. Details about the studies made in the area of Informetrics were reviewed in Chapter 2 of this thesis. Since the study is about Toxicology Literature it is necessary to have background information about the subject. For this general and subject dictionaries, encyclopaedias, monographs, primary periodicals, secondary periodicals and online databases in the field of Toxicology were consulted. After collecting the background information, the data from TOXLINE was collected. Collecting, organizing and analysing of data were done on the basis of established informetric methods. The down loaded data was transformed to CDS/ISIS programme. The data was sorted to prepare tables and figures and informetrically analysed using SPSS, a statistical software programme. Wherever found suitable, the dependence of different variables were tested statistically using formulae in order to prove the validity of hypotheses based on objectives. The Lotka's and Bradford's informetric distributions were used for analysing the data.
1.10 Organization of the study

After completing the analyses and formulating the results of the study, the format of the thesis was determined. The study is organised under six chapters as follows:

Chapter - 1 - Introduction

In this chapter a brief introduction of the whole study is provided. It introduces subject under the captions: the relevance of the topic, keyword definitions of the title, objectives of the study, hypothesis, methods of data collection and organization of the study.

Chapter - 2 - Review of Literature

The literature review covers almost all the important aspects of the topic from its origin to the period of this study i.e. from 1928 to 2004. The literature is collected for the purpose of the study was scrutinised under the following divisions such as definition of bibliometrics, scientometrics, informetrics, webometrics, genesis and development, literature reviews, informetric laws i.e. Lotka’s law, Bradford’s law, Zipf’s law, informetric distribution, Lotka - Bradford - Zipf relation, citation analysis i.e. aging or obsolescence, citation half-life, ranking and evaluation, impact factor, bibliographic coupling and clustering, co-citation, current trends, advanced studies and conclusion. Total number of documents reviewed include 285 journal articles, 46 books, 29 conference proceedings, 11 dissertations, 2 unpublished articles, 1 pre-print, 1 monograph and 2 articles from the Web.

Chapter - 3 - Toxicology: Its structure and development

This chapter starts with the genesis and development of Toxicology, outline of the subject, definition, terminological development, classification systems, Toxicology literature, other sources, popular works and online databases. The major divisions of Toxicology such as
environmental toxicology, economic toxicology and medical toxicology were examined in detail.

Chapter - 4 - Methodology & Data Collection

A detailed description of the methodology i.e. choosing the sample, sampling technique, variables for analysis are given in this chapter. For the collection of data TOXILINE, TOXLINE Core, TOXLINE Special, its accessibility and retrieval of information were described. The computer programmes used for analysis such as CDS/ISIS, SPSS, the standard format and finally the organization of data were given.

Chapter - 5 - Analysis of data

The description, statistical analysis and the results of the study are provided in this chapter. Authorship pattern, subject dispersion, language and types of documents cited, core books, core authors and scientific productivity, productivity of authors, application and extension of Lotka's law, core journals, rank distribution of cited journals, application and extension of Bradford's law, growth study, bibliographic coupling and self-citation were studied and the interpretation of the data were presented along with tables and figures.

Chapter - 6 - Findings, Areas for research and Conclusion

The findings and conclusions derived from the analysis of collected data are given in this chapter. Suggestions for further study and areas of application of the study are also included.

The dissertation ends with a general bibliography listing books and articles consulted by the researcher for the preparation of this work.
References


7. Ibid., p.5.


