CHAPTER -1

INTRODUCTION

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CHAPTER-I
INTRODUCTION

1.1 Introduction

Information has varied number of forms and various purposes for communication. Journals serve as major source of primary information; researchers tend to publish more and more research output in journals. Journals play a major role as primary research communication channel. The study of Literature & its evolution over a period reveals the growth or decay of subject. In the field of LIS a lot of research has been carried out on Literature i.e. Bibliometrics, Scientometrics, and Informetrics etc. for analyzing the growth and decision making. The ongoing revolution of ICT has altered the work of scholars and researchers in terms of communication and collaboration. Current society has become increasingly technology-driven and knowledge-based, Science and technology are often viewed as closely related, at times interacting systems. The role of science and relationship to technology has been a matter of great interest for policy makers and research communities.

The communication of research findings is therefore fundamental to any scientific endeavour, and scientists are constantly engaged in the mutual exchange of information and knowledge. During the last few decades we have witnessed a dramatic growth in co-production of research results. Almost every paper in the sciences is co-authored; not only by researchers at a given location but increasingly on a national and international level. Collaboration between research institutions tends to increase within research Fields and internationally co-authored articles have doubled during the last 10-15 years. Thus, internationalisation and collaboration are two very strong trends that characterise the scientific system of today. Science is not only co-used, it is also co-produced.

A substantial body of research has investigated the link between science and technology in a quantitative and especially bibliometric manner (Gao & Guan, 2009). Recent studies have shown that both the number of co-authored scientific publication and citation impact has steadily increased in all subject fields during the last two decades. An intensifying collaboration has been reported for all fields and at
practically all level of aggregations, for instance (Glänzel & De Lange, 1997) and (Glänzel 2001) for the macro level, (Gómez et al., 1995) for the meso level, and (Ding et al., 1999) (Glänzel 2002) for the micro level. Scientific knowledge has no real meaning as long as it is not made public and discussed; it simply has to be shared in order to become accepted.

Research collaboration is a phenomenon of growing interest from a research policy perspective as well as for deepened understanding of the social and cognitive mechanisms that shape the scientific practice of today. Scientific results are to a very large extent the product of teamwork, which becomes most obvious when looking at the high number of co-authored articles. If the results are published as co-authored texts, then they are also assumed to be co-produced. The rising awareness of collaborativeness in science has lead to a sharpened focus on the collaboration issue. (Goran Melin, 2000)

Citations can occur without authors knowing each other and can span across time. Co-authorship implies a temporal and collegial relationship that places it more squarely in the realm of social network analysis. The co-authorship network of scientists represents a prototype of complex evolving networks. Collaborations emphasis the various factors both intrinsic and extrinsic to research process, have contributed to this trend of cooperative research. The use of co-authored articles to study the nature of collaboration and communication patterns in research activities has been practised for several decades.

The trending research in LIS tends to more of surveys and user studies, the scientometric studies reveal the co-authored articles. The collaboration of authors through multilateral approaches for research quality in several developed and developing countries are happening due to the vast usage of ICT in all the field or in simple terms the technology has made the whole world as single village were people are communicable to each other with basic ICT skills. The reasons behind collaboration in developing countries towards developed countries were witnessed by previous researchers due to the infrastructure availability in developed countries. It is also witnessed that majority of funding agencies for research projects in Science and Technology are from Developed countries and due to which the major research and research contributors are from developed countries.
The connivances of authors or scientists that the collaboration is good thing or yields a good result may be another factor of collaboration. The reasons can be assumed based on the review of Literature related to collaboration, but actual fact has to be identified by more research on author collaboration. The present study emphasis the nodes of collaboration of authors in Biotechnology journal articles, but the research doesn’t uncover the reasons of collaboration among authors which can be area for future research.

The Literature on collaboration emphasis the identification what is research collaboration i.e. when can a researcher he/she are collaborator and when he/she are not collaborator. In present research the collaboration term is used only for Research article collaboration in Biotechnology journals. An author is said to be collaborator only when he/she as jointly published at least two articles together, the ego-network analysis or prolific authors has been identified on the basis of number of articles published over a period of Ten years in particular journal. Assessment of collaboration can be made in different other criteria’s and collaboration in research may be beneficiary for partners and may not be an advantageous.

The research collaboration can be classified in to several categories based on their geographical notion i.e. Local, National and International or on the basis of bilateral and multilateral based on collaborating research institutes. It can also be classified as Inter and Intra collaboration. The collaboration in research plays a major role when both the collaborator is beneficiary. The research world itself is considered as “small” and thus author network will identify the strong collaborative relation between authors and also weak ties between authors for minimum time. Another concern or effect of collaboration among author is that the international collaboration among researcher yields more references or wider reachability of research results compared to internal collaboration among researchers. The researchers get exposure to world with different countries for different information or different habits.

1.2 Need for the study

The increasing interest in understanding collaboration patterns in research is the belief that knowledge creation is an interactive process. Successful innovative research centres are usually those which are open to their cognitive environment.
They engage in interactive learning involving an array of various institutions. This interactive learning depends on the structure, types, scale and communication processes between relevant institutions with a tangible location in geographical, political, legal and cultural spaces. Cooperation is a viable alternative to gain access to complementary assets and skills. This is particularly relevant in cases of new technological and scientific areas of research.

In academia, co-authorship is the most visible and accessible indicator of scientific collaboration (Abbasi, Altmann & Hwang, 2010) and has thus been frequently used to measure collaborative activity (Milojevic 2010), especially in bibliometric (Borgman and Furner 2002) and network-analysis studies (Milojevic 2010). Bibliometric studies of co-authorship have emphasized the effects of collaboration on scientific productivity publications and citations as well as on organizational and institutional aspects of collaboration applied to different units of analysis authors, institutions, and countries (Milojevic, 2010) (Abbasi, Hossain, Uddin, Rasmussen, 2011).

In library and information science a lot of research has been carried out on scientific productivity using bibliometrics, scientometric etc., thereby helping in policy making of science. The bibliometrics focuses on number of publications, citations etc., and the network studies have focused primarily on the mechanisms in the formation of collaboration and understanding the underlying structures and purposes leading to the observed structure (Milojevic, 2010).

The study focused on the author collaboration in select journals along with the deepest view of author collaboration over years in different journals. Many investigators have carried out research on author collaboration, but their research limits to bibliometric or Scientometrics studies. In this study author collaboration at scientometric level and social network analysis has been done. The present research on Author collaboration would give clear picture of network strategies of author collaboration. Author network are complex networks since both the numbers of authors (nodes) and co-authorship links among them are growing over time. The author collaboration of Biotechnology has been studied using both Scientometrics and Social Network Analysis. There is not much research carried out on co-authorship network analysis in LIS field. The application of SNA to understand the author
network research is few and this study would enhance the knowledge to understand the ‘author network’ of Biotechnology community. The primary focus is to understand the factors which lead collaboration among authors and this study will help to understand the dynamics in author network of Biotechnology.

1.3 Statement of the Problem
The present study is conceived under the title “Social Network Analysis of Author Collaboration in Biotechnology: A study”

1.4 Definitions of concept
1.4.1 Social network analysis
A “social” network is defined as a group of collaborating (or competing) entities that have some type of relationship and interact within a shared environment often referred to as a community. Network graphs are notated in the form of an adjacency matrix that allows use of operations from matrix and linear algebra to mathematically define characteristics of the network. Social network analysis is grounded in the systematic analysis of empirical data using formal theory organized in mathematical terms. The goal is to capture patterns of human interactions. A network is represented as graph consisting of a finite set of nodes or vertices linked by lines or edges. The social network can be used to characterize and describe the community structure of its members. Some communities have a densely connected core of members with less central members scattered around the periphery. In others there is fairly uniform distribution of links across people, and still others have obvious divisions into sub-groups or “modules.”

1.4.2 Author collaboration
Research collaboration or Author collaboration can be defined as the working together of researchers to achieve the common goal of producing new scientific knowledge. An author is said to be collaborated with other author by co-authoring a research article i.e. at least one article together.

1.4.3 Bio-technology
Biotechnology is a branch of Science which deals the exploitation of biological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.
1.5. Objectives of the Study

The main objectives of the study are:

• To understand the growth of Biotechnology Literature over years
• To study the citation analysis of Biotechnology Literature.
• To find out country-wise and institute-wise contribution in Biotechnology Literature.
• To study the authorship pattern & characteristics of collaboration network using various scientometrics tools.
• To study the suitability of Lotka’s law of author productivity to Biotechnology Literature.
• To analyse the ego-network analysis of prolific authors in Biotechnology.
• To study the SNA of country-wise and Institute-wise collaboration in Biotechnology.
• To study the SNA of author collaboration of Biotechnology Literature.
• To study the core members by analysing collaboration network using SNA.
• To study the network pattern and characteristics of collaboration among countries, institutes and authors.

1.6. Hypotheses

1. There is significant correlation of growth of Biotechnology Literature along years
2. There is significant correlation of citation of Biotechnology Literature along years
3. There is significant correlation of growth of multi-authored articles along years.
4. Lotka’s law of author productivity is not acceptable to present Biotechnology Literature.
5. There is significant presence of homophily in ego-network of Biotechnology Literature.
6. There is dominance in collaboration among developed countries compared developing countries.
7. The Power-law distribution in collaboration of Biotechnologist community is not acceptable.
8. There is significant presence of small–world phenomenon in Biotechnology community.
1.7 Methodology

The methodology for the research is organized in to following:

1.7.1 Source of data collection

The identification of data for the research was made on the availability of journal for studying author collaboration network in electronic format, to understand its authenticity and reliability Thomson scientific – Web of Knowledge is regarded as standard which was identified as data source. The key term for identification was “Biotechnology”, In Web of Knowledge 65 journals from various publishers were indexed which are completely dedicated for bio-technology in 2015. The indexed journals were further filtered based on the selected time duration of journals i.e. 2003-2012, during this time duration 20 journals were shortlisted. The shortlisted 20 journals were further selected on availability of journals in University of Mysore website with full text accessibility and time span of 2003 -2012. 18623 articles from 10 journals were extracted from Web of Knowledge pertaining to scientometric criteria’s and analysis. The data contained minimal information of author details and affiliation which were essential for social network analysis. To resolve this issue investigator visited each journal website and collected each full text articles from all the 10 journal websites from each issue and volumes manually. The numbers of articles 20,000 from journals varied from the number of articles from Web of Knowledge i.e. 18623, on analysis the additional number in articles were identified as corrigendum, revisions, news etc. although patents are high in Biotechnology but in this patents have been not covered for Social network analysis. The obtained data was entered to MS-Excel and further extracted to Pajekk XXL and UCINET i.e. Social Network Analysis software for further analysis.

1.7.2 Methods used

For the present study the bilateral method is adopted i.e. Scientometrics and Social network analysis.

Scientometrics: The data from web of knowledge of ten journals were analyzed in accordance scientometrics basic criteria’s like growth rate, citation analysis etc. along with Lotka’s law of author productivity.

Social network analysis: Various metrics of SNA has been applied to understand
the patterns and characteristic of Biotechnologist community for a detailed analysis of ‘Author Network’.

- Complete Network analysis: Here the complete analysis, relations between authors in a network was analyzed.
- Ego Network analysis: The focal actor/ Individuals i.e. “Author” was analyzed and also presence or absence of homophily is identified.

The metrics of social network analysis measures the network of authors using various measures such as Degree, Centrality, ego networks; closeness etc. has been calculated and analyzed. There are many social network analyses software available, which is helpful in analysis as well, visualization of networks. Social network analysis software was applied to develop maps of network and for the detailed analysis of relations like ethnic, economic, and social etc. the socio-graphs for clear picture of communication between authors over a period. The investigator has used UCINET, commercial software and Pajek 3.02 which is freeware for analysis and NetDraw for visualization of network. Based on this metrics results the “core members” of Biotechnologist community has been identified.

There were issues involved in data collection and data extraction, Along with predetermined method. The data i.e. data for author collaboration were of five journals were unable copy through the usual process which was further converted from PDF to Microsoft word thorough Paperfort Software, but still some journal were unable to convert or utilize them for author data extraction. To resolve this issue the three journals i.e. journal of Biotechnology advances, Current Opinion in Biotechnology and Journal of Biotechnology data was manually entered to excel sheets for Social network analysis.

1.8 Scope and Limitation of the Study

The present study was focused on understanding the author’s collaboration among Biotechnologist community of Life science. The selection of Biotechnology as area of study was made on basis of interdisciplinary nature of subject. The Biotechnology is multidisciplinary in its application i.e. Industries, Pharmacy, Agriculture, Botany, Chemistry, technology etc. the list goes on. The researcher selected the area as Biotechnology to understand the collaboration of authors in this
field. The investigator also put forth the assumed that collaboration is high in Biotechnology compared to other individual subjects due to its multiple applications.

It deals with the analysis of ‘author network’ by using various metrics and it is limited to academic community of Biotechnologist. Although the author network is large but the present study focus on the collaboration of authors in Journals in the field of Biotechnology for the period 2003-2012. The present research has emphasized author collaboration in the selected ten journals of Biotechnology for only period of Ten years. The research is one of kind with application of two methods and analyzing the collaboration data of journals. The research limits to only empirical analysis of author collaboration in-depth, analysis for identifying the reasons behind collaboration and non-collaboration of authors is not analyzed. The ten journals selected for the study from web of knowledge are:

**Table -1**

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<tr>
<th>Sl. no</th>
<th>Name of Journal</th>
<th>Name of Publisher</th>
<th>Place of publication</th>
<th>ISSN</th>
<th>Impact factor</th>
<th>Publication Frequency</th>
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<td>1.</td>
<td>Food Biotechnology</td>
<td>Taylor &amp; Francis Inc</td>
<td>Philadelphia</td>
<td>0890-5436 (Print), 1532-4249 (Online)</td>
<td>0.52</td>
<td>4</td>
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<td>2.</td>
<td>Animal Biotechnology</td>
<td>Taylor &amp; Francis Inc.</td>
<td>Philadelphia, USA</td>
<td>1049-5398 (Print), 1532-2378 (Online)</td>
<td>0.92</td>
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<td>3.</td>
<td>Food Technology &amp; Biotechnology</td>
<td>University of Zagreb</td>
<td>Croatia</td>
<td>1330-9862 (Print) 1334-2606 (Online)</td>
<td>1.19</td>
<td>4</td>
</tr>
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<td>4.</td>
<td>Bioscience, Biotechnology and Biochemistry</td>
<td>J-stage ( Japan Society for Bioscience, Biotechnology, and Agrochemistry)</td>
<td>Japan</td>
<td>Online: 1347-6947 Print : 0916-8451</td>
<td>1.27</td>
<td>12</td>
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<tr>
<td>5.</td>
<td>Biotechnology and Bio-process Engineering</td>
<td>The Korean Society for Biotechnology and Bioengineering</td>
<td>Korea</td>
<td>1226-8372 (Print) 1976-3816 (Online)</td>
<td>1.27</td>
<td>6</td>
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<td>6.</td>
<td>Journal of Industrial Microbiology &amp; Biotechnology</td>
<td>Society of Industrial Microbiology</td>
<td>Fairfax, VA, USA</td>
<td>1367-5435 (print version) 1476-5535 (electronic version)</td>
<td>1.8</td>
<td>12</td>
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<tr>
<td>7.</td>
<td>Journal of Chemical Technology &amp; Biotechnology</td>
<td>Periodicals Service</td>
<td>USA</td>
<td>Online : 1097-4660</td>
<td>2.16</td>
<td>12</td>
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<td>8.</td>
<td>Journal of Biotechnology</td>
<td>Science Direct</td>
<td>USA</td>
<td>0168-1656</td>
<td>3.04</td>
<td>18</td>
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<td>10.</td>
<td>Biotechnology Advances</td>
<td>Science Direct</td>
<td>USA</td>
<td>0734-9750</td>
<td>9.64</td>
<td>6</td>
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(Source: Web of science, accessed on 12/12/2014)
1.9 Chapterization

The thesis has been organized into the following chapters.

Chapter 1: Introduction.

This chapter introduces the topic of research and explains need for the study. It states the research problem and defines the concepts related to the study. It explains objectives, hypotheses, methodology, scope and limitation of the study.

Chapter 2: Review of Literature

This chapter deals with the review of Literature pertaining to the research problem. The review is categorized into five categories based on the concepts of their coverage. The review literature chapter emphasizes the available Literature on the Scietometrics and social network analysis.

Chapter 3: Social Network Analysis

This chapter explains various concepts of social network analysis, Small world phenomenon, homophily etc. which gives a strong theatrical background for the present research analysis as well for the in depth concept insights.

Chapter 4: Scientometric analysis of Biotechnology

This Chapter deals with analysis of research data on the basis of scientometrics criteria’s like growth of Literature, citation analysis, authorship pattern, Lotka’s law for author productivity along with institutional wise distribution of articles, country wise distribution of articles.

Chapter 5: Social network analysis of Author collaboration in Biotechnology

This chapter analyses the author collaboration of Biotechnology articles of selected ten journals on basis of social network analysis metrics. In this chapter the emphasis is made on the socio graphs for understanding the collaboration between authors, institutes and countries.

Chapter 6: Summary of Findings and Conclusion

This final chapter provides the summary of findings i.e. results drawn on the basis of analyzed data. Further it gives suggestion for further research in Social network analysis along with detailed conclusion.

Bibliography
References


• Carolan, Brian V. (2008). The structure of educational research: The role of multimodality in promoting cohesion in an article interlock network. Social Networks, 30, 69–82.


