

CHAPTER-1

INTRODUCTION

1.1 Background of the Study

There is a great impact on the world of exploring the new trends of higher education and research. The role of the higher education system has become essential at the national and international level. Today we are living in a fast growing technical era. There are many Universities which are progressing day by day and getting connected to each other's to build global networks for knowledge and resource sharing.

The present study is focused on the research productivity of Heritage Universities from the period of 2014 to 2018. In the year of 2013, the Ministry of Human Resource Development (MHRD) decided to grant for a 'special heritage' status to universities that have been completed 100 years. The idea was to support excellence in education and identify the age-old educational institutes. The heritage status will be increased by a grant of up to Rs 60 crores, along with an annual grant.

In this study, the researcher identifies the year-wise research productivity of the selected Heritage Universities for the study and also identify the growth and development of research publications during the selected period.

1.2 Research

Research in simple terms refers to the search for knowledge. It is a scientific and systematic search for information on a particular topic or issue. It is also known as the art of scientific investigation. The word 'research' is derived from 'Latin' word.

Research means to search again and again. It is an art of scientific investigation. It is observed as a systematic effort to gain new knowledge.

Research plays an important role especially in developed and developing countries to achieve the height of success in every part of society. Research is known as the structured inquiry that uses scientific methodology to solve problems and create new knowledge. The research activities of universities are reflected through its publications and analysis of these publications helps in providing the research productivity of that particular universities (Siwach and Kumar, 2015).

According to S. R. Ranganathan “research to represent a critical and exhaustive investigation to discover new facts, to interpret them in the light of known ideas, theories, and laws, to revive the current laws and theories in the light of the newly discovered facts to apply the conclusion to practical purpose”.

In other words, Research plays a critical role in promoting the prosperity of a nation and the welfare of its citizens. Universities make important contributions to the growth and development of industries and government through research and promotes national and global development. Scientific research assessment is a complex process which can be simplified by measuring it indirectly using metric indicators based on the estimation of the output of researchers and institutions, which implicitly indicates productivity.

1.3 Productivity

Productivity is the indicator of the enactment of any activity and is an essential for any organization. Basically, it concern with the potential and the ability to generate, create and enhance.

1.4 Research Productivity

Research Productivity can be generate by the efforts of faculties, research staff, and research scholars and these efforts shows as research findings which is published in journals, conferences etc..

There are two components of research productivity such as:

(a) Knowledge creation (research), and (b) Knowledge distribution (productivity) (Gaston 1970). Research productivity is an outcome measurement of scholarly effort (Jacobs, Hartgraves & Beard 1986; Kurz et al. 1989)

1.5 Role of Research Productivity in Universities

Research Productivity plays an important role in the growth and development of universities research performance. It can be increased the productivity of faculty members and the researchers. The ranking of universities based on research productivity. The quality of research productivity of universities to be supporting current research and promoting research activities at national and international level it must be needed for the growth and development of higher educational Institutions, universities, etc.

Through the research, it must be evaluated the universities performance. It will very helpful for the learners to understand the universities or institutions positions at such levels.

1.6 Heritage

Heritage is the full range of our inherited traditions, monuments, objects, and culture. Most important, it is the range of contemporary activities, meanings, and behaviors that we draw from them. Heritage is the subject of active public reflection, debate, and discussion. What is worth saving? What can we, or should we, forget? What memories can we enjoy, regret, or learn from? Who owns "The Past" and who is entitled to speak for past generations? Active public discussion about material and intangible heritage--of individuals, groups, communities, and nations--is a valuable facet of public life in our multicultural world.

Heritage is a contemporary activity with far-reaching effects. It can be an element of far-sighted urban and regional planning. It can be the platform for political recognition, a medium for intercultural dialogue, a means of ethical reflection, and the potential basis for local economic development.

According to Oxford English Dictionary, 'heritage' means 'property that is or may be inherited; an inheritance', 'valued things such as historic buildings that have been passed down from previous generations', and 'relating to things of historic or cultural value that are worthy of preservation'.

1.7 Heritage Universities in India

Heritage University is a public, independent, recognized institutions of higher education which is offering the undergraduate and graduate education. Its mission is to provide master's degrees to whole populations that, for reasons of location, poverty, or cultural background, have been denied these opportunities in the past. Within its liberal arts curriculum, Heritage University offers strong professional and career-oriented programs designed to enrich the quality of life for students and their communities.

Heritage University seeks to provide leadership in supporting cultural pluralism within our own and other communities. Cultural pluralism creates a climate of respect and appreciation by fostering “learning about us” in an interdependent and connected world. Heritage University acts to make its curriculum, staffing, teaching, and other collegiate activities reflect this learning.

Heritage Universities are actually meant for those who know the relevancy of education, who are motivated and determined to see it through to the end and achieve their dreams. MHRD clearly defined the meaning of “Heritage Universities” in 2013 in India and had also suggested certain special grants to be given to such institutions, universities.

According to the Oxford English Dictionary, “heritage is something that can be passed from one generation to the next, something that can be conserved or inherited, and something that has historic or cultural value. Heritage might be understood to be a physical ‘object’: a piece of property, a building or a place that is able to be ‘owned’ and ‘passed on’ to someone else.”

1.8 Statement of the Problems

The researcher observed a number of studies carried out on 'research productivity' but did not find exact study related to '**Research Productivity of Heritage Universities in India**'. The problems involved in the present research can be represented through the following questions:

- ✓ What is the productivity level of the heritage universities during a period?
- ✓ What is the trend of research with regard to the sources, authorship pattern, gender-wise contribution etc?

The problem undertaken for the purpose is entitled “**Research Productivity of Heritage Universities in India: A Bibliometric study.**”

1.9 Significance of the Study

The present study is very useful for the researchers to understand the overall publications published in the selected heritage universities during a period. This study highlights the research productivity published in five years.

1.10 Objectives of the Study

The aim of the present study is to find out the research productivity of heritage universities from the year 2014-2018. The major objectives of the study are:

1. To know the contributions of Heritage Universities within stipulated period 2014 to 2018.
2. To identify the top Heritage Universities among them.
3. To examine the authorship pattern.

4. To know the authorship pattern of Single and More Than Three Authors.
5. To identify the document type contributions.
6. To find out access type.
7. To explore the top ten faculty members of the universities on the basis of their research productivity.
8. To investigate highly cited Titles among the Heritage Universities
9. To investigate highly cited Authors among the Heritage Universities
10. To investigate the gender-wise contributions of Heritage Universities.

1. 11 Scope of the Study

As it is not possible for the researcher to cover all the Heritage Universities in India, therefore, the researcher has been cover only seven State Heritage Universities out of fifteenth universities, research institutes etc., which are similar in nature. These are as follows:

- 1. Aliah University (Kolkata);**
- 2. Bangalore University;**
- 3. Panjab University;**
- 4. Presidency University (Kolkata);**
- 5. University of Calcutta;**
- 6. University of Mumbai;**
- 7. University of Madras.**

1.12 Limitations of the Study

The study has some limitations. This study covers only seven state heritage universities in India. This study makes a special attention on the contribution of research productivity of selected universities during a period from 2014 to 2018.

The data has been downloaded from the Web of Science database.

1.13 Methodology of the Study

The methodology used in this study is to evaluate the research productivity in specific disciplines. Five years of research activities from 2014 to 2018 have been selected for the study. The data has been downloaded from web of science database on dated: 29/03/2019. The researcher has identified the year wise contributions of authors, authorship pattern, single and multi-authored, etc. The data collected for the study has been organized in systematically calculated, tabulated form and graphs which is analyzed in Microsoft Excel, simple arithmetic and statistical methods for its results.

According to S. R. Ranganathan “research to represent a critical and exhaustive investigation to discover new facts, to interpret them in the light of known ideas, theories, and laws, to revive the current laws and theories in the light of the newly discovered facts to apply the conclusion to practical purpose”.

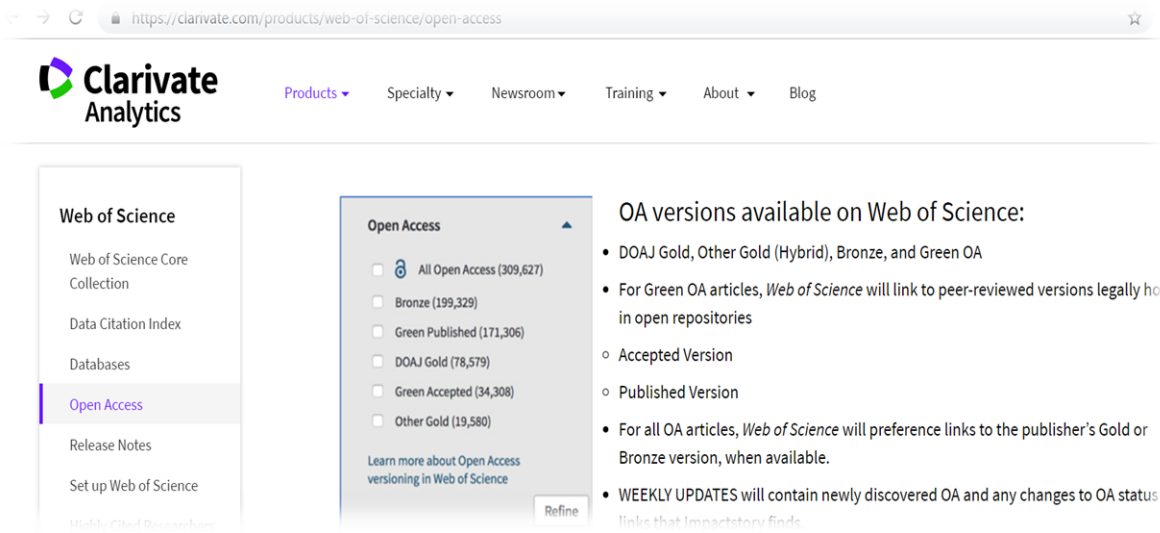
1.14 Web of Science Database

Web of Science is a multidisciplinary research platform which enables simultaneous cross-searching of a range of citation indexes and databases. It offers access to research tools like citation reports and cited reference searching, and also have personalized features such as saved searches and alerts. They have some searching features such as user can be search citation databases separately, also it have included General, advanced, Cited Reference, Phrase search, Standard Boolean operators, full citation searching system and so on.

1.14.1 Open Access on *Web of Science*

Open access status is provided across the Web of Science platform as a result of a partnership with Impact story, a not-for-profit organization that recently launched a knowledgebase of Open Access (OA) content.

Image 1.14.1.1 Open Access on *Web of Science*



Source: <https://clarivate.com/products/web-of-science/open-access>

1.14.2 Description of Access type

Access Types		Description
Gold	DOAJ	Articles published in journals listed on the Directory of Open Access Journals (DOAJ). To be listed on the DOAJ, all articles in these journals must have a license in accordance with the Budapest Open Access Initiative.
	Other	<i>Other Gold</i> open access articles are those identified as having a Creative Commons (CC) license by <u>Impactstory</u> 's Unpaywall Database but are not in journals listed on the DOAJ.

Bronze	The licensing for these articles is either unclear or identified by Impactstory's Unpaywall Database as non-CC license articles. These are free-to-read or Public Access articles located on a publisher's site.	
Green	Published	Final published versions of articles hosted on an institutional or subject-based repository (e.g. an article out of its embargo period posted to PubMed Central).
	Accepted	Accepted manuscripts hosted on a repository. Content is peer reviewed and final, but may not have been through the publisher's copyediting or typesetting.

1.14.3 Description of Document Type

Article: Reports of research on original works. Includes research papers, features, brief communications, case reports, technical notes, chronology, and full papers that were published in a journal and/or presented at a symposium or conference.

Abstract of Published Item: Bibliographic-only data on a published paper. Generally finds records dating back to 1974 or before.

Art Exhibit Review: Reviews of gallery or museum showings of artworks.

Bibliography: A list, often with descriptive or critical notes, of writings relating to a particular subject.

Biographical-Item: Articles focusing on the life of an individual, and articles that are tributes to or commemorations of an individual.

Book: A monograph or publication written on a specific topic.

Book Chapter: A monograph or publication written on a specific topic within a main division in a book.

Book Review: A critical appraisal of a book (often reflecting a reviewer's personal opinion or recommendation) that evaluates such aspects as organization and writing style, possible market appeal, and cultural, political, or literary significance.

Correction, Addition: Correction of errors found in articles that were previously published and which have been made known after that article was published. Includes additions, errata, and retractions.

Data Paper: The main purpose of a data paper is to provide facts about the data (metadata, such as data collection, access, features etc.)

Database Review: A critical appraisal of a database, often reflecting a reviewer's personal opinion or recommendation.

Editorial Material: An article that gives the opinions of a person, group, or organization. Includes editorials, interviews, commentary, and discussions between individual, post-paper discussions, round table symposia, and clinical conferences.

Letter: Contributions or correspondence from the readers to the journal editor concerning previously published material.

Meeting Abstract: A general summation of completed papers that were or will be presented at a symposium or conference.

Meeting Summary: A paper that covers multiple meeting abstracts in a variety of subjects.

News Item: News, current events, and recent developments.

Note: A paper that mentions or remarks on a published paper on a specific subject. Generally finds records dating back to 1996 or before.

Poetry: Compositions in verse; metrical writing.

Proceedings Paper: Published literature of conferences, symposia, seminars, colloquia, workshops, and conventions in a wide range of disciplines. Generally published in a book of conference proceedings.

Record Review: Reviews of recorded music or speech.

Reprint: An article that was previously published.

Retracted Publication: An article that has been withdrawn by an author, institution, editor, or a publisher because of errors or unsubstantiated data.

Retraction: A public notice that an article should be be withdrawn because of errors or unsubstantiated data.

Review: A renewed study of material previously studied. Includes review articles and surveys of previously published literature.

1.15 Organization of the Chapters

The present study has been organized into the following chapters.

Chapter 1: Introduction

In this chapter, following points have been included in this chapter such as background of the study, research productivity, heritage universities in India, objectives of the study, scope of the study, limitations of the study, methodology, and significance of the study.

Chapter 2: Review of Literature

The second chapter, related to Review of Literature which are previously published literature on Bibliometric studies, Research productivity carried out at international and national level were studied in detail with the reference.

Chapter 3: Bibliometric: An Overview

This chapter deals with the detailed overview and historical background of Bibliometric.

Chapter 4: Profile of Heritage Universities in India

This chapter presents the brief introduction of heritage universities in India.

Chapter 5: Data Analysis and Interpretation

This chapter deals with data analysis and interpretation.

Chapter 6: Findings and Conclusion

This chapter is ends with the findings of the study. It also offers conclusion which is based on findings of the study.

Bibliography

A detailed bibliography was presented related to study.

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Web of Science - Clarivate Retrieved on 5 May 2019 from https://images.webofknowledge.com/WOK48B3/help/WOS/hs_document_type.html

Web of Science - Clarivate Retrieved on 5 May 2019 from <https://clarivate.com/products/web-of-science/open-access>.

CHAPTER- 2

REVIEW OF LITERATURE

This chapter deals with the review of literature which is covering several aspects related to Bibliometric studies. It is an essential part of writing the topic. It has included the concepts of existing research studies.

In order to know about the existing review of the literature on the related study, the researcher has been chosen many different types of printed as well as online sources such as Google Scholar, Directory of open access journals, JSTOR, Institutional repositories, conference proceedings, etc. However, it is a critical analysis of the research studies related to a specific topic.

In this way, the researcher has also discussed several aspects related to research productivity, bibliometric study, scientometric study, etc.

Chauhan (2019) has conducted a study on Scholarly Output on Drone Research: A Bibliometric Study. 'Drones' – 'application key in surveillance and security' basically it is used in photography, disaster management, traffic tracking, logistics, etc., it also plays an important role in libraries to try to boost their book delivery service by keeping drone as a significant mode of delivery, mainly in the remote areas. In this study, they have collect publications related to drones research published from 1968 to 2017 and scopus citation index being used to covered publications. It was counts the research productivity of 50 years of publications at a global level. For this purpose, several bibliometric techniques were used and the results show that the growth rate of

publications 16% annually, minimum citation analysis 58.33% cited rate, authorship pattern and most productive countries, etc.

Tripathi et al (2019) analyzed a cross-sectional study of retraction notices of scholarly journals of science. In this study, the author discovered that bibliometric information 4716 documents were categorized as retractions in Science Citation Index. To understand trend form, and causes of retraction it was used Web of Science database to collected, downloaded and analyzed information. It results exposed that retractions had increased for the period, 2008-2017. In his study they have received 40 out of 4716 retraction notices had clearly stated that the reasons for retracting the published articles. This study will very helpful for library professionals and research scholars towards improved knowledge of the reasons behind retractions in a science discipline in the ten-year.

Chhatwal (2018) has studied to measure the world research output on e-resources and it identifies the bibliometric features of the research publications using the Scopus database for the study during a period 2006-2016. Also in this study researcher find the global literature output through e-resources.

Karak and Kower (2018) carried out a bibliometric study of the directory of open access journal: Special reference to the philosophy. The study explores the open access free e-journals that are accessible on DOAJ related to a particular field of Philosophy. Through the bibliometric methods, they have analyzed the distribution of studies such as language-wise, country-wise and review-wise distribution, the results found that the English have been the most popular language in open access journals. 126 OAJ

published in 33 different countries and as following 26 different languages at all over the world.

Mishra and Ramesh (2018) discussed a study of authorship pattern and degree of collaboration in business research during 1998-2017. The focused on the authorship pattern and collaboration in business research and they received 89259 publications and 180226 authorships during the period 1998-2017. It being used SCOPUS database for data as well as followed Bibliometric methods to acquire results.

Raju (2018) studied on Obsolescence of Literature in Library and Information Science Research. The purpose of the study to examined research productivity in LIS literature and based on 81 Ph.D. Theses and also focused on the obsolescence of literature by the period of cited 10,788 book and journals documents specify the convenient documents. The results show that the kinds of studies are very helpful and useful to accomplish the information resources and services in special libraries and information centers.

Sonkar et al (2018) has worked on Bibliometric Study of the Journal of Documentation from 2005 to 2015. The study examines the publication pattern of the articles published in 2005 to 2015, authorship patterns, geographical productivity, and Scholarly publications, lengthwise distribution of articles, subject-wise distribution of articles, ranking pattern and it also covers the growth of literature.

Singh and Jassal (2018) has carried out a Bibliometric analysis of the promotion of library automation and networking in the North-Eastern Region (PLANNER): A study. The researcher described the promotion of library automation and networking

in the North-Eastern Region (Planner) during the period of 2006 to 2016. It being followed bibliometrics techniques to finding institution contribution, author trends, average no. of citation, state wise contribution the pattern of keywords, etc. for data it was retrieved INFLIBNET website.

Weerasinghe (2018) discussed Current citation trends in LIS research output of Sri Lanka. the aims of the study to analyze the current citations trends in LIS research output during the period 2010 to 2017. The researcher received 61 articles in 1133 citations and analyzed determined items such as authorship pattern, highly preferred journals, chronological distribution of cited material, the format of citation, the degree of collaboration. The chronological distribution of cited material revealed that LIS researchers had mostly employed material published during the period of 2001 to 2010.

Aggarwal and Kaur (2017) analyzed the Quantitative measuring of research output of universities of Punjab in sciences based on Scopus database (period 1991-2014). Mainly this paper focused on the research output of universities of Punjab. The author analyzed data during the period 1991 to 2014 and it is retrieved data from the Scopus database. The researcher analyzed research activities to all universities at Punjab that has been taken in this research such as authorship pattern, citations, year wise distribution of papers, research publications, impact factor, h-index and also compared research progress of each university.

Narzary and Murugan (2017) studied on authorship pattern & collaboration in Etri journal it has been evaluated published publication in ETRI from the period 2010 to 2016 for this data collected from the web of science database and covered several

aspects document types, year wise distribution of publication, document types, authorship pattern, authors productivity etc., also including various methods such as doubling time, Relative growth rate, Average Authors per Paper, Degree of collaboration, Exponential Growth Rate.

Muthukrishnan and Senthilkumar (2017) worked on Author Productivity of Oncology Research Output in India: Testing Lotka's Law. In this article, they have analyzed author productivity of Oncology Research Output in India from the period, 2005 to 2015. Data was collected from the Web of Science database. They were analyzed received research items including author productivity, distribution patterns and testing through Lotka's law.

Shivakumaraswamy and Muthuraj (2017) discussed the Indian journal of traditional knowledge: A scientometric study (2002-2012). The study focused on the 'Indian Journals of Traditional Knowledge a scientometric study. It includes 938 articles during the period of 2002-2012. The researcher analyzed items of authorship pattern, month-wise distribution of articles, single, multiple author papers, country-wise distribution of articles; the state-wise contribution of articles, etc. The finding reveals that the maximum registered annual growth of 10 articles shows in 2002 and also 139 articles finds in 2012. The in 2010 maximum no of the highest number of articles (139, (14.81%)) were published and in 2003 having the lowest number of articles (10 (1.06%)). Moreover, 938 articles were published during the period and disseminated over 39 issues of the journals. Find an average of 24 articles were published per issue.

Shukla and Moyon (2017) carried out a study on Measuring Research Productivity of International Journal of Digital Library Services (IJODLS) by using Bibliometric Indicators. In this article, the researcher examines the research productivity of the journal IJODLS through bibliometric indicators.

Thavamani (2017) discussed the authorship patterns and collaborative research in the Journal the author explores several components of published articles in this journal Biofuels during the period of 2010 to 2016. Researcher covered 106 research articles and found 376 authors were studied the year wise total authorship patterns, year wise growth, etc.

Chaurasia et al (2016) worked on study a bibliometric analysis of world research output on cloud computing and found that the growth of cloud computing in modern years and also found some difficulties.

Hiremat et al (2016) analyzed India's science and technology output, 1989-2014: a scientometric analysis. In his study, the author points out the year-wise publication's growth in the field of S&T. The data was taken from the Web of Science database and researcher was received total citations 479429 and also found that the 1575365 World's output during the period. The results show that the highly productive countries 432093 publications, maximum 2 number of publications were published by the Bhabha Atomic Research Centre, Mumbai 4117 publications, 14,245 publications reveals the first ranked preferred journals, Current Science India, etc.

Neelamma and Anandhalli (2016) author has been analyzed the authorship pattern and research collaboration in the area of Crystallography during a period 1989-2013

and discussed kind of relevant terms such as authorship pattern, degree of collaboration, Multiple author papers etc., and follow Lotka's law for better results.

Kuri and Palled (2016) has analyzed the study on Bibliometrics study of the journal of Indian library association (ILA). In this paper, the researcher describes the ILA published articles and measured such items as authorship pattern, distribution of articles in chronological order, no of pages, degree of collaboration, institutions wise, etc.

Seshaiah and Rekha (2016) has carried out study websites of engineering colleges in Andhra Pradesh: a webometric study. Mainly this study analyzed the websites of engineering colleges with common webometric indicators. The results show that the 277 engineering colleges in Andhra Pradesh. The author identifies in this study to be count available link pages, web pages, analyzes their Simple Web Impact Factor, External Web Impact Factor, Self-Link Web Impact Factor, etc. Researcher covers the period from July 2014 to January 2015 for this it retrieved Google search engine, webmaster world, etc.

Aswathy and Gopikuttan (2015) carried out Bibliometric observation of publication output of university teachers: A study with special reference to physics. The purpose of the study to measure the publication output of university teachers. The published productivity is stated through no of papers published by a certain entity in a specified time. Mainly this study focused on the research productivity of universities faculty members. It covered 5 years during the period of 2005 to 2009 of the three general universities in Kerala. They followed a survey to collect data from the faculty

members of Physics Departments and also annual reports and the websites. To be analyzed year wise distribution, authorship pattern and so on.

Grace and Jeysankar (2015) has worked on Scientometric Analysis on Infertility Literature: An Indian Perspective. This study examines the research productivity in the field of infertility and to be analyzed author-wise, source wise, document-wise, and find collaboration pattern. The results reveal that the maximum growth rate has reduced slowly and similarly doubling time has increased and the data was retrieved from the Scopus database.

Biradar and Tadasad (2015) carried out Authorship Patterns and Collaborative Research in Economics. It found that the author has identified the authorship pattern and collaboration in the field of Economics.

Jeysankar (2015) has been analyzed Research Productivity of the scientists of Indira Gandhi Centre for Atomic Research (IGCAR) Kalpakkam (Chennai): A Scientometric Analysis. The paper explores that research publications trend between the scientists of Indira Gandhi Centre for Atomic Research from the period 1989 to 2013 and defined items such as publication years, language-wise, year wise publication, country-wise, institutions- wise, etc. The findings reveal that the maximum 96.26% of the researchers chosen the joint authorship for published their research papers. 0.84-0.99% it revealed that the IGCAR scientists under favored to publish their work in the Journal of Nuclear Materials and Transactions of the Indian Institute of Metals.

Verma et al (2015) analyzed the e-journal, of Library Philosophy and Practice from the period of 2005 to 2014. In this study the author discuss the authorship patterns and

growth of literature of the journals and geographical productivity in scholarly publications, subject wise distribution of articles, authors' degree of collaboration and ranking pattern, etc.

Verma et al (2015) revealed that the publication pattern of the articles published form the period 2008 to 2014. The study has also included the growth of literature, authorship patterns, and degree of collaboration etc.

Siwach and Kumar (2015) analyzed the research activities of Maharshi Dayanand University, from the period 2000-2013. It examined following terms in the study year-wise research productivity, citation impact, international and national collaborations, subject wise, most productive authors, highly cited papers, etc., for this is being used Scopus database for the collection of data.

Jeysankar and Vellaichamy (2014) has been conducted Bibliometric Analysis of Global Literature on Cervical Cancer. This article mainly examined the worldwide research productivity of Cervical Cancer research output from the period 2003 to 2012 and download data from the SCOPUS database.

El-Maamiry and Ghauri (2013) conducted a study on measuring information quality: concerns on the use of bibliometric studies. The author defined the measurement of information quality, critical elements and also defined bibliometric indicators, quantity, structural indicators, and quality indicators. Basically, this article based on theoretical information.

Okiki (2013) has been carried out a study on research productivity of Teaching Faculty Members in Nigerian Federal Universities the results show that the research

productivity of the faculty members of Nigerian federal universities and it were found the following research productivity in different type of sources such as conference papers, journal publications, technical reports, etc.

Kumar et al (2013) examined the research productivity of Scientists of Aryabhata Research Institute of Observational Sciences (Aries), Nainital and to be analyzed research performance of ARIES's Scientists. For the study data covered from the annual publication of ARIES scientists, from the period of 2004-2012.

Sudhier (2013) has been evaluated the research productivity of physicists at the Indian Institute of Science and the University of Kerala during the period 2004 to 2008.

Velmurugan (2013) has been discussed the bibliometric analysis of the Journal of Intellectual Property Rights during the period of 2007 to 2012 and also analyzed different items such as volume wise, authors productivity, issue-wise, authorship pattern, rank wise geographical distribution, page distribution, average citations and so on.

Prabu et al (2011) revealed that the study on “World Literature on Semantic Web Research: A Scientometric Study Based on Science Citation Index”. The article mainly focused on world Literature available in research. it shows that the quantitative growth and development of world literature on the semantic web also analyzed publication output through citation index during the period 1999 to 2010 in that period they were received 428 published papers by the scientist related to the semantic web including authorship pattern, productivity and so on.

Thanuskodi (2010) examined the study on Journal of Social Sciences: A Bibliometric Study. In this study, the author has considered the social science journals and it measured several items such as authorship pattern, year wise distribution of cited journals, etc.

Anyi et al (2009) revealed that the “Bibliometric studies on single journals: a review”. They have selected only a single journal of the study during the period 1998 to 2008. It has been covered total no. of 82 bibliometric studies into following fields such as Arts, Humanities, and Social Sciences and so on.

Wichian et. al. (2009) Studied on “Factors Affecting Research Productivity of Faculty Members in Government Universities: Lisrel and Neural Network Analyses”. The main purpose of the study to measures the affecting factors of Research Productivity of Faculty Members in Government Universities.

Sevukan and Sharma (2008) has analyzed “Bibliometric Analysis of Research Output of Biotechnology Faculties in Some Indian Central Universities”. The main purpose of the study to measure the faculties research performance of biotechnology in central universities of India during the period 1997 to 2006. For this study data was download from the different databases like PubMed, NCBI and ISI Web of Science and also following the bibliometric technique to analyzed data.

Costas and Bordons (2007) have carried out the study on “The h-index: Advantages, limitations and its relation with other bibliometric indicators at the micro level”. The main purpose of this study to analyze the relationship between the h-index and other bibliometric indicators at the micro level. They were found that the scientific

publications of scientists at the Spanish Research Council (CSIC) in the area of Natural Resources during the period of 1994 to 2004. The data received from the Web of Science database.

Junquera and Mitre (2007) examined the study on “Value of bibliometric analysis for research policy: A case study of Spanish research into innovation and technology management”. It is revealed that the value of bibliometric analysis for research policy and also focused on the role of the international literature in Spanish scientific invention in the research stream of modernization and technology management and to evaluate prestigious international journals in this research they were found 72 published articles at last decade.

Tower et al (2007) conducted a study on “A Multidisciplinary Study of Gender-based Research Productivity in the World's Best Journals”. Mainly this study focused on gender- wise research productivity and the result found that there is no largest difference between men and women research productivity.

Patra et al (2006) stated the study on “Bibliometric Study of Literature on Bibliometrics”. This study includes an analysis of core journals, growth pattern, authorship, and distribution in the field of LIS. It being used Bradford's law to identify core journals and also used Lotka's law to identify authors' productivity pattern.

Hirsch (2005) in his study, the author followed h-index to analyze the no. of research papers with the citation number. The h-index is useful to describe the systematic production of an investigator.

Glanzel et al (2004) the study revealed the role of author self-citations in scientific communication. The result of the self-citations consistencies contained by the method of documented scientific communication and thus laying the methodological basis for a potential thoughtful assessment at self-citation patterns in empirical studies at any level of the combination.

Bordons et al (2003) has analyzed research productivity at a different level from the period of 1994 to 1999. For this study data were downloaded from the Science Citation Index.

Ponzi (2002) worked on the study “intellectual structure and interdisciplinary breadth of Knowledge Management: A bibliometric study of its early stage of development”. The study focused on the intellectual structure and interdisciplinary scope of Knowledge Management in its early period of growth. An intellectual structure is established by the main element analysis that useful to an author co-citation frequency matrix. The author co-citation frequencies were imitative during the period of 1994 to 1998 academic literature and captured by the single examine expression of "Knowledge Management".

Jacobs (2001) has been analyzed the publication patterns of bibliometric study to cover academic and research scientists often universities of South Africa during a period of 1992 to 1996. In this study, the author was focused on the academic status of research productivity at different areas of science, etc. It adopted a scientometric analysis of science citation index and also using a questionnaire for better results.

Egghe (2000) has conducted a study on “New informetric aspects of the Internet: some reflections – many problems”. It found that some challenges that arise in the innovative world of internet related to informetric analysis and also analyzed the increasing problem of data gathering, Internet version of the informetric laws: are the same types of classical scatterings usable or not. In scientometric aspects: can have hyperlinks in web pages switch the role of classical references in scientific papers.

Gupta & Karisiddappa (1997) to analyze the distribution of scientific productivity of authors mainlyit’s covered the literature published during the period from 1870 to 1980.

Conclusion: In this way, the chapter review of literature identified several aspects related to the study during the period from 2019 to 1997. The review of literature is done with the help of research articles. It shows that there is a number of studies carried out on the Bibliometric study, research productivity, contributions of male and female authors, etc. In the next chapter, we discussed about the brief introduction of Bibliometrics.

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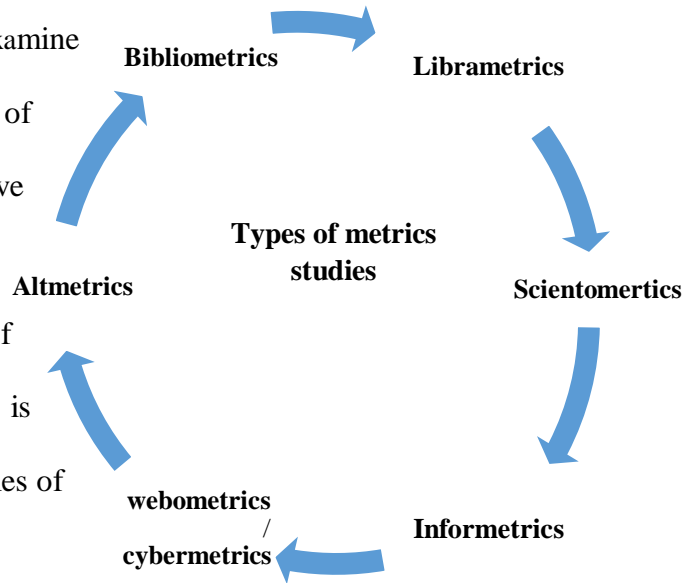
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CHAPTER-3

BIBLIOMETRICS: AN OVERVIEW

3.1 Introduction

Bibliometrics is a set of methods which is used to measure texts and information. Basically, bibliometrics study is based on quantitative descriptive methods such as mathematical and statistical analysis to examine written documents. With the help of quantitative analysis, we can improve recorded information, scientific documentation, communication activities of the library collection and their services. It is one of the best techniques to evaluate studies of scientific work.



Bibliometrics is a type of research method which is used in Library and Information Science. It is a quantitative study of several aspects of the literature which is published in various form in particular area and also it is used to identify the year-wise publication, authorship pattern, and secondary journal coverage with the objective of getting an insight into the dynamics of growth of knowledge in the areas under consideration.

The study of Bibliometric contains the growth of the literature in a particular subject. Researchers can easily identify how much literature has been contributed by the various institutions, universities, organizations in the research area.

“The term Bibliometrics and other different types of metrics are in existence since the eighteenth century and have been applied in many forms for a century or more.”
(Pritchard And Wittig 1981)

3.1.1 Historical Development

The ancient inquiry states that by the **F.J. Cole** and **Nellie B. Eates** presented the first recorded study on “bibliometrics” in science progression the year of **1917**.

E. W. Hulme was the first to use expression “**statistical bibliography**” in **1923**.

It is measured as second reported work on bibliometrics where **Hulme** analyzed the journal articles in “*English International Catalogue of Scientific Literature*” and imitated the ranking of countries by their productivity.

The first recorded study of citation data was brought out in **1927**. In **1948**, **S.R. Ranganathan** coined the term “**Librametry**” in **ASLIB conference**. But lastly One of the pioneers was **Alan Pritchard**, he suggested the word “**bibliometrics**” in **1969** in his article “*Statistical Bibliography or Bibliometrics*” published in the “*Journal of Documentation*”.

In the **1970s**, introduced The Russian concept “Scientometrics” and FIDs “Informetrics” were also applied almost for the same concept bibliometrics. Vassily V Nalimov and Z M Mulchenko coined the term in Russian as ‘Scientometrics’ (Naukometriya) which is used to describe the study of science, its growth, structure, interrelationships, and productivity in 1969. It gained wide gratitude by the publication of the journal ‘Scientometrics’ by Tibor Braun in Hungary in 1978. Much

of the scientometric studies are indistinguishable from bibliometrics and many bibliometric types of research are published in the journal 'Scientometrics'.

Nacke presented the term '**Informetrics**' which is closely related to scientometrics and bibliometrics in **1979**. The All-Union Institute of Scientific and Technical Information (VINITI) established a Federation Internationale de la Documentation (FID) committee on Informetrics under the chairmanship of Nacke's. In the year of 1948, informetrics was taken as a generic term for bibliometrics and scientometrics. Brooks suggested 'informetrics' in 1988, at the first International Conference on Bibliometrics and theoretical aspects of information retrieval. In 1995, Bossy introduced the term 'Netometrics' to describe scientific interaction with media. Almind and Ingwerson suggested 'Webometrics' for the study of the World Wide Web and all network-based communications in 1997.

3.1.2 Definitions and meaning

In the field of LIS, this study is gradually gaining relevance and has become very famous with the expansion of several citation databases.

The term "Bibliometric" is coined by two words i.e. **Biblio & Metrics**. *Biblio* is the combination of **Greek and Latin** word which means '**Books**' & *Metrics* indicates '**scale or Measure**'. Bibliometrics means the application of mathematical and statistical methods of books, data, and information. This is also called quantitative analysis.

Potter (1981) defined bibliometrics as "the study and measurement of all forms of written communication, their authors and publication patterns."

3.1.3 Elements of Bibliometric Study

Elements of bibliometric study are as follows:

1. Data Sources of bibliometric research – The analysis of bibliometric study can be conducted on the basis of any suitably large publication list compiled and issued for instance by a scientific institution.

- Science Citation Index (SCI)
- Social Science Citation Index (SSCI)

These are the Institution for Scientific Information (ISI), the most common source of data. Some databases are available in printed form but later on converted into electronic-form like magnetic tape, CD-ROM, On-line, etc.

Some other specialized databases are MEDLINE; Chemical Abstract; INSPEC; Mathematical Reviews.

2. Minimum Bibliographic Description for Proper Identification-

The purpose of the minimum description of bibliographic items plays an essential part in bibliometrics research.

The relevant information to be collected from bibliographical databases is as follows:

- i. Sources identification (Journal Title, Publication Year, Volume Page);
- ii. Names of Authors;

- iii. Corporate address;
- iv. References;
- v. Document type;
- vi. Title, Keywords, abstract, subject headings.

3.1.4 Software for Bibliometric Studies:

In this advance era, the information technology computerized data has promoted to development of bibliometric software among the researchers. Here we will discuss in details about the four types of software. Out of Four Softwares, two are freeware and the last two packages are commercial products.

i. The Bibliometrics Toolbox: It was first bibliometrics programme package developed at Terrence. A. Brooks was the person to assist bibliometrician in making statistic from their downloaded data. It contains a set of computer programs written in Turbo Pascal that measure the bibliometrics aspects of literature such as Bradford law and derivation of core journals, productivity ranks, the degree of clustering, and directories of concentration. Bibliometrics Toolbox has been reviewed by McLain (1990) and is freeware available.

ii. Dataview bibliometrics software: It is commercial software and developed by the Centre de Recherche Retrospective de Marseille (CRRM), at the Faculte Saint Jerome in Marseille (France). The Software doesn't provide a new bibliometrics method rather it provides a bridge between information sources and the various data analysis methods. Dataview is designed as a software tool for experts of scientific and

technological information processing. It provides the main necessary issues and formats used for bibliometric analysis.

iii. Bibexcel: It is a toolbox developed by the Olle Persson, Inforsk, Umea Univ. (Sweden).

iv. BibTechMon: This software has features to build a literature database as well as designing knowledge maps. It is a commercial creation developed at the Austrian Research Centres Seibesdorf (Austria).

3.1.5 Tools of Bibliometric

Some major tools of bibliometrics are available in an online form to measure the scholarly publication on different patterns. These are: Web of Science ,Journal Citation Reports, Highly Cited Research, Academic Ranking of World Universities, Google Scholar, Scholar H index calculator, Zotero Scholar Citations, SCImago Analysis of journal, SNIP and SJR, Eigenfactor Eigen, Publish or Perish, Researcher ID, ORCID, Science of Science (Sci2) Tool, Altmetrics, H-index, Field-weighted citation impact (only available in SciVal), Outputs in top percentiles (only available in SciVal, Scopus SNIP (only available in Scopus).

In this way, bibliometrics tools are available for measuring the research activities in the online form and a huge amount of data can be collected and analyzed by these tools but sometimes it is not easy to do. Mainly these tools are used by bibliometricians.

3.1.6 Scope of Bibliometrics

Nicholas & Ritche (1978) provided the scope of bibliometrics more clearly. They divided bibliometrics studies into two broad groups.

First, is describing the characteristics features of a body of literature (descriptive study). It is also known as productive counts and have following fields of study like bodies i.e. authors or associations responsible for the production and transmission of information, form of transmission (i.e. journals, monographs, etc.), medium of communication, nature of information conveyed, timing and frequency with which information is conveyed, amount of information conveyed by various individuals, groups, organizations, countries, etc.

Second is examining the relationship formed between components of literature (Behavioural studies)- This is another type of study, referred to as “citation studies”, related to which authors are most cited in articles, journals which type of documents used for citation, etc.

In the same way, Potter (1988) distributed bibliometrics studies into two categories.

First is descriptive, which attempts to study the body of literature by counting its contributing countries, authors, journals, year of publications, and disciplines.

The second category is more evaluative which attempts to study the use of a body of literature by using citation analysis.

Another important study under bibliometrics is assessing the productivity of authors and the impact of research on the existing field of study. This type study is referred to as “Evaluative Bibliometrics”.

3.1.7 Models of Bibliometric

The models of bibliometrics are discussed below:

- i. Growth and aging of information: This model says that literature and information grow exponentially but growth in a single field of research can be near or logistic. In information science and bibliometrics, changing frequency of citations given or received over time is assumed to reflect the aging of scientific literature (Glanzel, 2003). Growth and obsolescence of literature work inversely or is an inverse function. As the literature grows in a field, the faster it ages and the literature becomes obsolete.
- ii. Goffman and Neville have introduced the theory of intellectual epidemics as a model of scientific communication in 1964. This model defines itself as the population of readers and researchers can be distributed into three group – infected, resistant and infection sensitive person in any period of time.
- iii. The principle of cumulative advantage: It expresses the characteristics of systematic communication.

3.1.8 Bibliometrics Indicators:

There are few authors who said about the indicators of bibliometrics mainly it is based on bibliographic parameters or bibliographic features. These indicators are related to publication indicators, literature indicators, science indicators, etc.

Ley desdorff cleared bibliometric indicator as anything that might count about the text.

Diodato defined that they are the measures providing information about the nature of a subject.

Following indicators are as given below:

i. Direct bibliometric indicators: It is used in the bibliographic data that are available in a direct form of documents. These are a number of authors per paper or the collaborators, the number of pages and lines in a paper or a document, proportion of the text matter and the supporting matters and the illustrative matters. In the illustrative matter that considered in the tables, graphs, charts form, etc., a number of references or the reference size, distribution of references.

In this way, all these quantitative data as are directly accessible from the document.

ii. Derived Indicators: These indicators cannot be directly count the documents but it can count after using some features and items that contained in the documents. These consist- Citation counts, word frequency counts in the documents, mostly indicators based on the ranking procedure of, authors, countries, journals, etc. It is also based on productivity counts, reference count, citation counts, etc.

iii. Assigned indicators: It is based on bibliographic features or valuation of thought contents of so-called qualities of the documents or bibliographic items. These are based on peer judgment, use of documents, analysis of scattering, classification of the subject documents.

iv. Non-bibliometric indicators: Basically non-bibliometrics indicators are based on data which is unable to access and it can't be derived from the document description. They do not have assigned characteristic based on some features or aspects of the documents like library documents, records of documents delivery from a documentation center, number of published journals so on.

3.1.9 Laws of Bibliometrics Study

There are three types of bibliometrics law such as:

- i. *Lotka's Law of Scientific Productivity (1926, A. J. Lotka);*
- ii. *Bradford's Law of Scatter (1934, Samuel Clement Bradford);*
- iii. *Zipf's Law of Word Occurrence (1947, George K. Zipf).*

3.1.10 Advantages of Bibliometrics

This study is very beneficial to measure scientific production and standard research performance at multiple levels. The advantages of bibliometrics study are as follows:

It is very helps fully to measures the international impact of research and allows identifying leading organizations, assessing the impact of research funding on the scientific output of researchers and graduate students. It also identifies map collaboration networks and mutually beneficial collaboration opportunities. It provides other evidence in support of organizational decision-making and outcome assessment, peer review processes, organizational strategic review and provides decision makers current status to the particular discipline to which the study is being conducted.

3.2 Librametry

The term Librametrics has divided into two words - *Libra* and *Metrics*. The word *Libra* means ‘**library**’ and ‘**metrics**’ means ‘**measurement**’. In **1948**, the term librametry was introduced by **Dr. S. R. Ranganathan** in the **Aslib’s Annual Conference** held in Leamington Spa.

Librametry deals with the study that uses statistical calculations for the library operations. This term is not related to such terms like bibliometrics, scientometrics or informetrics. On the other hand, in 2001, Wilson specified that the value of the term ‘Librametrics’ and ‘Librametry’ for such studies not specifically analyzing literature but it includes analyses of book circulation, library collection, library acquisition, etc.

3.3 Scientometrics

Scientometrics devised as a Russian term. It measures the excellence of science. While bibliometrics used for measurement of the scientific publication as well as it includes various quantitative areas of the communication science, the science of science, science policy. This term came into prominence with the establishment of the journal named ‘Scientometrics’. Scientometrics is now measured as a part of the sociology of science and useful to science policy.

3.4 Informetrics

Basically, this study measures and analyze the several aspects of information and documents and also it covers all the quantitative aspects of information in any form. It includes the fields of studies which are related to quantitative aspects of science. It is the combination of information technology and complex intersections of

information theory, cybermetrics, decision theory, etc. Although bibliometric and scientometrics refers to all the quantitative aspects, printed media and sciences, as well as informetrics, are not limited to media or scientific communication. It's only restricted to scientific research.

3.5 Webometrics

In this advance era, an increased consequence of e-communication, internet, digital libraries, and other technologies have extended and replaced media from manual to print. Through the internet, anyone can access and search for information. As per increasing use of the web as a global book or a distributed collection of books, it is necessary for the study of the communicational form of this emerging new technology.

In **1977**, a new scientific study called webometrics or cybermetrics it was introduced which evaluate e-journals on the web and on the application of information techniques to cyberspace communication. Webometrics connect highly linked web to quantitative studies of e-communication. The web impact factor is an important concept of webometrics. Ingwersen was first to introduce this term. According to Ingwersen, "it is the sum of the number of citations to that entity that is divided by the no of pages set up in that unit at a specified point of time."

On the other hand, web impact factor is count as the sum of the series of web pages pointing to a given country or websites distributed by the digit of sheets found in that country or website at a given point of time.

3.6 Citation Analysis

Citation represents the full bibliographical description for a paper which an author has used while writing his research paper.

Sandison (1989) stated that “citation is not just a set of bibliographic data at the end of a paper as endnotes, footnotes, etc., or extracted from a citation index.”

Shaw (1979) defined that “citation establishes a relation among authors who is a measure of the extent to which they communicate indirectly through the literature.”

There are few authors said about the citation can be considered as a kind of language system with greater flexibility than an ordinary language.

According to Fulton (1945), and Pastell (1945), bibliographic citation assists two basic functions:

- i. Identify the source of a given statement, and
- ii. Describe the nature and scope of the printed document in which the statement is found.

The citation analysis rapidly uses in the growth of a number of studies. It has developed various techniques and measures, the exploitation of new tools and the study of a different unit of analysis. These are citation counts, bibliographic coupling and co-citation analysis and the most common and simple technique in citation analysis is a citation count method.

The main areas of this type of study are authorship study, types of document used, the language of the cited documents, a ranking of journals and books, self-citation study, dispersion of subjects and obsolescence & citation half-life studies.

3.6.1 Application of Citation Analysis

There are two broad areas of applications of citation analysis.

First is to find out the several features of literature to be used in citations by the librarians such as authorship pattern, age, documents, distributions of subjects, highly cited authors, the origin of country, etc.

Second, is useful to originate the research productivity in the field of study.

Conclusion: In this chapter the researcher, introduced the concept of bibliometrics study also including its history, meaning definitions as well as some other relevant aspects. In the next chapter, the researchers going to discuss a brief introduction of area of study.

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CHAPTER- 4

PROFILE OF HERITAGE UNIVERSITIES IN INDIA

This chapter presents a brief profile of seven state Heritage Universities in India which is selected for the present study.

There are number of heritage universities, colleges, institutes in India for higher education. Among all state government universities, seven universities have been selected for the study. Among them four are Deemed Universities, four are specialized research institute.

4.1 Profile of State Heritage Universities

4.1.1 Aliah University

Image: 4.1 Aliah University



Source: <https://www.aliah.ac.in/>

Earlier was known as Mohammedan College of Calcutta presently is known as Calcutta Madrasah, this educational and cultural institution has 229-years old received

independent university status in 2008 for inspiring the education of the Muslim community.

Primarily established for the study of Arabic, Persian languages and Muslim Law, today the varsity offers multiple UG and PG programs such as MBA, MCA, MTech, MA, MSc, and Ph.D. in wide domains including Science, Arts, and Engineering.

Aliah University is a State University under the Department of Minority Affairs and Madrasah Education, Government of West Bengal, it came into being through the Aliah University Act (Act 27 of 2007) passed by the West Bengal Legislative Assembly.

Following are the main objectives of Aliah University Act, 2007 which are as follows:

- To create educational prospects for higher education and studies;
- To promote the study of modern, technological and professional courses along with classical languages, oriental studies, religious studies, and Islamic culture;
- To promote higher education amongst the Minorities in the State;
- To disseminate and advance knowledge by providing instructional, educational, research and extension facilities in such branches of learning as it may deem fit;
- To provide students and teachers, the conducive atmosphere and necessary facilities for the promotion of –
 - ❖ innovations in education leading to the restructuring of courses, new methods of teaching and learning and integral development of personality,
 - ❖ studies in various disciplines,
 - ❖ inter-disciplinary studies;

- To develop centers of excellence for higher studies and research in theology, Islamic jurisprudence and Islamic culture, comparative religion, science and technology, professional and management education in the State by joint initiative i. e. State-Private partnership, if required;
- National integration, secularism, international understanding, non-violence, and humanism;
- To avail of better scope and opportunities to serve the societies and the Nation.

The motto of this University

The main motto of this University is “Advancement of Education and Culture” in Arabic, “Taqdeem-ut-Ta’leem wa-as Saqafah.”

4.1.2 Bangalore University

Image 4.2 Bangalore University



Source: <http://eng.bangaloreuniversity.ac.in/>

Bangalore University is a public state university which was established in 1886 and is one of the oldest universities in India. The Bangalore University is a part of "The

Association of Indian Universities (AIU)" and has got UGC recognition. The university operates from the Jnana Bharathi Campus in Bangalore.

In 1886, the university was started as the Central College, Bangalore by the British Government to award University degrees. On 10th July 1964, it was renamed as Bangalore University by the UGC under the then State Government of Mysore. The Central College, Bangalore and the University Visvesvaraya College of Engineering were merged into this university.

In 1964 UGC change the named central college to Bangalore University, Central College, Bangalore was established by the British Government. In 1912, the Central College, Bangalore and University Visvesvaraya College of Engineering were merged to Bangalore University.

The founder of Bangalore University for setting up further Universities such as National Institute of Mental Health and Neurosciences, Visvesvaraya Technological University and Rajiv Gandhi University of Health Sciences.

Bangalore University was established in July 1964 and is located in the Garden City of Bangalore. In the beginning, the two first colleges of this city, the University Visvesvaraya College of Engineering (UVCE) and the Central College (CC) and formed the core of Bangalore University.

After the establishment of Bangalore University, in the year 1965-66, the university introduced Honours Courses to reform of courses information. Honour's courses in 3 years like English, Economics, Mathematics, Chemistry, Zoology, Botany, Geology, Kannada and so on, which offered at the PG Departments. In the year 1948, the

University started Law College, and in 1959 the University started The Physical Education College which is located in the JB Campus.

Bangalore University has also recognized, Dr. B.R. Ambedkar Study and Research Centre, Gandhi Bhavan and Centre for Study on Social Exclusion and Inclusive Policy. The University has completed Fifty-two years of successful existence and has appeared to be hailed as one of the largest universities of Asia. In 2002, The University was first certified by NAAC with Five Star Status and also re-certified in the years 2008 and Nov 2016 in 2nd and 3rd Cycles with 'A' Grade. It is an international agency ranked Bangalore University at 151st position amongst BRICS nations-2016 (QS University Ranking).

The University is prepared into six faculties such as Science, Arts, Commerce & Management, Education, Engineering and Law. It has 48 Post Graduate Departments, 1 postgraduate Centre at Kolar, four University colleges, 684 affiliated colleges and numerous other Centres and Directorates of higher learning and research Centres. In the present time, the University recommends 50 Post Graduate Courses, Certificate Courses, and Employment Oriented Diploma Courses. The University has also started the Five years Integrated Courses in Biological Sciences.

Bangalore University has established by MOUs attained highlighted with the Universities and Institutions of national and international status. To provide a student population of over 3 lakhs, the University is determined to provide access, development, and distinction in higher education. The idea of this University is to make unique and important contributions to the source of higher education in Social Science, Humanities, Commerce, Law, Science & Technology. The University is

providing quality teaching, encouragement and goals appropriately symbolized by its emblem 'JNANAM VIGNANA SAHITHAM' to research in limited areas with social consequences that would replicate its mission.

4.1.3 Panjab University

Image 4.3 Panjab University



Source: <http://puchd.ac.in/>

Panjab University was established in 1882 at Lahore one of the oldest universities in India. It has a long tradition of pursuing excellence in teaching and research in science and technology, humanities, social sciences, performing arts and sports. The glorious traditions of the University established during the period of more than 133 years of its long service to the nation since its inception are a source of inspiration for the present generation of faculty members and students. By virtue of its history, experience, achievements, and philosophy, the Panjab University has a national character and it

enjoys an international stature drawing both faculty and students from all over the country and different parts of the globe.

One of the oldest Universities in India, the Panjab University (PU) initiated at Lahore in 1882, has a long tradition of pursuing excellence in teaching and research in science and technology, humanities, social sciences, performing arts and sports. The University supports excellence and innovation in academic programmes, promotes excellence in research, scholarship, and teaching. The University is committed to attract and support the best students and faculty, who excel at teaching and research. In independent India, Panjab University with its Campus at Chandigarh and nearly two hundred colleges in Punjab state and Chandigarh U.T., has served various societal needs with distinction.

The glorious traditions of the University established during the period of more than 133 years of its long service to the nation since its inception are a source of inspiration for the present generation of faculty members and students. By virtue of its history, experience, achievements, and philosophy, the Panjab University has a national character and it enjoys an international stature drawing both faculty and students from all over the country and different parts of the globe. Its faculty includes some of the most distinguished scientists and academicians. It continues to attract celebrated scholars at the campus. Over the years, the reputation of Panjab University has grown to emerge as an institution at the pinnacle in innovative teaching, research, and community outreach.

In Chandigarh, the newly built capital of Punjab, a beautiful red sandstone campus was designed for the Panjab University by Pierre Jeanneret under the general guidance

of Le Corbusier. Panjab University moved here during 1958-1960. Till the re-organization of Punjab in 1966, the University had its regional centers at Rohtak, Shimla and Jalandhar and its affiliated colleges were located in the States of Punjab, Haryana and Himachal Pradesh and the Union Territory of Chandigarh. With the re-organization of Punjab, the University became an Inter-State Body Corporate catering to the newly organized States of Haryana, Himachal Pradesh and Punjab and the Union Territory of Chandigarh. Gradually, the colleges of Himachal and Haryana were affiliated to the Universities in the respective states and the Panjab University was left with the affiliated colleges in the Union Territory of Chandigarh and some parts of Punjab. The Panjab University Campus at Chandigarh accommodates seventy-three teaching and research departments/institutes/centers besides four independent Chairs for research. Furthermore, the university has 189 affiliated/constituent colleges spread over Punjab and Chandigarh besides Regional Centres at Muktsar, Ludhiana, Hoshiarpur, and Kauni. In addition, there is the Vishveshvaranand Vishwa Bandhu Institute of Sanskrit and Indological Studies at Hoshiarpur.

The Campus of Panjab University is located in Chandigarh, Sector 14 and Sector 25, its area covers about 550 acres. To make it self-contained, infrastructural facilities like its own Health Centre, Shopping Centre, Bank, Post office, Gymnasium, Sports Grounds, Swimming Pool, Botanical Gardens, well maintained parks, Open Air Theatre, Guest Houses, Faculty House, Seminar Complexes, Alumni House, Community Centre and a school, have been afforded. Moreover, these amenities, the University have 9 hostels for girls, 8 hostels for boys.

Departments and Centres

The academic institutes on the campus and four Regional Centres are grouped under the Faculties of Arts, Science, Languages, Law, Education, and Fine Arts, Business Management and Commerce, Engineering and Technology, Medical Sciences, Pharmaceutical Sciences, and Dairying, Animal Husbandry and Agriculture. Most of the departments have their own specialized libraries, and the working period runs for at least 180 days in a year.

Centers of Excellence

The Department of Special Assistance, Departmental Research Support, Funds for Improvement of Science and Technology, Centre for Advanced Study. The Departments enclosed under different UGC and DST Programmes are as follows:

- i. Centre for Advanced Study (CAS) Departments of Anthropology, Chemistry, Geography, Geology, Mathematics, Physics, Political Science, Sociology, University Institute of Pharmaceutical Science and Zoology
- ii. Departmental Research Support (DRS) Departments of Biotechnology, Botany, Economics, English and Cultural Studies, University Business School, SSB University Institute of Chemical Engineering & Technology and the University Institute.
- iii. Department of Special Assistance (DSA) Department of Biochemistry, Statistics, Biophysic.
- iv. Funds for Improvement of Science & Technology (FIST) Departments of Anthropology, Biophysics, Biotechnology, Chemistry, Physics

Research Initiatives

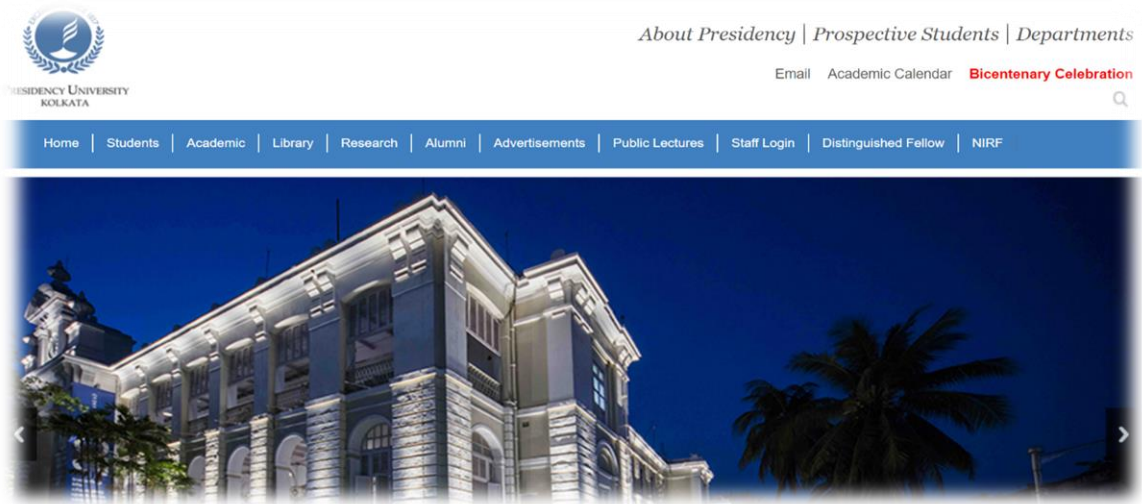
The University is participating in different important International High Energy Research Programmes at Fermilab (USA), KEK (Japan) and CERN (Switzerland). At present, the University is involved in a big way in CMS and ALICE Experiments at CERN (European Organization for Nuclear Research) Switzerland and Neutrino Programme at Fermilab, USA.

International and National Collaborations:

The University recently signed MoUs with University of Nottingham (UK), University of Birmingham (UK), Nottingham Trent University (UK) and University of Western Sydney (Australia). International Centre for Agricultural Research in Dry Areas (ICARDA), Morocco; World Vegetable Research Centre, Taiwan through its South Asia Centre at Hyderabad and Baylor Medical center, Dallas, U.S.A. The University has different important national collaborations with a number of national institutes like Indian Agricultural Research Institute, Delhi; GB Pant University of Agriculture and Technology, Pantnagar; Himalayan Forest Research Institute, Shimla; IIT, Roorkee; PGIMER, Chandigarh; Nuclear Science, Delhi; IMTECH; CSIO, Chandigarh; Institute of Nuclear Medicine and Allied Sciences (INMAS), New Delhi; Jamia Hamdard University, Delhi; Atomic Energy Regulatory Board of India, Mumbai etc.

4.1.4 Presidency University

Image 4.4 Presidency University



Source: <https://www.presiuniv.ac.in/web/>

Presidency University was one of the first institutes of Western type of higher education in Asia. It has a distinctive place in history. In 1817, a group of progressive Indians and westerners set up the Hindoo College. In 1855 over the British Government as the College of the Bengal Presidency, and was newly founded by the Calcutta University in 1857.

In July 2010, the official establishment of Presidency University permits it to modernize its admired traditions and continuing powers into an important institution of the prospects.

History of Presidency University

In 1817 the “Hindoo College” was established, and in 1855 was renamed as the ‘Presidency College of Bengal’ it became a government institution. Hindoo College was the initial institution of higher learning in the current intelligence in Asia. The anniversary Volume

(1955) notes: ‘The most striking feature of the Hindu College was its determined effort to impart secular education.’

4.1.5 University of Calcutta

Image 4.5 University of Calcutta



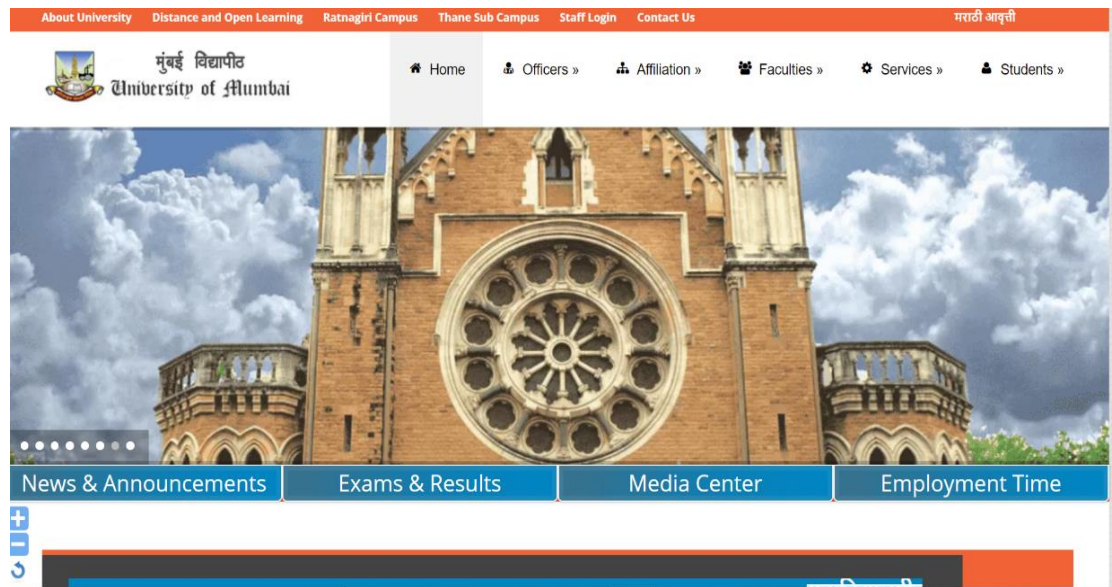
Source: <https://www.caluniv.ac.in/>

In July 1854 the Court of Directors of the East India Company sent to the Governor-General of India in Council, suggesting the organization of the Universities of Calcutta, Madras, and Bombay. In January 24, 1857, the University of Calcutta was established.

The University accepted in the first occurrence, the model of the University of London and gradually introduced modifications in its establishment.

4.1.6 University of Mumbai

Image 4. 6 University of Mumbai



Source: <http://mu.ac.in/portal/>

The University of Mumbai was earlier known as “University of Bombay” and was established in 1857 as an old premier university of India around 156 years for ensuing upon "Wood's Education Dispatch". On September 4, 1996, published Government Gazette, the university changes its name by the Government of Maharashtra issued notification from University of Bombay to University of Mumbai

University was concurrences 'A' grade status by the NAAC in April 2012. The shape of this University fixed out in 161 years of its execution confirms to its multiple accomplishments as the academic and moral inspiration of the people.

Now a day, it has 354 affiliated colleges, 36 Departments, 2 Campuses and 2 Post Graduate Centres. The university has run in different professional courses with its name in industrial collaborations. The areas of the 2 University Campuses are 243 acres at Vidya Nagri and 14 acres at Fort, Sub- Centres are 20 acres at Ratnagiri, 6.50 acres at Thane and 6.26 acres at Kalyan with 60 University Institutes and Departments and 749 affiliated colleges.

In the last 5 years, it has observed a 104% students increased in UG level, 112% students increased in PG level and 147% students increased in Distance Education. There is a 156% of research papers published in International journals. It has excelled in sports, cultural and outreach activities at the national level. 12 Departments are recognized under different national programmes, such as SAP, DSA, CAS, DRS, COSIST, and FIST. For academic activities, each year regarding 20 teachers visiting from abroad.

4.1.7 University of Madras

Image 4.7 University of Madras



Source: <http://www.unom.ac.in/>

In November 11, 1939, Public appealed to started the founding of Madras University. In January 1840 the University Board was comprised with Mr. George Norton as its President. After 14 years in 1854, the Government of India prepared an organized educational policy for India, by an Act of Legislative Council of India, the University was established on September 5, 1857. In the form of London University, the University was organized. Among the old universities of South India, Madras University is the mother of all. In the modern years, the university area of authority has been restricted to 3 districts of Tamil Nadu.

The Organisational structure of Madras University includes which are as follows:

- The Senate
- The Syndicate
- The Academic Council
- The Faculties
- The Finance Committee
- The Boards of Studies

The Chancellor of Madras University is the Governor of Tamil Nadu. The Principal Executive Officer is appointed for the Vice-Chancellor of the University. All the examinations of the University are managed by the Office of the Controller of Examinations (COE). The university teaches Post Graduate and also Under Graduate Education through the affiliated organizations which extend over the districts of Thiruvallur, Kancheepuram, and Chennai. The academic theme of the University is from research, teaching activities in Science, Arts, Management, Technology, and

Humanities. In 4 campuses, the university recommends research and teaching programmes. A large number of organizations associated with Madras University focus on research activities offering Ph.D. Programmes in their particular field of interest. The 68 University Departments of study and research are spread over 4 campuses organized into 18 Schools each of which suggests Post Graduate Courses in particular interest, Certificate, and Diploma courses, and part-time and full-time Ph.D. Programmes, etc.

Madras University also suggests the Post Graduate and Under Graduate Programmes through the association of Distance Education. These Institutes are popularly called as IDE of Madras University. Following are the courses suggest by IDE of Madras University which is as follows:

- M.A. Christian Studies
- M.A. Vaishnavism
- B. Music
- M. Music

The University has been qualified by the National Assessment and Accreditation Council (NAAC) with an A rating star. In the country, the UGC has accepted the University as one of the centers for "Potential for Excellence".

Conclusion

In the preceding pages, the researchers have tried their best to go thoroughly with the information given in the website and in this chapter they have covered up all the possible details. In the next chapter, we are going to discuss about the analysis of data and interpretation.

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CHAPTER: 5

DATA ANALYSIS AND INTERPRETATION

The Analysis of data is the last but one of the most important step in research work. It is linked with raw data and its major outcomes leading with ends. This process is result oriented and analysis of data is also based on set objectives of the study. After the collection of data with the help of some appropriate tools and techniques, the next consistent step to be following for the analysis and interpretation of data and also received at realistic solution to the problem.

In this chapter, the researcher discuss about data analysis and interpretation which is collected from web of science database.

The results and discussions concern with research output, the year wise contributions, authorship pattern, single and multi-author, etc. The data has been downloaded from the web of science database on dated: 29/03/2019. The data collected for the study has been organized in systematically calculated, tabulated form and graphs which is analysed in Microsoft Excel, simple arithmetic and statistical methods for its results. Analysis of the data has been carried out in the form of:

a. **Tables**

All the tables have been prepared on the basis of the set questions of the study.

They have been presented in systematically and well-arranged order with numerical form and represent in percentage.

b. Graphs

Data presented in the tables have been revealed with the help of graphs for clearly understanding.

c. Textual presentation

The result got through tables and graphs has further represent in textual form.

5.1 General Information of Seven Heritage Universities

S. No.	General Information	Name of Universities						
		AU	BU	PU	PRE.U	UOC	UOMUM.	UOM
1	Year of Universities Establishment	1780	1964	1882	1817	1854	1857	1857
2	History	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Status of the universities	State	State	State	State	State	State	State
4	Faculty Details	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	University Website	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The general information of seven state heritage universities are summarized in the Table 5.1, it shows that all universities are very oldest and largest in nature. In 1780, AU (Aliah University) were established, BU (Bangalore University) established in 1964, PU (Panjab University) were established in 1882, PRE.U (Presidency University) were established in 1817, UOC (University of Calcutta) 1854, UOM (University of Mumbai) and UOM (University of Madras) were established in the same year of 1857. All the Universities have their websites history, and faculty details.

Table 5.2 Research Contributions of Heritage Universities (2014-2018)

S. No.	Name of University	Abbreviations	Total	%
1	Aliah University	AU	225	1.60%
2	Bangalore University	BU	809	5.74%
3	Panjab University	PU	4491	31.84%
4	Presidency University	PU	514	3.64%
5	University of Calcutta	UOC	4489	31.83%
6	University of Mumbai	UOM	796	5.64%
7	University of Madras	UOM	2777	19.69%
Total			14103	100%

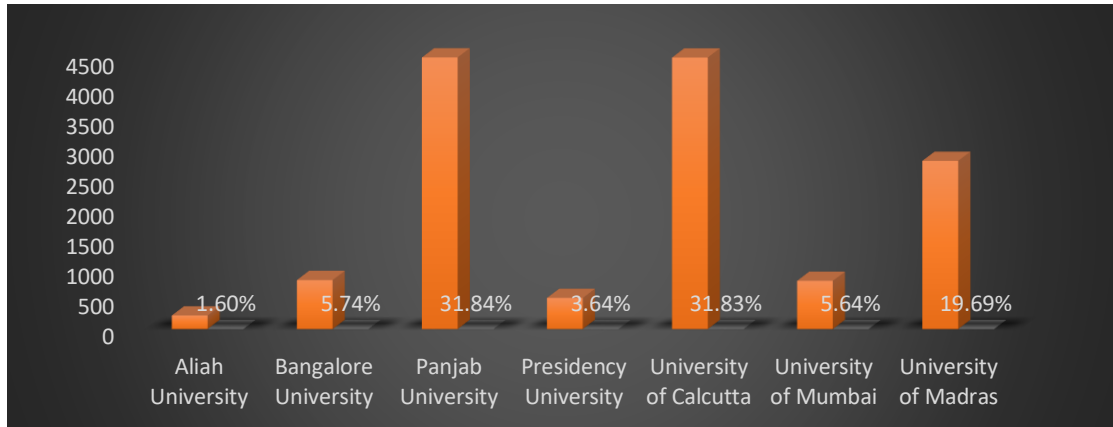


Figure: 1 Research Contributions of Heritage Universities

Table 5. 2 reveals that Seven Heritage Universities, PU (Panjab University) has highest number of publications (4491, 31.84%) and UOC (University of Calcutta) has (4489,

31.83%) followed by UOM (University of Madras) (2777, 19.69%), BU (Bangalore University) (809, 5.74%) UOM (University of Mumbai) (796, 5.64%), PU (Presidency University) (514, 3.64%), whereas the AU (Aliah University) (225, 1.60 %) have lowest research contribution among all heritage universities.

Table 5.3 Year-wise Research contributions of Heritage Universities

S. No.	Year	AU	BU	PU	PRE. U	UOC	UOMUM	UOM
1	2014	33 (15%)	137 (17%)	764 (17%)	86 (17%)	813 (18%)	99 (12%)	460 (17%)
2	2015	29 (13%)	160 (20%)	830 (18%)	109 (21%)	937 (21%)	152 (19%)	554 (20%)
3	2016	50 (22%)	169 (21%)	946 (21%)	96 (19%)	924 (21%)	154 (19%)	558 (20%)
4	2017	50 (22%)	179 (22%)	996 (22%)	114 (22%)	941 (21%)	184 (23%)	616 (22%)
5	2018	63 (28%)	164 (20%)	955 (21%)	109 (21%)	874 (19%)	207 (26%)	589 (21%)
Total		225 (100%)	809 (100%)	4491 (100%)	514 (100%)	4489 (100%)	796 (100%)	2777 (100%)

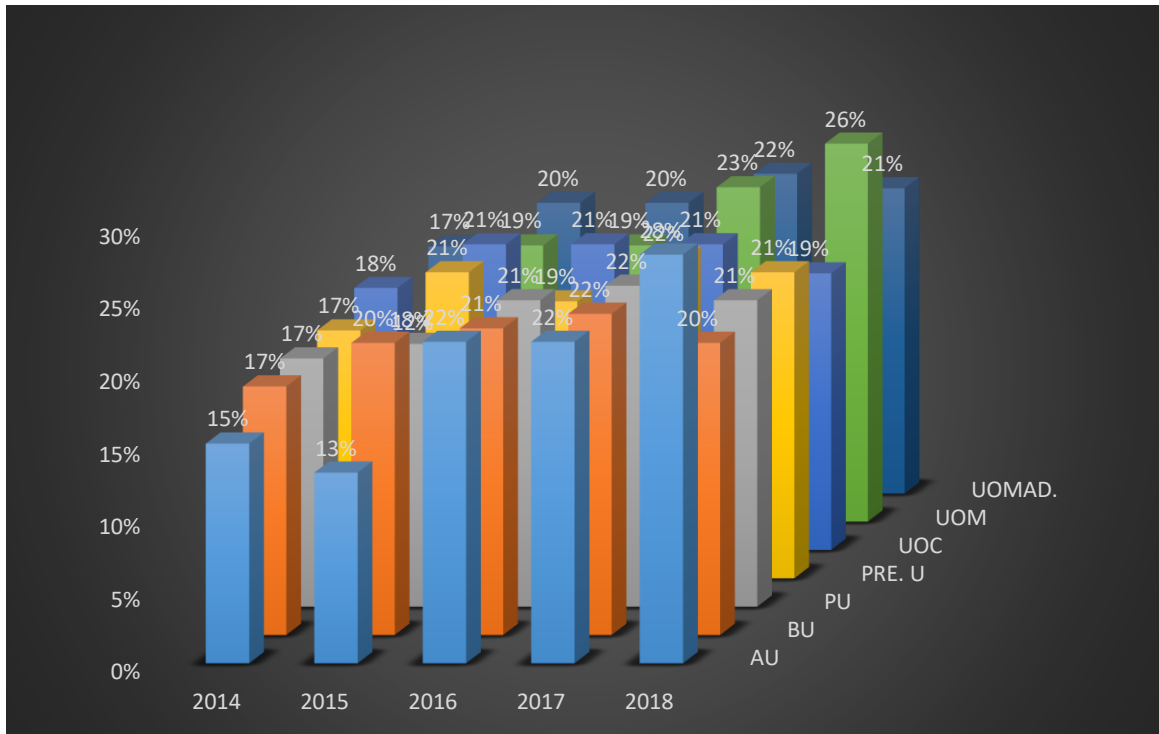


Figure: 2 Year-wise Research Contributions of Heritage University

Table 5.3 reveals that the PU (Panjab University) has highest contribution i.e., 996 (22%) in 2017. The highly contributed UOC (University of Calcutta), has the maximum number of contribution i.e. 941 (21%) in 2017 followed by 207 (26%) has been contributed by UOMUM (University of Mumbai) in 2018.

5.4 Authorship Pattern

Mainly the authorship studies deals with number of authors. This study includes kinds of authorship, collaborative efforts of authors or degree of collaboration an impact of citation rate on team research patterns of authors. In this way, there are different types of authors seemed in publications.

They can be grouped as personal author, corporate author and anonymous authorship. Personal authorship study includes study of single authorship, two authorship, three authors and more than three authors study.

In this study, the authorship studies is carried out for citing articles and for personal authorship. The given table 5.4.1 represents data about authorship patterns in each year and the distribution of authorship in percentage.

Table 5.4.1 Year-wise Authorship Pattern

S. No.	Year	Single	Two	Three	More Than Three
1	2014	82(15%)	475(17%)	528(18%)	1307(17%)
2	2015	128(23%)	545(20%)	591(20%)	1507(19%)
3	2016	117(21%)	570(21%)	577(20%)	1633(21%)
4	2017	137(24%)	624(23%)	585 (20%)	1734(22%)
5	2018	101(18%)	528(19%)	617(21%)	1715(22%)
Total		565(100%)	2742(100%)	2898 (100%)	7896 (100%)

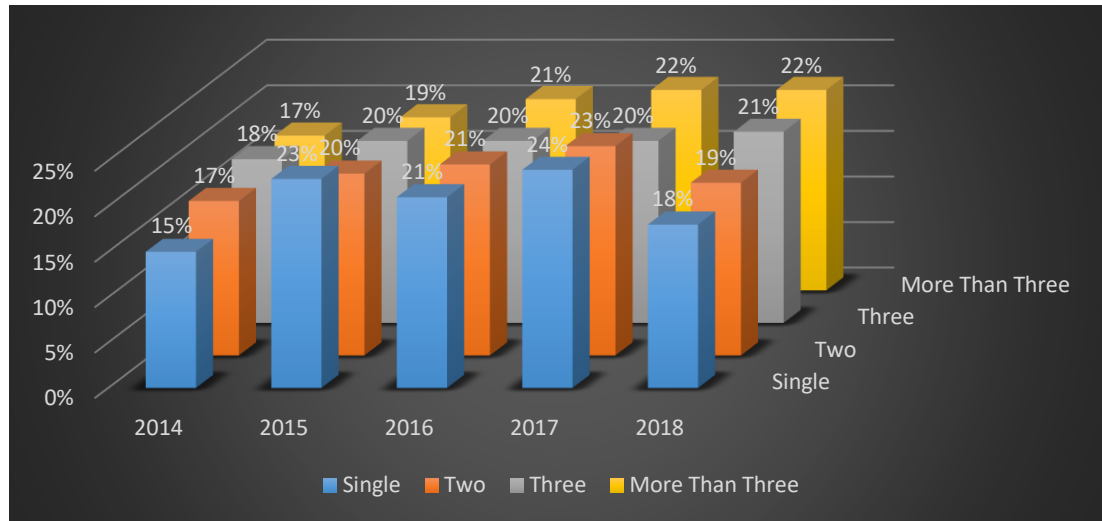


Figure: 3 Year-wise Authorship Pattern

The table.5.4.1 shows that the details about the year-wise authorship pattern. The maximum number of contributions i.e. 128(23%) of single authors were published their research papers in 2015. While, 624(23%) of contributions found by two authors in 2017. 617(21%) have been contributed by the three authors in 2018. The maximum no. of contribution i.e. 1734(22%) have been contributed by multiple authors in the year of 2017.

5.4.2 University-wise Authorship pattern

S. No.	Author	AU	BU	PU	PRE.U	UOC	UOMUM.	UOM	Total
1	Single	5 (2%)	17 (2%)	129 (3%)	61 (12%)	205 (5%)	96 (12%)	52 (2%)	514 (3.66%)
2	Two	35 (16%)	213 (26%)	685 (15%)	89 (17%)	930 (21%)	151 (19%)	639 (23%)	2742 (19.52%)
3	Three	62 (28%)	177 (22%)	834 (19%)	97 (19%)	1034 (23%)	135 (17%)	559 (20%)	2897 (20.62%)
4	More Than Three	123 (55%)	402 (50%)	2843 (63%)	267 (52%)	2320 (52%)	414 (52%)	1527 (55%)	7897 (56.21%)
Total		225 (100%)	809 (100%)	4491 (100%)	513 (100%)	4489 (100%)	796 (100%)	2777 (100%)	14050 (100%)

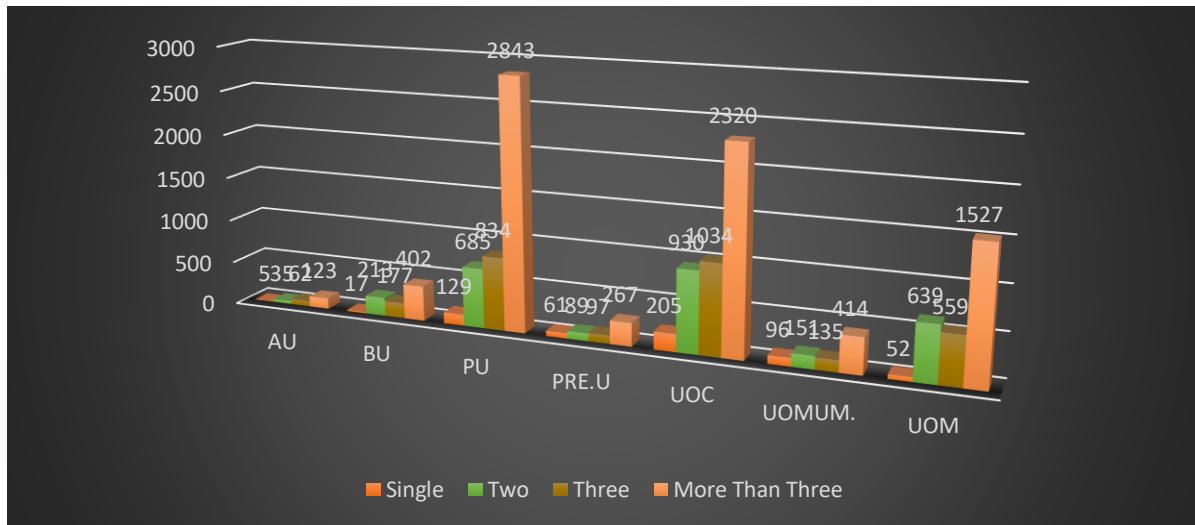


Figure: 4 University-wise Authorship Pattern

The table.5.4.2 shows that the universities-wise authorship pattern each university. It indicates that the highest number i.e., 205(5%) has been contributed by single author in UOC (University of Calcutta). 5(2%) has the lowest contribution of single author found in AU (Aliah University) whereas the 930(21%) of contributions by two authors found in UOC. Followed by PU (Panjab University) has highest contributions i.e., 2843(63%) by three authors. Its shows that the number of publications with two or three authors is the maximum in each universities whereas also it shows that Multi-authored research work is more in trend.

5.4.3 Authorship pattern of single and More Than Three Authors

S. No.	Name of University	Single	%	More Than Three	%
1	AU	5	1%	123	2%
2	BU	17	3%	402	5%
3	PU	129	23%	2843	36%
4	PRE.U	61	11%	267	3%
5	UOC	205	36%	2320	29%
6	UOMUM.	96	17%	414	5%
7	UOM.	52	9%	1527	19%
Total		565	100%	7896	100%

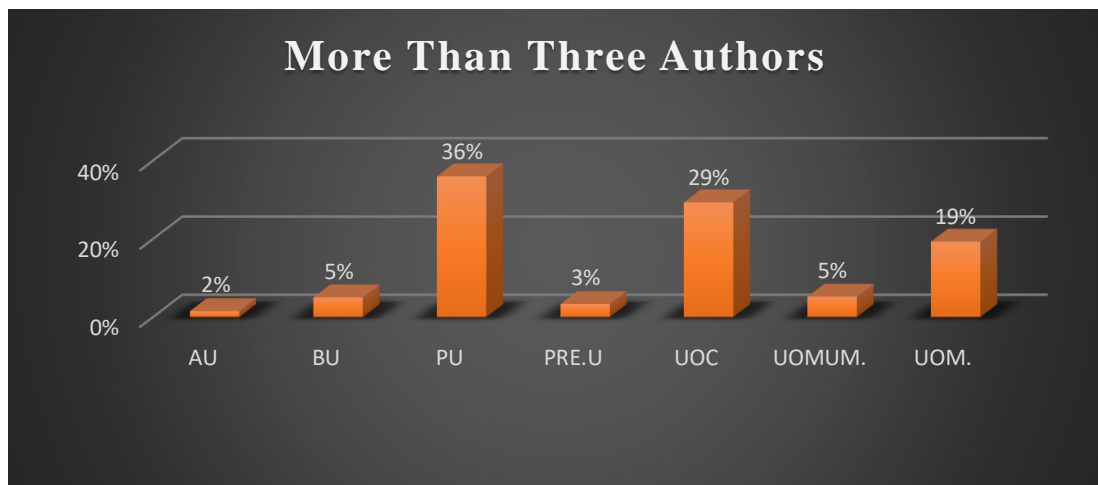
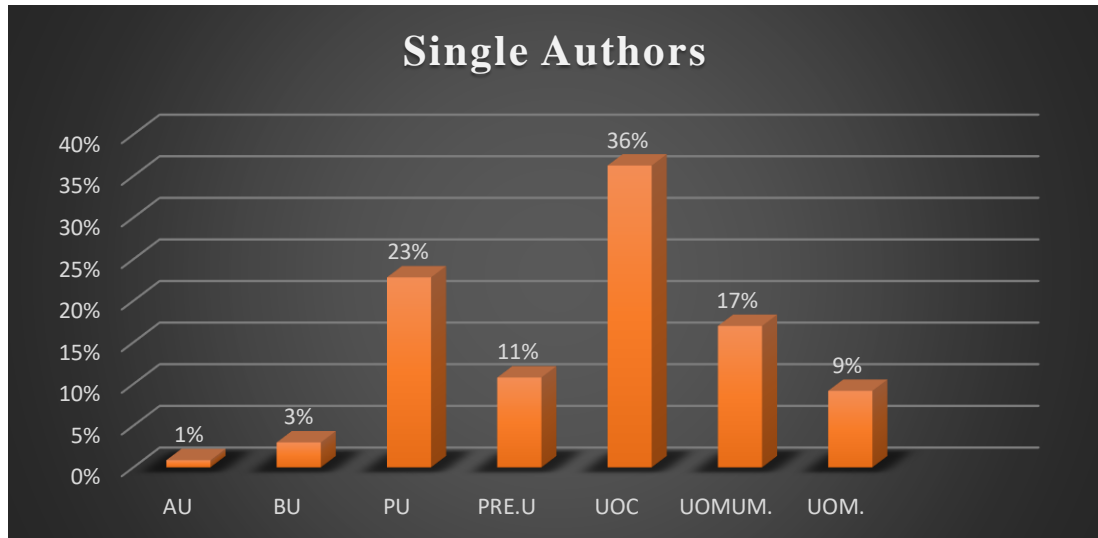


Figure: 5 Authorship pattern of single and More Than Three Authors

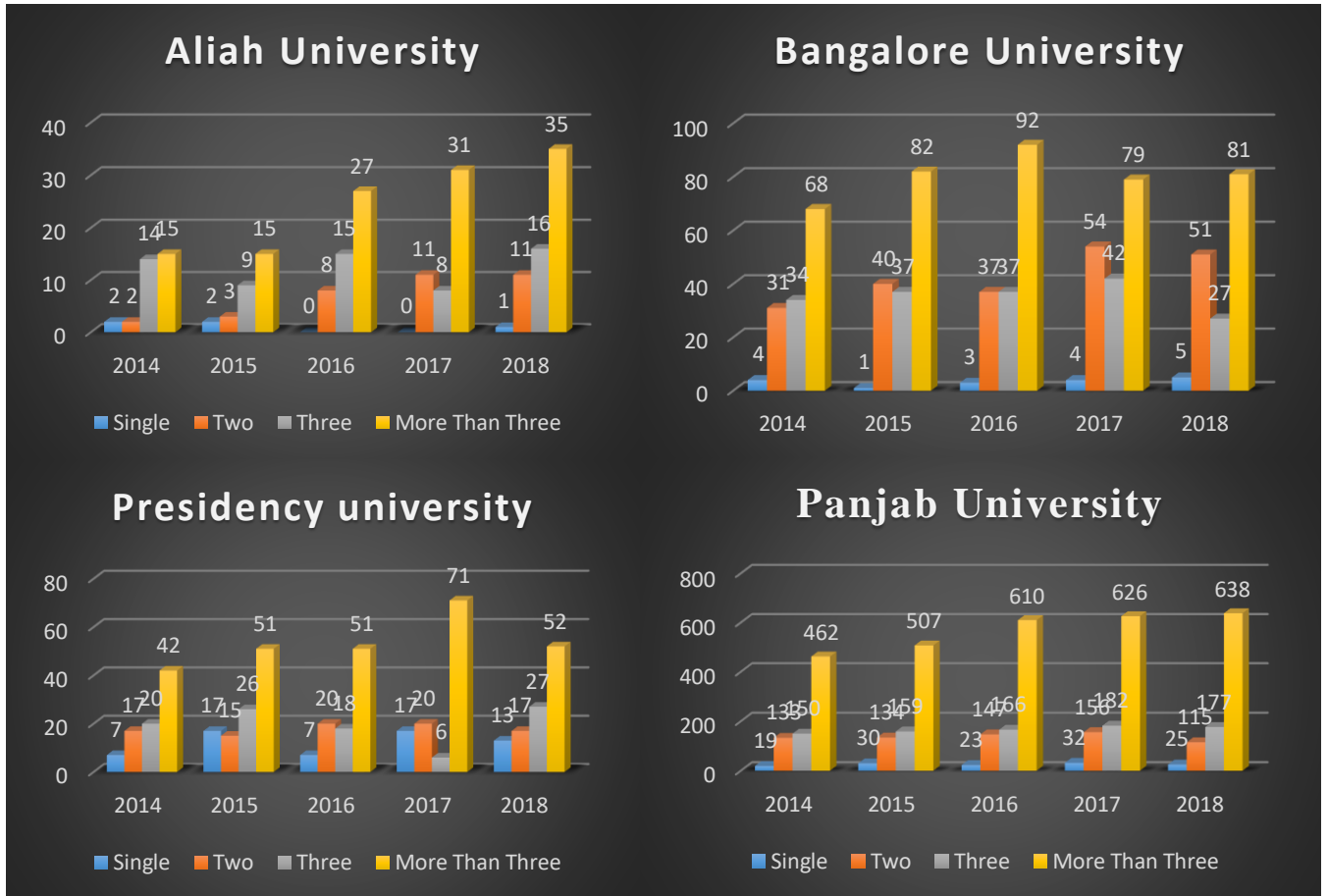
The above table 5.4.3 shows that the authorship pattern of single and more than three authors. Maximum number of contributions i.e., 36% has been contributed by single authors in UOC as well as 36% has been contributed by multiple authors in PU.

5.4.4 Total year- wise and university-wise Distribution of Authorship Pattern

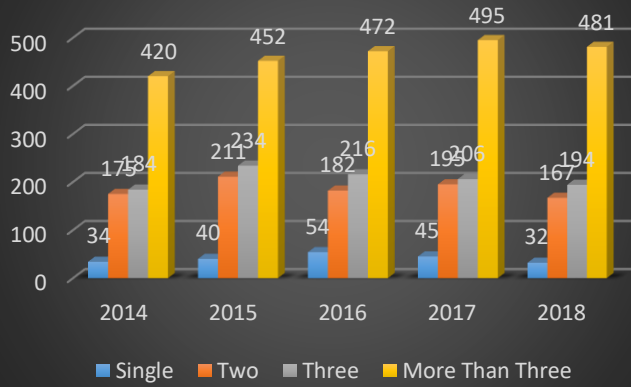
Aliah University						
Year	Single	Two	Three	More Than Three	Total	%
2014	2	2	14	15	33	15%
2015	2	3	9	15	29	13%
2016	0	8	15	27	50	22%
2017	0	11	8	31	50	22%
2018	1	11	16	35	63	28%
Total	5	35	62	123	225	100%
Bangalore University						
Year	Single	Two	Three	More Than Three	Total	%
2014	4	31	34	68	137	17%
2015	1	40	37	82	160	20%
2016	3	37	37	92	169	21%
2017	4	54	42	79	179	22%
2018	5	51	27	81	164	20%
Total	17	213	177	402	809	100%
Presidency university						
Year	Single	Two	Three	More Than Three	Total	%
2014	7	17	20	42	86	17%
2015	17	15	26	51	109	21%
2016	7	20	18	51	96	19%
2017	17	20	6	71	114	22%
2018	13	17	27	52	109	21%
Total	61	89	97	267	514	100%
Panjab University						
Year	Single	Two	Three	More Than Three	Total	%
2014	19	133	150	462	764	17%
2015	30	134	159	507	830	18%
2016	23	147	166	610	946	21%
2017	32	156	182	626	996	22%
2018	25	115	177	638	955	21%
Total	129	685	834	2843	4491	100%
University of Calcutta						
Year	Single	Two	Three	More Than Three	Total	%
2014	34	175	184	420	812	18%

2015	40	211	234	452	937	21%
2016	54	182	216	472	924	21%
2017	45	195	206	495	939	21%
2018	32	167	194	481	871	19%
	205	930	1034	2320	4483	100%
University of Mumbai						
Year	Single	Two	Three	More Than Three	Total	Percentage
2014	8	24	14	53	99	12%
2015	25	22	30	75	152	19%
2016	24	28	21	81	154	19%
2017	26	34	24	100	184	23%
2018	13	43	46	105	207	26%
Total	96	151	135	414	796	100%
University of Madras						
Year	Single	Two	Three	More Than Three	Total	%
2014	8	93	112	247	460	17%
2015	13	120	96	325	554	20%
2016	6	148	104	300	558	20%
2017	13	154	117	332	616	22%
2018	12	124	130	323	589	21%
Total	52	639	559	1527	2777	100%

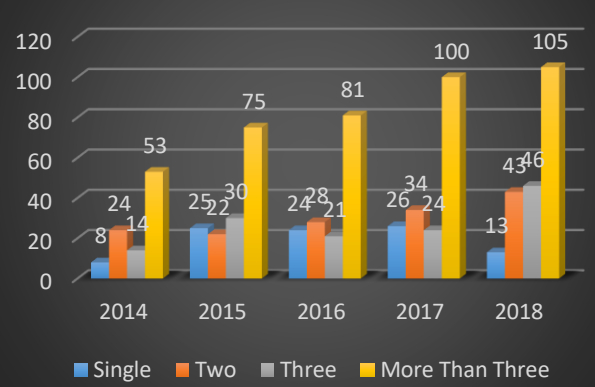
Figure: 6 Total year- wise and university-wise Distribution of Authorship Pattern



University of Calcutta



University of Mumbai



University of Madras

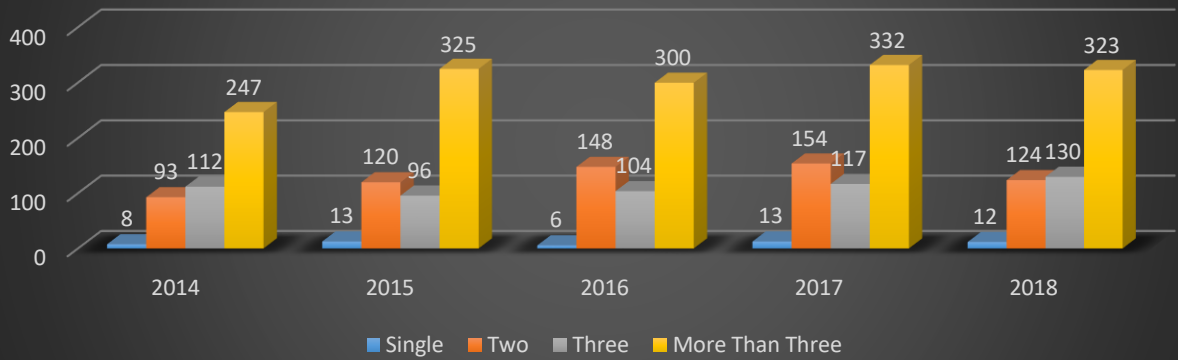


Table 5.5 Document Type distribution of publications

Table 5.5 reveals that the 21 types of documents published during a period such as: articles, article; book chapter, Article; proceedings paper, Book Review, correction, News Item, Letter, biographical item, reprint and editorial material, Review, Review; Book Chapter etc.

S. No	Items	AU	BU	PU	PRE.U	UOC	UOMUM.	UOM	Total	%
1	Article	215	765	3920	464	4192	675	2539	12770	90.55%
2	Article; Book Chapter	-	-	1	-	1	-	-	2	0.01%
3	Article; Data Paper	-	-	2	-	2	-	6	10	0.07%
4	Article; Early Access	-	-	-	-	3	-	-	3	0.02%
5	Article; Proceedings Paper	2	14	82	1	31	10	28	168	1.19%
6	Article; Retracted Publication	-	-	-	-	2	-	1	3	0.02%
7	Art Exhibit Review	-	-	-	-	-	-	1	1	0.01%
8	Biographical-Item	-	-	3	-	4	1	2	10	0.07%
9	Book Review	-	-	9	17	35	23	10	94	0.67%
10	Correction	4	2	33	2	18	1	12	72	0.51%
11	Editorial Material	-	5	23	2	32	16	19	97	0.69%
12	Letter	-	1	34	-	14	15	21	85	0.60%
13	Meeting Abstract	-	3	103	3	38	20	86	253	1.79%
14	News Item	-	-	-	-	3	1	-	4	0.03%
15	Poetry	-	-	-	-	5	1	-	6	0.04%
16	Retraction	-	-	2	-	4	-	1	7	0.05%
17	Reprint	-	-	1	-	-	-	51	52	0.37%
18	Review	4	19	268	25	105	33	-	454	3.22%
19	Review; Book Chapter	-	-	3	-	1	-	-	4	0.03%
20	Review; Retracted Publication	-	-	1	-	-	-	-	1	0.01%
21	Other	-	-	6	-	1	-	-	7	0.05%
Total		225	809	4491	514	4491	796	2777	14103	100.00%

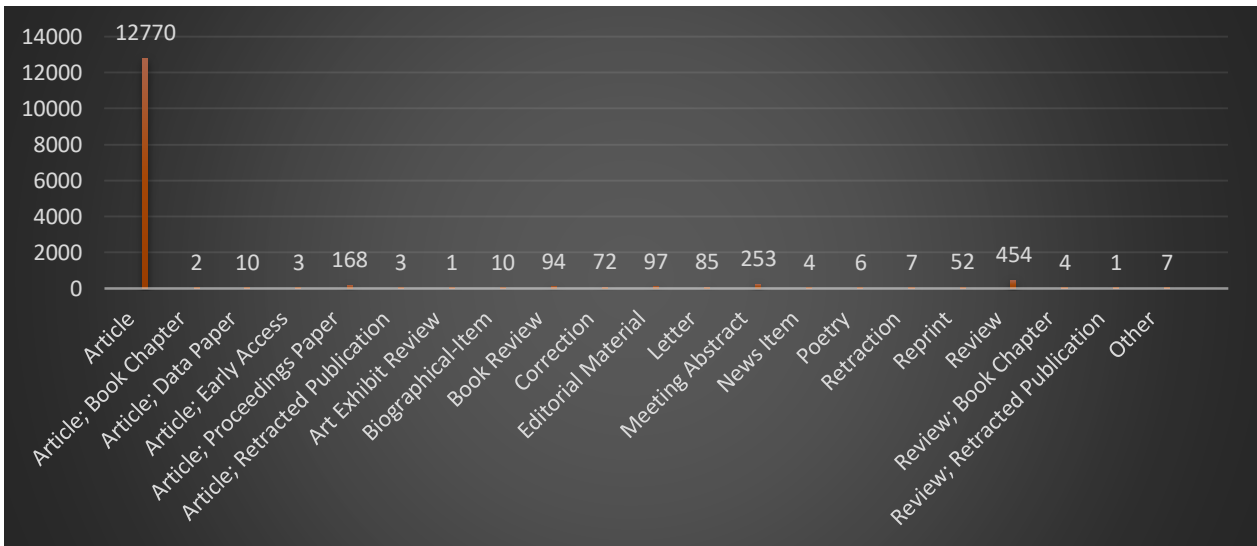


Figure: 7 Document Type

The table 5.5 revealed that the Document type Publications of all Universities. Most of the Universities were preferred journal articles, Article; Proceedings Paper, editorial Materials, Review and Correction.

Table 5.6 Access Type

S. No.	Items	AU	BU	PU	PRE.U	UOC	UOMUM.	UOM	Total	%
1	Bronze	11	25	150	37	159	36	102	520	3.69%
2	Gold	10	105	597	66	521	101	454	1854	13.15%
3	Green	12	185	173	13	72	13	41	509	3.61%
6	Other	192	494	3571	398	3737	645	2180	11217	79.55%
Total		225	809	4491	514	4489	795	2777	14100	100.00%

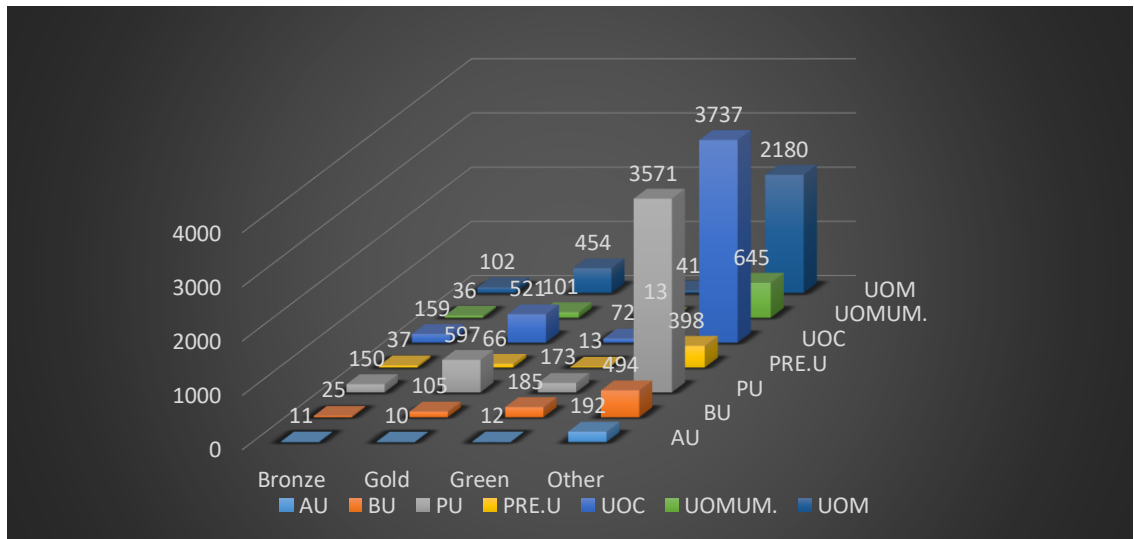


Figure: 8 Access Type

Table 5.6 shows, that the details about Access Type. Most of the Universities were access GOLD. Followed by the Bronze, Green and other were also access among all the Heritage Universities.

Table 5.7 Highly Contributed Authors

S. No.	AU		BU		PU		PRE.U		UOC		UOMUM.		UOM	
	Authors	Total	Authors	Total	Authors	Total	Authors	Total	Authors	Total	Authors	Total	Authors	Total
1	Ghosh, S	14 (21%)	Naika, MSM	18 (16%)	Khachatryan, V	249 (31%)	Acharyya, M	7 (16%)	Sengupta, S	25 (13%)	Kalambate, PK	8 (13%)	Bakthados, M	15 (17%)
2	De, N	9 (13%)	Shankar, BM	15 (13%)	Sirunyan, AM	209 (26%)	Chakraborty, S	6 (13%)	Ray, S	24 (13%)	Godbole, RM; Kaushik, A;	7 (12%)	Suresh, R	12 (14%)
3	Dutta, B;	9 (13%)	Devi, LG	14 (12%)	Adam, J	80 (10%)	Bhattacharjee, A	5 (11%)	Hazari, A	20 (11%)	Joob, B; Wiwanitkit, V	6 (10%)	Harichandran, G	8 (9%)
4	Kalam, M	7 (10%)	Shivakumara, IS	13 (11%)	Chatrchyan, S	59 (7%)	Chakraborty, P	5 (11%)	Sarkar, S	19 (10%)	Kakita, VMR	6 (10%)	Jhonsi, MA	8 (9%)
5	Obaidullah, SM	6 (9%)	Waghmore, HP	12 (10%)	Adamczyk, L	58 (7%)	Banerjee, A	4 (9%)	Sil, S	19 (10%)	Shaikh, AM	6 (10%)	Kumar, DR	8 (9%)
6	Dar, AA	5 (7%)	Siddheshwar, PG	11 (10%)	Abazov, VM	48 (6%)	Bose, S	4 (9%)	Saha, S	18 (10%)	Shimpi, NG	6 (10%)	Umadevi, M	8 (9%)
7	Wabaidur, SM	5 (7%)	Angadi, VJ	10 (9%)	Acharya, S	42 (5%)	Chakrabarti, U	4 (9%)	Roy, P	17 (9%)	Srivastava, RK	6 (10%)	Savithri, MP	8 (9%)
8	Ahmed, F	4 (6%)	Shivaramu, NJ	8 (7%)	Abelev, B	32 (4%)	Chowdhury, S	4 (9%)	Sen, S;	16 (9%)	Choudhary, S	5 (8%)	Francis, DL	7 (8%)
9	Halder, M	4 (6%)	Krishnamurthy, MS	7 (6%)	Chaudhary, S	22 (3%)	Bera, S	3 (7%)	Bandyopadhyay, U	14 (8%)	Gupta, S	5 (8%)	Andrew, JJ	6 (7%)
10	Sarkar, DN	4 (6%)	Nanjundappa, CE	7 (6%)	Abramowicz, H	17 (2%)	Bhattacharjee, S	3 (7%)	Sarkar, A	14 (8%)	Kalyanaram, G	5 (8%)	Arunkumar, G	6 (7%)
Total		67 (100%)	Total	115 (100%)	Total	816 (100%)	Total	45 (100%)	Total	186 (100%)	Total	60 (100%)	Total	86 (100%)

Table 5.7 shows the Ghosh, Soumen was highly contributed 21% in the AU. In PU by the V. Khachatryan was highly contributed i.e., 31%. Followed by BU 18% contributed by Naika, M. S. Mahadeva. PRE. U 16% M. Acharyya, UOC 25% by Sengupta, UOMUM. 13% by Pramod Kalambate, UOM 17% contributed by Manickam Bakthadoss among all the Heritage Universities.

Table 5. 8 Top Ten Highly Cited Titles

S. No.	AU		BU		PU		PRE. U		UOC		UOMUM.		UOM	
	Title	Total	Title	Total	Title	Total	Title	Total	Title	Total	Title	Total	Title	Total
1	Silver nano	52(17%)	A review on	108(20%)	A review on	310(17%)	Mechanism of	274(43%)	Men and ml	35(16%)	Nanodrug del	99(13%)	Global, regio	541(31%)
2	Synthesis of	50(17%)	Review on m	75(14%)	Energy Depe	229(13%)	The XXL Sur	78(12%)	pH-sensitiv	92(11%)	High perform	96(13%)	ZnO/Ag/CdO	206(12%)
3	Understand	37(12%)	Melting heat	52(10%)	Performance	211(12%)	Palladium na	54(8%)	Compact S	82(10%)	Voltammetric	82(11%)	ZnO/Ag/MnO	179(10%)
4	Cu(II)-anch	34(11%)	Computation	51(10%)	Multiplicity d	197(11%)	Agglomerated	40(6%)	Fungal Pla	80(10%)	The CRISPR-	79(10%)	Plant extract	142(8%)
5	Pd Nanopar	23(8%)	Synthesis, ch	48(9%)	Combination	169(9%)	Oxygenation	36(6%)	pH sensitiv	79(10%)	Efficient phot	76(10%)	Ce3+-ion-inc	136(8%)
6	Ruthenium	23(8%)	Development	47(9%)	Beam Energy	148(8%)	21 cm signal f	32(5%)	Ab-initio ca	77(9%)	Cobalt-Boride	69(9%)	Green Synth	113(7%)
7	A highly act	23(8%)	Novel Synthe	43(8%)	Report on the	145(8%)	Polyamines as	32(5%)	Synthesis, c	73(9%)	Progress in C	67(9%)	Visible light	112(7%)
8	Chromium(21(7%)	Synthesis of I	36(7%)	Organic-Inor	135(8%)	Giant negativ	32(5%)	Application	70(9%)	Copper and N	65(9%)	Fabrication	102(6%)
9	Incorporati	18(6%)	Reactivity of	36(7%)	Production o	126(7%)	Preparation, c	31(5%)	Hydrogena	68(8%)	Co-Ni-B nano	60(8%)	ZnO/CdO na	96(6%)
10	Anisotropic	17(6%)	Effect of RF	34(6%)	Centrality, ra	125(7%)	Pentanuclear	31(5%)	Fungal Pla	67(8%)	Comprehensiv	60(8%)	Bisphenol A	94(5%)
	Total	298(100%)		530(100%)		1795(100%)		640(100%)		823(100%)		753(100%)		1721(100%)

Table reveals 5.8 that the “A review on Alzheimer's disease pathophysiology and its management: an update” was highly cited i.e., 17% in the PU. This table also shows that the “Preparation, characterization and evaluation of fluoride adsorption efficiency from water of iron-aluminium oxide-graphene oxide composite material” was the least cited i.e., 5% in PRE.U whereas 31% of “Global, regional, and national levels and causes of maternal mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013” in UOM.

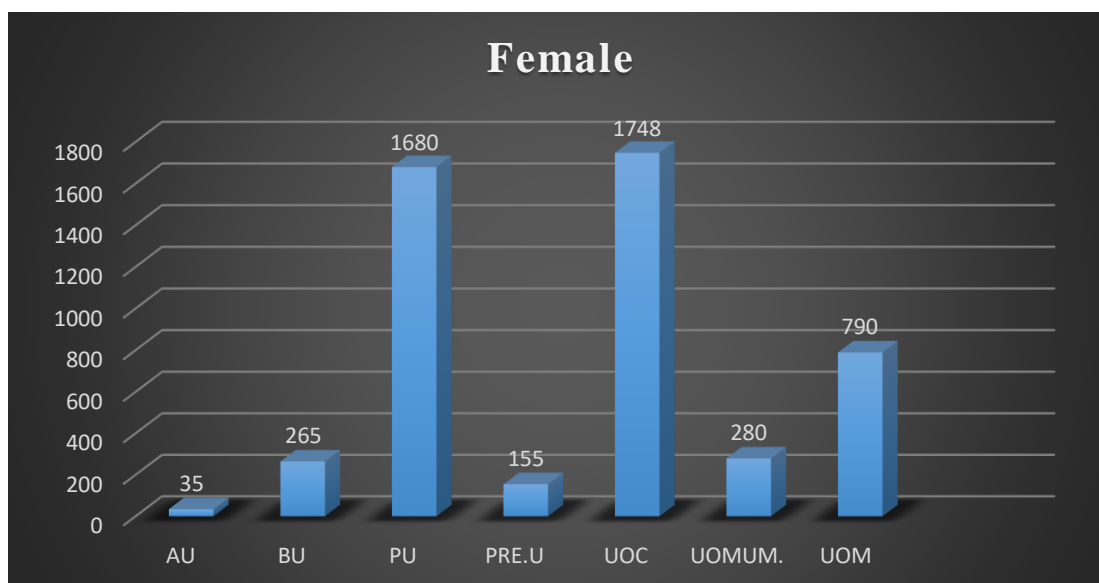
Table 5. 9 Top Ten Highly Cited Authors

S. No	AU			BU			PU			PRE.U			UOC			UOMUM.			UOM		
	Authors	HC	%	Authors	HC	%	Authors	HC	%	Authors	HC	%	Authors	HC	%	Authors	HC	%	Authors	HC	%
1	Salam, N	52	17%	Devi, LG; K	108	20%	Kumar, A;	310	17%	Gupta, B; I	274	43%	Dutta, S; Ser	135	16%	Kapse-	99	13%	Kasseba	541	31%
2	Salam, N	50	17%	Devi, LG; K	75	14%	Adameczyk,	229	13%	Pierre, M;	78	12%	Mukhopadhy	92	11%	Kalamb	96	13%	Saravana	206	12%
3	Das, SK;	37	12%	Gireesha, B;	52	10%	Abelev, B;	211	12%	Bej, A; Gh	54	8%	Siddiqui, JY	82	10%	Sanghar	82	11%	Saravana	179	10%
4	Roy, S; C	34	11%	Ghosh, D; P	51	10%	Abelev, B;	197	11%	Ghosh, A;	40	6%	Crous, PW;	80	10%	Rath, D	79	10%	Rajan, R	142	8%
5	Molla, R;	23	8%	Hemalatha, I	48	9%	Abramowi	169	9%	Mukhopad	36	6%	Mukhopadhy	79	10%	Patel, N	76	10%	Rajendra	136	8%
6	Ghosh, K	23	8%	Mohan, CD;	47	9%	Adameczyk,	148	8%	Ghara, R; C	32	5%	Nath, P; Cho	77	9%	Gupta,	69	9%	Annadha	113	7%
7	Islam, SM	23	8%	Keerthy, HK	43	8%	Reilly, AM	145	8%	Saha, J; Br	32	5%	Samanta, HS	73	9%	Patel, N	67	9%	Saravana	112	7%
8	Mandi, U	21	7%	Ashwini, N;	36	7%	Kaushik, A	135	8%	Ghosh, PK	32	5%	Banerjee, S;	70	9%	Jaiswal	65	9%	Devaraj,	102	6%
9	Mukhopa	18	6%	Lakshmeesh	36	7%	Abelev, B;	126	7%	Kanrar, S;	31	5%	Singh, AK; S	68	8%	Gupta,	60	8%	Saravana	96	6%
10	Kalam, M	17	6%	Srinatha, N;	34	6%	Abelev, B;	125	7%	Maity, M;	31	5%	Crous, PW;	67	8%	Bhogak	60	8%	Yamazak	94	5%
Total		298	100%		530	100%		1795	100%		640	100%		823	100%		753	100%		1721	100%

The Table 5.9, shows that the Anil Kumar 17% was highly cited authors in PU. The Devi, Gomathi 20% from BU, Bhaskar Gupta 43% from PRE.U were highly cited authors in heritage universities.

Table 5.10 Gender-wise Contribution of Authors

S. No.	Name of Universities	Female	Male	Unidentified	Total
1	AU	35	184	6	255
2	BU	265	494	50	809
3	PU	1680	2727	84	4491
4	PRE.U	155	326	33	514
5	UOC	1748	2649	91	4488
6	UOMUM.	280	438	78	796
7	UOM	790	1953	34	2777
Total		4953	8771	376	14130



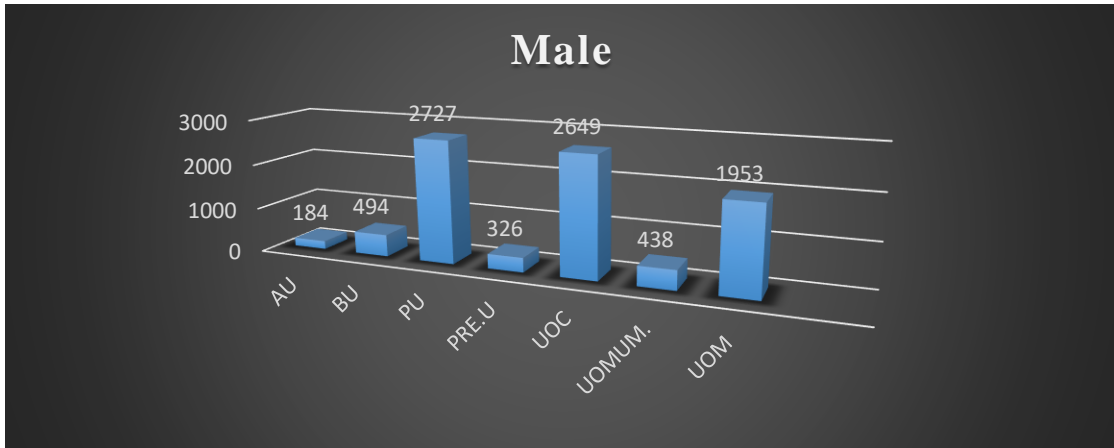


Figure: 9

Table 5. 10 reveals that the Gender-wise contributions. The maximum number of male i.e., (2727) are highly contributed in the PU as compared to female. Followed by male Contributions are UOC (2649), UOM (1953), BU (494), UOMUM (438), PRE.U (326) and AU (184).

CHAPTER- 6

FINDINGS AND CONCLUSION

This chapter deals with the findings and conclusion of the study. The major findings of the study are:

6.1 Findings

1. The findings indicate that the overall research productivity of all universities. PU (Panjab University) has 4491(32%) and UOC (University of Calcutta) has (4489, 31.83%) of highest number of publications among all the heritage universities.
2. The findings of study shows that the year-wise research productivity of Heritage universities. The Publications pattern has been yearly increased from the year 2014 to 2018.
3. The findings of the study reveals that the year-wise authorship pattern. The maximum number of contributions i.e. 128(23%) of single authors in 2015. While, 624(23%) of contributions found by two authors in 2017. 617(21%) have been contributed by the three authors in 2018. The maximum no. of contribution i.e., 1734(22%) have been contributed by multiple authors in the year of 2017.
4. The findings of the study shows that the university-wise authorship pattern of each university. It indicates that the highest number i.e., 205(5%) has been contributed by single author in UOC (University of Calcutta). 5(2%) has the lowest contribution of single author found in AU (Aliah University) whereas the 930(21%) of contributions by two authors found in UOC.

5. The finding of the study explores that the authorship pattern of single and multiple authors. Maximum number of contributions i.e., 36% has been contributed by single authors in UOC as well as 36% has been contributed by multiple authors in PU.
6. The findings of the study indicates that most of the Universities were preferred journal articles, Article; Proceedings Paper, editorial Materials, Review and Correction.
7. The findings of the study reveals that the Most of the Universities were access GOLD. Followed by the Bronze, Green and other were also access among all the Heritage Universities.
8. The findings of the study shows that the Ghosh, Soumen was highly contributed 21% in the AU. Followed by PRE.U 16% M. Acharyya, UOC 25% by Sengupta, and 13% by Pramod Kalambate in UOMUM.
9. The findings of the study illustrated that top cited Titles “A review on Alzheimer's disease pathophysiology and its management: an update” were highly cited 17% from Panjab university.
10. The findings of the study shows that the Anil Kumar 17% were highly cited authors in PU. The Devi, Gomathi 20% from BU, Bhaskar Gupta 43% from PRE.U were highly cited authors in heritage universities.
11. The findings of the study reveals that the Gender-wise contributions. Male are the highly contributed as compared to female.

6.2 Conclusion

There is a great impact on the world of exploring the new trends of higher education and research. The role of the higher education system has become essential at the national and international level. Today we are living in a fast growing technical era. There are many Universities which are progressing day by day and getting connected to each other's to build global networks for knowledge and resource sharing. Research Productivity plays an important role in the growth and development of higher education. The contributions from the Panjab University and University of Calcutta have the highest contribution from given period of study. This work explores the factors of efficiency of Research Productivity of Heritage Universities in terms of the number of publications, number of cited articles, number of authorship pattern and so on. However, it can be seen from the above quantitative analysis and its finding that the research productivity has been yearly increased. The present study will be very beneficial for the students and researchers to know the research productivity of universities which is also helpful for them to select right university for the education and research.

6.3 Further area of Study

The present study deals with the research productivity of Heritage universities.

The following areas are suggested for future research:

- i. Similar studies of research productivity of Heritage universities in India carried out on state, colleges, deemed universities and also special institutions.
- ii. For better result of the study, the data can also be downloaded from the Scopus database as compared to web of science database.

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