Scientometric Portrait of Professor K. Byrappa: Scientist of High Repute

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Abstract -The present study attempted to explore and analyze various attributes of research publications of Prof.K.Byrappa, a renowned Indian academician and researcher. The data used in the study have covered from K. Byrappa's early date of publication to 13th January 2020, indexed in Google Scholar. A total number of 378 articles have been retrieved from Google Scholar for the said period. His h-index is 31 and received 7774 citations for his scholarly research work. In this study, an attempt has been made to highlight the profile and publications of Prof. K. Byrappa as a role model for future researchers and academicians.
Keywords: Scientometric Portrait; Scientometrics; Publication productivity; Citations; Scientist; K. Byrappa.

I. INTRODUCTION

A researcher's scientific productivity is often estimated by the quality and number of publications during the person's academic career. The evaluation and assessment of scientific research output are essential to determine its success, eminence, growth, and development of an individual or an institution. Scientometric studies deal with the biographical study of the individual career of scientists and researchers and correlate this with the bibliographical analysis of publications or academic and scientific achievements. Hood and Wilson (2001) studied that Scientometric has increasingly been used over the last few years. It is concerned with the science growth, structure, interrelationships, and productivity of literature. Scientometrics is the science of measuring and analyzing science. These studies are useful to understand the evolution of literature or trends in particular fields or within a geographical area. In practice, scientometrics is often done using bibliometrics which is a measurement of the impact of publications. Bibliometrics and Scientometrics are a set of methods for measuring the production and dissemination of knowledge. In recent days many articleshave been written on scientometrics. The researchersprofessionally writing articles means of reporting their research activities to the scientific world, this model provides the latest knowledge to the research community and helps them in preparing their research proposals. Research productivity is assessed in terms of publications.

II. NEED AND SIGNIFICANCE OF THE STUDY

Scientometrics involves quantitative studies of scientific activities, including among other publications and so overlap bibliometrics to some extent. Price (1963) summarized the essence of scientometrics in the introduction to "Little science, big science" as follows, Science is a measurable substance, and consequently, the manpower engaged in science, the scientific literature, talent, and expenses afforded to science could be measured by properly selected statistical methods.

Scientometric research has wide potential applicability. Government and research institutions have expressed interest in applying "quantitative knowledge of scientific growth to the management of science." Scientific indicators are being used to estimate the relative "health" of science in various countries. Ultimately, scientometrics may be used to help nations make decisions on what areas of research need funding. Evaluation of research productivity is also in the ranking of universities and research institutions as well as in tracking advances in any scientific discipline. Furthermore, measuring the research productivity of individual researchers is important because they form the basic foundations of any group or institution. In this paper, we would like to look into the scientific work done by Prof. K. Byrappa and his role in the advancement of science in India and elsewhere. The work done by Prof. K. Byrappa will lead the younger scientists to emulate and thereby improve the research output of the individual, institute being served and help the country in moving towards better accreditation/ranking on the world map.

III. BIOGRAPHICAL SKETCH OF PROF. K. BYRAPPA

Prof.K.Byrappa, who is well known as a scientist, was born on February 22nd, 1954. He completed his schooling with his brothers from Mahajana School, Mysuru, and Yuvaraja's College, Mysuru. Prof.K.Byrappa was very fond of studies since childhood. He studied his Master of Science in Geology from the University of Mysore. He received his Ph.D. from Moscow State University, Russia, and then became a Professor at the University of Mysore. He has spent about 31 years at the University of Mysore in different capacities before becoming the Vice-Chancellor of Mangalore University, Karnataka in June 2014. From July 2018, he is the Pro-Vice-Chancellor of Adichunchanagiri University, B.G.Nagara, Mandya district, Karnataka. Along with his brilliant publications, Prof.K.Byrappa is also known for his transparent character. He never hesitates to put it in front of him. In the year 1983, he married Dr.K.T.Sunitha, who worked as a Professor of English in the Department of Studies in English, University of Mysore.

They are blessed with two children, Shayan who is working in Dallas, USA, and Nayan who is pursuing his Ph.D. under the guidance of Dr.S.Srikantaswamy in the Department of Studies in Environmental Science, University of Mysore. Scientists and researchers leave their footprints on the sands of time through their publications. Prof.K.Byrappa has been recognized as Ph.D. Guide in Physics, Chemistry, Materials Science, Earth Science, Environmental Science, Biotechnology, and Microbiology. After his Ph.D. from Russia, he has worked in several international laboratories abroad and visited more than 78 countries. Thoroughly concentrated on research publications and dedicated diligently to improving the research students. As a strong man with unparalleled skills and immense knowledge clearly shows his farsightedness as a scientist and also his sensing the general attitude of the masses he is shepherding.

Prof.K.Byrappawas awarded Sir CV Raman Birth Centenary Award for the year 2016-17 by the Hon'ble Prime Minister of India in recognition of his contribution to Science and Technology in India. One can appreciate, therefore, his popularity among them. Similarly, in the year 2011, he received several awards like the Dr. Raja Ramanna award for Science and Technology. He has also been conferred the Educational Leadership award by VijayVani, Bangalore in 2015. He is also serving in the international bodies and Indian National Science Academy (INSA) committees. He is the founder Coordinator of the M.Tech Course in Materials Science, at the Centre for Materials Science and Technology. He was the Chief Coordinator for the project University with Potential for Excellence (UPE), and also the Coordinator for the Center with Potential for Excellence in a Particular Area (CPEPA). Besides he was also the Founder Director of the Internal Quality Assurance Cell, at the University of Mysore. As Vice-Chancellor of Mangalore University, he was involved in several innovative programs to promote Mangalore University at the International level as one of the fast-growing universities. For the first time, he has brought more than 300 international students on the campus from over 35 countries to Mangalore University. He promoted interdisciplinary research. He has brought some of the finest academicians from all over the world to Mangalore University as Adjunct Professors. The campus beautification was given the highest priority with cleanliness and environmental awareness among the students. E-governance, Campus-wide Wi-Fi, and sophisticated Campus Surveillance system have been provided. As the Pro-Vice-Chancellor of Adichunchanagiri University in Mandya District, and has initiated several innovative programs in this university with inter-disciplinary research involving Medical, Engineering, Pharmacy, and Applied Science faculty and researchers. He has studied the Indian higher education system thoroughly concerning the socio-economic, geographic, gender-related religious, etc. issues, and published these articles in all Newsletter, which is a popular weekly newsletter on higher education in India.

IV. TIMELINE

1954: Prof.K.Byrappa was born on 22.02.1954
1969: Passed the Junior Level Examination of the Board of Commerce Institution
1975: Completed Master of Science in Geology from the University of Mysore
1976: Earned a Diploma certificate in the German language from the University of Mysore
1980: Certificate in the Russian Language from the University of Moscow, Russia
1981: Earned doctoral degree from University of Moscow, Russia
2007: Certificate in the Japanese language from ShiminCenter, Sendai, Japan
2014: Vice-Chancellor of Mangalore University of Karnataka, India
2018: Pro Vice-Chancellor of Adichunchanagiri University, B. G. Nagara, Mandya district, Karnataka.

V. OBJECTIVES OF THE STUDY

1. To identify the core journals and h-index, this has contained.
2. Prof. K. Byrappa's publications.
3. To study the year-wise distribution of his research productivity.
4. To know the most cited papers.
5. To examine scientific productivity.
6. To explore the authorship pattern in Prof.K.Byrappa's research publications.

VI. HYPOTHESES

1. There is a positive correlation between the number of articles and the year.
2. There is a significant difference in the number of publications of Dr.Byrappa's before and after taking charge as VC.

VI. REVIEW OF RELATED LITERATURE

As there are many numbers of articles available on scientometrics, a review of closely related literature is presented. This article aims to reveal the information science and scientometrics literature published, however, only a few relevant bibliometric studies have been covered for reviewing the past literature on the field. In the normal course of studies are conducted on the Nobel Laureates, founding father of the specialized field of study, etc. Levitt &Thelwall (2009) have examined the most highly cited information science and library science articles in the Web of Science from the perspectives of disciplinarily, annual citation patterns, and author citation profiles show that high-quality ideas and methods. However, credit and authenticity lie in citing the methodology written by those scholars.

Schubert &Glanzel (1992) have thoroughly explained that individual scientist including the Nobel Laureates is

becoming the focus of scientometric studies rather than gross statistical "macro" data. Besides Nobel Laureates, there are numerous scientometric studies on other scientists in various disciplines. Kalyane*et al*(1994) revealed the research contributions of M.S. Swaminathan, a distinguished Agricultural scientist, and researcher through a scientometric portrait.

In a similar light, Kalyane *et. al* (1994) studied the works of C.S. Venkata Ram, which revealed a solo research authorship pattern. Kademani *et al* (1996) have vividly analyzedthe research contributions of Nobel Laureate S Chandrasekhar, the distinguished scientist in the field of Astrophysics. The study revealed his research contributions, collaboration coefficient, productive coefficients, and other parameters. Angadi, *et al* (2004) portrayed a scientometric portrait of Nobel laureate Leland H. Hartwell about his outstanding research contributions to the field of Physiology and Medicine spanning over 41 years of his research publishing career. The study revealed his contributions spread over various domains of medical sciences. Kademani *et al* (2000) conducted a bibliometric study of Vikram Ambalal Sarabhai through the analysis of citations of his published papers.

The study analyzed the year's wise break up of citations, self-citations, distribution of citations, citing journals, citation impacts, and other such attributes of his publications. The paper analyzed the authorship pattern, collaborative trends of his publications, productive coefficients, and other key aspects of his research contributions.

Way (2010) studied the open access availability of Library and Information Science Research, a study was conducted using Google Scholar to search for articles from 20 top journals. Further, examine whether Google Scholar was able to find any links to the full-text open access versions of the articles that were available and where these articles were being hosted. However, the present study aims to present yet another Scientist whose contribution has not yet been explored.

VII. METHODOLOGY

The data used in the study was mainly collected from publication lists available at the Google Scholar and Web of Science that appeared in the journals listed (covered) in addition to interactions with his contemporaries and family members. For analysis, the database has been used to enter all the required bibliographical data such as the name of the authors, title, and source of documents, year and volume of publication, issue number, and article type.

They were collected and recorded on a spreadsheet with pre-designed columns. The data so collected were tabulated and analyzedto obtain the result.

VIII. DATA ANALYSIS

This paper analyses the curriculum vitae of Prof.K.Byrappa by using scientometric techniques. When the author asked for his CV, Prof.K.Byrappa generously supplied the needed documents, and whenever the author required any type of information he cooperated and provided information. The present study is limited to 378 papers by Prof.K. Byrappa (1980 - Jan 2020). The bibliographic activities are counted and analyzed by regular procedure e.g., to determine the domain, authorship, journals, and citation. Google Scholar is used for citation determinations of his publications.

TABLE I TOTAL PUBLICATION PRODUCTIVITY

Publication Productivity	Number of Research Publication	Percentage
Journals	378	82.71
Book Chapters	34	7.44
Book Reviews	34	7.44
Books (edited)	10	2.19
Handbook	1	0.22
Total	457	100%
H Index:31 (Source: Google Scholar)		Total Citations: 7774 (Source: Google Scholar)

The publication activity of Prof. K. Byrappa which began in 1980 at the age of 26 continues to date. Extracted data from the Google scholar indicate that he has produced a total of 457 scholarly publications which include 378 (82.71%) articles in his professional career (with high citation index), 34 book chapters and reviews (7.44%), 10 books edited (2.19%) and a famous handbook (0.22%) respectively (Table I & Figure 1). The portray of Prof. K. Byrappa with anh-index of 31 with a total of 7774 citations is widely popular among the researchers, which shows that individual contribution of about 25% (individual h index = 31).

These high values obtained after 41 years of scientific research indicate that Prof. K. Byrappa is a successful scientist to be taken as a role model for the younger generation to emulate.

According to Hirsch (2005), an h-index of 20 after 20 years of scientific activity characterizes successful scientists; an h-index of 40 after 20 years characterizes outstanding scientists, and an h-index of 60 after 20 years or 90 after 30 years characterizes truly unique individuals. It should be noted, however, that these publication data were retrieved in January 2020; hence the total productivity of the year 2020 might be incomplete.

The Chronological distribution of the publications is presented in Table 2. Although there are concerns that scholars' publication productivity tends to drop as they assume greater administrative responsibilities, this was not the case for Prof. K. Byrappa.
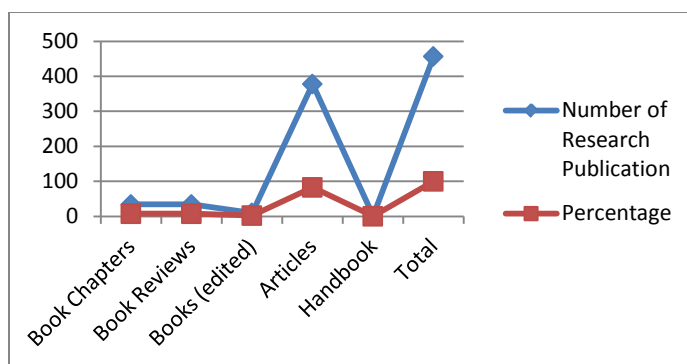
Fig.1 Publication Productivity of Prof. K. Byrappa

TABLE II YEAR-WISE DISTRIBUTION OF PROF. K. BYRAPPA'S PUBLICATIONS

Year	Year-wise publications	Cumulative productivity	Productivity age	Age of Prof. K. Byrappa
1980	1	1	1	26
1981	2	3	2	27
1982	2	5	3	28
1983	3	8	4	29
1984	1	9	5	30
1985	5	14	6	31
1986	15	29	7	32
1987	10	39	8	33
1988	1	40	9	34
1989	7	47	10	35
1990	5	52	11	36
1991	3	55	12	37
1992	11	66	13	38
1993	6	72	14	39
1994	4	76	15	40
1995	0	76	16	41
1996	2	78	17	42
1997	5	83	18	43
1998	3	86	19	44
1999	4	90	20	45
2000	3	93	21	46
2001	6	99	22	47
2002	6	105	23	48
2003	7	112	24	49
2004	6	118	25	50
2005	3	121	26	51
2006	12	133	27	52
2007	13	146	28	53
2008	13	159	29	54
2009	4	163	30	55
2010	24	187	31	56
2011	11	198	32	57
2012	11	209	33	58
2013	8	217	34	59
2014	14	231	35	60
2015	23	254	36	61
2016	29	283	37	62
2017	33	316	38	63
2018	39	355	39	64
2019	19	374	40	65
2020	4	378	41	66

Table II depicts the year wise publications of Prof. K. Byrappa. During the period 1980 to January 2020, along 41 publication years, he has published a total number of 378 articles with an average of 9-10 papers per year.

His 1st publication has been identified in the year 1980 when he was a man of 26 years old. The number of papers grew steadily to 2 and 3 in the next two years. It is observed in the table that, except in the year 1995, he has constantly published his research publications. Prof. K. Byrappa has received the Attractive Paper award in the IX International Conference on Crystal Growth, held in Japan during August 1989, when he was 35 years old with 47 research publications and Sir CV Raman Birth Centenary Award for the year 2016-17 by the Hon'ble Prime Minister of India, at the age of 63 years with 316 research publications.

During these years Prof. K, Byrappa has published the highest 39 papers in the year 2018 followed by 19 papers in the year 2019 and 33 papers in the year 2017.

TABLE III MORE THAN 100 TIMES CITED PAPERS OF PROF. K. BYRAPPA

Title of the Article	Year of Publication	No. of Citations	Ranking
Handbook of hydrothermal technology	2012	1197	1
Hydrothermal technology for nanotechnology	2007	905	2
Hydrothermal processing of materials: past, present, and future	2008	471	3
Nanoparticles synthesis using supercritical fluid technology–towards biomedical applications	2008	426	4
Mechanochemical–hydrothermal synthesis of carbonated apatite powders at room temperature	2002	339	5
Springer handbook of crystal growth	2010	325	6
Preparation of magnesium-substituted hydroxyapatite powders by the mechanochemical–hydrothermal method	2004	296	7
Photocatalytic degradation of rhodamine B dye using hydrothermally synthesized ZnO	2006	275	8
Solution synthesis of hydroxyapatite designer particulates	2002	196	9
Photocatalytic degradation of indigo carmine dye using TiO2 impregnated activated carbon	2007	185	10
Soft solution processing: a strategy for one-step processing of advanced inorganic materials	2000	166	11
Crystal growth technology	2003	157	12
Hydrothermal preparation of ZnO:CNT and TiO2:CNT composites and their photocatalytic applications	2008	141	13

In every research, the citation is considered a common benchmark to evaluate the impact and quality of the research publication. The more numbers of authors referred to a paper, the more numbers of citations will be incurred and simultaneously it will favor the rise of the h-index of the publishing journal/ book and the researcher/author. It is seen from table 3 that out of 378 papers highest 268(70.90%) papers are cited by different authors and 13(3.44%) papers are more than 100 times cited papers.

A famous Handbook of hydrothermal technology, published in the year 2012 has been cited highest 1197 times and ranked 1st amongst his all publications, followed by the paper "Hydrothermal technology for nanotechnology" published in the year 2007 has been cited 905 times and ranked 2nd and the paper "Hydrothermal processing of materials: past, present, and future" published in the year 2008 has been cited 471 times and ranked 3rd, etc.

TABLE IV QUINQUENNIUM-WISE PRODUCTIVITY

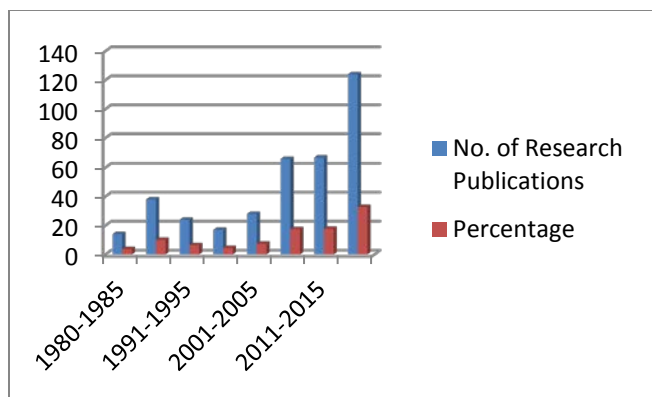| Year	No. of Research Publications	Percentage
1980-1985	14	3.70
1986-1990	38	10.05
1991-1995	24	6.35
1996-2000	17	4.50
2001-2005	28	7.41
2006-2010	66	17.46
2011-2015	67	17.72
2016-2020	124	32.80
Total	378	100%

Fig. 2 Quinquennium-wise Productivity

Table IV and Figure 2 describe quinquennium-wise productivity which consists of eight quinquenniums from 1980-2020. Prof. K. Byrappa's most productive years for publishing scientific articles in refereed journals were 2006-2010, 2011-2015, and 2016-2020 in which he had published 257 papers(67.99percent) (Figure 2). During these years he had published a minimum of 66 papers each year in scientific articles. He had published 14research papers in 1980-1985.

TABLE V AUTHORSHIP PATTERN OF ARTICLES

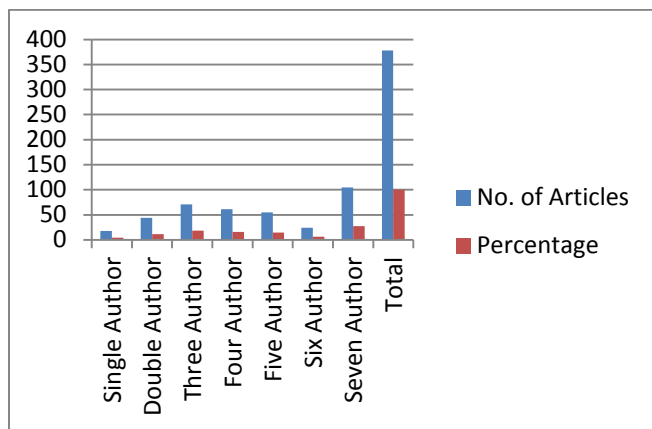| Authorship	No. of Articles	Percentage
Single Author	18	4.76
Double Author	44	11.64
Three Author	71	18.78
Four Author	61	16.14
Five Author	55	14.55
Six Author	24	6.35
Seven Author	105	27.78
Total	378	100%

Fig.3 Authorship pattern of articles

Collaboration among researchers is inevitable to share expertise and resources as well as to increase the visibility of research works. Table V depicts the authorship pattern of Prof. K. Byrappa in publishing articles. He has published a total of 378 articles in which he published 18 articles as an individual, 44 articles with 1 collaborator, 71 articles with 2 collaborators, 61 articles with 3 collaborators, 55 articles with 4 collaborators, 24 articles with 5 collaborators, and 105 articles with 6 collaborators. Thus, collaborated research is found to be dominant with seven authors (Fig.3).

IX. CONCLUSION

Publications are one way of understanding a person's contribution to science, but there are other actions also. The publication productivity of Prof. K. Byrappa was found to be consistent and he made an outstanding contribution to the field of science in the last 41 years. He has increasingly been active in research despite his many administrative responsibilities. He prefers to work in teams and he has a high degree of collaboration at the institution, national and international levels. The high rate of citations to his papers proves the usefulness and impact of his scientific works in the field of science and technology. Handbook of hydrothermal technology has been cited more than a thousand times by many students and researchers stand as testimonies to his commitment to science. Based on the results it can be conferred that Prof. K. Byrappa is one of the highly cited scientists who serve as a motivator for younger researchers. He is undoubtedly one of the most outstanding scientists to be taken as a role model for the younger generation to emulate.

REFERENCES

[1] Angadi, M., Koganuramath, M. M., Kademani, B. S., Kalyane, V. L., & Sen, B. K. (2004). Scientometric portrait of Nobel laureate Leland H. Hartwell. 10-30.
[2] Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences, 102*(46), 16569–16572.
[3] Hood, W., & Wilson, C. (2001). The Literature of Bibliometrics, Scientometrics, and Informetrics. *Scientometrics, 52*(2), 291–314.
[4] Kademani, B. S., Kalyane, V. L., & Kademani, A. B. (1996). Scientometric portrait of Nobel Laureate S. Chandrasekhar. *JISSI : The International Journal of Scientometrics and Informetrics.*
[5] Kademani, B. S., Kalyane, V. L., & Kumar, V. (2000). Scientometric portrait of Vikram Ambalal Sarabhai: a citation analysis. *SRELS Journal of Information Management, 37*(2), 107-132.
[6] Kalyane, V. L., & DevaraiRajashekhar, S. (1994). Informetrics on C.S.Venkata Ram. *New Horizons in Library and Information Science: Dr.VelagaVenkatappaiah Festschrift, Editors: CP Vashishth, LS Ramaiah, NV JaggaRao and TV Prafulla Chandra, Madras: TR Publications,* 475-478.
[7] Kalyane, V. L., & Kalyane, S. V. (1994). Scientometric portrait of MS Swaminathan. *Library Science, 31*(1), 31-46.
[8] Levitt, J. M., & Thelwall, M. (2009). Citation levels and collaboration within the library and information science. *Journal of the American Society for Information Science and Technology, 60*(3), 434-442.
[9] Price D. J. D. S. (1963). *Little Science, Big Science*. Columbia University Press.
[10] Schubert, A., & Glanzel, W. (1992). The most frequent family names among science authors 1981-85. *Scientometrics, 60*(3).
[11] Way, D. (2010). The openaccess availability of library and information science literature. *College & Research Libraries, 71*(4), 302-309.

Authorship Patterns and Degree of Collaboration of Cited Literature in Indian Chemistry Research Publications

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Abstract - **The purpose of this study is to identify the authorship patterns and degree of collaboration of Indian research publications in the field of Chemistry. The main data source for the study is the citations/references of research publications of chemistry indexed in Web f Science during the period 2009-2018. The research method of this study was citation analysis method. Findings of the analysis revealed that the majority of the publications are contributed by multiple authors and the degree of collaboration found to be very high in cited journal literature compared to books and other forms of citations.**
Keywords: Citation analysis, authorship pattern and degree of collaboration

I. INTRODUCTION

The number of authors contributing to scholarly publications in terms of authorship pattern is an interesting part of any bibliometric study. A count of number of authors contributing to articles offers some indication to the degree of collaboration between authors. Cronin (2001) comments, authorship as "undisputed coin of the real in academia" and "absolutely central to the operation of the academic reward system". However, the concept of authorship was evolved over the course of the 20th century, with a steady increase in collaboration. This trend was anticipated by Price (1963), who stated, "by 1980 the single-author paper will be extinct" and scholarly publications will "move steadily toward infinity of authors per paper". Collaborative research refers to a research in which any research project is being carried out by at least two people by engaging their efforts in mind and body. It is very common in the field of sciences as compare to humanities.

II. REVIEW OF LITERATURE

As part of literature search, the authors found various studies in different disciplines based on the authorship pattern and collaborative research. Some the earlier studies are mentioned here. Karisidappa, Maheswarappa & Shirol (1990) studied authorship pattern and collaborative research in psychology based on the data collected from Psychological Abstracts' for the year 1988, where 39.43%

of the papers accounted for single-authorship and the degree of collaboration in psychology was 0.80. Khaiser Jahan Begum & Rajendra (1990) studied research collaboration in Zoological Sciences analysing 7854 items published during 1975-84, where 67.02% of the literature was by multiple authors. Munshi, Vashishth & Gautam (1993) have studied Research collaboration in agricultural sciences' analyzing about 9500 papers published during 1982-86 by six agricultural universities in India. Here 15.36% of the articles were single authored.

Sen (1997) has studied articles with ten or more authorship. Five percent of the papers published in Proceedings of the National Academy of Science New York, February - July 1996 were 'mega authored. Joshi & Maheswarappa (1994) in Multiple authorship trends in different subjects of science and technology: A review of literature" reviewed the studies related to multiple authorship trends in different subjects like mathematics, physics, chemistry, geology, engineering, agricultural sciences and chemical technology. In mathematics 94% of the papers were single-authored in 1940, 79% in 1960 and 44.23% in 1983.

Study conducted by Sudhier & Dileepkumar (2018) indicated that papers in biochemistry are found to be multi authored to an extent of 76.3%. Study also showed that the degree of collaboration of authors of research publications in biochemistry emanating from India is estimated as in the range of 0.97 to 0.98 during 2004-2013. Pupo & Katz (2018) revealed that the journal articles authored by library professionals were collaborative ones which accounted for 69%. Contrary result was observed in the study on economics theses that scholars while preparing doctoral theses had cited a large number of single authored sources which accounts for 72.81%.

III. OBJECTIVES OF THE STUDY

The main purpose of this study is to know the amount solo and collaborative researches Cited in the research publications of chemistry.

The objectives of the present study are:

1. To examine the nature of authorship patterns in chemistry research;
2. To study the single v/s multi- author papers and average number of authors and
3. To determine the degree of research collaboration on chemistry literature.

IV. METHODOLOGY

21025 number of citations appended in the 728 research publications of University of Mysore in the field of chemistry indexed in the Web of Science during 2009-2018 were considered for the study.

In order to perform a quantitative analysis, this study considered only journal articles indexed in the database. Selected articles were downloaded from the concerned websites of journals, institutional repository of University of Mysore and Research Gate. Further, cited references were recorded in MS excel, analyzed and tabulated for making observations.

And to calculate the degree of author's collaboration, the mathematical formula proposed by Subramanyam in 1983 is used.

V. ANALYSIS AND RESULTS

According to the objectives of the study, analysis and findings of the study are outlined below

TABLE I AUTHORSHIP PATTERNS OF CITATIONS TO JOURNALS

Authorship patterns	Citations	%	Cumulative citations	Cumulative %	No. of Authors
Single	1894	9.89	1894	9.89	1894
Two	3346	17.48	5240	27.38	6692
Three	3506	18.32	8746	45.69	10518
Four	3000	15.67	11746	61.37	12000
Five	2519	13.16	14265	74.53	12595
Six	1528	7.98	15793	82.51	9168
Seven	952	4.97	16745	87.48	6664
Eight	566	2.96	17311	90.44	4528
Nine	374	1.95	17685	92.39	3366
Ten	302	1.58	17987	93.97	3020
Above ten	945	4.94	18932	98.91	15241
Not available	209	1.09	19141	100.00	0
Total	19141	100			85686
Average authorship					4.47

It is observed from the Table I that journal citations authored by three authors are high (18.32%) followed by two authored (17.48%) and four authored (15.67%). Single authored journal citations constituted 9.89% of total citations. Average authorship among journal citationsin the chemistry research publications of University of Mysore is 4.47.
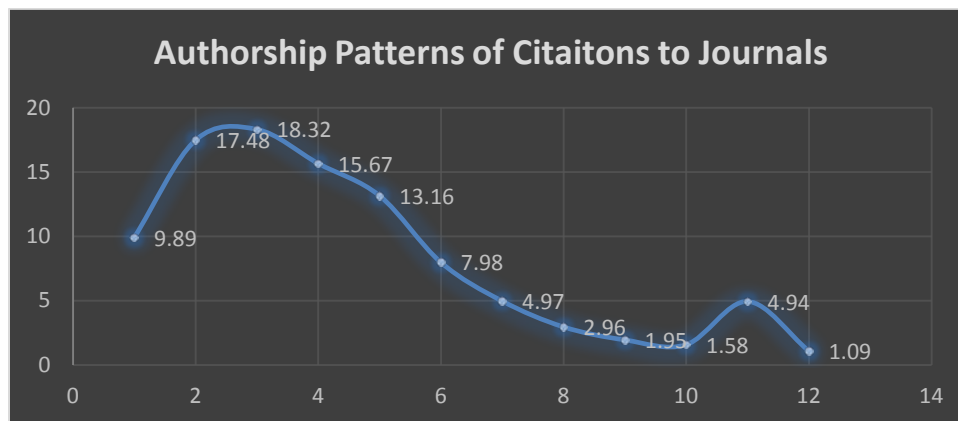

Fig.1 Authorship Patterns of Citations to Journals

TABLE II AUTHORSHIP PATTERNS OF CITATIONS TO BOOKS

Authorship pattern	Citations	%	Cumulative citations	Cumulative %	No. of Authors
Single	403	41.33	403	41.33	403
Two	221	22.67	624	64.00	442
Three	86	8.82	710	72.82	258
Four	70	7.18	780	80.00	280
Five	20	2.05	800	82.05	100
Six	4	0.41	804	82.46	24
Seven	5	0.51	809	82.97	35
Eight	5	0.51	814	83.49	40
Nine	1	0.10	815	83.59	9
Ten	3	0.31	818	83.90	30
Above ten	1	0.10	819	84.00	11
Not available	156	16.00	975	100.00	0
Total	975	100			1632
Average authorship					1.67

It is evident from the table II that single authored books are heavily cited by the chemistry researchers of University of Mysore. Percentage of single authored books citations predominated over multi authored books citations with41.33% of total citations and the remaining percentage of citations were spread among two (22.67%) three (8.82%) and four (7.18%) and other groups of authorship pattern (3.99%). Average authorship among books citations is 1.67.
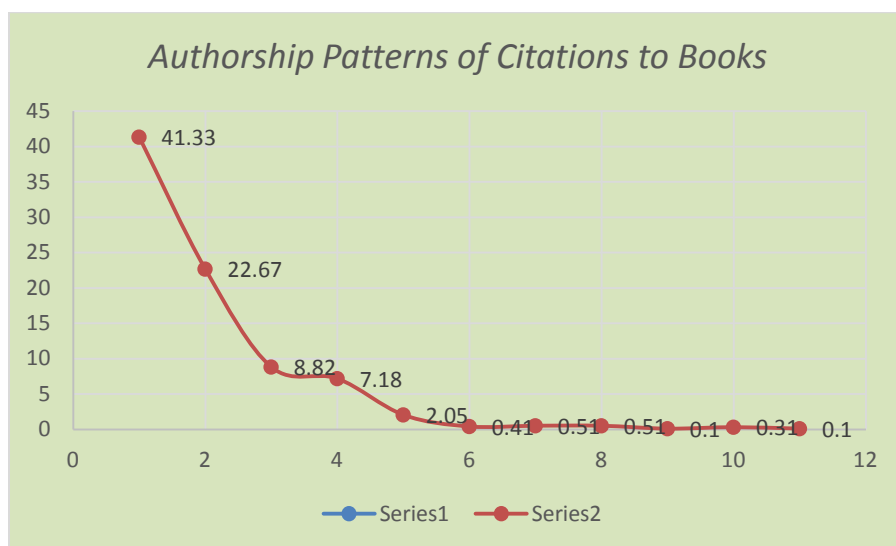
Fig. 2 Authorship Patterns of Citations to Books

Table III shows that 25.74% other forms of cited sources were by single authors followed by two (10.45%) and three (8.69%) authors. 37.62% of other sources cited are anonymous. Average authorship among other forms of cited sources in chemistry research publications of University of Mysore is 1.93

TABLE III AUT HORSHIP PATTERNS OF CITATIONS TO OTHER FORMS OF SOURCES

Authorship pattern	Citations	%	Cumulative citations	Cumulative %	No. of Authors
Single	234	25.74	234	25.74	234
Two	95	10.45	329	36.19	190
Three	79	8.69	408	44.88	237
Four	49	5.39	457	50.28	196
Five	37	4.07	494	54.35	185
Six	16	1.76	510	56.11	96
Seven	12	1.32	522	57.43	84
Eight	5	0.55	527	57.98	40
Nine	4	0.44	531	58.42	36
Ten	10	1.10	541	59.52	100
Above ten	26	2.86	567	62.38	357
Not available	342	37.62	909	100.00	0
Total	909	100			1755
Average authorship					1.93
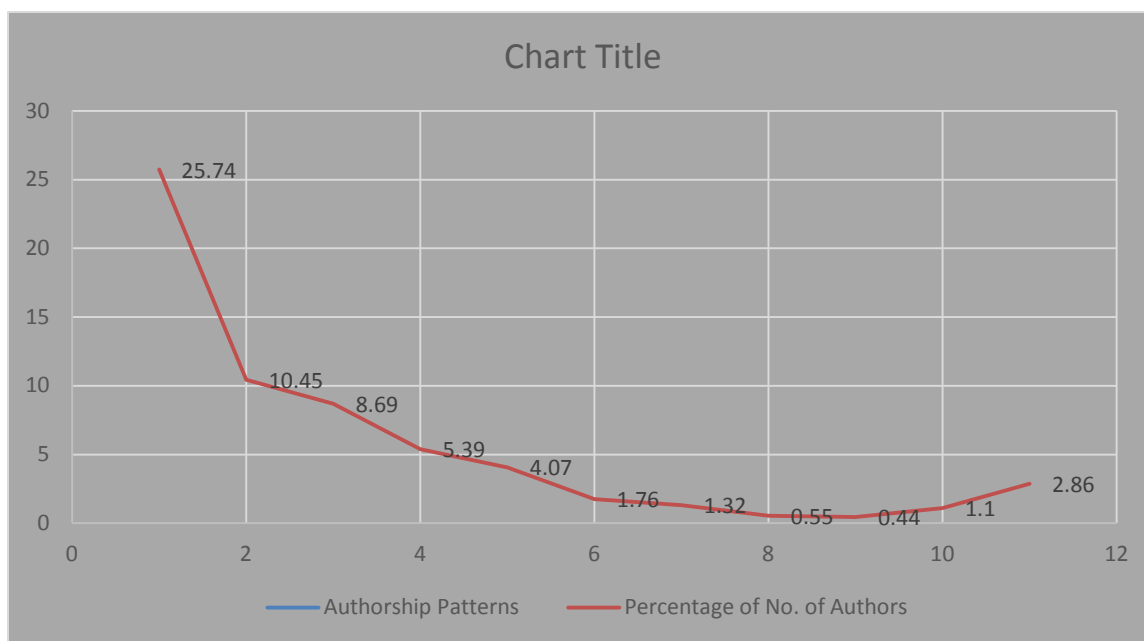
Fig.3 Authorship Patterns of Citations to other forms of sources

It is observed from the Table IV that majority of journals citations by single as well as multi authors cited by researchers in chemistry of University of Mysore were mainly published during 2001-2010. Single authored journal citations were increased by 4.57% from the period 1910 and before to 2001-2010. Similar trend was observed in the other authorship pattern like two authors, three authors and so on.

TABLE IV DECADE WISE AUTHORSHIP PATTERNS IN CITATIONS TO JOURNALS

Periods		Single	Two	Three	Four	Five	>five	Not Available	Total
Oldest to 1910	No.	23	8	0	1	1	3	1	37
	%	0.12	0.04	0.00	0.01	0.01	0.02	0.01	0.19
1911-1920	No.	2	2	0	0	0	0	0	4
	%	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02
1921-1930	No.	2	12	0	0	1	0	0	15
	%	0.01	0.06	0.00	0.00	0.01	0.00	0.00	0.08
1931-1940	No.	13	14	1	0	0	1	0	29
	%	0.07	0.07	0.01	0.00	0.00	0.01	0.00	0.15
1941-1950	No.	22	21	11	8	1	0	0	63
	%	0.11	0.11	0.06	0.04	0.01	0.00	0.00	0.33
1951-1960	No.	42	48	25	34	4	5	0	158
	%	0.22	0.25	0.13	0.18	0.02	0.03	0.00	0.83
1961-1970	No.	71	108	43	23	12	9	2	268
	%	0.37	0.56	0.22	0.12	0.06	0.05	0.01	1.40
1971-1980	No.	69	287	141	52	15	15	10	589
	%	0.36	8.58	4.02	1.73	0.60	0.32	4.78	3.08
1981-1990	No.	193	360	336	183	95	209	17	1393
	%	1.01	1.88	1.76	0.96	0.50	1.09	0.09	7.28
1991-2000	No.	423	689	674	612	302	612	29	3341
	%	2.21	3.60	3.52	3.20	1.58	3.20	0.15	17.45
2001-2010	No.	898	1376	1719	1473	1424	2099	106	9095
	%	4.69	7.19	8.98	7.70	7.44	10.97	0.55	47.52
2011-2018	No.	136	420	556	614	664	1714	44	4148
	%	0.71	2.19	2.90	3.21	3.47	8.95	0.23	21.67
Not available	No.	0	1	0	0	0	0	0	1
	%	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01
Total	No.	1894	3346	3506	3000	2519	4667	209	19141
	%	9.89	17.48	18.32	15.67	13.16	24.38	1.09	100.00

TABLE V DECADE WISE AUTHORSHIP PATTERNS IN CITATIONS TO BOOKS

Periods		Single	Two	Three	Four	Five	>five	Not Available	Total
1910 and before	No.	2	0	0	0	0	0	0	2
	%	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.21
1911-1920	No.	0	0	0	0	0	0	0	0
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1921-1930	No.	0	0	0	0	0	0	3	3
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31
1931-1940	No.	1	0	0	0	0	0	0	1
	%	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10
1941-1950	No.	2	0	0	0	0	0	1	3
	%	0.21	0.00	0.00	0.00	0.00	0.00	0.10	0.31
1951-1960	No.	12	9	1	1	0	0	2	25
	%	1.23	0.92	0.10	0.10	0.00	0.00	0.21	2.56

1961-1970	No.	36	14	6	1	0	1	2	60
	%	3.69	1.44	0.62	0.10	0.00	0.10	0.21	6.15
1971-1980	No.	59	39	5	6	3	0	11	123
	%	6.05	4.00	0.51	0.62	0.31	0.00	1.13	12.62
1981-1990	No.	96	36	20	22	2	2	23	201
	%	9.85	3.69	2.05	2.26	0.21	0.21	2.36	20.62
1991-2000	No.	118	75	25	14	5	5	45	287
	%	12.10	7.69	2.56	1.44	0.51	0.51	4.62	29.44
2001-2010	No.	65	40	23	18	8	7	61	222
	%	6.67	4.10	2.36	1.85	0.82	0.72	6.26	22.77
2011-2018	No.	12	8	6	8	2	4	7	47
	%	1.23	0.82	0.62	0.82	0.21	0.41	0.72	4.82
Not available	No.	0	0	0	0	0	0	1	1
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.10
Total	No.	403	221	86	70	20	19	156	975
	%	41.33	22.67	8.82	7.18	2.05	1.95	16.00	100.00

Table V shows that researchers of chemistry belonging to University of Mysore preferred to cite single authored books that were published during 1991-2000. The percentage of growth of single authored books from 1910 and before to 1991-2000 is 11.89. The same growth of citations is observed among other authorship patterns in research publications of University of Mysore.

VI. DEGREE OF AUTHORSHIP COLLABORATION IN THE CHEMISTRY RESEARCH PUBLICATIONS

The degree of collaboration is the ratio of multi authored papers published to the total number of papers published in a discipline during certain period of time. The formula given by Subramanyam is useful for determining the degree of collaboration in quantitative terms. The study followed the same formula which is mathematically put as:

$$C = \frac{Nm}{Nm + Ns}$$

Where, C= Degree of collaboration in a discipline.
Nm = number of multi-authored papers
Ns = number of single- authored papers

TABLE VI DEGREE OF COLLABORATION IN THE CITED LITERATURE

Authorship	Single author	Multi authors	Total	Degree of collaboration
Journals	1894	17038	18932	0.89
Books	403	416	819	0.50
Others	234	333	567	0.58
Total	2531	17788	20319	0.87

In the present case C is 0.87 for total citations in chemistry research publications of UOM and the calculation of the same is presented as below

$$C = \frac{17788}{17788+2531} = 0.87$$

From the Table VI it is observed that the degree of authorship collaboration for journal citations is 0.89, for books 0.50 and for forms of documents 0.58.The degree of collaboration in the field of chemistry for overall citations of University of Mysore is 0.87.

VII. CONCLUSION

The authors studied patterns of authorship in the cited literature of Indian scholarly output in chemistry. The authorship pattern reveals a remarkable difference between the number of single author and multiple authors. As a far

as cited journal literature is concerned citations to journals authored by three authors are high (18.32%) while citations to books shows contrary results that 41.33% of citations were single authored. The degree of authorship collaboration for citations to journals is 0.89. The study concludes that multiple-authorship researches were predominantly cited as compared to solo researches in Indian researches in chemistry.

REFERENCES

[1] Begum, K. J., and Rajendra, N. (1990). "Research collaboration in zoological sciences," *IASLIC Bulletin*, 35(2), 79-82.

[2] Joshi Anupam N. and Maheswarappa B. S. (1994). "Multiple authorship trends in different subjects of science and technology. A review of literature," *ILA Bulletin,* 30(1), 31-37.

[3] Karisiddappa, C. R., Maheswarappa, B. S., and Shirol, M. V. (1990). "Authorship pattern and collaborative research in psychology," *IASLIC Bulletin*, *35(2)*, 73-78.

[4] Ronda-Pupo, G. A., and Katz, J. S. (2018). "The power law relationship between citation impact and multi-authorship patterns in articles in Information Science & Library Science journals," *Scientometrics*, 114(3), 919-932.

[5] Sen, B. K. (1997). "Mega-authorship from a bibliometric point of view," *Malaysian Journal of Library & Information Science*, 2(2), 9-18.

[6] Sudhier, K. G., and Dileepkumar, V. (2018). "Collaborative authorship in scholarly Indian publications in biochemistry," *ILIS Journal of Librarianship and Informatics,* 1(1), 19-27.

[7] Usha, M. M., Vashishth, C. P., and Gautam, J. N. (1993). "Research collaboration in agricultural sciences," *ILA Bulltin*, *28(2),* 57-60.

A Comparative Study of Library Automation in First Grade College Libraries in Four Districts of Karnataka

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Abstract - **The present paper compares library automation in first-grade college libraries affiliated to the University of Mysore. A structured questionnaire was used to collect primary inputs from college libraries to understand the present status. A total of 160 colleges were taken up for the study in which 135 (84.37%) colleges responded,15 first grade college libraries did not have librarians and ten librarians did not respond. The study's findings reveal that 94 (69.62%) college libraries are automated. Among them, 29 (30.85%) college libraries are fully automated, 65 (69.14%) college libraries are partially automated and 41 (30.37%) libraries are not automated.   The study's findings reveal that all autonomous colleges are automated—the main reason for not automating the library in Government colleges, Private aided colleges and Unaided colleges are inadequate of finance and lack of trained manpower. It is suggested that the librarians have to attend intensive training programs on deputation or become proficient in automation work to provide effective and efficient services to users.**
*Keywords***: Library automation, college libraries, software**

I. INTRODUCTION

Library automation has shifted from an emphasis on local concerns to global concerns. These goals evolved through three incremental phases--the efficiency of internal operations, access to local resources, and access to resources outside the library--before reaching the present stage of addressing interoperability among systems and services.

The challenge facing libraries today is how to act locally--to implement strategies that ensure internal efficiencies and high levels of service to the community--while thinking globally, assuring that local systems can exchange data with other systems located around the world (Borgman, 1997).The key developments in library automation include online database vendors; bibliographic utilities; local online systems, i.e., turnkey circulation systems and academic systems that have incorporated online catalogues, circulation, acquisitions, and serials control; commercial integrated systems; CD-ROMs; local online database searching; microcomputers; the facsimile or fax machine; and future possibilities(Boykin, 1991).

II. REVIEW OF LITERATURE

Abbas (2014) analyzed the Nigeria ICT environment, the current state of automation in Nigerian university libraries with particular reference to Ahmadu Bello University, Zaria and University of Ibadan Libraries and concluded by proposing a model for achieving automated library system in our universities for effective information access, management and delivery based on enormous benefits accruable to libraries that embraced the system. Anas, *et al.* (2014) investigation revealed that 3 of 4 libraries are partially automated, except Al-Barkaat, completely automated. Seventy percent of librarians believe that automation has improved their library's services. Anjanappa (2014) stated that out of 9 universities in Karnataka, 33.3% of universities used SOUL, 33.3% LIBSYS, 22.2% used New-Genlib software. Rashmi Verma & Sandeepayadav (2014) investigated library software position at Aligarh University, Banaras Hindu University, Allahabad University, and Babasaheb BhimRao Ambedkar University and concluded Liary software worked well in university libraries. Bhagachand (2015), in his study based on Nasik and Malegaon's 14 college libraries, Maharashtra, revealed that various ICT facilities were readily available in the selected libraries, such as computers, printers, photocopier, Internet connectivity, etc. Though Open Source Software like KOHA, Evergreen software was available, all libraries still used local commercial software.

III. OBJECTIVES OF THE STUDY

1. To know the first-grade college libraries that has undertaken automation.
2. To study the present status of the automation of college libraries affiliated to the University of Mysore.
3. To find the reasons for non-automation in college libraries.
4. To know the success level of library automation among college libraries.

IV. METHODOLOGY

The First Grade Colleges affiliated to the University of Mysore, Mysore have been categorized into four types, i.e., Government Colleges, Private Aided Colleges, Private Unaided Colleges, and Autonomous Colleges. A comparative study of these four types was conducted. The details of affiliated colleges to the University of Mysore were taken from the University of Mysore's official website.

The present study used a structured questionnaire as a tool. The questionnaires were distributed to all the160 librarians of first-grade colleges affiliated to the University of Mysore. Besides distributing the questionnaires, informal personal interviews with selected librarians were conducted, and observation in the libraries was also done.

A total of 135 duly filled-in questionnaires were received, with a response rate is 84.37 % (135). It was found that 15 first grade college libraries did not have librarians and ten librarians did not respond. The collected data are tabulated using the SPSS statistical package.

V. DATA ANALYSIS AND INTERPRETATION

TABLE I DISTRIBUTION OF THE QUESTIONNAIRE

Type of Management	Questionnaires Distributed	Questionnaires Received	
		Frequency	Percentage
Government	68	60	88.23
Private Aided	24	19	79.16
Private Unaided	59	47	79.66
Autonomous	09	09	100.00
Total	160	135	84.37

TABLE II NAAC ACCREDITATION OF THE COLLEGES

NAAC Accreditation	Government (N=60)	Private Aided (N=19)	Private Unaided (N=47)	Autonomous (N=09)	Total (N=135)
Yes	41(68.33)	18(94.73)	06(12.76)	09(100.00)	74(54.81)
No	19(31.66)	01(05.26)	41(87.23)	00(00.00)	61(45.18)
Grade Allocated by NAAC (N=74)					
NAAC Grade	Government (N= 41)	Private Aided (N=18)	Private Unaided (N= 06)	Autonomous (N= 09)	Total (N=74)
C	09(21.95)	04(22.22)	02(33.33)	00(00.00)	15(20.27)
B	18(43.90)	10(55.55)	03(50.00)	01(11.11)	32(43.24)
B+	01(02.43)	01(05.55)	00(00.00)	00(00.00)	02(02.70)
B++	05(12.19)	02(11.11)	01(16.66)	02(22.22)	10(13.51)
A	08(19.51)	01(05.55)	00(00.00)	05(55.55)	14(18.91)
A++	00(00.00)	00(00.00)	00(00.00)	01(11.11)	01(01.35)
Note: Figures in parentheses indicate percentage					

It is observed from Table-II that 74 (54.81%) colleges are accredited by the NAAC, and 61 (45.18%) colleges are not accredited by the NAAC.

The Table-II also depicts that 41 (68.33%) Government colleges, 18 (94.73%) Private Aided colleges, 06 (12.76%) Private Unaided colleges and 09 (100.00%) Autonomous colleges are accredited by the NAAC.

About 19 (31.66%) Government colleges, 01 (05.26%) Private Aided colleges and 41 (87.23%) Private Unaided colleges are not accredited by the NAAC. It can also be noted that 32 (43.24%) colleges are accredited with 'B' grade by the NAAC, followed by 15 (20.27%) colleges accredited with'C' grade, 14 (18.91%) colleges accredited with 'A' grade, 10 (13.51%) colleges accredited with 'B++', 02 (02.70%) colleges are accredited with 'B+', and 01 (01.35%) college is accredited with 'A++' grade by the NAAC.

The above table also depicts that 18 (43.90%) Government colleges, 10 (55.55%) Private Aided colleges and 03 (50.00%) Private Unaided colleges are accredited with 'B' grade by the NAAC and 05 (55.55%) Autonomous colleges are accredited with 'A' grade by the NAAC.

The Table III depicts that out of 135 librarians in the First Grade College libraries, 78 (57.77%) are 'Male' and the remaining 57 (42.22%) are 'Female'.

The Table III also shows that 35 (58.33%) librarians from Government colleges, 10 (52.63%) librarians from Private Aided colleges, 28 (59.57%) librarians from Private Unaided colleges and 05 (57.77%) librarians from Autonomous colleges are 'Male'. About 25 (41.66%) librarians from Government colleges, 09 (47.36%) librarians from Private Aided colleges, 19 (40.42%) librarians from Private Unaided colleges and 04 (44.44%) librarians from Autonomous colleges are 'Female'.

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TABLE III GENDER-WISE DISTRIBUTION

Gender	Government (N=60)	Private Aided (N=19)	Private Unaided (N=47)	Autonomous (N=09)	Total (N=135)
Male	35(58.33)	10(52.63)	28(59.57)	05(55.55)	78(57.77)
Female	25(41.66)	09(47.36)	19(40.42)	04(44.44)	57(42.22)
Note: Figures in parentheses indicate percentage					

The Table III depicts that out of 135 librarians in the First Grade College libraries, 78 (57.77%) are 'Male' and the remaining 57 (42.22%) are 'Female'.

The Table III also shows that 35 (58.33%) librarians from Government colleges, 10 (52.63%) librarians from Private Aided colleges, 28 (59.57%) librarians from Private Unaided colleges and 05 (57.77%) librarians from Autonomous colleges are 'Male'.

About 25 (41.66%) librarians from Government colleges, 09 (47.36%) librarians from Private Aided colleges, 19 (40.42%) librarians from Private Unaided colleges and 04 (44.44%) librarians from Autonomous colleges are 'Female'.

TABLE IV PROFESSIONAL QUALIFICATION OF LIBRARIANS

Qualification	Government (N=60)	Private Aided (N=19)	Private Unaided (N=47)	Autonomous (N=09)	Total (N=135)
M.L.I.Sc.	23(38.33)	04(21.05)	33(70.21)	02(22.22)	62(45.92)
M.Phil.	28(46.66)	09(47.36)	08(17.02)	02(22.22)	47(34.81)
PhD	09(15.00)	06(31.57)	06(12.76)	05(55.55)	26(19.25)
Note: Figures in parentheses indicate percentage					

It is observed from the Table IV that 62 (45.92%) of librarians are having professional qualification as 'M.L.I.Sc.', followed by 47 (34.81%) of librarians are having 'M.Phil.' degree and 26 (19.25%) of librarians are having professional qualification as 'Ph.D.' degree. The Table IV also presents that 28 (46.66%) of 'Government' College librarians are having professional

qualification of 'M.Phil.', followed by 09 (47.36%) of 'Private Aided' college librarians are having professional qualification of 'M.Phil.', 33 (70.21%) of 'Private Unaided' college librarians have the professional qualification of 'M.L.I.Sc.,' and 05 (55.55%) of 'Autonomous' college librarians are having professional qualification of 'Ph.D.'

TABLE V EXPERIENCE WISE DISTRIBUTION

Years	Government (N=60)	Private Aided (N=19)	Private Unaided (N=47)	Autonomous (N=09)	Total (N=135)
1-5	00(00.00)	05(26.31)	19(40.42)	00(00.00)	24(17.77)
6-10	00(00.00)	06(31.57)	14(29.78)	02(22.22)	22(16.29)
11-15	39(65.00)	04(21.05)	10(21.27)	01(11.11)	54(40.00)
16-20	08(13.33)	01(05.26)	03(06.38)	03(33.33)	15(11.11)
21-25	09(15.00)	02(10.52)	01(02.12)	02(22.22)	14(10.37)
26 and above	04(06.66)	01(05.26)	00(00.00)	01(11.11)	06(04.44)
Note: Figures in parentheses indicate percentage					

The experience wise distribution of librarians has been summarized in the Table-5. It can be observed from the table that 54 (40.00%) librarians are having experience of '11-15' years as a Librarian, followed by 24 (17.77%) librarians having experience of '1-5' years, 22 (16.29%) librarians having experience of '6-10' years, 15 (11.11%) librarians having experience of '16-20' years, 14 (10.37%) librarians having experience of '21-25' years and 06 (04.44%) librarians having experience of '26 and above'

years as a librarian. The Table V also illustrate that 39 (65.00%) of librarians from 'Government' colleges have experience of '11-15' years as a librarian, followed by 06 (31.57%) of librarians from 'Private Aided' colleges have experience of '06-10' years as a librarian, 19 (40.42%) of librarians from 'Private Unaided' colleges have experience of '01-05' years as a librarian and 03 (33.33%) of librarians from 'Autonomous' colleges have experience of '16-20' years as a librarian.

TABLE VI LIBRARY AUTOMATION

Library Automation	Government (N=60)	Private Aided (N=19)	Private Unaided (N=47)	Autonomous (N=09)	Total (N=135)
Yes	48(80.00)	15(78.94)	22(46.80)	09(100.00)	94(69.62)
No	12(20.00)	04(21.05)	25(53.19)	00(00.00)	41(30.37)
Note: Figures in parentheses indicate percentage					
χ2=19.332, df=03, P =0.00023341					

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.088	3	1.363	7.298	.000
Within Groups	24.460	131	.187		
Total	28.548	134			

The information gathered about the automation of first-grade college libraries has been summarized in Table VI. The data shows that that 94 (69.62%) libraries have been automated and the remaining 41 (30.37%) libraries have not been automated.

The Table VI also depicts that 48 (80.00%) Government colleges, followed by 15 (79.94%) Private Colleges, 22 (46.80%) Private Unaided Colleges and 09 (100.00%) Autonomous colleges have been automated. About 12 (20.00%) Government colleges, followed by 04 (21.05%) Private Colleges and 25 (53.19%) Private Unaided Colleges have not automated their libraries.

The χ2-test and ANOVA conducted for 03 d.f. at the 5% level of significance shows an association between Library Automation and the type of colleges (χ2=19.332, p=0.00023341<0.05).

TABLE VII STATUS OF LIBRARY AUTOMATION

Status	Government (N=48)	Private Aided (N=15)	Private Unaided (N=22)	Autonomous (N=09)	Total (N=94)
Completely Automated	10(20.83)	04(26.66)	07(31.81)	08(88.88)	29(30.85)
Partially Automated	38(79.16)	11(73.33)	15(68.18)	01(11.11)	65(69.14)
Note: Figures in parentheses indicate percentage					
χ2=16.601, df=03, P =0.00085363					

The Status of Library Automation in the libraries has been summarized in Table-VII. It can be seen from the table that 29 (30.85%) libraries are completely automated and 65 (69.14%) libraries are partially automated. The Table VII also presents that 10 (20.83%) Government colleges, followed by 04 (26.66%) Private Colleges, 07 (31.81%) Private Unaided Colleges and 08 (88.88%) Autonomous colleges are completely automated. About 38 (79.16%) Government colleges, followed by 11 (73.33%) Private Colleges, 15 (68.18%) Private Unaided Colleges and 01 (11.11%) Autonomous are partially automated.

The χ2-test conducted for 03 d.f. at the 5% level of significance shows an association between the Status of Library Automation and the type of colleges (χ2=16.601, p=0.00085363<0.05).

TABLE VIII REASONS FOR NON-AUTOMATION OF LIBRARIES

Reasons	Government (N=12)	Private Aided (N=04)	Private Unaided (N=25)	Total (N=41)
Inadequate finance	10(83.33)	03(75.00)	21(84.00)	34(82.92)
Lack of trained manpower	07(58.33)	02(50.00)	19(76.00)	28(68.29)
Lack of computer and ICT facilities	06(50.00)	00(00.00)	08(32.00)	14(34.14)
Management is not interested	03(25.00)	01(25.00)	13(52.00)	17(41.46)
Library collection is very less	09(75.00)	00(00.00)	06(24.00)	15(36.58)
Lack of Initiative	05(41.66)	01(25.00)	13(52.00)	19(46.34)
Note: Figures in parentheses indicate percentage and because of multiple-choice options the percentage is exceeded to more than 100%.				

The reasons for non-automation in the First Grade Colleges has been summarized in Table-VIII. The table depicts that 34 (82.92%) of librarians stated that 'Inadequate finance' as a reason for not automating the library, followed by 28 (68.29%) librarians opine 'Lack of trained manpower', 19 (46.34%) librarians opine 'Lack of Initiative', 17 (41.46%) gave the reason that the 'Management is not interested', 15 (36.58%) librarians opine that 'Library collection is very less' and 14 (34.14%) librarians opine that 'Lack of

computer and ICT facilities' as a reason for not automating the library.

The Table VIII also shows that 10 (83.33%) librarians of Government colleges, 03 (75.00%) librarians of Private Aided colleges and 21 (84.00%) librarians of Private Unaided colleges stated that 'Inadequate finance' as a reason for not automating their libraries.

TABLE IX METHOD FOLLOWED FOR BIBLIOGRAPHICAL DATA ENTRY/ CONVERSION

Method of Data Entry	Government (N=48)	Private Aided (N=15)	Private Unaided (N=22)	Autonomous (N=09)	Total (N=94)
Directly from books	27(56.25)	12(80.00)	14(63.63)	01(11.11)	54(57.44)
Preparing Data Entry Worksheet	16(33.33)	02(13.33)	04(18.18)	05(55.55)	27(28.72)
Transfer/ Import catalogue data	02(04.16)	01(06.66)	02(09.09)	01(11.11)	06(06.38)
All the above	03(06.25)	00(00.00)	02(09.09)	02(22.22)	07(07.44)
Note: Figures in parentheses indicate percentage					

The method followed for bibliographical data entry/conversion by the librarians has been summarized in Table IX. The table depicts that 54 (57.44%) librarians have done bibliographical data entry 'Directly from books', followed by 27 (28.72%) librarians have done bibliographical data entry by 'Preparing Data Entry Worksheet', 07 (07.344%) of librarians have done bibliographical data entry by following 'All the methods,' i.e., directly from books, Preparing Data Entry Worksheet, Transfer/ Import catalogue data.

About 06 (06.38%) of librarians have done bibliographical data entry by 'Transfer/ Import catalogue data' from other sources. The Table IX also presents that 27 (56.25%) of Government colleges, followed by 12 (80.00%) of Private Colleges and 14 (63.63%) of Private Unaided Colleges librarians have done bibliographical data entry 'Directly from books'. About 05 (55.55%) of Autonomous colleges librarians have done bibliographical data entry by 'Preparing Data Entry Worksheet'.

TABLE X OPINION ABOUT SUCCESS LEVEL OF THE LIBRARY AUTOMATION

Success Level of Automation	Government (N=48)	Private Aided (N=15)	Private Unaided (N=22)	Autonomous (N=09)	Total (N=94)
Very Successful	05(10.41)	06(40.00)	02(09.09)	03(33.33)	16(17.02)
Successful	06(12.50)	02(13.33)	01(04.54)	02(22.22)	11(11.70)
Partially Successful	18(37.50)	03(20.00)	06(27.27)	02(22.22)	29(30.85)
Needs improvements	03(06.25)	01(06.66)	01(04.54)	01(11.11)	06(06.38)
Needs data cleaning	16(33.33)	03(20.00)	12(54.54)	01(11.11)	32(34.04)
Note: Figures in parentheses indicate percentage					

The opinion about the success level of the library Automation in the First Grade College libraries has been summarized in Table X. It can be observed that 32 (34.04%) librarians stated that they need data cleaning, followed by 29 (30.85%) librarians who have opined that library automation is partially successful, 16 (17.02%) librarians have opined that library automation is very successful, 11 (11.70%) librarians have opined that library automation is successful and 06 (06.38%) librarians have opined that library automation needs improvements. The Table X also depicts that 18 (37.50%) Government college librarians have stated that library automation is partially successful, followed by 06 (40.00%) Private college librarians opined

that library automation is very Successful, 12 (54.54%) Private Unaided college librarians opined that library automation needs data cleaning and 03 (33.33%) of Autonomous college librarians opined that library automation was very successful.

VI. FINDINGS

1. A total of160 questionnaires were distributed and 135 filled-up questionnaires were received with a response rate of 84.37%
2. Out of the 74 (54.81%) colleges that are accredited by NAAC, 41(68.33%) are Government colleges, 18

(94.73%) are Private Aided colleges, 06 (12.76%) are Private Unaided colleges and 09 (100.00%) are Autonomous colleges.

3. Among 135 respondents, 78 (57.77%) are 'Male' librarians and the remaining 57 (42.22%) are 'Female.' As usual, there are more male librarians than female librarians.

4. There are 62 (45.92%) librarians having professional qualification as 'M.L.I.Sc.', followed by 47 (34.81%) librarians are having 'M.Phil.' degree and 26 (19.25%) librarians have a professional qualification as 'Ph.D.' degree.

5. A total of 54 (40.00%) librarians are having experience of '11-15' years as a Librarian, followed by 24 (17.77%) of librarians having experience of '1-5' years, 22 (16.29%) of librarians are having experience of '6-10' years, 15 (11.11%) of librarians are having experience of '16-20' years as a librarian.

6. With regards to the library automation, 48 (80.00%) 'Government' colleges, followed by 15 (79.94%) 'Private Colleges', 22 (46.80%) 'Private Unaided' Colleges and 09 (100.00%) are 'Autonomous' colleges librarians opine as 'Yes' towards library automation. It is highlighting to note that all autonomous colleges are automated.

7. While referring to the status of library automation, 29 (30.85%) librarians opine as 'Completely' automated and 65 (69.14%) librarians opine the status of library automation as 'Partially' automated. Among 'Completely' automated 10 (20.83%) are 'Government' colleges, followed by 04 (26.66%) are 'Private Colleges', 07 (31.81%) are 'Private Unaided' Colleges and 08 (88.88%) are 'Autonomous'.

8. A large majority of librarians 34 (82.92%) opine that 'Inadequate of finance' as a reason for not automating the library, followed by 28 (68.29%) opine as 'Lack of trained manpower', 19 (46.34%) opine as 'Lack of Initiative', 17 (41.46%) gave the reason that the 'Management is not interested,' for not automating the library.

9. Regarding opinion about success level of the Library Automation 32 (34.04%) librarians have opined as they 'Need data cleaning', followed by 29 (30.85%) of librarians have opined as 'Partially Successful', 16 (17.02%) of librarians have opined as 'Very Successful', 11 (11.70%) of librarians have opined as 'Successful' and 06 (06.38%) of librarians have opined level of library automation as they 'Needs improvements'.

VII. SUGGESTIONS

The partially automated college libraries must fully automate all the library automation software modules, as all the modules are interlinked in an integrated library management system. The correct use of the module automatically complements the activities of the subsequent modules in some way or other. The non-automated colleges can implement open source library management software to save a considerable amount of budget.

VIII. CONCLUSION

Adverting to the trend of creating digital libraries and automating libraries and information centers' functions, the management of the colleges has to give due priority and make adequate budgetary provision. Further, the library staff has to be deputed to undergo training and attend workshops organized on library automation and digital information services management. A thorough knowledge and skill relating to integrated library management software is also an essentiality for the library staff.

REFERENCES

[1] Abbas, K. D. (2014). Automation in Nigerian University Libraries: Mirage or Reality?. *Information and Knowledge Management*, *4*(4), 1–6.

[2] Anas, M., Iqbal, J., & Ahmad, P. (2014a). Impact of automation on library services in selected management institutes at Aligarh: A survey. *The Electronic Library*, *32*(3), 296–307. Retrieved from https://doi.org/10.1108/EL-11-2011-0157

[3] Anjanappa.M. (2014). Library automation in universities of Karnataka. *International Journal of Library Science and Research*, *4*(1), 1-7.

[4] Bhagachand, B. N. (2015). Availability, Use and Barriers to ICT in the College Libraries in Nashik-Malegaon Town: A Survey. *Pearl : A Journal of Library and information science*, *9*(3), 141. Retrieved from https://doi.org/10.5958/0975-6922.2015.00019.4

[5] Borgman, C. L. (1997). From Acting Locally to Thinking Globally: A Brief History of Library Automation. *The Library Quarterly*, *67*(3), 215–249. Retrieved from https://doi.org/10.1086/629950

[6] Boykin, J. F. (1991). Library Automation, 1970-1990: From the Few to the Many. *Library Administration & Management*, *5*(1), 10–15.

[7] Rashmiverma & Sandeepayadav. (2014). Automated Libraries of Central Universities of Uttar Pradesh: A comparative study. Retrieved December 15, 2016, from https://www.worldwidejournals.com/ international -journal-of-scientific-research (IJSR)/articles.php?val=Mjc0OA==&b1=269&k=68

The Role and Impact of an Open Courseware Learning Management System in Higher Education

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Abstract - **The essential cause of this find out about to check out the influence of e-learning in greater education. The learn about observed out that the use of e-learning structures suggests a fine effect on scholar studying in greater training current world. Most instructors utilized e-learning gadget as presentation and education device in educating and learning. Higher training establishments advantage from the use of an Open Courseware Learning Management System in the following ways: teacher and pupil get entry to to mastering content material each time and anywhere, a centralized supply of learning, monitoring and reporting equipment to beautify pupil getting to know and performance, elevated effectivity in scholar things to do such as undertaking submission, accelerated communication, and mastering analytics. Higher schooling is widely described as one of key drivers of increase performance, prosperity, and competitiveness.**
Keywords: **Learning experience; Higher Education; Open Courseware; Learning Learning Management**

I. INTRODUCTION

Today trending education system is eLearning. Information technological know-how and web technology are going more and more growing our capabilities and knowledge. Education had been growing presenting on line getting to know possibilities and excessive boom and adoption in training technology, although the everyday mannequin remained targeted on face-to-face learning. However, at some point of a new world of social distancing, schooling has end up definitely virtual. Meanwhile, eLearning administration system additionally had to rapidly adapt to a internet model, often with some distance much less ride and fewer sources for instructors and students.

Higher training establishments gain from the usage of an LMS in the following ways: teacher and pupil get right of entry to to mastering content material each time and anywhere, a centralized supply of learning, monitoring and reporting equipment to decorate pupil getting to know and performance, multiplied effectively in scholar things to do such as undertaking submission, improved communication, and studying analytics. (Trends and the Future of Learning Management Systems (LMSs) in Higher Education, n.d.). E-Learning ride of students challenge education. More especially the study offers with evaluating the effectiveness of e-Learning throughout gender, course, and town.(Trakru

& Jha, 2020) India aspects a file of easiest net customers in world and web penetration is reached 31%. Increasing net penetration in tier II, tier III cities and rural areas gives excessive achievable for the enlargement of e-learning. Nearly 725 million e-learning person bases are projected to be triumphant in by using 2021.There are pretty 300 million smart phone customers in India and is forecasted to upward jab with the aid of five hundred million by way of 2021.

Online content material vendors have designed their platform to be on hand in smart phones. The interface of the functions is well matched even inside the low-end phones. Thus this growing penetration of smart phones and web is anticipated to force the India Market over forecast period. Government's digital initiatives like Swayam, E-Basta, and Rashtriya Madhyamik Shiksha Abhiyan are anticipated to crate beneficial possibilities for market over forecast period. Enable the infrastructure wanted by means of college students to join in online education courses.

II. IMPACT OF AN OPEN COURSEWARE LEARNING MANAGEMENT SYSTEM IN HIGHER EDUCATION INDIA

E-Learning in India has come an prolonged way with the match of technology. India is one amongst the international locations this is growing at an exponential fee in phrases of technology. With a populace of pretty 1.3 billion, the furnish of high-speed web and smart phones, India has the primary quantity of technologically pushed persons. The upward jostle of the net has modified the way of existence in India. People want to do the entirety online, they save online, do commercial enterprise online, make buddies online, study online, etc. While e-commerce is that the most imperative on-line industry, on-line schooling and gaining knowledge of stand proper subsequent thereto. With the ever-increasing records on hand on the internet and consequently the infinite range of on line courses, many of us in India like higher to study online.(Popescu, 2013)The modern-day country in truth wares in India the place textual training conquers over the smart knowledge, there may be an great scope for betterment if ELearning and on-line courses are adopted inside the each day timetable after or at some point of lectures. It's really helpful that faculties'

professors interact in imparting a minimal of as soon as each week realistic understanding lectures with the help of such on line courses. The convenience, attain affordability, easy access, and easy collaboration will supply on-line education a foothold over the regular techniques of getting to know and it is predicted that college students pursuing research on line will develop exponentially over time.(Bhadauria, 2016) By seeing the practicable and huge recognition of e-learning improvement and fashion digital technological know-how in India, our honorable Prime Minister has expected reworking our country and growing possibilities for all residents by using harnessing digital applied sciences via the "Digital India' initiative. The initiative consists of a number of initiatives in a range of areas regarding health, education, labor, employment, etc. As a local of the 'Digital India' project, many schools and universities provide on-line correspondence courses. Now let's endure a variety of fascinating information about on line training in India.

1. E-learning market in India used to be really worth $247 million in 2016, which is expected to develop via about $1.96 billion by means of 2021. That's a compound annual charge of boom of 52%.
2. The variety of customers enrolled for a range of on-line getting to know guides is estimated to be 1.6 million in 2016, which is expected to develop by using about 9.6 million through the pinnacle of 2021.
3. It is estimated there may be a 175% expand in the value of school room education, this presents on line training extra favored due to the fact it is cost-effective.
4. Nearly 48% populace in India, an age bracket between 15–40 with excessive aspirations however decreases income, perhaps a precise goal market for on-line education. And, the acceptability of on-line channels is excessive inside the youthful demographic. Online training in India. These elements genuinely exhibit the involvement and future plausible of e-learning in India.

III. ADVANTAGES OF E-LEARNING IN HIGHER EDUCATION OVER TRADITIONAL METHODS

A. Greater and Easy Access

One of the should benefits of e-learning in greater education is that it somewhere and whenever can get right of entry to and handy to attend instructions and courses. It permits college students and instructors the advantage of a technological know-how and skills, irrespective of their bodily location.

All data is structured and geared up way in the identical place, making on hand to very friendly to college students and teachers. Courses, resources, multimedia content, calendars, archives and opinions materials are on hand in simply one click. All customers have get entry to to gaining knowledge of content material and resource's substances at every time and from wherever the place they have web access.

B. Resource Scalability and Saving time and money

Second largest benefits of e-learning in higher education are Resource Scalability and Saving time and cash to greater schooling institutes. By bringing the whole lot on line to users, e-learning saves time, money, and resources. In education, it makes getting to know feasible even in the remotest locations of the anywhere. As a result, college students get to examine they courses on an character basis, at their convenience.E-learning systems to create, manipulate courses and lift out academic and courses coaching packages store the time when in contrast to normal education. And these guides can then be used repeat and repeat with new organizations of users

C. Up to date and immediate content and better results

E-learning enable directors instantaneous get right of entry to to replace and add the content material of publications and substances and resource's, for college students for on the spot get entry to in greater education. E-learning in greater training has been recognised to enhance capabilities productivity, increase center of attention and thereby, supply higher tutorial results. This is due to the fact audio-visual and video mastering coupled with a host of variable media formats, have a tendency to forged a effective have an impact on on the learner's potential to hold close and continue information. This similarly improves rankings & refines outcomes of users. Here's greater on the Importance of Digital technological know-how in Higher Education.

D. Improved Pace

The system of e-learning is by means of and large, self-paced. This is to say that e-learning permits college students to analyze subjects, at a time and tempo of their convenience. They don't have to fear about lacking out on different possibilities in simple terms to enhance their tutorial credentials. Similarly, college students can pick out their personal tempo of understanding, barring having to ride the consistent peer strain to examine shortly and operate well.

E. Cost-Effectiveness

Must of education institutions, on line studying can show to be price fantastic for users. Traditional schooling extra steeply-priced due to the fact they desires bodily area classrooms, fees of trainers, tour and accommodation, path materials. However, on-line studying receives rid of all these cost, its supporting to customers to sign up for their courses of their choice.

F. Quick Lesson Delivery

As comparative to ordinary strategies instructing of lesson delivery, e-learning is plenty extra handy and sophisticated, dynamic and rapid learning. Most e-learning instructions are blanketed up inside a single tutorial period. Nonetheless, college students are given the pliability to expand or limit their session time, counting on their wishes and requirements. Learners can opt for to ignore the areas that they're already conversant in whilst focusing their energies on greater applicable subjects. Here's all you would like to apprehend about The Making of Future-proof Online Learning Programs and Courses.

G. Personalization

E-learning in training does not typically appear in the course of a team setting. Instead, it imparts schooling at some stage in a extra personalized, distinct, precise and obvious way. Students can select to ask questions, go away feedback, get responses, are seeking for repetitions and make clear doubts as per their personal degree of comprehension. This getting to know approach addresses issues, resolves troubles and customizes the total route shape to go well with the student's demands.

H. Instant Up skilling

In a time the place abilities are required to be up to date regularly, e-learning can persuade be an immensely useful tool. Be it students, veterans, beginners, specialists or mid-career gurus – e-learning permits every person to up skill themselves at a time and location of their choice.Neither do they want to join throughout a formal school, nor are they required to discover the different opportunities. With e-learning, they will analyze rapidly & thereby, operate better.

I. Traceable Outcomes

Last however now not the smallest amount, e-learning works wonders when it includes measuring outcomes, tracing outcomes and gathering feedback.

While it is not possible to continue to be on in depth tab on each pupil looking for schooling underneath the regular system, e-learning techniques make certain that limitless and constant assessment are frequently undertaken to check everyday progress. As a result, the necessities of every scholar are accommodated & the widespread of mastering turns into better.

IV. FUNCTION OF LMS IN HIGHER EDUCATION

As referred to formerly Learning Management System may also be a software program primarily based software which assist us to administrate, document, track, file and consider the educating studying process, education programs, digital classes, and e-Learning programs.(Beaty, Liz (Head, Staff Developmen & McGill, Ian, 2020) Functions of Learning

Management System are regularly largely divided into four essential components then sub components are going to be mentioned beneath the most category:

A. Stakeholder Functionality

In this phase the participant or stakeholder has their very own area by means of which they're equipped to get right of entry to the subsequent services:

1. View the popularity in reality and completion of courses.
2. Facility to print or view the certificates 2- Content or Course Management.
3. Manage, add or delete the content material of the path or modules. b) Introduce new courses. c) Setting the path calendar.

B. Management of Information

1. View and music the records and existing reputation of participants.
2. Reports and records handy about the direction and participants.

C. Assessment

1. Help us to add and retrieve undertaking and resources.
2. Allow to make on line stand- on my own assessment.
3. Provide grades and last output of learning. (Chen & Almunawar, 2019)

V. IMPORTANCE OF E-LEARNING IN HIGHER EDUCATION

The modern challenges going through ordinary schools and universities such as greater tuition, price range cuts, and path shortages - purpose many college students to seem for alternatives. With almost three million college students presently enrolled in wholly on line packages and 6 million taking a minimal of one on line direction as a section of their degree, on-line training has without a doubt emerge as one amongst the predominant famous training alternatives. The continuously enhancing popularity of on-line mastering helped gasoline its expansion, as preliminary skepticism faltered inside the face of proof displaying that on line gaining knowledge of are regularly even as superb as face-to-face education.(Naresh & Reddy, 2018)

VI. THREE STAKEHOLDERS OF LEARNING MANAGEMENT SYSTEM

A. Administrator

Administrator preserves the proper go with the flow of operation of offerings and its users. He is accountable to enrollment of the users control the courses and run the

system. Manages the complete environment(Sampson & Zervas, 2012)

B. Instructor

The coach usages LMS to supervise, guide, help and consider the learners. Generate events, courses or topics in accordance to the thematic areas described Generate training or activities which are exact

C. Learner

Learners are the most users of Learning Management System and that they are the major client of the services. Accesses and interacts with a precise match and participates in the topics they are subscribed.(Kushwaha & Singhal, 2019)All of this suggests that students, from working specialists to current excessive faculty graduates, locate many motives to require all or a range of their publications online. The subsequent listing consists of benefits to on line getting to know.(Singh, 2005)Students in on line applications can efficiently manipulate their time, examine the materials, and whole assignments on their very own schedules to name simply a couple of benefits of on line learning.(Pradeep *et al*., 2016)

1. View Original sort of programs and courses

From common four-year universities to absolutely on-line profession colleges, training nowadays gives a unfold of selections for university youngsters . this suggests that regardless of what college students study, from nursing to neuroscience, they will discover the guides or applications they have online. Students additionally can earn each diploma online, from a profession certificates to a doctorate.

2. Lower total costs

Online packages show a more cost-effective choice than ordinary colleges. Though now not all on line levels provide much less pricey internet training costs than standard colleges, related prices almost continually fee less. for occasion , there are no longer any commuting costs, and every so often required path materials, like textbooks, are on hand on-line at no cost. moreover , many schools and universities take delivery of credit earned by free massive open online courses (MOOCs), the major current boost in on line education. These free on-line guides can assist college students fulfill standard education requirements.

3. Easier learning environment

Commercials that function on line college students reading in their pajamas solely skims the floor of 1 of the blessings of on line education: no bodily type sessions.

Students hear lectures and entire assignments despatched to them electronically, with no acquired to combat traffic,

depart work early for sophistication , or leave out necessary household time.

4. Convenience and flexibility

Online courses provide college students the danger to sketch learn about time spherical the the rest of their day, instead than the contrary way around. Students can find out about and work on their convenience. Course fabric is generally on hand online, making one-of-a-kind library journeys unnecessary. All of these advantages assist college students stability work and household commitments with their training.

5. More interaction and greater ability to concentrate

While contradictory proof about the velocity of on-line pupil participation versus participation in typical publications exists, one issue stays certain: Online guides provide shy or greater reticent college students the threat to take part in faculty discussions greater effortlessly than face-to-face category sessions. Some college students even record higher awareness in on-line instructions thanks to the scarcity of lecture room activity.

6. Career advancement

Students can take on line publications and even entire complete levels whilst working, whilst in-between jobs, or whilst taking time to enhance a family. This tutorial work will provide an explanation for any discontinuity or gaps in the course of a resume additionally . Also, incomes a diploma can exhibit ambitiousness to potential employers and a wish to remain knowledgeable and equipped for company spanking new challenges.

7. Continue in your profession

Albeit any person desires to end a degree, it is going to no longer imply they want to go away their present day job. for many college students today, growing university charges mandate that some college students proceed working whilst in classification . The until now noted flexibility of on line packages allow college students to remain working whilst additionally pursuing educational credentials.

8. Avoid commuting

During snowstorms and thunderstorms, schools may also cancel lessons to keep away from placing commuting college students in chance of unsafe riding conditions.

Rather of omit necessary classification sessions, college students in on-line publications can constantly "attend" by way of taking part in dialogue boards or chat sessions, handing over their work on time, and observing lectures or analyzing materials. Many college students additionally locate giant financial savings on gas expenses with no shuttle for classes.

9. Improve your technical skills

Even the important simple on line path requires the tournament of state-of-the-art pc skills, as college students research to navigate special getting to know administration structures (LMS) and programs. The participation competencies college students examine inside their on-line guides translate to quite a few professions, inclusive of developing and sharing documents, incorporating audio/video substances into assignments, finishing on line coaching sessions, etc. Some colleges even provide college students free laptops or iPads.

10. Transfer credits

College understudies who received to attend summer season classes, alternatively stay too an prolonged way from their colleges additionally as preserve summer time sources of income, taking over the on-line instructions from a licensed college and transferring the credit to their crucial college are frequently helpful. Understudies can achieve college credit score whilst so a ways making the primary of their late spring tour or gratifying the duties of their everyday work. Correspondingly, if a college or university does not provide adequate open areas of a essential course, understudies can take the route on line at every other college and pass the credits.

VII. CHALLENGES FOR ONLINE EDUCATION IN INDIA

There are some common challenges that were considered while preparing the new education policy. A number of them are provided below.

1. More than 30% of the country's population isn't computer literate. A number of them even don't SKILLS to start out a computer.
2. Not everyone can afford a computer or a laptop. Some sections of the society like farmers, maids, housecleaners, sweepers and waiters may face difficulties purchasing a laptop.
3. Some teachers aren't conversant in the new format of education. They're not well trained for online education classes. Besides this, it's not necessary that an honest classroom teacher are going to be an honest teacher within the online classroom.
4. There are a limited number of resources available to conduct a web examination in India. Besides this, there's a limitation for the amount of questions which will be asked within the exam.
5. Certain sort of subjects and courses like science and humanistic discipline can't be taught within the digital education space.
6. The online education system is more of a kind of screen-based learning system which restricts the scholars to perform practical.
7. The internet connectivity isn't good everywhere. There are some cities of India where the people are still using 2G or 3G internet connection.
8. A good concentration and self-motivation are required for online education. Students below the age of 17 years may lack these skills.

VIII. BENEFITS OF ONLINE EDUCATION

Online education is appreciated with the aid of humans that will possibly be unable to shape it for lessons all through a traditional bodily type of college due to specific reasons. Beneath we are going to test out some of the advantages these energizing training offers to such understudies.

A. Adaptability

Understudies have the risk to shuffle their vocations and college when you consider that they're no longer secured to a challenging and speedy calendar. During a traditional find out about corridor setting, category assembly instances are set, and therefore the understudy has no manage over this, riding them to parent their calendars round these dates. An high-quality many of us who select net primarily based mastering will commonly have distinctive responsibilities, and want this technique of mastering due to the fact it offers them manipulate over how they're going to assign their time in the direction of their a variety of ventures.

B. Decreased Costs

Online education can fee much less due to an assortment of reasons. as an instance , there may be no price for driving. Grouped prices that are recognized with transport, for occasion , fuel, leaving, automobile upkeep, and open transportation charges do not affect the net understudy.

C. Systems administration Opportunities

Online practise likewise furnishes understudies with the danger to coordinate with friends crosswise over nations or possibly a number of landmasses. This regularly prompts distinct open doorways related to joint effort with distinctive humans inside the execution of a venture. Simultaneously, it makes them socially sensitive and organized to swimsuit into exclusive stipulations correctly given their presentation to one of kind societies.

D. Documentation

All the data that you virtually will want are going to be securely put away in a internet database. This accommodates matters like stay discourse records, getting ready substances and messages. this suggests if there is normally something have to be explained, the understudy will have the desire to urge to these reviews quick, sparing vast time. this is regularly mainly precious for people that bought to entire lookup for a task and current their discoveries to a board.

E. Expanded Instructor - Student Time

Understudies in traditional homerooms may no longer get the custom-made consideration they want to possess thoughts explained. In spite of the very truth that classification sizes are little at CCA, most schools have instructions of understudies that wide variety inside the hundreds. this is now not a trouble for this kind of coaching in mild of the very truth that on-line guided discourses and man or woman discuss time with their educators and audio system may also be a signal of on line classes. It expands the probabilities of an understudy performing top notch due to the time their educators supply them. This moreover improves their quintessential questioning and relational abilities, even as realizing the way to shield their contentions to bosses if necessary.

F. Access to Expertise

An on line college practise might also provide understudies get entry to to precise diploma guides which will no longer be on hand in an efficaciously accessible or regional institution of learning. as an instance , at CCA you may are searching for after a diploma in Marketing or an endorsement in C++ Programming barring dwelling on the brink of the organization. Online training allow the sharing of capacity that assists greater with peopling method preparation that may also no longer instantly reachable insure geographic areas. This kind of teaching has emerge as during the predominant current few years and has encountered fashionable acknowledgment. With a internet class, you get the prospect to modify your gaining knowledge of condition, which in the end encourages you construct up a extra profound comprehension of your diploma course. New fashions of getting to know are consistently leaping up inside the market, giving understudies fluctuated probabilities to fashion their guidance into something that fits them, now not the contrary route round. It moreover offers human beings an probability to end a diploma they shall have begun and weren't capable proceed with for a few explanation. The destiny of on-line diploma practise appears encouraging, and exposes education to a lots better place of the populace than at the different time. One problem that emerges inside the on line training versus traditional classes' dialogue identifies with test-taking, because educators and understudies impart basically. Teachers do not administer the method to make sure that no swindling happens. to elucidate this issue, places of work may additionally require diploma searchers to go to focuses the place a delegate can direct the evaluation. Another choice consists of utilising web administering administrations that display screen understudies as they work. On the off hazard that the pupil suggests any habit that demonstrates bamboozling, the administration may additionally warning the varsity. This manner licenses diploma opportunity to get rid of value determinations from grounds, and moreover offers college's simple task that understudies surely earned their evaluations.

IX. CONCLUSION

LMS purposes in education will nonetheless innovative. It offers a virtually dependable and organized journey of digital learning. Students are increasingly more predicted web-based studying substances for his or her courses. However LMS might also be a web-based machine however the utilization of the LMS isn't always restrained to on-line instructions only. it is been broadly used and can nonetheless develop in schooling and industries in future. It does not restriction to the net surroundings however additionally built-in into the hybrid and web-enhanced instructing and getting to know environment. The facets of the LMS made each people to undertake LMS in their day to day life. This paper we made an strive to factors in the direction of the function of LMS in instructing and gaining knowledge of pedagogy, access, flexibility, and fee effectiveness in education. So as to recognise wonderful mastering consequence it is counseled for training institute to combine LMS in their educating and gaining knowledge of process.

REFERENCES

[1] Beaty, Liz (Head, Staff Developmen, & McGill, Ian. (2020). Action Learning in Higher Education. *Action Learning*, 230–252. https://doi.org/10.4324/9781315042480-21

[2] Bhadauria, R. (2016). E-Learning – A boon for Indian Higher Education System. *International Journal of Engineering Technology Management and Applied Sciences Www.Ijetmas.Com*, *4*(2), 2349–4476.

[3] Chen, C. K., & Almunawar, M. N. (2019). *Cloud Learning Management System in Higher Education. September 2015*, 29–51. https://doi.org/10.4018/978-1-5225-7473-6.ch002

[4] Kushwaha, R. C., & Singhal, A. (2019). Online learning: An emergence of new model of education. *International Journal of Recent Technology and Engineering*, *7*(6), 75–78.

[5] Naresh, B., & Reddy, D. B. (2018). E-Learning in Indian Higher Education and Future Prospects. *International Journal of Pure and Applied Mathematics*, *118*(18), 4301–4308.

[6] Popescu, M. (2013). *The impact of SNS in higher education. January*, 296–300. https://doi.org/10.1109/ECONF.2015.72

[7] Pradeep, E., Ji, K., & Panchanatham, N. (2016). Research & Reviews : Journal of Educational Studies E-Learning Strategy in Higher Educational Institutions in India. *Journal of Educational Studies*, *2*(1), 18–23.

[8] Sampson, D. G., & Zervas, P. (2012). Mobile Learning Management Systems in Higher Education. *Virtual Learning Environments*, *July 2014*, 1249–1264. https://doi.org/10.4018/978-1-4666-0011-9.ch608

[9] Singh, G. (2005). A Study Into The EffecSingh, G. (2005). A Study Into The Effects Of eLearning On Higher Education A Study Into The Effects Of eLearning On Higher Education. Journal of University Teaching and Learning Practice, 2(1).ts Of eLearning On Higher Education A S. *Journal of University Teaching and Learning Practice*, *2*(1).

[10] Trakru, M., & Jha, T. K. (2020). Blended Learning Effectiveness in Higher Education. *International Journal of Engineering and Advanced Technology*, *9*(3), 105–108. https:// doi.org/ 10.35940/ ijeat.c4801. 029320 *Trends and the Future of Learning Management Systems (LMSs) in Higher Education*. (n.d.). Retrieved October 20, 2017, from https: //www. buffalo.edu /content/dam/ www/ubcei/reports/ CEI Report - Trends and the Future of Learning Management systems in Higher Education.pdf

A Study on the Impact of Researchers of the Botanical Survey of India (BSI)

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Abstract - **The evaluation of any institution helps to authenticate its real position to the funding agency for improvement as well as to validate the fund utilization. In this concern, the impact of the researchers of Botanical Survey of India in terms of various aspects were evidently studied to reveal the facts like their collaborative pattern, position of the collaborative institute, author capacity and effect of career longevity of the researchers on the research contribution of BSI.**
Keywords: **Bibliometrics, Research impact, Collaborative Pattern, Authorship Pattern, Career Longevity Study**

I. INTRODUCTION

This study includes the analysis of all forms of published research works and the contributors of entire BSI research communities like scholars, research assistants, scientific staffs, and Scientists etc were taken into account.

There are about 10 well established regional centres of BSI, those were located in different places of India with the headquarters at Kolkata. In this article, the regional centres were denoted by the acronyms namely BSIANRC-Andaman Regional Centre, BSIAPRC-Arunachal Pradesh Regional Centre, BSIARID-Arid Zone of India, BSICNH-HQ, BSICRC-Central Regional Centre, BSIERC-Eastern Regional Centre, BSINRC-Northern Regional Centre, BSISHRC-Sikkim Himalayan Regional Centre, BSISRC-Southern Regional Centre, BSIWRC-Western Regional Centre. Its major research works are the plant taxonomy, plant identification, phytogeography, floristic studies, ethno botany etc.

II. OBJECTIVES OF THE STUDY

1. To unveil the position of the institutions collaborated with BSI
2. To study the impact of the research contributors in terms of author capacity with that of publications and number of pages
3. To analyze the impact of the researchers' career longevity with that of research publications

III. HYPOTHESES

1. There is a relationship between the number of research publications and the number of research contributors at BSI.
2. There is a relationship between the large articles production and the Research career longevity of the BSI Scientists.

IV. REVIEW OF LITERATURE

Das (2012) carried out a bibliometric analysis of 210 papers and 2999 citations published in the journal Nelumbo for the period 2004 to 2011.

The study showed that joint authorship pattern covered 74.76% which was higher than single authorship pattern. Out of 2999 citations maximum (52.59%) were from journals.

Number of papers on new plant record has been marked in first place with 20%. The foreign Journal of Hattori Botany Lab held the top position in journal rank study followed by two Indian journals i.e. Journal of Economic and Taxonomic Botany and the studied journal Nelumbo respectively.

Jena, Swain and Sahu (2012) aimed to divulge the patterns of scholarly communication of The Electronic Library from 2003 to 2009. Seven volumes of The Electronic Library (TEL) published during the years 2003-2009 were collected from Emerald Management Xtra, that constituted 42 issues and a total number of 417 articles carrying 7,442 citations, have been taken up for the analysis. The findings showed that the majority of articles published in TEL fall under the category of research papers, followed by case studies and general reviews. Regarding the bibliographical distribution of citations, it was found that the majority of citations were from journals, followed by web resources and books. In regard to authorship patterns, the single authored articles were highest (47.24%) followed by joint authored articles (34.77%). It showed that the average length of articles was 13 pages and the scattering of contributors was limited within a few countries. The inference gained from the above

reviews gives an idea of the researches of BSI since Nelumbo is the official journal of the institute. The research shows the subject patterns existed among the botanists. Moreover, the data analysis techniques were identified.

V. METHODOLOGY

Data were collected extensively from annual report details, the databases like Indian Science Abstracts, Indian Citation index, Scopus, Web of Science, Scientists' profile of the BSI website were also browsed to develop the comprehensive Meta data to suit the development of the institutional repository of BSI. The search term "Botanical Survey of India" was used in the affiliation/address field of the citation databases to retrieve and compare the records with the annual reports of BSI. A total of 1241 research

contributions were out of collaborative work with other research centres by BSI Scientists during the research period 1954-2012.

VI. RANK LIST OF THE COLLABORATIVE CENTRES

The top 15 research institutes, those have contributed along with the BSI were specified in the Table I. In which, NBRI, Lucknow has contributed 55 publications with BSI and obtained the first position in the collaborative centre's list. DAV College, Dehra Dun (46) has acquired second place followed by Central Drug Research Institute, Lucknow with 44 publications. Collaboration in one way or other will certainly help to share the infrastructure of other centres to improve the quality of the research.

TABLE I TOP 15 RANK LIST OF THE COLLABORATIVE CENTRES

Rank	Collaboration Institutes	No. of Contributions	Percentage
1	National Botanical Research Institute, Lucknow	55	4.43
2	DAV College, Dehra Dun	46	3.71
3	Central Drug Research Institute, Lucknow	44	3.55
4	Forest Research Institute Colleges, Dehra Dun	40	3.22
5	Royal Botanic Garden, Kew	39	3.14
6	Gauhati University. Guwahati, Assam	37	2.98
7	University of Kalyani, Kolkata	35	2.82
8	University of Calcutta, Kolkata	28	2.26
9	Banaras Hindu University, Varanasi	27	2.18
10	Central Institue of Medicinal and Aromatic Plant Sciences (CIMAP), Lucknow	26	2.09
11	BhojVishwavidhyalaya, Madhya Pradesh	22	1.77
11	Government College, Port Blair	22	1.77
11	Presidency College, Kolkata	22	1.77
12	G.C.Bose Biological Research Unit, Kolkata	21	1.69
13	Lucknow University, Lucknow	20	1.61
13	St.Xavier's College Palayamkottai	20	1.61
14	PG Institute of Basic Medical Sciences, Kolkata	18	1.45
14	Ranchi University, Jharkhand	18	1.45
15	G B Pant Institute, Uttaranchal	17	1.37
15	Govt. P.G.College, West Bengal	17	1.37

It was observed that 574 records of collaborative work were covered by those of above listed research institutes and shows a strong research link with BSI during the research period of 1954-2012.

VII. AUTHORSHIP PERCAPITA ANALYSIS

From the Table II, the per capita authorship could be calculated with the following formula

Per Capita Authorship = Number of items / Number of authors

Here the items referred to the number of contribution in the Table II and number of pages in the Table No. 3 and 4. It has been revealed that per capita authorship was 5.64 contributions per BSI author for the entire research contribution of the concerned period. It has to be noted that BSICNH-HQ shows the highest author capacity of 8.48 which was followed by BSISRC with 7.8.

The above data was utilized to study the relevance of the hypothesis 1 (there is a relationship between the number of research publications and the number of research contributors at BSI) using the Pearson's Coefficient correlation and the calculated value was stated below:

Pearson's correlation $r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$

Where x and y are the mean difference of the variables; Number of Contributors-X and Number of Contributions-Y as tabulated in the Table No.2

$$r = \frac{585830.7}{609548.9151}$$

Pearson's coefficient correlation = 0.96

It shows a strong positive correlation, that the increase of number of contributors will have positive effect on the number of contribution. By this Hypothesis 1 was proved valid.

TABLE II CENTRE WISE AUTHOR CAPACITY ON PUBLICATION

Sl.No.	Centre	X	Y	x (X-M)	y (Y-M)	x^2	y^2	xy	Author Capacity
1	BSIANRC	78	383	-52.7	-353.9	2777.29	125245.21	18650.53	4.91
2	BSIAPRC	77	157	-53.7	-579.9	2883.69	336284.01	31140.63	2.04
3	BSIARID	56	168	-74.7	-568.9	5580.09	323647.21	42496.83	3.00
4	BSICNH-HQ	339	2875	208.3	2138.1	43388.89	4571471.61	445366.23	8.48
5	BSICRC	134	671	3.3	-65.9	10.89	4342.81	-217.47	5.00
6	BSIERC	162	514	31.3	-222.9	979.69	49684.41	-6976.77	3.17
7	BSINRC	136	673	5.3	-63.9	28.09	4083.21	-338.67	4.95
8	BSISHRC	52	148	-78.7	-588.9	6193.69	346803.21	46346.43	2.85
9	BSISRC	150	1171	19.3	434.1	372.49	188442.81	8378.13	7.8
10	BSIWRC	123	609	-7.7	-127.9	59.29	16358.41	984.83	4.95
11	All Centre	NI	5(NI)						-
	Total	1307	7374			62274.1	5966362.9	585830.7	5.64
	Mean Value (M)	130.7	736.9						

*NI = Not included for calculation, X = No. of BSI Contributors, Y= No. of Contributions, x = X–[Mean value of X], y = Y-[Mean value of Y]

A. Centre wise Quantum of Pages per Contribution

There were 1307 BSI authors have contributed 120768 (117887+2881) pages. BSICNH-HQ has produced 43825 pages which was followed by BSISRC with 19453 pages but the per capita authorship shows that BSISRC author capacity ratio was high when compared to BSICNH-HQ.

BSINRC has contributed 11962 pages and obtained third position. Pearson's Correlation coefficient was used to study the relationship between the number of BSI authors alone (X) and the total number of pages (Y) produced by each centres. It shows a strong positive correlation exists, revealing that the increase of number of contributors will have positive effect on the production of number of pages.

Pearson's correlation $r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$

Where x is the mean difference of X and y is the mean difference of the Y as tabulated in Table III.

TABLE III CENTRE WISE AUTHOR CAPACITY ON PAGES

Sl.No.	Centre	X	Y	x (X-M)	y (Y-M)	x²	y²	xy	Author Capacity
1	BSIANRC	78	3488	-52.7	-8300.7	2777.29	68901620.49	437446.89	44.72
2	BSIAPRC	77	2755	-53.7	-9033.7	2883.69	81607735.69	485109.69	35.78
3	BSIARID	56	3948	-74.7	-7840.7	5580.09	61476576.49	585700.29	70.5
4	BSICNH-HQ	339	43825	208.3	32036.3	43388.89	1026324518	6673161.29	129.28
5	BSICRC	134	10071	3.3	-1717.7	10.89	2950493.29	-5668.41	75.16
6	BSIERC	162	8861	31.3	-2927.7	979.69	8571427.29	-91637.01	54.7
7	BSINRC	136	11962	5.3	173.3	28.09	30032.89	918.49	87.96
8	BSISHRC	52	2351	-78.7	-9437.7	6193.69	89070181.29	742746.99	45.21
9	BSISRC	150	19453	19.3	7664.3	372.49	58741494.49	147920.99	129.69
10	BSIWRC	123	11173	-7.7	-615.7	59.29	379086.49	4740.89	90.84
11	All Centre	NI	2881(NI)						
	Total	1307	117887			62274.1	1398053166	8980440.1	92.4
	Mean Value (M)	130.7	11788.7						

*NI = Not included for calculation, X = No. of BSI Contributors, Y= No. of Pages Contributed, x = X–[Mean value of X], y = Y-[Mean value of Y]

$$r = \frac{8980440.1}{9330729}$$

Pearson coefficient correlation = 0.96

It shows a strong positive correlation, that the increase of number of contributors will have positive effect on the number of pages of research publications.

B. Subject Wise Contribution on Pages

Table IV states that the 47.2 percentage of research communications in terms of pages were developed in the Floristic Studies (56953 pages).

Revisionary studies have obtained 14.1 percentage, covering 16971 pages followed by Cryptogamic Botany with 9809 pages (8.12%).

General Botanical Studies comprising biography of great botanists, case study of the research institutions, herbaria, personal research experiences have obtained 6455 pages with 5.34% of total research pages of production by BSI.

c. Prolific Authors on Various Factors

Table V had provided the rank list of 25 prolific authors based on the total number of research contributions by the BSI Scientists irrespective of the bibliographic form namely journals, book chapters, proceedings, published reports etc.

Further, the prolific authors in primary author position covering the entire research contributions were stated in the second column of the Table V.

TABLE IV SUBJECT WISE CONTRIBUTION BY NUMBER OF PAGES

Sl.No.	Subject Sub-Fields	No. of Pages	Percentage
1	General Studies	6455	5.34
2	Cryptogamic Botany	9809	8.12
3	Economic Botany	3850	3.19
4	Ethno botany	4657	3.87
5	Floristic Studies	56953	47.16
6	New Plant Discovery	2970	2.46
7	Nomenclatural Notes	775	0.64
8	Palynology	768	0.64
9	Phytochemistry	1239	1
10	Phytogeography	3470	2.87
11	Plant Conservation	8476	7.01
12	Plant Genetical Notes	1249	1
13	Revisionary Studies	16971	14.1
14	Taxonomical Notes	3126	2.6
	Total	120768	100

CNPA was the list of contribution made by the BSI authors in other than (Non) primary author position.

The last column of the Table V shows the prolific author list based on their journal articles' publication regardless of their position in the authorship pattern of the article concerned.

The author Jain S K, Nair N C, Balakrishnan N P, Chakrabarty T, Panigrahi G, Nayar M P, Mao A A, Dixit R D, Henry A N, Thothathri K, Srivastava R C, Singh N P, Srivastava S K, Singh S K, Sreekumar P V, Singh K P, Anandkumar, Ansari A A, had found place in all the four columns.

Jain S K (235) and Nair N C (213) have occupied first two positions in overall research contribution.

As far as the journal article contribution, Nair N C (174) and Chakrabarty T (171) occupied the first two positions.

TABLE V RANK LIST OF THE AUTHORS ON VARIOUS FACTORS

Rank	No. of Research Contributions	(CPA) Primary Author position	CNPA	No. of Journal Articles alone
1	Jain S K (235)	Jain S K (158)	Singh D K (108)	Nair N C (174)
2	Nair N C (213)	Nair N C (141)	Balakrishnan N P (90)	Chakrabarty T (171)
3	Balakrishnan N P(188)	Panigrahi G (125)	Jain S K (77)	Balakrishnan N P (153)
4	Chakrabarty T (175)	Nayar M P (111)	Nair N C (72)	Jain S K (150)
5	Panigrahi G (168)	Chakrabarty T (110)	Sinha G P (70), Nair V J (70)	Panigrahi G (139)
6	Nayar M P (162)	Deb D B (101)	Chakrabarty T, Henry A N (65), Daniel P (65)	Nayar M P (131)
7	Singh D K (145)	Balakrishnan N P (98), Dixit R D (98)	Srivastava S K (61)	Singh D K (123)
8	Dixit R D (136)	Thothathri K (83)	Sreekumar P V (59)	Thothathri K (110)
9	Henry A N (127)	Srivastava R C (82)	Singh N P (56), Pal D C (56)	Dixit R D (106)
10	Thothathri K (122)	Hosagoudar V B(65)	Nayar M P (51)	Srivastava S K (103)
11	Srivastava R C (119)	Gupta S L (63)	Diwakar P G, Singh S K (49)	Srivastava R C (101)
12	Singh N P (110)	Henry A N (62)	Singh K P (48)	Deb D B (96)
13	Deb D B (109)	Ansari A A (61)	Chowdhery H J (47), Lakshminarasimhan P (47)	Sreekumar P V (95)
14	Daniel P, Srivastava S K (107)	Rao R S (58)	Panigrahi G, Hajra P K (43)	Henry A N (91)
15	Singh S K (103)	Ghosh R B (55)	Thothathri K (39)	Daniel P (89)
16	Sreekumar P V (102)	Singh S K (54), Singh N P (54)	Dixit R D (38)	Singh S K (88)
17	Singh K P (101)	Singh K P (53), Pandey R P (53)	Srivastava R C, Sanjappa M, P Singh (37)	Singh N P (87)
18	Sinha G P (95)	Bandhyopadyay S (51)	Khanna K K (35)	Singh KP (83)
19	Nair V J (94)	Mao A A (50), Subramanyam K (50)	Pandey R P (34)	Sinha G P (82)
20	Ansari A A (93)	Anandkumar (47), Joseph J (47)	Anandkumar, Sharma J R (33)	Ansari A A (81)
21	Chowdhery H J (88)	Srivastava S K (46)	Ansari A A, Mao A A,Bhargavan P, Ghosh S R (32)	Pandey R P (80)
22	Pandey R P (87)	Khanna K K (45)	Vivekananthan K, Chauhan A S (31)	Nair V J (78)
23	Pal D C (84)	Singh V (44)	Bhattacharya U C (30)	Anandkumar (77)
24	Mao A A (82)	Sreekumar P V (43)	Sharma B D, Rao P S N, Gangopadhyay M (29)	Chowdhery H J (74)
25	Anandkumar, Khanna K K (80)	Daniel P, Vajravelu E (42)	Uniyal B P, Kumar R, Murthy G V S (28)	Mao A A (73)

CNPA - Contributions in non primary authorship position

D. Impact of Career Longevity of BSI Researchers

The coefficient correlation is the technique use in this section to study the relationships existed between research career longevity of the BSI scientists with that of the research journal articles produced by them. Pearson's

Coefficient Correlation was employed in this section with two variables namely research career longevity and the research articles.

The BSI researchers/scientists with more career longevity were all included in the Table No. 6. The career longevity was considered from the institutional repository database starting from first research article appearance to the last of the corresponding author.

As far as the research article concerns those who have published with and above 15 articles were all considered for the impact assessment. Further, it was observed that those

who have contributed below 15 were mostly the research scholars with below 10 years of research career longevity associated with BSI and not been assessed in this particular impact.

In statistics the Pearson Product Moment Correlation Coefficient is widely used in measuring the degree of linear dependence between two variables, here in this section the variables are research career tenure of the BSI Scientists (X) and the number of journal articles produced by them (Y) using the following formula

Pearson's correlation $r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$

Where x and y are the mean difference of the variables X and Y as tabulated in the Table VI.

A total of 198 pairs were considered to study the correlation existed among them.

TABLE VI IMPACT OF THE AUTHOR'S CAREER LONGEVITY WITH THAT OF ARTICLE PUBLICATION

Sl.No.	Author's Name	Research Career Longevity X	No. of Research Articles Y	x = (X-M)	y = (Y-M)	x²	y²	xy
1	Singh K P	49	83	26.57	43.43	705.96	1886.16	1153.94
2	Nair V J	49	78	26.57	38.43	705.96	1476.86	1021.09
3	Verma D M	49	34	26.57	-5.57	705.96	31.02	-147.99
4	Deb D B	47	96	24.57	56.43	603.68	3184.34	1386.49
5	Balakrishnan N P	42	153	19.57	113.43	382.98	12866.36	2219.83
6	Roychowdhury K N	40	20	17.57	-19.57	308.70	382.98	-343.84
7	Murti S K	38	26	15.57	-13.57	242.42	184.14	-211.28
8	Raju D C S	37	31	14.57	-8.57	212.28	73.44	-124.86
9	Nair N C	36	174	13.57	134.43	184.14	18071.42	1824.22
10	Thothathri K	36	110	13.57	70.43	184.14	4960.38	955.74
11	Dixit R D	36	106	13.57	66.43	184.14	4412.94	901.46
12	Ghosh R B	36	71	13.57	31.43	184.14	987.84	426.51
13	Sur P R	36	30	13.57	-9.57	184.14	91.58	-129.86
14	Nayar M P	35	131	12.57	91.43	158.00	8359.44	1149.28
15	Pal D C	35	70	12.57	30.43	158.00	925.98	382.51
16	Shetty B V	35	35	12.57	-4.57	158.00	20.88	-57.44
17	Kulkarni B G	35	24	12.57	-15.57	158.00	242.42	-195.71
18	Singh N P	34	87	11.57	47.43	133.86	2249.60	548.77
19	Anandkumar	34	77	11.57	37.43	133.86	1401.00	433.07
20	Wadhwa B M	34	34	11.57	-5.57	133.86	31.02	-64.44
21	Vohra J N	34	32	11.57	-7.57	133.86	57.30	-87.58
22	Basak R K	34	17	11.57	-22.57	133.86	509.40	-261.13
23	Mitra R L	34	15	11.57	-24.57	133.86	603.68	-284.27
24	Panigrahi G	33	139	10.57	99.43	111.72	9886.32	1050.98
25	Ansari A A	33	81	10.57	41.43	111.72	1716.44	437.92
26	Sharma B D	33	55	10.57	15.43	111.72	238.08	163.10
27	Ghosh S R	33	48	10.57	8.43	111.72	71.06	89.11
28	Basu D	33	32	10.57	-7.57	111.72	57.30	-80.01
29	Banerjee L K	33	26	10.57	-13.57	111.72	184.14	-143.43
30	Srivastava S C	33	19	10.57	-20.57	111.72	423.12	-217.42
31	Kataki S K	33	17	10.57	-22.57	111.72	509.40	-238.56

32	Henry A N	32	91	9.57	51.43	91.58	2645.04	492.19
33	Paul T K	32	37	9.57	-2.57	91.58	6.60	-24.59
34	Parmar P J	32	31	9.57	-8.57	91.58	73.44	-82.01
35	Ellis J L	32	29	9.57	-10.57	91.58	111.72	-101.15
36	Singh J N	32	29	9.57	-10.57	91.58	111.72	-101.15
37	Pandey H S	32	16	9.57	-23.57	91.58	555.54	-225.56
38	Chakrabarty T	31	171	8.57	131.43	73.44	17273.84	1126.36
39	Srivastava R C	31	101	8.57	61.43	73.44	3773.64	526.46
40	Bhattacharya U C	31	47	8.57	7.43	73.44	55.20	63.68
41	Lal, Jagdish	31	35	8.57	-4.57	73.44	20.88	-39.16
42	Shukla B K	31	33	8.57	-6.57	73.44	43.16	-56.30
43	Mohanan M	31	18	8.57	-21.57	73.44	465.26	-184.85
44	Srinivasan S R	31	17	8.57	-22.57	73.44	509.40	-193.42
45	Pandey R P	30	80	7.57	40.43	57.30	1634.58	306.06
46	Chowdhery H J	30	74	7.57	34.43	57.30	1185.42	260.64
47	Singh V	30	58	7.57	18.43	57.30	339.66	139.52
48	Sanjappa M	30	47	7.57	7.43	57.30	55.20	56.25
49	Paramjit Singh	30	46	7.57	6.43	57.30	41.34	48.68
50	Raghavan R S	30	45	7.57	5.43	57.30	29.48	41.11
51	Vajravelu E	30	45	7.57	5.43	57.30	29.48	41.11
52	Chakraverty R K	30	43	7.57	3.43	57.30	11.76	25.97
53	Gopalan R	30	41	7.57	1.43	57.30	2.04	10.83
54	Sarkar A K	30	25	7.57	-14.57	57.30	212.28	-110.29
55	Malick K C	30	20	7.57	-19.57	57.30	382.98	-148.14
56	Mondal M S	30	20	7.57	-19.57	57.30	382.98	-148.14
57	Jain S K	29	150	6.57	110.43	43.16	12194.78	725.53
58	Khanna K K	29	63	6.57	23.43	43.16	548.96	153.94
59	Basu S K	29	47	6.57	7.43	43.16	55.20	48.82
60	Vivekananthan K	29	21	6.57	-18.57	43.16	344.84	-122.00
61	Singh D K	28	123	5.57	83.43	31.02	6960.56	464.71
62	Diwakar P G	28	64	5.57	24.43	31.02	596.82	136.08
63	Rao T A	28	57	5.57	17.43	31.02	303.80	97.09
64	Rao M K V	28	52	5.57	12.43	31.02	154.50	69.24
65	Subba Rao G V	28	39	5.57	-0.57	31.02	0.32	-3.17
66	GuhaBakshi D N	28	29	5.57	-10.57	31.02	111.72	-58.87
67	Debnath H S	28	20	5.57	-19.57	31.02	382.98	-109.00
68	Srivastava S K	27	103	4.57	63.43	20.88	4023.36	289.88
69	Lakshminarasimhan	27	68	4.57	28.43	20.88	808.26	129.93
70	Joseph J	27	59	4.57	19.43	20.88	377.52	88.80
71	Sharma J R	27	58	4.57	18.43	20.88	339.66	84.23
72	Banerjee R N	27	36	4.57	-3.57	20.88	12.74	-16.31
73	Deshpande U R	27	28	4.57	-11.57	20.88	133.86	-52.87
74	Sastry A R K	27	26	4.57	-13.57	20.88	184.14	-62.01
75	Pal G D	27	19	4.57	-20.57	20.88	423.12	-94.00
76	Singh B	27	15	4.57	-24.57	20.88	603.68	-112.28
77	Daniel P	26	89	3.57	49.43	12.74	2443.32	176.47
78	Sinha G P	26	82	3.57	42.43	12.74	1800.30	151.48
79	Bandhyopadhyay S	26	70	3.57	30.43	12.74	925.98	108.64
80	Chauhan A S	26	33	3.57	-6.57	12.74	43.16	-23.45
81	Sen Gupta G	26	16	3.57	-23.57	12.74	555.54	-84.14
82	Uniyal B P	25	49	2.57	9.43	6.60	88.92	24.24
83	Kumar S	25	34	2.57	-5.57	6.60	31.02	-14.31
84	Karthikeyan S	25	33	2.57	-6.57	6.60	43.16	-16.88
85	Gupta S L	25	32	2.57	-7.57	6.60	57.30	-19.45
86	Krishna B	25	30	2.57	-9.57	6.60	91.58	-24.59
87	Ramamurthy K	25	30	2.57	-9.57	6.60	91.58	-24.59
88	Agarwal V S	25	20	2.57	-19.57	6.60	382.98	-50.29
89	Kothari M J	25	19	2.57	-20.57	6.60	423.12	-52.86
90	Rao A V N	25	18	2.57	-21.57	6.60	465.26	-55.43
91	Arora C M	25	18	2.57	-21.57	6.60	465.26	-55.43
92	Chaudhuri, Rai H N	24	33	1.57	-6.57	2.46	43.16	-10.31
93	Prasad V P	24	29	1.57	-10.57	2.46	111.72	-16.59
94	Mukherjee A K	24	20	1.57	-19.57	2.46	382.98	-30.72

95	Sreekumar P V	23	95	0.57	55.43	0.32	3072.48	31.60
96	Gangopadhyay M	23	57	0.57	17.43	0.32	303.80	9.94
97	Rao R R	23	44	0.57	4.43	0.32	19.62	2.53
98	Mudgal V	23	33	0.57	-6.57	0.32	43.16	-3.74
99	Kumar R	23	32	0.57	-7.57	0.32	57.30	-4.31
100	Murthy G V S	23	31	0.57	-8.57	0.32	73.44	-4.88
101	Ansari M Y	23	24	0.57	-15.57	0.32	242.42	-8.87
102	Kammathy R V	23	17	0.57	-22.57	0.32	509.40	-12.86
103	Giri G S	22	64	-0.43	24.43	0.18	596.82	-10.50
104	Rao R S	22	62	-0.43	22.43	0.18	503.10	-9.64
105	Majumdar N C	22	34	-0.43	-5.57	0.18	31.02	2.40
106	Hynniewta T M	22	33	-0.43	-6.57	0.18	43.16	2.83
107	Venu P	22	31	-0.43	-8.57	0.18	73.44	3.69
108	Chandrasekaran V	22	23	-0.43	-16.57	0.18	274.56	7.13
109	Panda S	22	22	-0.43	-17.57	0.18	308.70	7.56
110	Singh S	22	20	-0.43	-19.57	0.18	382.98	8.42
111	Subramaniam A	22	16	-0.43	-23.57	0.18	555.54	10.14
112	Pradhan S G	22	15	-0.43	-24.57	0.18	603.68	10.57
113	Hajra P K	21	33	-1.43	-6.57	2.04	43.16	9.40
114	Banerjee S P	21	30	-1.43	-9.57	2.04	91.58	13.69
115	Roy G P	21	27	-1.43	-12.57	2.04	158.00	17.98
116	Malhotra S K	21	25	-1.43	-14.57	2.04	212.28	20.84
117	Kamble S Y	21	21	-1.43	-18.57	2.04	344.84	26.56
118	Janardhanan K P	21	16	-1.43	-23.57	2.04	555.54	33.71
119	Mao A A	20	74	-2.43	34.43	5.90	1185.42	-83.66
120	Chandrabose M	20	35	-2.43	-4.57	5.90	20.88	11.11
121	Phukan S	20	31	-2.43	-8.57	5.90	73.44	20.83
122	Balodi B	20	31	-2.43	-8.57	5.90	73.44	20.83
123	Kumari G R	20	28	-2.43	-11.57	5.90	133.86	28.12
124	Swaminathan M S	20	23	-2.43	-16.57	5.90	274.56	40.27
125	Rathakrishnan N C	20	19	-2.43	-20.57	5.90	423.12	49.99
126	Sinha B K	19	51	-3.43	11.43	11.76	130.64	-39.20
127	Malhotra C L	19	46	-3.43	6.43	11.76	41.34	-22.05
128	RAO A S	19	41	-3.43	1.43	11.76	2.04	-4.90
129	Rau M A	19	21	-3.43	-18.57	11.76	344.84	63.70
130	Arti Garg	18	60	-4.43	20.43	19.62	417.38	-90.50
131	Rao P S N	18	54	-4.43	14.43	19.62	208.22	-63.92
132	Gupta R K	18	32	-4.43	-7.57	19.62	57.30	33.54
133	Agrawala D K	18	20	-4.43	-19.57	19.62	382.98	86.70
134	Moorthy S	18	17	-4.43	-22.57	19.62	509.40	99.99
135	Subramanyam K	17	54	-5.43	14.43	29.48	208.22	-78.35
136	Bhaumik M	17	41	-5.43	1.43	29.48	2.04	-7.76
137	Pathak M K	17	30	-5.43	-9.57	29.48	91.58	51.97
138	Dash S S	17	29	-5.43	-10.57	29.48	111.72	57.40
139	Sampath Kumar V	17	22	-5.43	-17.57	29.48	308.70	95.41
140	Bhargavan P	17	20	-5.43	-19.57	29.48	382.98	106.27
141	Pramanik A	17	20	-5.43	-19.57	29.48	382.98	106.27
142	Padhey P M	17	18	-5.43	-21.57	29.48	465.26	117.13
143	Ray L N	17	15	-5.43	-24.57	29.48	603.68	133.42
144	Ghosh B	16	24	-6.43	-15.57	41.34	242.42	100.12
145	Sen R	16	17	-6.43	-22.57	41.34	509.40	145.13
146	Rajendran A	15	39	-7.43	-0.57	55.20	0.32	4.24
147	Hemadri K	15	28	-7.43	-11.57	55.20	133.86	85.97
148	Deori N C	14	17	-8.43	-22.57	71.06	509.40	190.27
149	Chatterjee U	14	16	-8.43	-23.57	71.06	555.54	198.70
150	Nair K K N	14	15	-8.43	-24.57	71.06	603.68	207.13
151	Hosagoudar V B	13	69	-9.43	29.43	88.92	866.12	-277.52
152	Dwarakan P	13	34	-9.43	-5.57	88.92	31.02	52.53
153	Kundu S R	13	26	-9.43	-13.57	88.92	184.14	127.97
154	Prasanna P V	13	19	-9.43	-20.57	88.92	423.12	193.98
155	Mitra, Krishna	13	16	-9.43	-23.57	88.92	555.54	222.27
156	Rama Rao N	13	15	-9.43	-24.57	88.92	603.68	231.70
157	Pandurangan A G	12	15	-10.43	-24.57	108.78	603.68	256.27

158	Jayanthi J	11	34	-11.43	-5.57	130.64	31.02	63.67
159	Pande H C	11	32	-11.43	-7.57	130.64	57.30	86.53
160	Jagadeesh Ram T A	11	31	-11.43	-8.57	130.64	73.44	97.96
161	Ramachandran	11	23	-11.43	-16.57	130.64	274.56	189.40
162	Meena S L	11	21	-11.43	-18.57	130.64	344.84	212.26
163	Kholia B S	11	19	-11.43	-20.57	130.64	423.12	235.12
164	Joshi, Pragya	11	15	-11.43	-24.57	130.64	603.68	280.84
165	Murugan C	10	48	-12.43	8.43	154.50	71.06	-104.78
166	Sumathi R	10	30	-12.43	-9.57	154.50	91.58	118.96
167	Karthigeyan K	10	27	-12.43	-12.57	154.50	158.00	156.25
168	Sebastine K M	10	26	-12.43	-13.57	154.50	184.14	168.68
169	Mathew, Sam P	10	21	-12.43	-18.57	154.50	344.84	230.83
170	Bose R B	10	15	-12.43	-24.57	154.50	603.68	305.41
171	Pusalkar P K	9	31	-13.43	-8.57	180.36	73.44	115.10
172	Srinivasan K S	9	30	-13.43	-9.57	180.36	91.58	128.53
173	Singh D	9	25	-13.43	-14.57	180.36	212.28	195.68
174	Singh, RajeevKumar	9	21	-13.43	-18.57	180.36	344.84	249.40
175	Sikdar J K	8	30	-14.43	-9.57	208.22	91.58	138.10
176	Dubey, Rashmi	8	24	-14.43	-15.57	208.22	242.42	224.68
177	Arora R K	8	22	-14.43	-17.57	208.22	308.70	253.54
178	Ansari R	8	20	-14.43	-19.57	208.22	382.98	282.40
179	Kumar P	8	20	-14.43	-19.57	208.22	382.98	282.40
180	Maina, Vinod	8	16	-14.43	-23.57	208.22	555.54	340.12
181	Ranjan V	8	16	-14.43	-23.57	208.22	555.54	340.12
182	Rawat V K	8	16	-14.43	-23.57	208.22	555.54	340.12
183	Maity D	8	15	-14.43	-24.57	208.22	603.68	354.55
184	Jalal J S	7	44	-15.43	4.43	238.08	19.62	-68.35
185	Benniamin A	7	30	-15.43	-9.57	238.08	91.58	147.67
186	Gogoi R	7	26	-15.43	-13.57	238.08	184.14	209.39
187	Dey, Monalisa	7	25	-15.43	-14.57	238.08	212.28	224.82
188	Datta N	7	22	-15.43	-17.57	238.08	308.70	271.11
189	Bhattacharjee A	7	20	-15.43	-19.57	238.08	382.98	301.97
190	Tripathi A K	7	19	-15.43	-20.57	238.08	423.12	317.40
191	Sreemadhavan	7	18	-15.43	-21.57	238.08	465.26	332.83
192	Bennet S S R	7	16	-15.43	-23.57	238.08	555.54	363.69
193	Kabeer K A A	7	15	-15.43	-24.57	238.08	603.68	379.12
194	Rasingam L	6	23	-16.43	-16.57	269.94	274.56	272.25
195	Pandey Y P S	6	18	-16.43	-21.57	269.94	465.26	354.40
196	Palanisamy M	6	16	-16.43	-23.57	269.94	555.54	387.26
197	Barbhuiya H A	5	24	-17.43	-15.57	303.80	242.42	271.39
198	Puri G S	5	22	-17.43	-17.57	303.80	308.70	306.25
Total		4441	7835			19336.51	177570.51	26911.49
Mean	(M)	22.43	39.57					

X = Researc h Career Longevity, Y= No. of research

articles, x = X–[Mean value of X], y = Y-[Mean value of Y]

Pearson's correlation $r = \dfrac{26911.49}{\sqrt{19336.51*177570.5}}$

r=0.46

The value 0.46 represents there would be a moderate positive correlation exists between the author's career tenure and the research article publication that means that larger values on one variable are associated with larger values on the other variable under consideration.

Hypothesis 2 was tested with the Pearson's coefficient and proved there is a moderate relationship exists between the number of research articles produced and the career longevity of the BSI Scientists.

VIII. FINDINGS AND CONCLUSION

There was 1241 research publications emerged out of collaborative work with other research centres by the BSI Scientists. The analyses of collaborative works show only 16.8% of research contributions were from the collaboration with other centres. The highest percentage (45.2%) with 561 out of 1241 records was yielded during the period 2001-2012. However, when compared to the total research publication of the period 2001-2012 (1992 records), the collaborative work has obtained 28 percentage. It is a good sign and helps to overcome the problem of lacking of infrastructure by resource sharing among the researchers of other centres.

To the extent 1307 of BSI authors have contributed the research publications under study. There exists a strong positive Correlation between the number of contributors and the number of research contributions. Per capita authorship of BSI authors alone was calculated and shows 5.64 research contributions per author as stated in the Table No. 3. The per capita authorship in terms of pages of production was calculated as 92.4 pages/author as stated in the Table IV. These 1307 of BSI scientists/researchers have shown strong positive correlation with that of research contribution and in terms of pages of production.

The Scientists of BSI have published 1, 20,768 pages on different sources which spread across 7374 corpus. The highest number of 56953 pages was produced in the sub-field Floristic Studies (47.2%). Revisionary studies have obtained 14.1% which was followed by Cryptogamic Botany with 9809 pages (8.12%).

The moderate positive correlation existed between the author's career tenure and the research article publication was proved using Pearson's Coefficient Correlation.

Here, the fact has to be admitted that the nature of research work in respect to the survey departments of government cannot be evaluated only by the publication production alone as the survey reporting consumes more valuable time and efforts which results in peculiar research communications that has impact in the growth rate of the institution. Steps need to be taken for the research collaborations with other taxonomic oriented research institutions in national as well as international level. This will overcome the downfall lies in the expertise and other infrastructure for performing a useful and highly influential research outcome.

REFERENCES

[1] Balakrishnan,N.P. (1983). The Andaman and Nicobar Circle, Botanical Survey of India, Port Blair. *Bulletin of the Botanical Survey of India.*, 25(1-4), 336-340,1983.

[2] Basak,R.K. (1983). *Botanical Survey of India (BSI): An account of its establishment, development & activities.* Howrah, West Bengal: Botanical Survey of India.

[3] Das,H.K. (2012). Bibliometric analysis of the plant taxonomy journal Nelumbo, 2004-2011. *International Journal of Library and Information Studies*, l.2(4), 51-61.

[4] Davis, P.M. & Connolly,L. (2007). Institutional repositories: evaluating the reasons for non-use of Cornell University's Installation of DSpace. *D-Lib Magazine*, 12(3-4). http://www.dlib.org/dlib/march07/davis/03davis.html

[5] Jena, K.L., Swain, D.K., and Sahu, S.N. (2012). Scholarly communication of The Electronic Library from 2003–2009: A bibliometric study. *The Electronic Library*, 30(1), 103-119.