Chapter 0

Introduction

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Chapter 0

Introduction

Research in every discipline, be it social sciences or economics, is growing so much and so vast that a researcher is likely to get lost in this information explosion. An information scientist helps a researcher to keep track of the developments in his field of work.

Today we are living in an information age in which information—past and present—plays a vital role in all spheres of human activity. The all-round progress of human society depends exclusively on our achievements in scientific, technological and social research. In turn, research is possible in an environment of free flow and universal availability of current and retrospective knowledge.

The world has now entered the era of the knowledge revolution that is likely to have at least as profound an impact on the well-being and welfare of human mind as well as on national economic power equations as did the industrial revolution a couple of centuries ago. The extension of knowledge becomes increasingly economic and business goal specific. The evolution of classical and neoclassical economics was contemporaneous with the progress of the industrial revolution. Capital accumulation was regarded as the key to economic progress and assigned a central role in the theory of capitalist development.

Economic reforms come in waves. In our own country, the first wave of reform started with the launching of planning with an emphasis on industrialization, more particularly of heavy industries. The second wave began when it was found that the growth rate was weak and the trickle down effect was not adequate and when the need to focus directly on poverty alleviation becomes evident. The third wave, which began in late eighties, gathered momentum after 1991. The period since 1991-1992 has seen some important changes in the approach to and content of economic policy.

Now technology is a major contribution to economic growth and research and development constitute the soul of technology. Goal oriented research and technology driven process improvement has helped to reduce cost in term of
economizing on materials or varying the material inputs or using totally new materials. These aspects of technical progress through adopting of newer technologies and creation of new products are thus directly related to overall wealth creation. Reflecting the changed perception of knowledge in wealth creation, research and development is no longer the preserve of academic institutions.

The role of research in several fields of economics has greatly increased in modern times. Research, as an aid to economic policy, has gained added importance, both for government and business. Government’s budgets rest in part on an analysis of the needs and desires of the people and on the availability of revenues to meet these needs. The cost of needs has to be equated to probable revenue and this is a field where research is most needed. Through research we can devise alternative policies and can as well examine the consequences of each of these alternatives.

It is generally agreed that the developed world has made tremendous progress in science and technology which has enabled it to adopt ways and means for achieving higher standards of living, while the under-developed world is struggling for the same. How has the developed world succeeded in better means of prosperity? It is though higher standards in research. Research is done in universities, laboratories, research institutes, and in agricultural industry. The research findings appear in the form of dissertations, research reports and research articles.

Promotion of research is one of the prime functions of the university. Research is carried in the university at two levels-first, by the faculty members as their obligation in extending the boundaries of knowledge and for their own professional prospects and secondly, by the research scholars for the award of Ph.D. degree, which is the highest academic degree. The subject (Economics) is assuming greater prominence in the field of education and research today. The universities all over the world offer courses in economics education and research.

The word research is derived from the French recherché (r) meaning to search or seek again. It means intensive search with a view to becoming certain. It is an endeavor to discover facts by the scientific study of a subject, course of fact. It involves the treatment of materials, concepts or symbols for the purpose of
generalizing to extend, correct or verify knowledge. Research can be defined as creation of knowledge through investigation, recording and analysis of evidence. It is the logically or the rationality of relationship of various pieces of evidence that makes research valid.

Research is composed of two words ‘re’ and ‘search’, which means to search again, or to search for new facts or to modify older ones in any branch of knowledge. Random House Dictionary of the english language defines research as “Diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications etc.”.

It must be based on facts. Observable data forms a sound basis of research. Inductive investigations lend greater support to research findings. For analysing facts a specific methodology of analysis must be developed and results interpreted logically. The modern concept of research is, therefore, broad-based and provides for a well meaningful investigation into any field of academics. Research these days is treated as advancement in knowledge acquired through scientific methods.

0.1. Bibliometrics : Genesis and Development —

Bibliometric analysis has now become a well-established part of information research, and a quantitative approach to the description of documents and examination of services is gaining ground both in research and practice. It first appeared in 1969, and it became more popular during 1980s. It is the analytical study of the literature using bibliometric techniques. It means analysis done based on the bibliographic phenomena (growth of literature, citation pattern etc.) coming under bibliometric.

The word bibliometrics is derived from Latin and Greek words, i.e., biblio and metrics. So the word etymologically biblio-metrics stands for the application of mathematics to the study of bibliography. According to the British Standards Institution, bibliometrics is the study of the use of documents and pattern of publication in which mathematical and statistical methods have been applied.
Bibliometric is a branch of information theory, which analyses quantitatively the recorded knowledge to know its properties and behaviour. The recorded knowledge may be in the form of books, journals, doctoral theses, dissertations etc. In almost all subject disciplines, bibliometric research has developed a body of theoretical knowledge and a group of techniques based on bibliographic data elements. It studies are used to identify the pattern of publication, authorship, citations and/or secondary journals coverage in the hope that such regularities can give an insight into the dynamics of the area under consideration of information resources which can be effectively used.

The term ‘bibliometrics’ has found wide acceptance. Diverse interpretation of the term have put forwarded by some authors, Alan Pritchard\(^3\) is generally credited with coining the term ‘bibliometrics’ to describe “all studies which seek to quantify the processes of written communication”. He defined it as, “the application of mathematical methods to books and other media of communication”. Fairthorne\(^4\) defined bibliometrics as the “quantitative treatment of properties of recorded discourse and behavior appertaining to it”. Hawkins\(^5\) in 1977 in his on-line bibliometric study interpreted bibliometrics as “quantitative analysis of the bibliographic features of a body of literature”. More recently Potter\(^6\) defined bibliometrics “the study and measurement of the publication patterns of all forms of written communication and their authorship”. Broadus\(^7\) presented a historical overview of various definitions of bibliometrics and proposed an alternative definition. According to him, “bibliometrics is the quantitative study of physical published units or of bibliographic or of surrogates of either”.

Bibliometric studies fall mainly into two broad groups - those describing the characteristics or features of literature (descriptive studies), and those examining the relationships formed between components of a literature (behavioral studies, sometimes referred to as citation studies but not restricted to them).

The descriptive studies are probably the most easily understood, and can be thought of as resembling in many ways population censuses. Both have to provide comprehensive and accurate data about rapidly changing population, in one case of
people, in the other of literature. Literature descriptions are assembled from the bibliographic characteristics of individual members of the literature. But only certain aspects of bibliographic description are of interest to bibliometric study; those that provide data on the condition or character of the literature as a whole. There is therefore, an important distinction between bibliographic and bibliometric data.

Bibliometric as a technique has extensive applications in identifying the research trends in a subject, trends in authorship and collaboration in research. Core journals, obsolescence, and dispersion of scientific literature useful in estimating the comprehensiveness of secondary journals studying the author productivity, characteristics of subject literature including structure of knowledge, historical and sociological aspects of science and helpful in formulation of need based collection development policy, weeding and stacking policy, science policy studies and many others.

Based on the correlation of the data, various laws have been formulated. The three basic laws have been formulated in bibliometrics based on some important studies. These are statistical expressions derived on the basis of studies on some characteristics such as scattering of articles on a subject in various journals, measuring the productivity of authors on the basis of the number of articles contributed by them, the ranking of words in a text on the basis of their frequency of occurrence etc. The three basic laws in bibliometrics are-

0.1.1. Lotka’s Law – Alfred J Lotka in 1926 formulated a law of scientific productivity based on correlation between the numbers of authors and their contributions. His law provided fundamental theoretical base for bibliometric studies involving authorship. He was interested in determining ‘the part which man of different caliber contribute to the progress of science’.

Lotka proposed his Inverse Square Law correlating contributors of scientific papers to their number of contributions. Mathematically Lotka’s law stands as:

\[ x^n \propto \frac{1}{y} \]

Or \[ x^n y = c \]

\[ 5 \]
Where ‘y’ is the frequency of authors contributing ‘n’ papers each and ‘c’ is a constant.

0.1.2. Bradford’s Law – Samuel Clement Bradford\textsuperscript{9} in 1934 described the scattering pattern in the area of applied geophysics and lubrication. Bradford’s law is based on the distribution of publications (usually journals) in a particular discipline or articles in a set of journals.

Bradford enunciated his law of scattering as ‘Articles of interest to a specialist must occur not only in the journals specialising in his subject, but also, from time to time, in other journals, which grow in number as the relation of their fields to that of his subject lessens and the number of articles on his subject in each journal diminishes’. Bradford concluded that if scientific journals are listed in decreasing order of productivity of papers on a specific subject, then they stand divided into a nucleus of journals more particularly devoted to the subject and several other zones containing the same numbers of journals in the nucleus and succeeding zones will be 1 : N : N\textsuperscript{2} : N\textsuperscript{3} : N\textsuperscript{4} .......... 

0.1.3. Zipf’s Law – George Kingsley Zipf\textsuperscript{10} working on the statistics of vocabularies, formulated his law in 1935 taking statistical technique of ranking of word – frequency, beginning with the most productive. Zipf’s Law is based on word – frequency ranking in a defined set of documents.

Zipf in his law proposed an equation correlating high and low frequency words of a long textual matter of natural language and showed a reciprocal relationship between rank word and frequency of words. His law states that in a long textual matter if the words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the word. Mathematically Zipf’s Law can be written as:

\[ r \propto \frac{1}{f} \]

or \[ rf = c \]

Where ‘r’ denotes rank word, ‘f’ stands for frequency word and ‘c’ is constant.
An exponential growth of literature on bibliometrics has been noticed during the last five decades mostly based on these laws. Many standard statistical tests have been made either to substantiate, modify, extend, link or criticise these laws by subsequent researchers and as a consequence number of other important new empirical laws, theoretical models have been developed on the subject. Some of the new empirical laws are –

The **Square Root Law of Price**\(^{11}\) states, "Half of the scientific papers are contributed by the square root of the total number of scientific authors". In other words, \(N^{1/2}\) source yields a fraction \(1/2\) of the items. This phenomenon is associated with the occurrence of invisible colleges. This law is sometimes called ‘Rousseau’s Law’ since Jean Jacques Rousseau had mentioned the same thing quite clearly in his ‘Social Contract’ about the size of the elite, i.e. those participating in the government.

**Garfield**\(^{12}\) in his law of concentration argues, “A basic concentration of journals is the common core or nucleus of all fields”. He talked about the number of journals involved in publishing the literature of a single field. He did not say anything about how much the journals in one field might overlap with other fields. Infacts, there is a significant degree of overlap. Several studies have shown that relatively few journals are involved in the publishing of an overwhelming majority of the material in a subject. A study of the Science Citation Index (SCI) database showed that 500 journals accounted for 70% of the material indexed in SCI in 1969. Almost half of the 3.85 million references published that year was found to emanate from only 250 journals. This type of evidence makes it possible to move from Bradford’s law of dispersion to Garfield’s law of concentration.

This law in other words, the tail of the literature of one discipline consists, in a large part, of the cores of the literature of other disciplines. So large is the overlap among disciplines that the core literature of all scientific disciplines involves a group of not more than 1000 journals.

**Sengupta**\(^{13}\) in his new bibliometric law comments, “During phases of rapid and vigorous growth of knowledge in a scientific discipline appear in increasing
number in journals distant from that field”. Mathematically Sengupta’s law stands in the following form –

\[ f(x + y) = a + b \log (x + y) \]

Where \( f(x + y) \) is the cumulative number of references as contained in the first \((x + y)\) most productive journals, \(x\) indicate number of journals in the same discipline and \(y\) stands for number of journals of unrelated discipline \((y > x)\) and \(a\) and \(b\) are two constants.

Bibliometrics, as a sub-discipline in information science, is first known to have been applied by F J Cole and N B Ealse\(^{14}\) in 1917. E W Hulme\(^{15}\) conducted a subsequent study in 1923. Hulme was the first to use the expression ‘statistical bibliography’, which was later used by others. In 1948 at the Aslib conference in Leamington spa, S R Ranganathan\(^{16}\) suggested to develop ‘librametry’ on the lines of econometry, biometry, etc. Under this term he suggested using of mathematical and statistical methods for analysing library activities and library resources. But this term did not take its place in library science and was forgotten for many years. Later, it was called ‘Librametrics’. Alan Pritchard\(^{17}\) in 1969 coined the term ‘Bibliometrics’ in preference to the term ‘Statistical bibliography’. In the same year another term ‘Scientometrics’ was suggested by V Nalimov and Z Mulchenko\(^{18}\). The term ‘Informetrics’ was first proposed by Otto Nacke\(^{19}\) of Germany in 1979.

0.2. **Librametrics** – Library Science is a well-recognized discipline and the metric studies pertaining to library science can be termed as librametrics. The term’s librametrics and bibliometrics, it may be asserted that these two terms are to some extent analogous and synonymous. The former, however, has a broader scope because of its involvement not only with written documents but also with the library activities are measurable. For example, the average number of books, that a person can classify, catalogue, accession, or even shelve within a given span of time (e.g. an hour, a day etc.) can be determined. Similarly, the average time required for charging or discharging a book, writing a call number on the book, putting various labels and stamps on a book, all can be determined employing mathematical and statistical technique. The number of books issued or the number of queries answered per day can
also be measured. Here the term book can be used, because till now, books remain the most predominant factor in libraries. In the case of metric studies, what is true of books is also true for other documents in a library. The library activities discussed above and certain other activities are measurable. All such library activities as are measurable are encompassed by librarnetrics. Librarnetrics was concerned mainly with management of libraries while bibliometrics studied quantitatively process of written communication.

0.3. Scientometrics - This term was introduced and came into prominence with the founding of the journal named ‘Scientometrics’ by Tibor Braunin 1977. Originally published in Hungary and currently from Amsterdam. The scope of the journal is to publish all those studies of quantitative aspects of science as a discipline or economic activity. Scientometrics is part of the sociology of science and has application to science policy making. It involves quantitative studies of scientific activities, including among others, publication and so overlaps bibliometrics to some extent. Scientometrics is branch of the ‘Science of science’.

The organisation of science and its productivity analysis results in scientometrics. It has emerged as a new discipline. Which uses bibliometric methods for evaluation and measurement of scientific progress and its social relevance. Scientometrics as a scientific discipline which performs reproducible measurements scientific activity and reveals its objective quantitative regularities. Scientometric methods, and indicators as to the number of citations, term etc. There are two aspects within science of science, first – the analytical aspects which deals with the general laws of the development of science as a knowledge system and a specific social institution, and second – the normative aspect which deals with the development of practical recommendations for raising research efficiency. Nalimov and Mulchenko (1969) define this term, “as a sub-field study of science as an information process”. In this information model, publications are carriers of information and promoters of communication.

The principal aim of ‘Scientometrics’ is to determine the state and prospect of a subject and its future development. Several scientometric indicators are
used for this purpose, and one of the most significant indicators is the number of publications, its changes over time is usually considered as a measure of research topicality in a given field. These indicators are one of the ways to become a standard tool of evaluation and analysis in research management of science policy making. Considerable attention has been paid in recent years to ways to measure scientific information to users. As far as the strategic use of information is concerned it implies the monitoring of science development and the analysis of the changing structure of science. Simply scientometrics is a complex of mathematical and statistical methods, used to investigate such aspects as research staff, economics, history, etc. of science, and to define evolutionary prospects of science.

0.4. Informetrics - The term 'Informetrics', as suggested by German Scientists Blackert and Zygel is a newly formed branch of science, using mathematical and statistical methods to investigate scientific and technical information on theoretical level and practical information activities.

Informetrics was first proposed by Otto Nacke of Germany in 1979. In 1984, a committee on informetrics was set up by FID which set up its objectives for providing reliable data for research and development, for policy making and planning, and for management of institutions, projects, programmes and activities. In 1987, the first international conference on bibliometrics was held in Belgium. In the second conference on bibliometrics, scientometrics and informetrics held at London in 1989, B C Brookes suggested to use the generic term 'informetrics' to denote the use and development of a variety of measures to study and analyse several properties of information in general and documents in particular. For the third conference held at Bangalore in 1991, the name informetrics was used. For the fourth conference held in Germany in 1993 all the three terms were used and for the fifth conference to be held at Illinois, the term informetrics and scientometrics are include in the title. Thus there exists some more confirmation for the term 'informetrics' to be universally accepted.

Informetrics is being used to cover both sciento - and biblio-metrics 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.
As a general field of study, it includes the earlier fields ‘Bibliometrics’ and ‘Scientometrics’.

The scope of informetrics has grown very wide with the starting of a series of international conference on the topic. Research in the field is also very active, as seen by the number of papers published in various information science journals. Milestones in the history of informetrics are the formation of various regularities such as Lotka’s law $^{22}$ in 1926 for author productivity studies, Bradford’s law $^{23}$ of scattering of journals in 1934 and Zipf’s law $^{24}$ of word occurrence in 1935. A proliferation of papers based on these laws and its refinements was seen afterwards. This led to the formation of new laws such as Price’s square root law of scientific productivity; Garfield’s law of concentration; Sengupta’s law of bibliometrics, etc. Based on various studies, models were developed for the application in quantitative studies. Important among these are Price’s cumulative advantage distribution; Brook’s logarithmic model, Bookstein’s model linking the three basic laws; Mandelbrot’s model of Zipf’s law; Vickery’s model of Bradford’s law; Leimkuhler’s model of journal productivity; Garfield’s citation analysis, impact factor for scientific journal; Sengupta’s weightage formula; Naranan’s power law model; Goffman’s epidemic process; Groos model connecting Keenan – Atherton data to Bradford’s law; Kessler’s bibliographic coupling; Small’s co-citation and clustering; Ravichandra Rao’s negative binomial model, etc.

Informetric analyses are applied in science policy studies especially in countries like US, UK Netherlands, etc. This helps to evaluate the research and development activities for decision-makers by measures like research productivity, impact and quality. Interest in this field of quantitative indicators for science and technology is increasing in other countries also. The evaluation helps national funding agencies and policy-making bodies towards proper allocation of funds. These studies are having some criticism as in the case of citation studies for scientific publication evaluation. But this method can be relied upon combination with other measures for decision making.
Scientometrics/Informetrics are marked by extensive use of quantitative and qualitative techniques. In recent years, such quantitative methods are being extensively used for studying the structure of literature (of 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. In fact, in the last one decade a number of tools, techniques and indices for this purpose have been developed and applied to various areas.

M Bonitz\(^{25}\), to investigate relationship and correlation of bibliometrics, scientometrics and informatics on the theoretical level, trying to define limits of their competence. According to him:

- Bibliometrics is a methodological subdiscipline of library science, including the complex of mathematical and statistical methods, used for analysis of scientific and nonscientific documents and library network;
- scientometrics is a complex of mathematical and statistical methods, used to investigate such aspects as research staff, economics, history, etc. of science, and to define evolutionary prospects of science;
- informetrics is a methodological subdiscipline of information science, including the complex of mathematical and statistical methods used to investigate indexing languages, information systems, communication systems, information networks, etc.

Other author's the Spanish scientist A Lara\(^{26}\), the Russian I Marschakova\(^{27}\), the German D Schmidmayer\(^{28}\), the Belorussian V Lazarev\(^{29}\), the Lithuanian D Voveriene\(^{30}\) to name a few, proposed their own solutions, defining the limits of competence of these three – 'metrics'.

0.5. Citation Analysis –

Citation analysis is one of the most commonly used forms of bibliometric studies. Normally, the bibliographical references appended to research communications are considered. Analysis of such references can reveal the relative use of different kinds of documents, age of used documents, most frequently used items, preferences of country and language and the scattering of literature. It is often used for
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journal ranking and also for evaluation of individuals and departments. It is one of the most important bibliometric techniques involving analysis of the references forming part of primary communication.

Research in every discipline, is growing so much and so vast that a researcher is likely to get lost in this information explosion. An information scientist helps a researcher to keep track of the developments in his fields of work. Many techniques developed in information science help in the organization and dissemination of knowledge in various disciplines as well as in the appraisal of the latest trends that are taking shape within each discipline. Bibliometrics has established itself as a viable and distinctive research technique for studying science of science based on citation data. Citation analysis as a technique for bibliometrics study of literature is based on the principle that there is some degree of relationship between the citing and cited articles. J Martin has defined citation analysis of citation or reference, which forms a part of primary scientific communication.

The word ‘citation’ and ‘reference’ are commonly used interchangeably, but in actuality there is a suitable differences, Citation – a full bibliographical description for a paper which an other has used, while writing his research paper, and Reference – a specific direction referring a reader to another passage of book.

The primary function of citation is to provide “a connection between two documents, one which cites and the other which is cited. Citation indices are providing information scientists with useful materials for studying literature patterns, information generation, propagation, etc. All such activities are based on the hypothesis that between a citing item and cited set of items, there is a cognitive relationship linkage of some form. The underlying philosophy is that the citing item makes use of some piece of information contained in the cited items for some purpose relevant to the context and content of its. A systematic citation study helps in measuring the degree of interaction among the researchers.

The technique of citation is largely statistical and is used for arranging those cited materials in some kind of rank to study their relative importance. Broadus defines the “true citation analysis as one which deals with worked cited as
having actually been used in preparation of, or having otherwise contributed to, the source paper. Dhalig used citations to trace the diffusion of an idea and pointed out that some papers became sociometric stars while others are isolated. Gross and Gross for the first time in 1927 applied a method of simple statistical method to the grading of scientific serials according to their relative importance based on citation counting from source journals.

The purpose of citation is to enable a reader to go to the referred document for information on a point or check the authenticity of a particular view, finding or method. Each citation is a message from the author of a document to his readers. Citations also serve other purposes like —

as a bibliography

for preparing ranked list of journals.

for understanding the relative use of different types of documents.

for calculating the usefulness of documents.

to find out the relatedness and dependence of subjects.

to calculate the citation rate of journals.

to find out the impact factor for a concerned journal.

to calculate the immediacy index etc.

Citation analysis refers to empirical, observational and applied studies of outcome of citation in various aspects. It is one of the popular methods employed in recent days for the identification of core documents in various subject fields or for a particular specific community in a geographical proximity. In fact, citation study is one of the effective and indirect methods to understand the information requirements of users. Citation analysis makes use of bibliographic references, which form an active part of the primary literature and its analysis gives valuable results. It provides a convincing statistical study of scientific literature and helps in the examination of professional interaction among the scientists.

There are some basic concepts in the area of citation analysis, which are frequently used for variety of studies. These are —
0.5.1. Direct citation;

0.5.2. Bibliographical coupling;

0.5.3. Co-citation.

0.5.1. Direct Citation –

Eugene Garfield\textsuperscript{35} developed the idea of using direct citation patterns to study the variety of probable relationship among the citing and cited papers. Derek de J Solla Price\textsuperscript{36} provided a conceptual framework in the understanding of this development technique. With regard to the relationship, between the publication chosen for the citation and citing publication, it may be argued that cited publication are those which have been important to the research activity dealt with in the citing paper. Further the cited articles are indicative of the influence experienced by the citing author in his field of study. This reveals that the material cited by the independent authors working on the same problem would be identical. Continuous increase in the rate of citations of papers in a field indicates the increase of activity in that field. Simply if an author is citing any reference in his scientific paper, there is a strong probability that it may be related to it. This concept of direct citation has been used by variety of researchers to establish relationship among documents and researchers.

0.5.2. Bibliographical Coupling –

Analytical study using bibliographic coupling technique was first suggested by Fano\textsuperscript{37}. This was further enhanced and named by Kessler\textsuperscript{38} in 1958. It makes use of the assumption that when the two papers cite the same reference or have at least one reference common in them then there may exist some relation between the two citing papers. The more the number of citations common, between the citing papers, the stronger is the strength of coupling between them. Bibliographic coupling links source documents and is generally used to assemble papers on any subject.

0.5.3. Co-citation –

A co-citation pattern indicates the probable relationship that exists when the two citations are cited together. The frequency of their occurrence together
determines the strength of linkage. It represents the degree of relationship among the papers as observed by the practicing scientists. The fluctuation in co-citation patterns may be observed in a particular field, as and when the interests and intellectual patterns of that field undergoes changes with time. This further provides the clues to understand the mechanism of specialty development.

The study of these changing structures of co-citations provides a tool for monitoring the development of scientific fields and for assessing the degree of inter-relationship among specialties.

Research is the only sure way to constantly expand the fund of human knowledge and solve the problems that face the mankind today. It is the most remarkable phenomenon of development in any subject. Research is the most important tool for the advancement of knowledge, scientific discoveries, technological achievement and scholarly publications. It is carried out to develop new concepts and theories and to contribute towards new knowledge.

The importance of bibliometric study to see the effectiveness of a system is already well accepted, as it is a distinctive research technique for measurement of science based on citation data. Bibliometrics is a well-established discipline for a quantitative study of the various aspects of literature of a given subject. In almost all subject disciplines, bibliometric research has developed a body of theoretical knowledge and a group of techniques and applications based on the distribution of bibliographic data elements.

Citation analysis as a research area and technique is a bibliographic representation – counting technique, which reflects linkage between scientific papers, technical notes, reviews and other forms of written communication. The citation link provides a quantitative picture of journal usage and relationship of journals whose primary function is to communicate research results. It provides results in the form, structure and volume of scientific communication thus giving additional knowledge on the conditions and patterns of scientific activity and research.
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