Library Waves

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(An official Organ of Shri Shakti Degree College, Kanpur)

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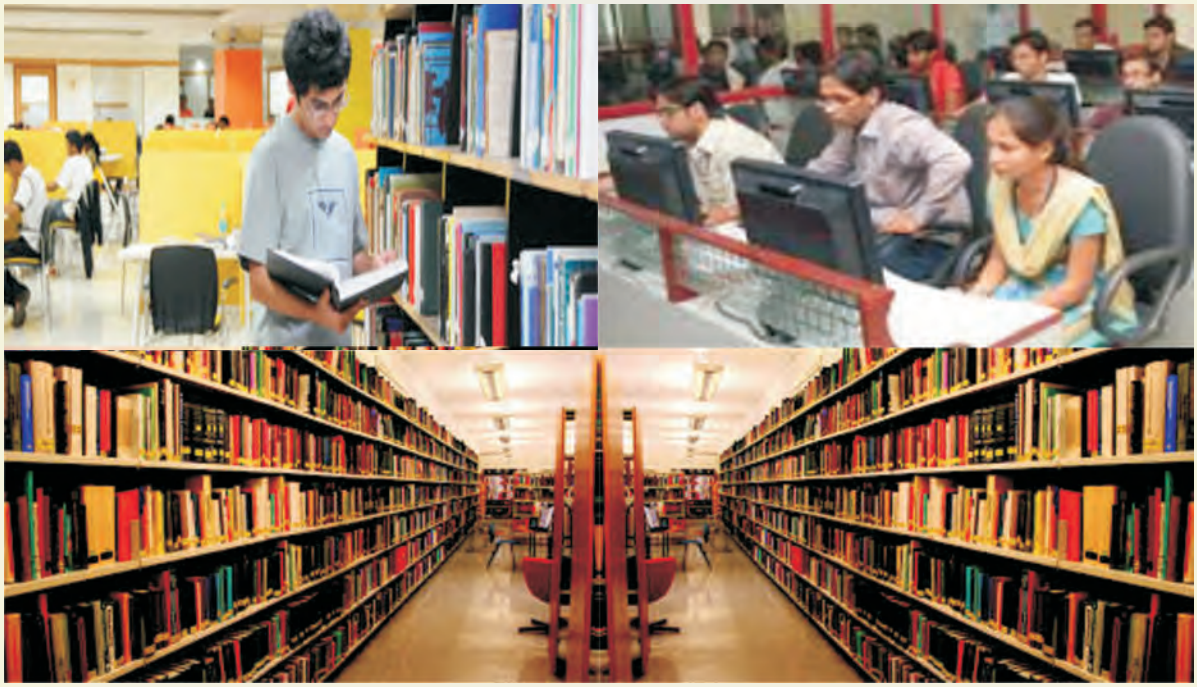

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From The Editors Desk

In the changing scenario of advancement of new technologies, libraries have to establish value as 'place of collaboration, learning and innovation' by considering technology as enabler which facilitate knowledge creation and sharing and promote knowledge management services in Libraries. Deployment of technology in libraries must takes place in various ways, not only including changes about management thought, manage system, and manage mode, but also innovations about work content, service mode, and self-development of librarians. Today popular internet search engines have altered the role of libraries by offering students easier ways to discover research materials online and cutting the necessity of physically visiting a library. On the other hand, librarians, concerned with library usability rates, now have more flexibility undertaking marketing efforts through the use of the internet, thus expanding the horizon of finding new ways of advertising library services. Increasing the visibility of their library through high technologies has become the top priority of librarians. The introduction of technologies that are Web 2.0 oriented has added an element of fun to the user experience; moreover, these technologies expose users to informally published materials produced by colleagues and promote the sharing of digital materials and user expertise. Although users still consider library resources much more trustworthy and credible than web search engines, internet encyclopaedias, and other freely available web services, the typical information seeker is attracted to the ease of use and the online availability of content that the latter resources provide. 'Library Waves' is an effort to add a valuable academic creativity to the library and information science horizon and covers the numerous significant ideas of broad spectrum of topics related to ICT enabled library services. This first issue contain a total number of eight papers. We are thankful to the contributors who have shown great interest to the 'Library Waves'.

Vijayadasmi, 2015 **Dr. Pankaj Kumar Singh**

Place: Kanpur **Dr. Shri Ram Pandey**

CONTENTS

Library Waves Vol.1. No.1 January to June 2015
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Lotka's Law and Authorship Distribution in Cloud Computing Research

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Abstract:

This paper examines the validity of Lotka's law to authorship distribution on the subject Area "Cloud Computing Research. In the process, we chose to consider the articles published under 2007 – 2013 for the study. Lotka's law constituting the most significant bibliometric law is applied and tested using various methods like Sen's Method, Pao's Method, and Maximum Likelihood Method and finally verified through Kolmogorov-Smirnov (KS) Test. The Hypotheses is thus tested with these measures for its validity and it is found that the values of exponent *n* and constant *c* obtained through the above said three methods proves that Lotka's Law does not hold good for the authorship pattern in cloud computing research and hence the hypotheses gets rejected.

Keywords

Lotka's law, Cloud Computing, Least Square Method, Maximum Likelihood Method, Sen's Method , Kolmogorov-Smirnov Test.

Introduction

The communication of scientific insights, experience, discussions, logic and decision making, stands on the platform of quantitative data, its mathematics and statistical interpretation. The process of theory-measurement cycle is powerful, producing authenticated and reliable inferences. The Science of measurement of bibliographies though began in 1923 , gradually got transformed into a huge area of study called Bibliometrics incorporating many Laws, and Methods. Hence, Bibliometrics, the science of quantitative study and analysis of literature have proved through Bibliometric Laws and Methods, the impact of the Researchers, their papers and thereby, the emergence of new scientific thoughts and the growth of literature. It has become such an indispensable tool, in the academic and research world today, without, which, the measurement and predictions are becoming impossible. In many of the Research Excellence Determining, the Bibliometrics has become an auxiliary tool for assessing, allocating and funding the research agencies.

The major empirical laws of bibliometrics are Lotka's Law , Zipf's Law and Bradford's Law used often in the literature to model the distribution of information phenomena. Lotka's Law is one of the most basic Law of Bibliometrics, which deals with the frequency of publication by authors in any given field. The generalized form of Lotka's law can be expressed

as $$x^n y = c \qquad \ldots(1)$$

Where y is the number of authors with x articles, the exponent n and constant c are parameters to be estimated from a given set of author productivity data.

The Lotka law is named after Alfred J. Lotka when he came out with an observation that, there exists a quantitative relation among the authors and their scientific productivity during 1926 . Lotka published a paper on the frequency distribution of scientific productivity using the publications appearing on Chemical Abstracts from 1907 to 1916 and proposed an inverse square law of scientific productivity . The Law states that the number of authors making x contributions is about $1/x^n$ of those making one contribution. In other words, it implies, that, most authors occur few times, and, few authors most times. It clearly states that, as the number of publications increases, the authors producing the same decreases. If N is the number of authors, Ny_1, in Lotka's equation gives the number of authors who have published a single paper each. The Lotka's equation is determined by three parameters namely, the number of scientists with minimal productivity, the maximum productivity of a scientist ($X_{max)}$) and the characteristic exponent n. The proportion of authors that makes a single contribution is about 60%. The result can be considered as a rule of thumb even today, even after 75 years after its formulation and publication.

Literature Review

There are few landmark applications that are worth stating that discusses the situations, wherein the author productivity is far from Lotka's Law. Tsay, Ming-Yueh et.al investigated the Semiconductor Literature obtained from INSPEC Database and found that the Number of authors contributing more articles is high and which was quite opposite to the prediction of Lotka and therefore, the Fitted Curve also disproves the application of Lotka Law to the Semiconductor Research.

Rousseau discusses the issue of Lack of Standardisation in Informetric Research. He recommends that there should certainly be the measure of evenness or measure of concentration like Gini co-efficient to be a part of a standard indicator set.

Rousseau and Egghe discusses about the theory and practice of the Shifted Lotka function. The function which is put forward enables the consideration of sources with zero item and having one free parameter. It is a huge advantage when developing a theory.

Gupta B M, et al. discusses about the statistical distributions that can be used to describe the distribution of the number of authors per article. The article discusses the Inverse Gaussioan Poisson distribution. The author also finds that the geometric and truncated poisson distribution is adequate for the description of authorship. In later part, the authors investigate about the applicability of truncated binomial distribution.

Murphy applied Lotka's Law, to the humanities field and concluded that the law obeyed without applying any statistical verification measures to check the significance degrees.Schorr, makes several tests on legal medicine, map librarianship to prove the validity of Lotka's Law. Radhakrishnan

and Kerniza examines the application of Lotka's Law to Computer Science Literature and opines that there is difference between the estimated and observed value and there was an emphasis that verification would be conducted on applied science and engineering. Pao employs the test of validity of Lotka's law on 48 sets of data using least square method and found that 80% of datasets confirmed to Lotka's Law in which only seven sets corroborated n=2.

There are continuous efforts that are made to study the application of Lotka's Law to many areas in many countries. Few such efforts that are worth listing are Narendra Kumar examines the applicability of Lotka's Law on research productivity of CSIR publications. Nazim and Ahmad observed the scientific productivity on Nanotechnology research that the Lotka's Law exhibits a wide difference from the observed and expected value. Zabed et al. works on Nutrition Research pertaining to Bangladesh to test the author's productivity using the K-S Goodness of Fit test and found that there is variation and however, by excluding the high productivity authors and maximum likelihood methods, that, the Lotka Law holds good for nutrition research of Bangladesh. Sen in his article puts forth the method to Derive the value of Alpha.

Allison et al. puts forth many of their interpretations on Lotka's Law. Price opines that "the total number of scientists goes up as the square, more or less, of the number of good ones'. After on, John Stewart and Paul Allison questions the consistency of Price 'Square Root Law" with Lotka's Law.*(Half of the Scientific papers are contributed by the square root of the total number of scientific authors- Price's Law)*. Later on, Michael Moravscsik and Belver Griffith explicate the difference between the Allison and Price papers. The complete round of discussion and correspondences are compiled by the Editor of Social Studies of Science and finally comes out with the explanation, that, considering only the minimum scores of prolific authors, the elite group generally contributes atleast half of the total production of papers.

Ahmed, Zabed et al. attempts to test the Lotka's Law on the field of Nutrition Research of Bangladesh. He uses Kolmogorov-Smirnov Goodness of Fit Test and finds that the Lotka's Law does not apply for Nutrition Research as suggested in Inverse Square Law. However, Using Least Square Method and Maximum Likelihood methods, the Lotka's law is found to be applicable.

(MacRoberts et al puts forth a note which examines the database used by Lotka in propounding his law, and by Price in elaborating it, and questions the validity of the generalizations drawn from it. They conclude that the data needs to be taken from multiple abstracting sources and they also opine that what portion contributed how many research publications would lead to a less of a problem.

With this background work, that, already attempted to Test the applicability of Lotka's Law, it is found that in most of the cases, the K-S Test of Goodness of Fit, Least Square methods. Many studies have also shown that the observed value deviates to the power being 3 and 4 instead of estimated 2. However, the present study aims to study the application of Lotka's Law on the author productivity of cloud computing research.

Cloud Computing Research

Cloud Computing is the buzz word and the present trend of the I.T. industry. Cloud Computing is an emerging commercial infrastructure paradigm that promises to eliminate the need for maintaining expensive computing hardware. Through the use of virtualization and resource time-sharing, cloud address with a single set of physical resources a large user base with different needs. Cloud computing enables their owners to benefit from the reduced operating costs of many applications.

Academic Institutions and Libraries are one of major beneficiaries of technology. Databases, Campus Solutions, Networks (LAN/WAN applications) are all becoming a single point access using the Cloud Computing. Therefore, it is high time, that the Academic establishments and Libraries to explore the possibilities, the pros and cons involved in getting on to the Cloud. Many National and International Cloud Sharing Debates are happening in most of the Countries, where, India is not an exception.

The authors makes an effort to evaluate the area of Cloud Computing Research by applying the Bibliometric Techniques in determining the Author productivity. Here indirectly tries to measure the intensity in which the Cloud Computing Research field is marching.

Hypotheses:

1. **The Observed Authorship Data Distribution is same as the Theoretical Authorship Data Distribution i.e., Lotka's Law**

Objective of the Study

1. By applying Inverse Square Law, Pao and Maximum Likelihood method, to arrive at the value of exponent *n* and constant *c*.
2. To determine whether the *n* value confirms to Lotka's Law through K-S Test.

Scope of the Study:

This is a new effort in applying, testing of Lotka Law on "Cloud Computing" research literature. The study is confined towards the Cloud computing research published worldwide during 2007-2013 as reflected in Web of Science (WoS) database. Cloud computing research being an emerging area, the author tries to evaluate the one of the Bibliometric Law on its literature. However, the paper gives scope to attempt and analyze many other Bibliometric Laws and techniques.

Methodology:

The Dataset is obtained from ISI Web of Knowledge database considers only the Authors of the Articles that appear in 3153 Articles Section from 2007 to 2013 in a Text Format Delimited by Tab. The Text File is read into a Excel Sheet which gives two columns ie. Author Names and No. of Articles. There is no fractional counting for multiple authored papers. All the authors are treated equal. The file is sorted on No. of Articles Field and counted.

Table 1 – Frequency distribution of research contributions

No. of articles (x)	No. of authors observed (y)	Percentage of authors	Total No. of contributions
1	5737	76.7594	5737
2	1114	14.9050	2228
3	325	4.3484	975
4	132	1.7661	528
5	57	0.7626	285
6	41	0.5486	246
7	25	0.3345	175
8	6	0.0803	48
9	6	0.0803	54
10	10	0.1338	100
11	5	0.0669	55
12	4	0.0535	48
13	5	0.0669	65
15	1	0.0134	15
16	2	0.0268	32
19	1	0.0134	19
22	1	0.0134	22
26	1	0.0134	26
43	1	0.0134	43
Total	7474	100	10701

The value of **exponent** *n* is calculated by the least-squares method **described by Pao** using the following formula:

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2} \qquad \ldots (2)$$

N = number of pairs of data

X = logarithm of x, i.e. number of articles

Y = logarithm of y, i.e. number of authors

The value of constant c is calculated using the following formula:

$$c = \frac{1}{\sum_1^{P-1} \frac{1}{x^n} + {}^1/_{(n-1)(P^{n-1})} + {}^1/_{2*P^n} + {}^n/_{24*(P-1)^{n+1}}} \quad \ldots (3)$$

$$\sum_1^{P-1} \frac{1}{x^n} = \textit{obtained by summing the first 19 terms of } \frac{1}{x^n}$$

With x = 1, 2, 3, . . . 25

Here, P = 25; n = value obtained using formula (2); x = number of articles

Deriving the value of n and c by Sen's Method

$x^n y = c$ *Lotka Equation*

Putting the value of Table-1 given in the first row in the equation (1), we get

$1^n * 5737 = c \quad [1^n = 1]$

$5737 = c$

Determining the value of n

Using the data of the second row, we can find out the value of n

Putting the data of 2nd row in equation (1), we get

$2^n * 1114 = 5737$

$=> 2^n = {}^{5737}/_{1114}$

$=> 2^n = 5.15$

$=> n\,log2 = log5.15$

$=> n * 0.301 = 0.7118$

$=> n = {}^{0.7118}/_{0.301}$

$=> n = 2.3648$

This paper is also applies maximum likelihood (ML) method to test Lotka's law for the Cloud Computing research output. The best-known fitting ML method currently available is a computer program called Lotka by Rousseau & Rousseau . It offers two columns for data input: source and production. Once the data are properly entered, the program returns the “best fitting” value of β (the

Lotka exponent) and *C* for the dataset.

It should be noted here that obtaining a "best fit" does not guarantee that the fitted distribution is in fact a good fit in statistical terms. To assess that one needs to perform an accepted statistical test. Pao , Nicholls and Burrell suggested using Kolmogorov-Smirnov (K-S) test, a goodness-of-fit statistical Test, to assert that the observed author productivity distribution is not significantly different from a theoretical distribution. This test is based on the maximum absolute difference between the observed and theoretical cumulative frequency distributions.

The K-S critical value at 5% level of significance is calculated as $1.36/\sqrt{\sum y}$, where $\sum y$ is the total number of authors under study. If the absolute maximum difference (D_{max}) is less than the K-S critical value, then the null hypothesis is accepted that the observed value and theoretical distribution are the same. Kolmogorov-Smirnov test at 5% significance level obtain "best fit" for the dataset.

Table 2 – Calculations of exponent *n* for *Cloud computing research*

No. of articles (x)	No. of authors observed (y)	Percentage of authors	Total No. of contributions	Log no. of articles (X)	Log no. of authors (Y)	XY	X^2
1	5737	76.7594	5737	0.0000	8.6547	0.0000	0.0000
2	1114	14.9050	6851	0.6931	7.0157	4.8629	0.4805
3	325	4.3484	7176	1.0986	5.7838	6.3542	1.2069
4	132	1.7661	7308	1.3863	4.8828	6.7690	1.9218
5	57	0.7626	7365	1.6094	4.0431	6.5070	2.5903
6	41	0.5486	7406	1.7918	3.7136	6.6538	3.2104
7	25	0.3345	7431	1.9459	3.2189	6.2636	3.7866
8	6	0.0803	7437	2.0794	1.7918	3.7259	4.3241
9	6	0.0803	7443	2.1972	1.7918	3.9369	4.8278
10	10	0.1338	7453	2.3026	2.3026	5.3019	5.3019
11	5	0.0669	7458	2.3979	1.6094	3.8593	5.7499
12	4	0.0535	7462	2.4849	1.3863	3.4448	6.1748
13	5	0.0669	7467	2.5649	1.6094	4.1281	6.5790
15	1	0.0134	7468	2.7081	0.0000	0.0000	7.3335
16	2	0.0268	7470	2.7726	0.6931	1.9218	7.6872
19	1	0.0134	7471	2.9444	0.0000	0.0000	8.6697
22	1	0.0134	7472	3.0910	0.0000	0.0000	9.5545
26	1	0.0134	7473	3.2581	0.0000	0.0000	10.6152
43	1	0.0134	7474	3.7612	0.0000	0.0000	14.1466
Total	7474	100	138822	41.08758	48.4970	63.7293	104.1607

Results of the study:

Table-1 shows that almost (5737) 76% produced single article, (1114)14% produced 2 articles, (325) 4% produced 3 articles, (132) 1.7 % produced 4 articles, (57) 0.7% produced 5 articles, (41) 0.5% produced 6 articles, (25) 0.33% produced 7 Articles and the authors produced more than 8 articles is 0.0.08% and gradually, the number of authors producing 16 and more articles is 0.002%. We can observe that the authors contributing 17 and more papers to the Cloud Computing Research is as less as 0.0134%.

From Table 2, the estimated valued n for the dataset is calculated using formula (2). The value of *n* of the Cloud Computing Research through Least Square Method produces a value of *n*=2.6777

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

$$= \frac{19 * 63.7293 - 41.0875 * 48.4970}{19 * 104.1607 - 41.0875^2}$$

$$= -\frac{781.7631}{290.8707}$$

$$= -2.6877$$

The constant *c* for the dataset is calculated using the formula (3) and the value of *c* =0.7826. Applying the value of *n* and *c* to the generalized Lotka's equation, it is found that the value of Y decreases with the increase of the value of X.

$$c = \frac{1}{\sum_1^{P-1} \frac{1}{x^n} + {}^1\!/_{(n-1)(P^{n-1})} + {}^1\!/_{2 * P^n} + {}^n\!/_{24 * (P-1)^{n+1}}}$$

$$= \frac{1}{\sum_1^{19} {}^1\!/_{x^{2.6877}} + {}^1\!/_{1.6877 * 20^{1.6877}} + {}^1\!/_{2 * 20^{2.6877}} + {}^{2.6877}\!/_{24 * 19^{3.6877}}}$$

$$= \frac{1}{1.2739 + 0.0037 + 0.000159 + 0.000001553}$$

$$= \frac{1}{1.2777}$$

$$= 0.7826$$

The *n* value was also calculated by maximum likelihood method using *Lotka* program. The β-value (the Lotka exponent) is **2.7865 and constant** C= 0.7997 for the dataset.

Results from the Pao's Method:

The obtained calculated value of *n* being 2.6877 and the value of *c* being 0.7826 suggests that, the, Lotka's Law is observed to be slightly deviating from the Linear Line. It is observed that there are x

and y co-ordinates for the higher value of x correspondingly, an higher value of y also which, summarizes that there are more number of authors contributing more articles which is reverse to the concept of Lotka Law. This is the case with higher values of x and y, if we truncate these values, Lotka's Law is observed to be valid by applying the value of *n* and *c*. The Y-intercept (2.6877) increases as X increases.

Figure 1 – Fitted linear line for authorship distribution in *Cloud Computing Research*

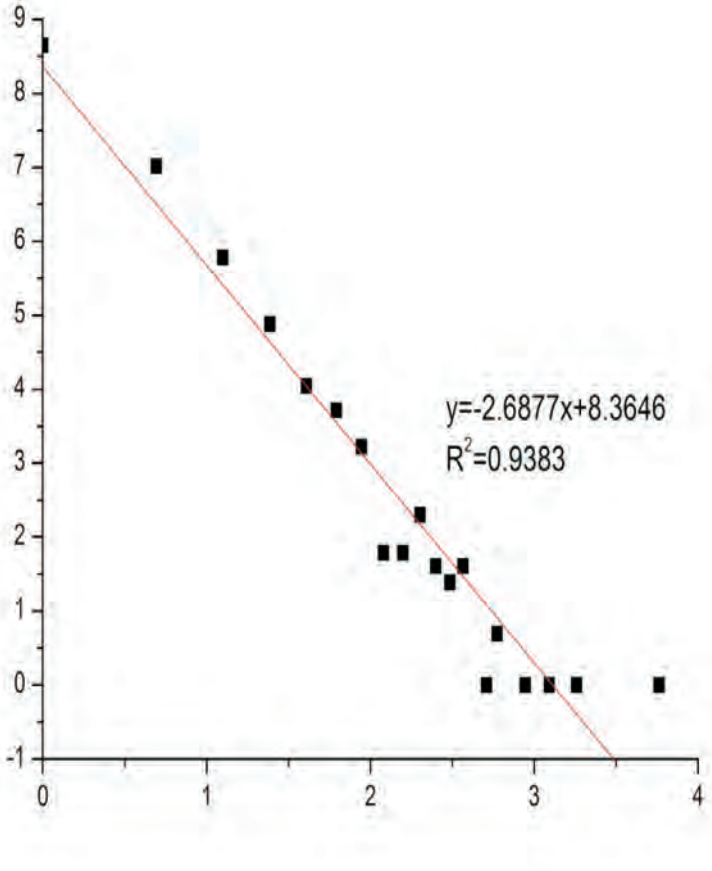

Figure-1 clearly shows the Linear relationship of the Variable x, y through the Scatter Plot. The graph represents the straight line y=mx+c, where the slope m=2.6877 and c = 8.3646 and a R^2 value of 0.9383. This infers that the data set fall into a linear relationship where the value of variable y decreases with the increase in the value of x. Therefore, the graph clearly indicates the validity of the Lotka's Law in case of truncating the higher values of x and y coordinates.

Table 3 – Fitted Lotka distribution with LS *n* =2.6877, ML *n* =2.7404, SM *n* =2.3648

No of Acticles (x)	No. of authors observed (y)	Log no. of articles (X)	Log no. of authors (Y)	Y=nX+C	Expected with LS n=2.6877	LS n=2.6877 (standardized)	Expected with ML n=2.7404	ML n=2.7404 (standardized)	Expected with SM n=2.3648	SM n=2.3648(standardized)
1	5737	0.0000	8.6547	8.3646	4292.39	5872.86	5737.00	5939.18	5737.0	5400.27
2	1114	0.6931	7.0157	6.5016	666.23	911.53	858.50	888.76	1113.8	1048.43
3	325	1.0986	5.7838	5.4119	224.05	306.54	282.61	292.57	426.96	401.90
4	132	1.3863	4.8828	4.6387	103.41	141.48	128.47	133.00	216.24	203.55
5	57	1.6094	4.0431	4.0389	56.76	77.67	69.70	72.16	127.57	120.09
6	41	1.7918	3.7136	3.5489	34.77	47.58	42.29	43.78	82.89	78.03
7	25	1.9459	3.2189	3.1346	22.98	31.44	27.72	28.70	57.57	54.19
8	6	2.0794	1.7918	2.7757	16.05	21.96	19.22	19.90	41.98	39.52
9	6	2.1972	1.7918	2.4591	11.69	16.00	13.92	14.41	31.78	29.91
10	10	2.3026	2.3026	2.1759	8.81	12.05	10.43	10.80	24.77	23.31
11	5	2.3979	1.6094	1.9198	6.82	9.33	8.03	8.32	19.77	18.61
12	4	2.4849	1.3863	1.6859	5.40	7.38	6.33	6.55	16.09	15.15
13	5	2.5649	1.6094	1.4708	4.35	5.96	5.08	5.26	13.32	12.54
15	1	2.7081	0.0000	1.0862	2.96	4.05	3.43	3.55	9.49	8.94
16	2	2.7726	0.6931	0.9127	2.49	3.41	2.88	2.98	8.15	7.67
19	1	2.9444	0.0000	0.4508	1.57	2.15	1.80	1.86	5.43	5.11
22	1	3.0910	0.0000	0.0568	1.06	1.45	1.20	1.24	3.84	3.61
26	1	3.2581	0.0000	-0.3922	0.68	0.92	0.76	0.79	2.59	2.43
43	1	3.7612	0.0000	-1.7444	0.17	0.24	0.19	0.20	0.79	0.74
Total	7474	41.0876	48.4970		5462.65	7474	7219.57	7474	7940	7474

Table 3: Displays the testing of *n* value in different modes. They are through Least Square Method, Maximum Likelihood Method, and Sen's Method. The values of *n* obtained are n=2.6877 (LS), n=2.740 (ML) and n=2.3648(SM). When the number of authors expected from these methods compared with each other, it is clear from the above table that the values of LS < ML < SM. From the Table-3, we can infer that Maximum Likelihood Method is closer to the observed values of Cloud

Computing Research as compared with Least Square Method and Sen's Method.

Table 4 – Kolmogorov-Smirnov test for n = 2

No. of articles (x)	Observed frequency of authors	Observed cumulative frequency of authors	Theoretical frequency of authors	Theoretical cumulative frequency of authors	Difference
1	0.7676	0.7676	0.6079	0.6079	0.1597
2	0.1491	0.9167	0.152	0.7599	-0.0029
3	0.0435	0.9602	0.0675	0.8274	-0.0240
4	0.0177	0.9779	0.038	0.8654	-0.0203
5	0.0076	0.9855	0.0243	0.8897	-0.0167
6	0.0055	0.9910	0.0169	0.9066	-0.0114
7	0.0033	0.9943	0.0124	0.919	-0.0091
8	0.0008	0.9951	0.0095	0.9285	-0.0087
9	0.0008	0.9959	0.0075	0.936	-0.0067
10	0.0013	0.9972	0.0061	0.9421	-0.0048
11	0.0007	0.9979	0.005	0.9471	-0.0043
12	0.0005	0.9984	0.0042	0.9513	-0.0037
13	0.0007	0.9991	0.0036	0.9549	-0.0029
15	0.0001	0.9992	0.0027	0.9576	-0.0026
16	0.0003	0.9995	0.0024	0.96	-0.0021
19	0.0001	0.9996	0.0017	0.9617	-0.0016
22	0.0001	0.9997	0.0013	0.963	-0.0012
26	0.0001	0.9998	0.0009	0.9639	-0.0008
43	0.0001	0.9999	0.0003	0.9642	-0.0002

The D_{Max} from the Table-4 is 0.1597 and is greater than the Critical Value of Kolmogorov-Smirnov Test at the level of significance 0.05 is 0.0157 determined with Lotka's exponent n=2 and hence doesn't supports for the consideration of Hypotheses i.e., the Observed Authorship Data Distribution doesn't holds good for the Lotka's Law.

Similarly a Kolmogorov-Smirnov Test is applied for the fitness of the Lotka's law for the values

of Lotka's exponents obtained from LS and ML methods. The results indicate that the values of D-Max, i.e. 0.0276 and 0.0306 determined with Lotka's exponents, i.e. n=2.6877 (LS) and n=2.7404 (ML) respectively. The critical value determined at the 0.005 level of significance is 0.0157 which is lesser than the D-Max value and hence does not supports for the consideration of Hypotheses i.e., the Observed Authorship Data Distribution does not holds good for the Lotka's Law and therefore, the Lotka's Law for the Cloud Computing Research literature is not accepted for the Authorship Distribution.

Conclusion:

The Authorship Data Distribution at the Cloud Computing Research is being tested for the application of the Lotka's Law and the Hypotheses assumed is that the Observed Data Distribution is same as the theoretical Data Distribution. The value *n* is determined through various methods like Least Square Method, Maximum Likelihood and Sen's Method. The calculated data is verified through Kolmogorov Smirnov Test for various values of *n*. It is found that Lotka's Law does not hold good for the all the three methods used with KS-Test. The observed distribution is also tested against the inverse square law using the exponent n=2; it is found that Cloud Computing Literature do not confirm to Lotka's law.

As this is a primary effort in just finding out the applicability of Lotka's law to a small piece of sample with broad conditions of considering equal weightage to all contributors, the effort can be extended to multiple authors, authorship pattern considering other publication types, author affiliations etc.,

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An Investigation of trends of Semantic Solutions for the Digital Libraries

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1 Introduction

Paradigm shift from traditional digital library to social semantic digital library opens innovative and fresh possibilities to define digital library landscape. Contemporary digital library is not merely considered as a digitized collection with information management tools rather than digital library creates an environment to bring together collections, services, and people in support of the full life cycle of creation, dissemination, use, and preservation of data, information, and knowledge (Kalinichenko, 2015). This notion opens a door to a new kind of digital libraries popularly known as 'Semantic Digital Library(SDL)'which integrates information based on different metadata e.g.: resources, user profiles, bookmarks, taxonomies, provides interoperability as well as delivering more robust, user friendly and adaptable search and browsing interfaces empowered by semantics(Kruk, 2010). By using social media tools and applications to the digital libraries, the ever changing relationship between a library and its users which are highly social media literate can be facilitated. This may be seen as real transition of library to the new social media era where users have options to create, annotate, share and collaborate.

Social Semantic Digital Library (SSDL) is basically an outcome of the synergy between digital libraries, the Semantic Web, and social networking with aim to improve, among other things, usability of information discovery. Social networks are explicit representations of the relationships between individuals and groups in a community and provide the backbone for SSDL (Pandey and Panda, 2014). Several of these social network based virtual communities have begun to publish members' public profile information, including social links, using the semantic web language resource description framework (RDF) (Tim et al.,2005). Such RDFs can be reused and deployed to SSDL for better visualization of friends and community profiles as well as sharing and creation of knowledge within user communities.

SSDL brings out several key features to the end users/readers that are not available to the traditional digital library where focus is on delivering content/information and not on knowledge sharing within a community of users (Baruzzo et al., 2009). SSDL make users/readers involved in the content annotation process and allow users/readers to share their knowledge within a community as well as provide better communication between users in and across communities. Social Semantic digital libraries follows the ideas of semantic web and extend the digital libraries by describing and exposing its resources in a machine 'understandable' way and enforce the transition from a static information to a dynamic (collaborative) knowledge space.

Availability of literature in the field of semantic solutions for the digital libraries has many perspectives. To know the trends secondary resources have consulted several books, reports, subject specific journals, databases and online journals, theses and dissertations in both Indian and international context. There are enormous amount of resources available in the field of digital libraries and semantic web individually, but there is a scarcity of resources in the field of semantic solutions for a digital library or semantic digital library.

2 The Methodology

Literature is available in various forms including books, conference proceedings, journals and newsletters, doctoral theses, patents, standards etc., in both electronic and printed forms. The databases help users to access literature they desire. During the secondary research survey, a lot of subject specific journals were referred time and again. As the topic covers broad spectrum of technological aspects of digital library system, The LISTA (Library and Information Science Technology Abstracts) was referred to know the availability of literature in respective fields. The number of literature found on the domain of current investigation covering the period 1990-2013 using different keywords are depicted in the following table for a view.

Table.1.1: Digital Library Literature in LISTA

	LISTA(Library, Information Science & Technology Abstracts)*	
Period/Year	KW1=Digital Libary,/Digital Libraries	KW2=Semantic Digital Library/Semantic Digital Libraries
1990-1995	120(2.12%)	00(0.00%)
1996-2000	993(17.57%)	00(0.00%)
2001-2005	1662(29.41%)	02(22.22%)
2006-2010	2105(37.25%)	06(66.67%)
2011-2013	771(13.64%)	01(11.11%)
Total	**5651(100%)**	**09(100%)**

(Keywords search KW_1 = Digital Library/Digital Libraries;KW_2=Semantic Digital Library/Digital Libraries)

As shown in the Table 1.1 above, from online database of library and information science abstract (LISTA)the researcher tried to find out the number of literature appeared on keyword "Digital Libary,/Digital Libraries" and 'Semantic Digital Library/Semantic Digital Libraries'from 1990 to 2013. The table clearly unearths that there is gradual increase in the literatures on Digital Libraries, and Semantic Digital Libraries and its related topics.

Table 1.2 below presents a comparison chart of availability of literature on Keyword(KW) 'Digital Library/Digital Libraries' and 'Semantic Digital Libraries' among the leading publishers databases on Management, Science and technologies i.e. Emerald Insight, Science Direct by Elsevier and ACM Digital Library by Association for Computing Machinery. The reason to choose these databases instead of choosing library specific database is that semantic enabled technologies in the digital library domain is a technology related area of research and availability of literature slanted towards Science, technology and Management. The researcher used the advance search mode with an aim to extract maximum literature from these databases. The 1990s were a particularly formative decade of digital library development and this is the reason for which the researcher tried to find out the number of literatures appeared on 'Digital Libraries' and 'Semantic Digital Libraries ' from 1990 to 2013.

Table.1.2: Digital Library Literature in different Databases

	Emerald		**Elsevier**		**ACM DL**	
Period/ Year	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**
1990-1995	1(0.89%)	0(0.00%)	4(2.05%)	0(0.00%)	4(0.60%)	0(0.00%)
1996-2000	8(0.71%)	0(0.00%)	28(14.36%)	0(0.00%)	86(12.82%)	1(6.25%)
2001-2005	355(31.64%)	11(37.93%)	47(24.10%)	1(16.67%)	227(33.83%)	4(25.00%)
2006-2010	518(46.17%)	13(44.83%)	74(37.95%)	3(50.00%)	237(35.32%)	7(43.75%)
2011-2013	240(21.39%)	5(17.24%)	42(21.54%)	2(33.33%)	117(17.44%)	4(25.00%)
Total	**1122(100%)**	**29(100%)**	**195(100%)**	**6(100%)**	**671(100%)**	**16(100%)**

(Keywords search KW_1 = Digital Library/Digital Libraries;KW_2=Semantic Digital Library/Digital Libraries)

The search queries bring in these databases quite interesting outputs with digital libraries and semantic digital libraries keywords. The resultant data are shown in the table 1.3 given below. The emerging output clearly shows that, there gradual increase in the literature on digital library topics while very limited papers are available in the field of Semantic Digital Libraries.

Table.1.3: Digital Library Literature in ProQuest Dissertations & Theses Database

	ProQuest Dissertations & Theses Database*	
Period/Year	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**
1990-1995	00(00.0%)	00(00.0%)
1996-2000	17(12.98%)	1(33.33%)
2001-2005	35(26.72%)	00(00.0%)
2006-2010	59(45.04%)	1(33.33%)
2011-2013	20(15.28%)	1(33.33%)
Total	**131(100%)**	**3(100%)**

(Keywords search KW_1 = Digital Library/Digital Libraries;KW_2=Semantic Digital Library/Digital Libraries)

As shown in the Table 1.3 above, from ProQuest Dissertations & Theses Database, the researcher tried to find out the number of literature appeared on keywords "Digital Libary,/Digital Libraries" and 'Semantic Digital Library/Semantic Digital Libraries'from 1990 to 2013. The table also clearly shows that there is a gradual increase in the literatures available on Digital Libraries, but there is a scarcity of available resources on keywordsSemantic Digital Library/Semantic Digital Libraries'.

Table.1.4: Digital Library Literature in Web of Science and Scopus

	WOS(Web of Science) by Thomson Reuters		**Scopus by Elsevier**	
Period/Year	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**	**KW_1=Digital Libary,/Digital Libraries**	**KW_2=Semantic Digital Library/Semantic Digital Libraries**
1990-1995	NA*	NA*	13(0.45%)	0(0.00%)
1996-2000	301(11.58%)	0(0.00%)	260(8.91%)	3(3.22%)
2001-2005	1010(38.86%)	2(50.00%)	993(34.04%)	9(9.68%)
2006-2010	893(34.36%)	1(25.00%)	973(33.36%)	58(52.37%)
2011-2013	395(15.20%)	1(25.00%)	678(23.24%)	23(24.73%)
Total	**2599(100%)**	**4(100%)**	**2917(100%)**	**93(100%)**

Note: *-Wos coverage is year 1999 onwards in limit search by year; Keywords search KW_1 = Digital Library/Digital Libraries; KW_2=Semantic Digital Library/Digital Libraries

As shown in the Table 1.4 above, from Web of Science and Scopus Database, the researcher tried to find out the quantum of literature available on keywords "Digital Libary,/Digital Libraries" and 'Semantic Digital Library/Semantic Digital Libraries'from 1990 to 2013. The resultant figures clearly show that there is a gradual increase in the literature on Digital Libraries in both the database, but there is a scarcity of resources on keywordsSemantic Digital Library/Semantic Digital Libraries' in WOS where as Scopus covers large number of literature on keyword Semantic Digital Library/Semantic Digital Libraries'.

3. Conclusions

As semantic solutions for the digital library covers much of the technical aspects of design and development of digital libraries, the literature were divided to cover different aspects or areas of the problem of research such as semantic web and enabling technologies such as RDF, XML, Ontologies and Intelligent Agent. The availability of literature in the domain concerned is retrieved through various leading databases such as web of science, Scopus and others. It is observed that, semantic web and its application to the digital library domain covered a broad spectrum of literature which seems to be widely scattered and there are not much literature available exclusively on exclusively on semantic application to digital libraries.

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Working and Advantages of Digital Library: An Analysis

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Abstract:

A digital library is a library that contains materials in digitized form or access to internal or external digital resources that can be manipulated and delivered in many ways that a conventional version of the materials cannot be given. The collection of resources available in the digital format has become a necessity to satisfy the ever-increasing information needs of the users. Also digital libraries offer different types of services, the procedure of which is varied but typically serves the same purpose as traditional library services. It is important to ensure that information in digital records remains accessible and is not inadvertently destroyed; and hence strategies and skills needs to be developed for ensuring the long-term retention of digital information.
Keywords: Digital library, Traditional library, Resources.

1. Introduction

We have been able to see rapid advances in information technologies that have revolutionized the role of libraries. As a result, libraries face new challenges, competitors, demands, and expectations. Libraries are redesigning services and information products to add value to their services and to satisfy the changing information needs of the user community. Traditional libraries are still handling largely printed materials that are expensive and bulky. Information seekers are no longer satisfied with only printed materials. They want to supplement the printed information with more dynamic electronic resources. Demands for digital information are increasing. Digital libraries will start gaining ground in India in the present century. We are heading toward an environment in which digital information may substitute for much print based information. A library's existence does not depend on the physical form of documents. Its mission is to link the past and the present, and help shape the future by preserving the records of human culture, as well as integrating emerging information technologies. This mission is unlikely to change in the near future. Digital libraries come in many forms. They attempt to provide instant access to digitized information and consist of a variety of information, including multimedia.

2. Objectives:

The main objectives of the presents study is to highlight on different aspects of digitization of library resources and the formation of digital libraries along with its role, functions and significance.

3. Methodology:

The study is an analytical one mainly based on secondary sources of data like books, journals, e-journals, magazines, published and unpublished research works in their discipline.

4. Characteristics of Digital Libraries

Recent developments in library technology and practices have helped bring some of Lancaster's paperless society to reality. The effects that digital technology has brought include: Digital library collections contain permanent documents. The digital environment will enable quick handling and/or

ephemeral information. Digital libraries are based on digital technologies. The assumption that digital libraries will contain only digital materials may be wrong. Digital libraries are often used by individuals working alone. The physical boundaries of data have been eliminated. Support for communications and collaboration is as important as information-seeking. Compression of data storage is enabling publication and storage of digital information. Telecommunications is facilitating the storage, retrieval, use, and exchange of digital resources.

5. Functions of Digital Library

- Provides access to a very large information collection.
- Support multimedia content
- Provided user- friendly interface
- Network accessibility on Intranet and Internet
- Unique referencing of digital objects
- Enable link representation to local/external object (hypertext)
- Client-server architecture
- Advanced search and retrieval.

6. Purpose of Digital Library

- Expedite the systematic development of procedures to collect, store, and organize, information in digital form.
- Promote efficient delivery of information economically to all users.
- Encourage co-operative efforts in research resource, computing, and communication networks.
- Strengthen communication and collaboration between and among educational institutions.
- Take leadership role in the generation and dissemination of knowledge

7. Components

The components of a digital library are:

- Infrastructure
- Digital Collection
- Systems function
- Telecommunication facility
- Human resources
- Human resources

8. Planning for Digital Library

A digital library committee should be formed to plan for its creation and maintenance. The members must be from various library departments, and, if necessary, consultants can be hired. There are at least two ways of developing a digital library: converting a traditional library into a digital library, and direct development of a digital library.

Planning includes:

- IT Infrastructure
- Digitization
- Access
- Staffing
- Furniture, equipment, and space
- Services
- Funding

9. Creation of Digital Resources

- Database of digital material that is open to all users over the campus-wide LAN.
- High bandwidth Internet connectivity
- Focus selectively on acquiring digital resources
- Electronic journals and gradual elimination of print subscriptions
- Licensed databases
- Creation of local digital content available within the university

10. Advantages of a Digital Library

The advantages of digital libraries include

- Nearly unlimited storage space at a much lower cost
- Re-allocate funds from some staff, collection maintenance, and additional books.
- No physical boundary
- Round the clock availability
- Multiple access
- Enhanced information retrieval.
- Preservation for some print material
- Added value
- Universal accessibility

11. Limitations

- Lack of screening or validation
- Lack of preservation of a fixed copy (for the record and for duplicating scientific research)
- Lack of preservation of "best in class"
- Difficulty in knowing and locating everything that is available, and differentiating valuable from useless information.
- Job loss for traditional publishers and librarians
- Costs are spread and many become hidden.

12. Conclusion

Digital Library is a very modern useful technique to access the information in instantly and in a cost effective way simultaneously multiple access of information are possible. In a very small space huge amount of data can be stored. An **electronic library** is a library in which collections are stored in electronic media formats and accessible via computers. The electronic content may be stored locally, or accessed remotely via computer networks. An electronic library is a type of information retrieval system. Traditional libraries are limited by storage space; digital libraries have the potential to store much more information, simply because digital information requires very little physical space to contain it. As such, the cost of maintaining a digital library can be much lower than that of a traditional library. A physical library must spend large sums of money paying for staff, book maintenance, rent, and additional books. The user of a digital library need not to go to the library physically; people from all over the world can gain access to the same information, as long as an Internet connection is available. A major advantage of digital libraries is that people can gain access 24/7 to the information. Thus, the use of information from digital library is a becoming essential component for modern research in all fields.

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Use of QR codes in Library and Information Science teaching and research

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Abstract:

This paper reports an attempt made in the Dr. Ranganathan Institute of Library and Information Science (DRILIS), Bundelkhand University (BU), Jhansi towards use of QR codes as part offocused, methodical, and evaluative approach to emerging technologies in LIS teaching and research. Details about QR codes, its generation and the areas where QR codes are implemented in DRILIS are discussed. The paper ends with discussing some of the lessons learnt during the implementation of this initiative.

Introduction

Mobile devices are ubiquitous and are very popular among the young generation. Among the mobile devices, smart phones are the most popular devices as per recent market studies. Library and Information Science(LIS) students are neither exception to this, in fact in the present class of LIS students 30% have smart phones. This is inline with a 2009 ECAR study of undergraduate students and information technology of United States, found that 51.2 percent of respondents owned an Internet-capable handheld device, and another 11.8 percent planned to purchase one within the next 12 months(Smith, Salaway, & Caruso, 2009). On the other hand, most students have only option of reading e-resources on mobile devices, as most of the LIS students do not have other electronic devices like laptop or PC. Analogously, shift towards Mobile site creation by academic institutions, easy social network access, and the growing number of popular mobile apps, points to the likelihood that more students will opt for the convenient and useful data available to them via handheld devices(Ashford, 2010).

This paper reports an attempt made in the Dr. Ranganathan Institute of Library and Information Science (DRILIS), Bundelkhand University (BU), Jhansi towards use of QR codes. DRILIS, BU, Jhansi is a prestigious library school in middle India. The institute offers BLibISc, M.Lib.I.Sc., MPhil(LIS) and PhD in library and Information Science courses. The institute has established itself as lead provider of competent, qualified and quality trained professionals. The products of the institute are working in national and state level libraries all over India at various capacities. This pilot project is part of focused, methodical and evaluative approach to application of emerging technologies in teaching and research activities of the institute.

About QR codes

Quick Response(QR) codes,a type of barcode, are beginning to make inroads in India.They are still unknown, but early adopters such as marketing campaigns and advertisements are creating some impact and generating awareness about QR codes.QR code is more embraced by higher educational institutions than barcode(Ashford, 2010; Hoy, 2011; Lombardo, Morrow, & Le Ber, 2012). It is important to understand the uses and benefits of QR codes in teaching and research.

QR codeswere developed inJapan in 1994 by a Japanese corporation Denso Wave, a subsidiary of Toyota. These were developed as an improvement to the existing barcodes for application in inventory management. Denso Wave freely shared the idea for the codes with others. QR code technology is in the

public domain; Denso Wave released QR codes freely instead of licensing the technology(Wave, 2015).

QR (for "quick response") codes are a type of two-dimensional barcode or data matrix,where data are coded based on the position and combination of black spots within a white matrix. The QR code is a matrix barcode readable by smartphones and mobile phones with camera. Unlike barcode, there is no requirement for buying a separate barcode reader device. They are referred to as *QR*because they allow the contents to be decoded at high speed. QR codes can hold much more information than a regular barcode. QR codes can be encoded to transmit many types of information and some QR code creation sites can handle more types of content than others. A few standard examples of the types of information that can be shared using QR codes include:

- Any text: Include a message up to 250 characters long.
- URLs: Link to mobile optimized web pages, or shortened URLs.
- A phone number,
- an short message service (SMS) messages,
- a V-card: a format for visiting card information.
- an email message with pre-written Subject: and To: fields.

Generating QR codes:

As QR code is a public technology, several free QR code generators are available. The QR codes can be generated using QR code generators. An easy-to-use Google Chrome QR code extension allows one to create a QR code while visiting any URL in one easy click.

In DRILIS, i-nigma QR code generator was used("i-nigma create barcodes QR DataMatrix," 2013). The web page of QR code generator allows four different content types, a URL, text, phone number, or SMS and a choice of four sizessmall, medium, large, or extra-large. Code generation is very easy, first the content type has to be selected, then the data is added after wards clicking the "generate" button will generate QR code. The created QR code can be copied, saved, printed or embedded in a webpage. The QR codes were then printed on papers and pasted at appropriate places in the DRILIS.

Figure 1: QR code- encoded with author's email-id

Application areas in LIS teaching and research

In all over the world, academic institutions, research centers, universities, liberal art institutions are experimenting and discovering useful ways to implement QR codes(Walsh, 2011). In India also, although QR codes are a relatively new technology, several institutions are using them. The QR codes provide simple connections between print and virtual resources(Kane &Schneidewind, 2011).Wells (2012) used QR codes to link students to music collections. QR codes could be used to provide information and access to the electronic resourceseither subscribed through the library or available elsewhere.

Following applications of QR code is done in DRILIS, BU, Jhansi.

- Printing QR codes on printed reading lists, scanning the QR codes students were able to connect directly, as accurate hyperlinks were available to click unlike typing them in the address bar.
- Job placements, direct links to job vacancies, or notifications were encoded in QR code format and were printed on paper and were displayed on the "Placement Notice Board" this helped students to get important updates for job placement notifications.
- Displaying QR codes for class schedules, by scanning QR codes the students were able to import the time-table or class schedules in calendar application of their devices and further able to receive notifications or set reminders.
- QR codes were placed at appropriate pages on the copies of DDC, UDC, and CC available in the DRILIS, these copies are used at the time of teaching classification and practicing classification by the students. These QR codes were encoded with URLs of webpages having detailed explanation with appropriate examples. For example, use of tables in DDC and auxiliaries in UDC.
- Similarly, QR codes were placed at appropriate pages on the copies of AACR2R and Classified Catalogue Code(CCC), these copies are issued to the students while teaching cataloguing practice. These QR codes were encoded with the URLs of webpages having detailed explanation with appropriate examples. For example, choice of headings, access points, rendering.
- For teaching information sources and reference sources paper, the URLs of the webpages of the resources were encoded with QR code. These QR codes were printed on papers and distributed at the time of teaching. This practice helped the students to get updated information about the reference source and were helpful in proper evaluation of reference sources.
- For teaching IT applications papers, the URLs of famous library OPACs are encoded and printed on paper and distributed to students. Similarly, the demo websites of library specific software such as, DSpace and KOHA were encoded in QR codes and were distributed to the students. This helped the students to try software and do customizations as required off the class timings.
- All the faculty members hosted their classroom presentations on websites like Dropbox or Google drives and then generated the QR codes of the public URLs. These QR codes were then pasted on the notice board. This helped students to download the PPTs to their devices rather than asking in their flash drives from each faculty member.
- Placing QR codes on printed posters and that link toonline video tutorials and training videos.
- A recommendation list containing the books and other resources with call numbers available in

the departmental library or in the central library of the university were prepared. This list was uploaded on Dropbox and the public link was encoded in QR code format. This practice helped the students in choosing appropriate resources from the library.

- The research students of the department have access to the Xerox machine of the institute, a QR code mounted on this machine linking to the online tutorial of the Xerox machine. Similarly, this is done for printers and other equipment available in the department.
- The contact details with the profile pages of, faculty members, supporting staff, and other important numbers of the university officials were encoded in QR code and pasted on the doors of the respective faculty member and notice boards. This helped students in saving the contacts without the requirement of typing the contact details. Also the new students were able to know about the details of the faculty member and could directly contact the faculty members. This practice eventually reduced the gap between faculty members and students.
- QR codes were generated for the "feedback page" of the university website to collect feedback from the students about the DRILIS or the university.
- Another area where QR codes were implemented was to put QR codes on general departmental notices. Such as, availability of online examination forms, university functions and activities, etc.
- The institute is under the process of getting Wi-Fi connectivity, the institute has planned to generate the QR code containing the details of the network for students to scan. This will help the students in simplification of connection process, as the requirement of user to input lengthy network name and passwords would not be needed.

Issues

Although QR codes are easy to implement, involve less cost, and easy to use, there are several issues that prevent the wide adoption of this emerging technology in classrooms.

Still, the number of students having smartphones is very low. Most of the students in DRILIS are first time college goers with low income group families it is hard for them to buy a smartphone.

Another issue is of data plan prices as offered by the telecom service providers. Paying for data plan price is felt as an extra burden for many students, so apart from having a smartphone many of them do not use them to access Internet. Text-based QR codes and automated calling and texting codes will still work for these users, but anything requiring access to the Internet will not work(Hoy, 2011). But, with the dropping data plan prices in last few months the situation seems to be changing. Also, after the proposed Wi-Fi connectivity is available in the institute this issue would be automatically resolved.

Another issue observed in the project was that, some smartphones were not capable of running QR code software. Currently, most smartphones do not come with code-scanning software preinstalled, so users must download and install an application and learn to use it before they can begin scanning QR codes. As new smartphones are released with pre-installed QR code software, this issue would also be resolved.

The low awareness about QR codes among the students was another challenge. To overcome this challenge, the students were made aware about the benefits of QR codes and their use during the class lectures. Also the materials being provided by the QR code are made to be compelling enough to raise the curiosity among the students.

Similarly, another issue was the non-availability of mobile friendly sites of referred resources. As the mobile phone has limitations such as, smaller screens, with uncomfortable input mechanisms, and difficult to navigate. Linking the students to a website designed for just access on a desktop would lead to displeasure when accessed through a mobile phone. This issue was resolved in two ways, first, by encoding URLs of mobile friendly page of the referred website if available. Second, by avoiding one

page for all information but separate QR codes for separate information so that less information is available at every scan with least required navigation.

Conclusion

The project proves that academic departments are benefitted with the application of QR codes in teaching and research. For maximum effectiveness of QR codes, awareness about the usefulness and benefits of QR codes to the enrolled students needs to be done. Also, as far as possible links to mobile friendly websites should be encoded.

Further studies need to be done to know how useful the specific linked resources were to the students, or even if they were used for research purposes or simply scanned out of curiosity(Kane &Schneidewind, 2011). These user experience studies would be helpful to refine practices and maximize utility.

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The role of Academic Libraries in Open Educational Resources (OER) Initiatives

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Abstract

States that how the academic libraries are preparing themselves for the new type of resources emerged as "OER", and getting recognition among the academic community; and the area where library professionals can offer advice and collaborate with the institutions, academic staff, and students as they engage with OERs.

Key words : Academic library, Open Education Resource, OER

Introduction

The growing demand for higher education and the ongoing rollout of ICT infrastructure and scholarly resources required to support teaching and research have created big challenges for higher education institutions all over the world. It has been estimated that current global enrolments higher education of 165 million will grow by a further 98 million by 2025. (http://www.col.org). However, this growth is unlikely to be accompanied by equivalent increases in the human and financial resources available to the higher education sector. To cater the academic needs of this huge student's population; particularly in developing countries such as India, China, ,Brazil; where the students have become habitual of using subscribed e- resources and demanding for new educational resources but budget has not been increased, is a big challenge for educational institutions and libraries to support this increased enrolments.

Research and educational institutions worldwide are incorporating Information and Communication Technologies (ICT) into their management, administration and educational programs in order to serve their students more cost-effectively and to prepare them for the world into which they will graduate, post graduate or Doctorate. In many developing countries, however, access to hardware, software and connectivity is remaining challenges. It is therefore critical to adapt pedagogical approaches and learning materials to this environment while ensuring high quality and relevant educational opportunities to all.

The open access movement is not the only potential solution to the serious problems that educational institutions and libraries face in the conventional scholarly communication system, but it is a very important one. Open access has struck a sympathetic cord in the library community, which has long suffered the debilitating effects of the serials crisis and budget cuts by the governments; however, libraries have been somewhat cautious in their embrace of open access, uncertain about its destabilizing effects on the scholarly publishing system and its ultimate impact on their budget and operations. However, massive open online course materials are being widely explored as alternatives and supplements to traditional university course textbooks, especially in STEM discipline.

What is Open Educational Resources (OERs)

The term " Open Educational Resources "was coined by UNESCO at its 2002 Forum on Open Courseware (UNESCO, 2002), and emphasized at their published Paris OER Declaration (UNESCO,

2012). Open Educational Resources (OER) are "*teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work*" (UNESCO, 2012).

In reference to "OER" the term "open" generally means that the resource can be accessed and used by everyone in a non-discriminatory manner, and also that it can be adapted, modified, and shared. More specifically, the characteristic of openness addresses the removal of technical, economic, and legal barriers to gain access to and make use of open educational resources. OER include a varied range of digital documents from full course materials, modules, collections, students guide, teaching notes, text books, research articles, videos, images, music, interactive materials such as simulations and role plays, mobile apps, software, databases and any other educationally useful materials. But it should be always in mind that the term 'OER' is not synonymous with online learning, eLearning or mobile learning. Many OERs while shareable in a digital format are also printable.

The Journey of OER

The movement or concept of OER is a part of previous movements towards participatory learning, innovation processes and open access to scholarly knowledge such as the Open Access (OA) movement; the Open Source Software (OSS) movement; or the Open Content movement. After that, a connection first established by the neologism coined by David Wiley in 1998 to be applied to any creative work "*that is licensed in a manner that provides users with the right to make more kinds of uses than those normally permitted under the law - at no cost to the user"* and introduced the concept by analogy with open source.

It was the "Creative Commons Licenses" which could make "openness" possible, and it has a particular interest in and engagement with educational materials. Open Course Ware from MIT is the best example using it. The two, MIT OCW launched in 2001 and the subsequent international OCW Consortium created in 2005 was key initiator of the OER. Both and many others dealing with instructional videos, open textbooks and a broad range of materials at repositories and digital libraries rely on CC Licensing. Even Creative Commons is partnering with academic publishers of educational content. The Cape Town Open Education Declaration released in 2008 which emphasize and urging governments and publishers to make publicly funded educational materials available at no charge via the internet was also a move to strengthen the OER movement. (Cape Town Declaration, 2007)

Internationally, high hopes have been voiced for OERs to alleviate the digital divide between the global North and the global south and to make a contribution to the development of less advanced economies. Many countries around the world have make or making available multilingual OER. European countries, USA, South Korea and some developing and underdeveloped countries like India and Bangladesh have also make available class 1 to 12 textbooks in digital form under OER. Recently launched NDL project by the Indian Government may be considered as a big step in the OER movement.

Role of Academic Libraries in OER

Academic libraries are committed to improving dissemination to scholarly and educational content for their users and, with that aim in mind; they regularly create and organize collections of learning and teaching materials. But in the preparation, collection, management and dissemination of OERs, the libraries are not been widely recognized yet at the same level as their role in Open Access to

science and data. In development and management of OER, academic libraries may play a big role. However, it is debatable whether this role would be as creator of OER or helper in creating OER and make accessible to the end users as other library resources.

Generally Academic libraries in beginning keep a distance with the OERs thinking that these are not directly related to them. That's why most of academic libraries generally not linked these resources with the library resources (Hirst, 2009) and not worried about digital educational resources (Davies, 2009). However, Kleymeer, Kleinman, and Hanss (2010) consider libraries to be among the first OER producers, as they have been digitising and sharing digital materials even before the generalization of public Internet. Libraries have a central position in the lives of the academic community members even despite the changes brought by technology and availability of scholarly knowledge online. In this sense, librarians have relevant skills, including outreach and education, curriculum development, and instructional support, which could benefit OER programs. As Robertson (2010b) suggests libraries can best offer advice and engage in meaningful relationships with Open Education in relation to: metadata and resource description; information management and resource dissemination; information literacy (finding and evaluating OERs) ; subject guides; and managing and clearing Intellectual Property Rights.

How Can Academic Libraries Support OERs?

After the use of Internet as a vehicle of scholarly communication, academic libraries around the world are playing an increasingly active role in the teaching-learning process. That is why academic libraries sometimes being redefined as Learning Resource Centers (LRCs). Among other functions, LRCs are intended to develop educational digital resource collections, gathering both institutional and externally created resources. In this context, OER take up an important and prominent position.

Academics around the world in the releasing OERs have thus far had success making their learning materials available informally on personal websites, or through tools like Slide Share or YouTube. But the process is more complex for an institution especially if it is considering how it might maximize the return on its investment in terms of openness such as publicity, goodwill, efficiency, or an improved student experience. Furthermore learning materials, where they are available, may be poorly integrated into the user's view of library resources (Tony Hirst, 2009). Also, as pointed out by the Downes (2002), whichever way an institution chooses to approach sharing resources, the general failure of a Learning Object economy points to the need to develop less complex, more scalable and sustainable approaches to sharing OERs . Here academic libraries can fill in parts of this picture and called to play a key role.

As the institutions and governments are coming forward to boost up the OER movement, the number of OERs and their potential users are increasing. Many institutions worldwide have created digital repositories for the management of teaching and learning resources produced by their academic community, or included these resources as specific collections in their institutional repositories (Bueno-de-la-Fuente and Hernández-Pérez, 2011). Now most of the academic libraries are realizing the statements of Belliston (2009) which states:

> *"Librarians can help by contributing their own OERs to the commons; screening for, indexing, and archiving quality OERs; using OERs in their own teaching; and participating in discussions leading toward responsible intellectual property policies and useful standards."*

Librarians had a predisposition toward assuming that their role would be managing OER repositories, developing generic OER, indexing, cataloguing, and promotion the use of OER. They

have still, however, some concerns about third party copyright clearance, currency and quality of OERs, funding, etc. (Nikoi, 2010). However, (de Beer, 2012), highlights the low demand for librarians to locate OER, and confirms the predominance of intellectual property concerns. Apart from supporting payment or reimbursement for open access publishing fees, academic libraries are beginning to provide financial support for and promotion of open educational resources (OERs). Oregon State University Libraries and Press Open Textbook Initiative is the best example of this new role (http://oregonstate.edu & http://www.geneseo.edu).

After reviewing what has been discussed above so far, libraries can offer advice and collaborate with the institutions, academic staff, and students as they engage with OERs in the following areas:

- Preserving of created OERs
- Lend expertise in search and discovery
- Metadata and resource description
- Information management and resource dissemination
- Digital or Information literacy (finding and evaluating OERs)
- Subject-based guides to finding resources
- Managing Intellectual Property Rights and promoting appropriate open licensing
- Financial support for the promotion of OERs
- Integrating OERs with library resources

Conclusion

In this rapidly changing landscape where the technology is changing at very low interval and changing the information seeking behavior of students and researchers, researchers will continue to require support and guidance from library and information science professionals in navigating the requirements of open access and the development, management and promotion of OERs (Boon, Stuart, 2012). In addition, library and information science professionals will need to stay informed and lead the way in collaborating with their institutions, publishers, organizations, and other academic libraries to develop new funding mechanisms and incentives to support faculty involvement in open access publishing. The time has come to encourage decision makers in governments and institutions to invest in the systematic production, adaptation and use of OER and to bring them into the mainstream of higher education in order to improve the quality of curricula and teaching and to reduce costs.

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Institutional Repository Software and their Use by the National Institutions of India: A Survey

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Abstract:
Recent changes in ICT have opened new ways of information creation, organisation, storage, and dissemination for scholarly communication. The institutional repositories act as central digital archive to make research and intellectual outcomes of the institutions available online to their needy ones. The paper discusses the concept, need, pros and cons related to institutional repositories. Besides this, paper also discusses the survey results based on its framed objectives and concluded that DSpace & EPrints are most prevalent software for the purpose.

Keywords: Institutional Repositories, Digital Archives, DSpace, EPrints, Fedora, Greenstone

Introduction:

Computers have been everywhere on the globe since the late 1980s. More advancement of information & communication technology (ICT) has changed the world dramatically. Libraries have undergone an extreme change in the modes of access of information i.e. closed access to open access as well as in the modes of scholarly communication that is print to electronic form. There are very vast change in the information creation, classification, storing and dissemination. Libraries and information centres are the store house of human generated knowledge in the print and non-print form. To disseminate the organizational research outcomes like doctoral dissertations, theses, publications etc., libraries have started using Institutional Repositories (IR) software to make them available online inside and outside of the organisation.

The world's academic institutions have treasures in the forms of archives, print and non-print forms and in a variety of storage mediums. These treasures contain scientific, technological, cultural and historical assets basically unavailable to researcher and to the general public. The IRs was created to manage, preserve and maintain the digital intellectual output of institutions. Librarians and information professionals are taking initiative in planning, creating and managing IR for conservation and preservation of intellectual outputs and fulfilling their organizational goals.

The essence of IR is to make research and development publications available on the Internet. The IR was experimented by educational organisations and R&D institutions to disseminate their research and other publication outcomes. The management and sharing of organizational knowledge may lead to further academic growth and development. Published documents like journals, papers, articles, books, book chapters, patents, technical reports, etc. and unpublished documents like pre-prints, working papers, theses and doctoral dissertations are the main contents of an IR. The IR is now become an essential platform for sharing of organizational generated knowledge.

Meaning and Definition:

Institutional repositories are the digital collection of an institutional research and intellectual output

which generally contains in the form of articles, theses, dissertations, book chapters and audio visual form, etc.

According to Lynch[1] "It is a set of services which the organization offers to the members of its community or the management and dissemination of digital materials created by the institution and its community members and thus an organizational commitment to the stewardship of these digital materials, including long-term preservation where appropriate, as well as organization and access or distribution."

For establishing IR, following things must be taken into considerations:

a) Hardware: Server PC, Network, etc.
b) Software: OS, IR software like DSpace, EPrints, Greenstone, etc.
c) Trained staff: Skilled Professional who can handle IR installation, managing and development.
d) Content: Theses, dissertations, reports, book chapters etc.
e) Perpetual License: Author grants the right to the institution to preserve and distribute their work in the repository.

Availability of Institutional Repository Software:

There are number of IR software which has been used by number of academic & research institutions. The brief sketch of some well known and most prevalent IR software are given below:

A) Dspace[2]

DSpace is open source software used for creation of open access institutional repositories and developed by HP Labs & MIT Libraries in November 2002.

B) Eprints[3]

EPrints is open source software for creation of open access repositories that are compatible with Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) and developed by University of Southampton in 2000.

C) Greenstone[4]

Greenstone is open source, multilingual software package basically used for creation of digital libraries and repositories and developed by University of Waikato, New Zealand in 1999.

D) Fedora[5]

Flexible Extensible Digital Object Repository Architecture (FEDORA) is basically digital assets management software which is mainly used for IR, and Digital Archives; designed and developed by Researchers at Cornell University in 2003.

Table 1: Most Prevalent IR Software: Basic Information

Features	DSpace	EPrints	Greenstone	Fedora
Origin	MIT Libraries & HP	University of Southampton	University of Waikato	Cornell University & University of Virginia
Open Source	Yes	Yes	Yes	Yes
Language	Java	Perl	Perl	Java
Release date	Nov, 2002	2000	1999	May, 2003
OS	Cross-Platform	Cross-Platform	Cross-Platform	Cross-Platform
Database	PostgreSQL and Oracle	MySQL	GDBM	MySQL
Web Server	Apache/IIS	Apache	Apache	Tomcat

Need of the Institutional Repository (IR):

There are following needs for the establishment of an institutional repository:

a) To provide a central archive facility.

b) Increase the dissemination and impact of research outcomes.

c) For increasing institution's visibility, prestige, status and public value.

d) For wider and fast access.

e) Resource discovery.

f) Information asset management by institutions.

g) Store once, use many times.

Objectives of the Study:

The present study has following objectives:

a) To know the institutional repository software used by the national institutes of India.

b) To know the contents covered by institutional repositories of India.

c) To find out pros and cons of an institutional repository.

Scope of the Study:

The present study is confined with the use and benefits of institutional repository used by the National Institutes of India.

Methodology:

The National Institutes of India who are using IR software were collected from OpenDOAR[6]. The observation survey is found suitable to conduct the study. The data collected were analyzed and investigated carefully. From the analysis of data tables has been prepared and graphs has been plotted by using the suitable statistical software tools.

Analysis and Interpretation of Data:

In India, there are number of academic and research institutions using institutional repositories software. Following Table 2 display the list of national institutes of India those are using IR software.

Table 2: National Institutes of India & IR Software(s)

SN	Name of Institutional Repository	Name of the Institute	IR Software used	Content Covered
1.	Architexturez South Asia	ABA-NET	Architexturez	Articles; Books; Learning Objects; Multimedia; Special
2.	Archives of Indian Labour	V. V. Giri National Labour Institute	[Not specified]	Books; Multimedia; Special
3.	ARIES, Digital Repository	Aryabhatta Research Institute of Observational Sciences	DSpace	Articles; Conferences; Theses
4.	Eprints@CMFRI	CMFRI, ICAR	EPrints	Articles; Conferences; Theses; Books; Patents
5.	DeepBlue Knowledge Repository@PDPU	Pt. Deen Dayal Petroleum University	DSpace	Articles
6.	Delhi College of Engineering Repository	Delhi Technological University	DSpace	Articles; Learning Objects; Multimedia; Special
7.	Digital Knowledge Repository of Central Drug Research Institute(DKR@CDRI)	Central Drug Research Institute	DSpace	Articles
8.	Digital Library at Indian Statistical Institute, Bangalore	Indian Statistical Institute, Bangalore Centre	DSpace	Articles
9.	Dyuthi	Cochin University of Science & Technology	DSpace	Articles; Theses; Learning Objects
10.	Digital Repository of West Bengal Public Library Network	West Bengal Public Library Network	DSpace	Books
11.	DigitalLibrary@CUSAT	Cochin University of Science & Technology	DSpace	Articles; Conferences; Theses; Books; Learning Objects; Multimedia; Special
12.	DIR@IMTECH	Institute of Microbial Technology	EPrints	Articles; References; Theses
13.	DRS at National Institute of Oceanography	National Institute Of Oceanography	DSpace	Articles; Conferences; Theses
14.	DSpace @ GGSIPU	Guru Gobind Singh Indraprastha University	DSpace	Articles; Theses; Learning Object
15.	DSpace@GIPE	GIPE, Pune	DSpace	Books; Multimedia
16.	DSpace @ SDMCET	SDM College Of Engineering and Technology Dharwad.	DSpace	References; Theses; Books; Learning Objects
17.	DSpace@IITB	IIT Bombay	DSpace	Articles; Conferences
18.	DSpace@IIMK	IIM, Kozhikode	DSpace	Articles; Conferences; Theses
19.	DSpace at IUCAA	Inter-University Centre for Astronomy and Astrophysics	DSpace	Articles; Conferences
20.	DSpace at M S University	Maharaja Sayajirao University of Baroda.	DSpace	Theses

21.	DSpace at NCRA	IIT, Bombay	DSpace	Articles; Theses; Learning Objects; Multimedia
22.	DSpace at Vidyanidhi	University of Mysore	DSpace	English; Hindi; Kannada
23.	DSpace@IMSC	Institute of Mathematical Sciences	DSpace	Conferences; Learning Objects
24.	DSpace@INFLIBNET	Information and Library Network Centre	DSpace	Conferences; Learning Objects; Special
25.	DSpace@NITR	NIT, Rourkela	DSpace	Articles; Conferences; Theses; Books
26.	DSpace@TU	Thapar University	DSpace	Articles; Conferences; Theses
27.	DU EPrints Archive	University of Delhi	EPrints	Articles; Conferences; Theses; Books; Patents
28.	eGyankosh	Indira Gandhi National Open University	DSpace	Learning Objects
29.	ETD@IISc	IISc, Bangalore	DSpace	Theses
30.	EPrints@NML	National Metallurgical Laboratory	EPrints	Articles; Conferences; Theses; Books; Learning Objects; Patents
31.	EPrints @MDRF	Madras Diabetes Research Foundation	EPrints	Articles; Theses; Books
32.	EPrints@IARI	Indian Agricultural Research Institute	EPrints	Articles; Conferences; Theses
33.	EPrints@IITD	IIT, Delhi	DSpace	Articles; Theses
34.	EPrints@NII	National Institute of Immunology	EPrints	Articles
35.	EPrints@SBT MKU	Madurai Kamaraj University	EPrints	Articles
36.	Etheses - A Saurashtra University Library Service	Saurashtra University	EPrints	Articles; References; Theses
37.	IACS Institutional Repository	Indian Association for the Cultivation of Science	DSpace	Articles; Theses
38.	ICRISAT Open Access Repository	International Crops Research Institute for the Semi Arid Tropics	EPrints	Articles; Conferences; Learning Objects; Multimedia
39.	Bhagirathi	IIT, Roorkee	DSpace	Articles; Conferences; Multimedia
40.	Indian Academy of Sciences: Publications of Fellows	Indian Academy of Sciences	EPrints	Articles
41.	DSpace@IIA	Indian Institute of Astrophysics	DSpace	Articles; Theses; Multimedia; Special
42.	IIM, Kozhikode Digital Library	IIM, Kozhikode	Greenstone	References; Books; Multimedia
43.	Indian Institute of Petroleum Institutional Repository	Indian Institute of Petroleum, Dehradun	DSpace	Articles
44.	Institutional Repository of Intellectual Contributions of Delhi	Delhi Technological University	DSpace	Articles; Theses; Multimedia

45.	Institutional Repository@CSIO	CSIR-CSIO	EPrints	Articles; Conferences; Theses; Learning Objects; Multimedia; Special
46.	Institutional Repository@VSL	IIM, Ahemdabad	DSpace	Articles; Conferences; Theses; Multimedia
47.	IR@CECRI	CSIR-Central Electrochemical Research Institute	EPrints	Articles
48.	IR@NPL	CSIR - National Physical Laboratory	EPrints	Articles; Conferences; Books; Multimedia
49.	Kautilya@IGIDR	Indira Gandhi Institute of Development Research	DSpace	Conferences; Theses
50.	E-Repository@IIHR	ICAR, IIHR	DSpace	References; Special
51.	KNoor	University of Kashmir	DSpace	Articles; Conferences; Theses
52.	Librarians' Digital Library	DRTC, ISI, Bangalore	DSpace	Articles; Conferences; Theses; Multimedia
53.	Mahatma Gandhi University Theses Online	Mahatma Gandhi University	Nitya D'Arch	Theses
54.	DSpace@MDI	Management Development Institute	DSpace	Articles; Conferences; Books; Special
55.	NAL Repository	ICAST	EPrints	Articles; Conferences; Theses; Learning Objects; Multimedia; Patents
56.	NSDL	NISCAIR	DSpace	Books
57.	EPrints@NIRT	National Institute for Tuberculosis Research	EPrints	Articles; References; Conferences; Theses; Books
58.	NISCAIR Online Periodical Repository	NISCAIR	DSpace	Articles; References
59.	OpenAgri	Agropedia, IIT Kanpur	[Not specified]	Articles; Conferences; Books
60.	EPrints@IISC	IISc, Bangalore	EPrints	Articles; References; Conferences; Books; Patents; Special
61.	OpenMED@NIC	Bibliographic Informatics Division, NIC	EPrints	Articles
62.	OUDL	Osmania University	DSpace	Articles
63.	RRI Digital Repository	Raman Research Institute	DSpace	Articles; Learning Objects
64.	EPrints@SVNIT	Sardar Vallabhbai National Institute of Technology	EPrints	Articles; Conferences
65.	ShodhGanga	INFLIBNET	DSpace	Theses
66.	Social Science Cyber Library	Aligarh Muslim University	CALIBRE	Articles; Theses; Books
67.	EPrints@UoM	University of Mysore	EPrints	Articles
68.	Vidya Prasarak Mandal Thane	Vidya Prasarak Mandal	DSpace	Articles; Conferences; Learning Objects; Multimedia

Table 3: IR Software & No. of Users in In

Name of Software	No. of Users
DSpace	42
EPrints	20
Architexturez	01
CALIBRE	01
Nitya D' Arch	01
Greenstone	01
Not Specified	02

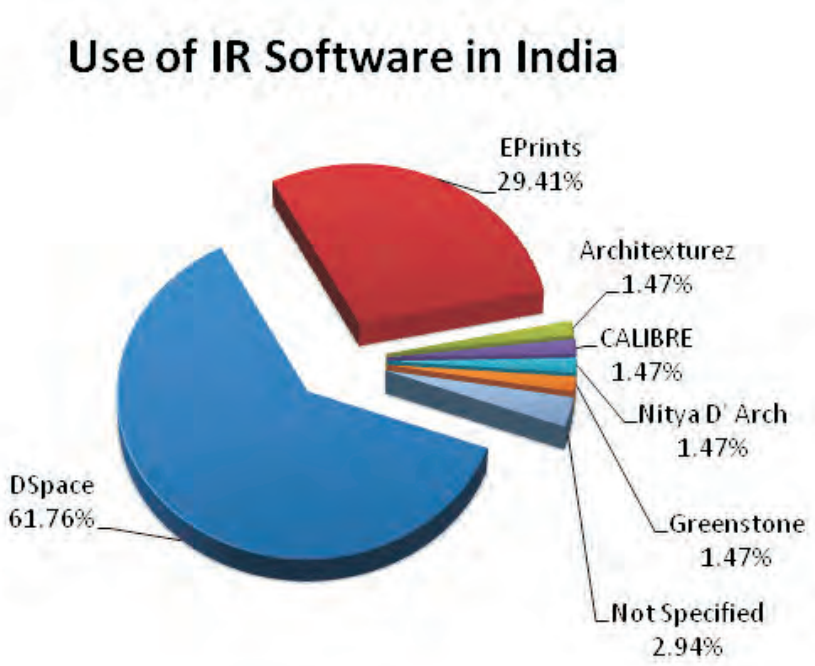

Fig. 1: IR Software used by National Institutes of India

On the analysis of Fig.1, it was found that DSpace (62%) and EPrints (29%) are most used IR software amongst Indian institutes whereas Greenstone, Calibre, Nitya and Architexturez like IR software has shown their presence.

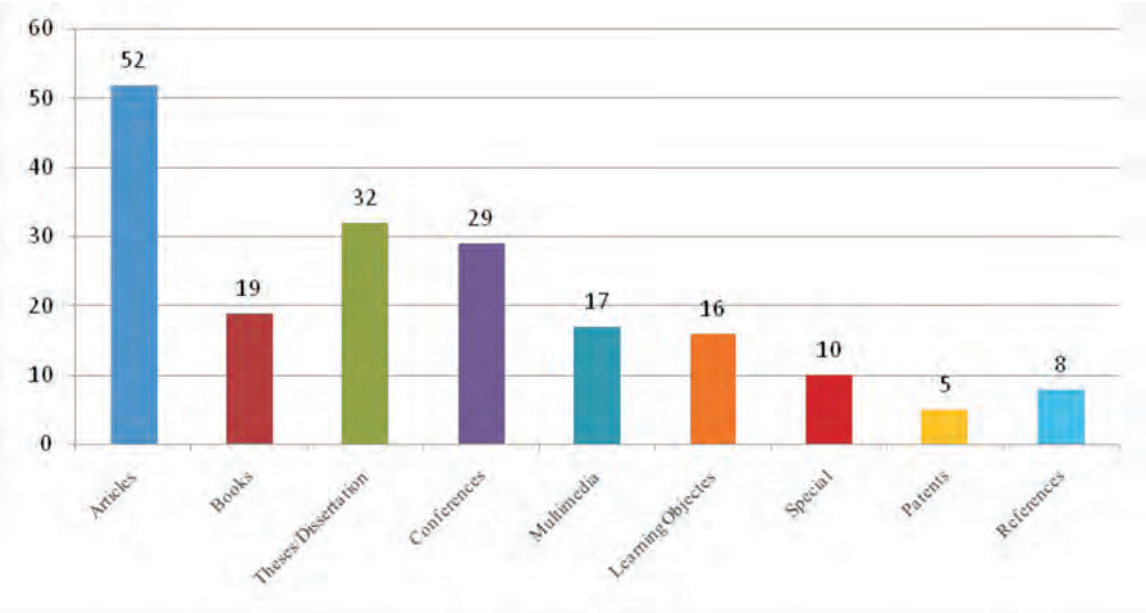

Fig. 2: Coverage of Content vs No. of IRs in India

After analysing the coverage of content by established IRs in India, it has been found that Articles (52) are most prevalent content for IRs followed by Theses/Dissertations (32),

Conference Articles (29), Books (19), Multimedia (17), Learning Objects (16), Special Documents

(10), References (8) and Patents (5).

Advantages of Institutional Repository:

a) Opening outputs of the institution to the globe.
b) Wider, faster access and visibility of organisational archives.
c) Preserve institutional heritage.
d) Managing and measuring research outcomes.
e) Best way to scholarly communication.
f) Increase the citation to the organisation research output.

Disadvantages of Institutional Repository:

a) Publishers unbending behaviour towards copyright policy.
b) Installation and customization of open source software is a big problem.
c) Variety of content like language, content format, etc.
d) Lack of organisation interest.
e) Lack of trained professionals in India.
f) Lack of funds for IT infrastructure and manpower.

Discussion:

India has been shown remarkable growth in establishment of Institutional Repositories since last fifteen years. There have been 68 functional IRs in India. This emerges due to emergence of open access initiatives and open source movement in all over the world. There are many open source and commercial IR software. Analysis has shown the DSpace & EPrints are mostly used IR software among all IR software. Three new IR softwares have come up in the field namely CALIBRE, Nitya D'Arch, and Architexturez. Further analysis has shown individual articles/research papers, theses/dissertations, conference proceedings, e-books, and multimedia items have been the prime focus of the IRs in its scope of content coverage. There are many pros and cons with the IRs but we cannot ignore its cultural, social, and academic benefits.

Conclusion:

The library and information science professionals in developing countries like India need to be more aware of new opportunities provided by these technologies. Everyday published and unpublished content is increasing so it's very difficult for the libraries to handle these information resources. Institutional Repositories acts as a digital archive for published and unpublished information resources of an organisation. Librarians and information professionals have to take initiative in planning, creating, and managing IR for conservation and preservation of intellectual outputs and fulfilling their organizational goals. It is very beneficial for academician, researcher, scientists, and students to provide them opportunity to access, communicate, and publish their intellectual output freely.

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School Libraries in Modern Era: An Overview

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Abstract:

The school library is integral to the teaching and learning process. The school library facilitates the work of the classroom teacher and ensures each student has equitable access to resources, irrespective of home opportunities or constraints Schools are the base of education that directly develops a connection between secondary to senior secondary and after that senior secondary to higher education. Responsibility of the Librarian is to develop the keen interest for learning in students and assist as much as possible to teaching staff and others. Development of ICT has completely changed the Environment of the libraries, not only in operations even in sources of information also. This paper will show the various aspects about the paradigm shifting from print to digital and manual to automate. . While the role of the school library remains constant, its design, digital platform, strategies and tools change as pedagogy and technology changes.

Keywords:ICT, Library Automation, Digital Libraries, School Library, software, Social Networking, Cloud Computing, Blogging etc.

Introduction:

The school library is the heart of the school; stimulating currents go out of it into every corner of the school. A school library does not exist for itself. It exists to serve the objectives of its parent organizations. A school library can play a very important role in helping the educational system to achieve its goals. The aim of a good school library is to become a force for educational excellence. School library also helps in developing reading interests in children when they are young so that books may serve as lifelong sources of knowledge for them. Explosion of information and development in ICT completely changed the role, services and functions of libraries. Library automations software's, Digital Library software's, Cloud Computing, Social Networking and blogging are the main components of libraries in modern scenario.

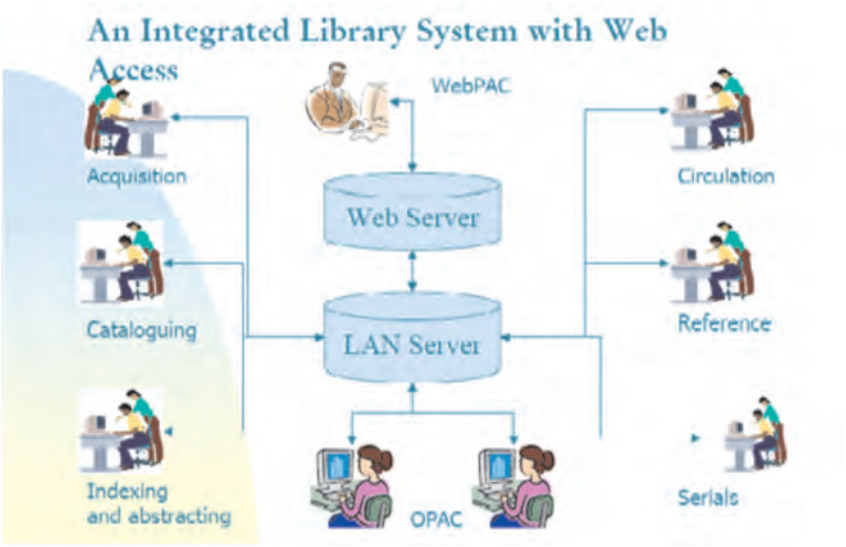
Effect of ICT in School Libraries

Information and Communication Technology (ICT) gives a broad way to libraries for fast working with library automation, Digital information Sources with Digital Library platforms, cloud computing to make accessibility without walls, Social Networking and blogging for communication with groups or individual not only for information sharing even aware them time to time for the latest information's time to time.

Need of Library Automation

When Library software was not available, then everything was running with manual operations. But after the development of Library software's maximum operations of library are handled by the computers and accessories. Library automation is beneficial to students, librarians, faculty members, administrators and parents for various reasons. The library is the resource center that supports and enhances the curriculum for the school. Students can expand their horizons more effectively with an automated library. Teachers can reinforce their classroom instruction with

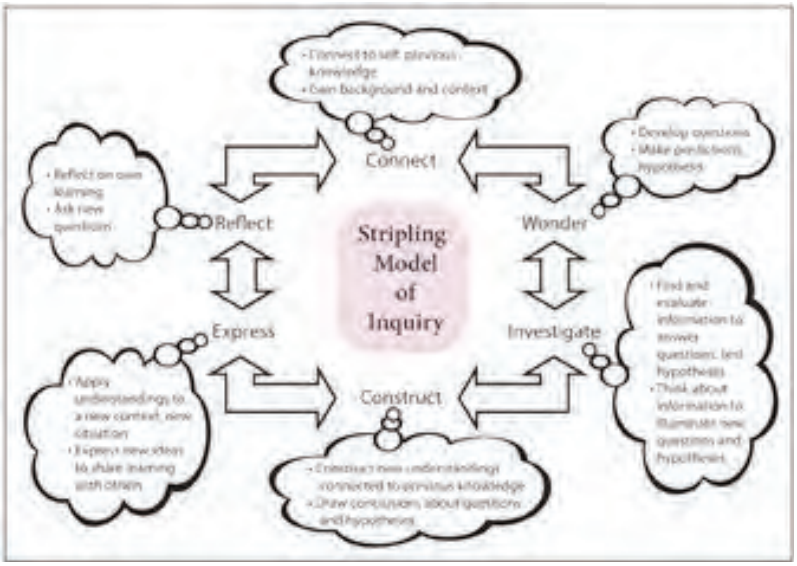
assignments that guide students to research opportunities within the school library. An automated library helps administrators complete accreditation requirements for the school. Parents can feel good about the school library being available to their students anytime the students want to access it via a Web browser. Everyone benefits when the school library is automated.



The library is part of their experience at school. It should be automated to permit the students to be excited about finding and using materials that enhance their studies. Schools that have automated their libraries report that students actually check out two to three times more items after automation than they did before automation. Why? One reason is that searches are easy and quick for students. Another reason is that links to other materials via subject headings and Authors enable the students to go to Other items of interest with one or two clicks of the mouse. Searches can be sorted instantly by author's names, title, copyright year and other ways with a single mouse click also. Another reason is that visual searches are possible for the youngest users and visual search is helpful for remedial learners. Still another reason is that the catalog card electronically displayed helps the student know details about it when tested on standardized tests. Library automation cover these area: Acquisitions, Cataloguing, serial controls, circulations, reporting and most important is OPAC (online public access catalogue).

Digital Libraries:

The digital environment presents both opportunities and challenges to today's learners Given the opportunities and challenges of the digital environment that confront students throughout their digital learning experiences, school librarians must teach digital literacy and inquiry skills at every phase of the inquiry/learning process.



The digital library must not be seen as merely a digitized collection of information objects plus related management tools, but as an environment bringing together collections, services, and people to support the full cycle of creation, dissemination, discussion, collaboration, use, new authoring, and preservation of data, information, and knowledge. The challenges and opportunities that motivate advanced DL initiatives are associated with this view of the Digital library environment Work on digital libraries aims to help in generating, sharing, and using knowledge so that communities become more efficient and productive and the benefits of collaboration

are maximized. It seeks to aid existing communities and to facilitate the emergence of new communities of research and education.

Library Automation and Digital Library software's:

There are a lot of variety of Library automation and digital library software's. Some software's are available on payment basis where as some software's are freely available. For Library automation koha is best software which is freely available whereas e-granthalaya and soul are freely available for government institution in India and paid for private institutions. In the context of Digital Library D-space and Greenstone are free available on website. A lot of library automation and digital library software's are available in the market on paid and free of cost. In this connection free and open source software's are playing a vital role among the maximum institutions across the globe.

Cloud Computing

Cloud computing technology came up as a boon for libraries and is offering various opportunities for libraries to connect their services with clouds. The paper presents an overview of cloud computing and its possible applications that can be clubbedwith library services on the web based environment. This study may be helpful inidentifying and generating cloud based services for libraries.

Cloud computing is not a new technology that suddenly appeared on the web but it is a new form of computing. Cloud computing is a kind of computing technology which facilitates in sharing the resources and services over the internet rather than having these services and resources on local servers/ nodes or personal devices. The combination of servers, networks, connection, applications and resources is defined as 'cloud'. Cloud computing is acting as a resources pooling technology for accessing infinite computing services and resources as per demand of users and can be compare with models of pay as you use or utility model same as used for mobile services usages and electricity consumption.

Social Networking

Social networking can be relevant to information seeking and sharing on information retrieval perspective by providing speed and quick information to the information community by connecting and collecting digital information required by the user**.** Social networking sites like MySpace, FaceBoook represent a new and powerful service through web 2.0. User can connect to other user from various part of internet domain by applying social networking tools for information communication, organization and information distribution. The idea behind the social networks is that they operate on many levels, right from the family level up to the level of the nations. They have come to play a very important role in determining how problems are solved, how organizations are run, and the efficiency with which individuals succeed in achieving their goals. Social networking websites function like an online community of internet users. Depending on the website in question, many of these online community members share a common interest such as hobbies, religion, or politics. Once you are granted access to a social networking website you can begin to socialize. This socialization may include reading the profile pages of other members and possibly even contacting them.

Blogging

Web attracts us by its interactive and communicative tools. The power of the blog lies not only in ease of publishing new content, but also in its ability to automatically archive old posts and refresh the content of the main page. Therefore, blog is one of the most important and interesting tools for sharing information and communication on the Web. The term “Weblog” was coined by Jorn Berger on 17 December 1997. The short form “Blog” was coined by Peter Merholz, who jokingly broke the word into the fresh “weblog” in his blog in 19991. Evan Williams, one of the creators of the popular blogging tool blogger, describes it as “the blog concept is about three things: Frequency, Brevity, and Personality.

Blog is an online diary where one can post information (not only text but also audio, photographs

and videos) on a regular basis. There are some related terms in creating blogs like blogger, blogging, blogging software, blogrolling, blogosphere, etc. Blogger is a person who can create, maintain, and edit or write entries to a blog. Blogging is the act of creating, authorising, maintaining or adding an article to a blog. Blogging software (Blogger, Word Press) makes it easier for people to create blogs. Blogrolling is the act of moving from one blog to another and blogosphere is the world or community of blogs and blogging.

Conclusion

In coming time school libraries are going to change in digitally environment. Indian school librarians have the same level of passion and commitment to the profession like theircounterparts from the developed nations. But, if they have to be on the same platform asthem, they need to equip themselves with the essential digital skills and thereby enhance theteaching & learning skills of their users. Attending continuous professional development programs however few they might be would give them an opportunity to understand thetrends and latest technological developments for providing effective and efficient services attheir workplace. Competence and collaboration are the key factors that may determine their professional growth and contribution.

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Research Productivity of Botany Department in Lucknow University, Lucknow, Uttar Pradesh, During 1921-2007: A Study

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Abstract

This paper examine research productivity of Botany department PhD theses literature emanating from Lucknow University over 224 theses from 1921-2007. Data has been collected from Botany Department, Lucknow University, and analyzed to examine the chronological growth of research contribution of Department during study period. Total 224 theses scattered in 27 subdivisions of Botany branch. This paper also presents year wise distribution of theses, discipline wise, branch wise ranking of Botany, and growth of literature, predominant research domains, growth and direction of Botany Research etc over a period of 88 years. Botany department research output seems that to concentrate in the area of "Genetics" and other "branch of Botany". This study identified that the highest number of theses submission was 93 during 2007-1998 and highest 22 number of theses were submitted in Genetics branch of Botany. We also examine the relative influence of the disciplinary context and attributes of scholars on research productivity.

Keywords: Subject collaboration, Research productivity; Biology.

Introduction: Today we are passing through an era which can aptly be called as an era of knowledge explosion and it is becoming increasingly difficult for an individual scientist or research worker or a specialist to keep himself a breast in informed of the latest through in his field of specialization.

Botany is the study of plant and branch of life sciences. It is the major fields of Biology, together with zoology (the study of animals) and microbiology (the study of bacteria and viruses). Specializations with in the field of botany include the study of mosses, Algae, lichens, ferns and fungi etc. Other specialties in botany include plant physiology, photosynthesis, respiration and plant nutrition, Plant pathology, Paleobotany, ecology, Agrology, Bryologist, Plant Breeding and Cytogenetic, Mycology and Plant Pathology, Plant virology etc[1].

Theophrastus is called the "Father of botany", because of his two Surviving works on plant studies. The first step in the history of Botany would have been taken with the empirical plant lore passed from generation to generation in the oral traditions of our Paleolithic hunter-gatherer ancestors. The written record of plants dates from the Neolithic Revolution as the domestication of plants and animals was established in settled agricultural communities around the world about 2,500 to 10,000 years ago. Human intervention in the cultivation of plants has contributed equally to plant development.

Various Branches of Botany:

- **Taxonomy**: Identifying, naming and classifying the living**.**
- **Bryology:** diversified aspects of Bryophytes.
- **Lichenology:** Post-harvest pathology and other aspects.
- **Taxonomy and Morphology:** morphology of several living plants.
- **Morphology**: study of form and external structure of organisms.
- **Anatomy**: study of internal structure of organism is called**.**

- **Histology**: study of details of tissue structure.
- **Hydro Biology:** aspects of hydrobiology and pollution.
- **Cell Biology**: study of structure, function, reproduction, history of cells.
- **Exobiology**: study of the kind of life that may exist in outer space.
- **Genetics**: The study of heredity and variation is called.
- **Ecology**: interrelation between organisms and their environment**.**
- **Physiology**: study of process and function associated with plants.
- **Molecular Botany:** study, physico-chemical organization of biomoleules.
- **Embryology**: study, fertilization of the egg, and development of the embryo**.**
- **Biophysics:** Study of plant activities on the basis of principles of physics.
- **Microbiology:** Study of microorganisms. It includes the study of viruses, bacteria, micro fungi, microalgae and protozoa in relation to plants.
- **Molecular biology:** Study of biochemistry at molecular level.
- **Palynology:** Study of pollen grains in relation to taxonomy and evolution etc.
- **Biometrics:** Statistical analysis of different results of biological experiments.
- **Agronomy:** Is the science which deals with the crop plants.
- **Pharmacognosy:** Is the branch of science dealing with the medicinal plants.
- **Environmental science:** The study of continuous genetic adaptations of population of organisms to the environment**.**
- **Cytogenetic and Plant Breeding:** cytotaxonomy, mutation breeding, biometric genetics
- **Palaeobiology (Paleobotany and Palaeozoology):** The study of origin, growth and structure of organisms of the past with the help of their fossil-forms is known as referring to the study of fossil plants and animal respectively.
- **Horticulture:** Is the science which deals with the study of flowering and fruiting plants.
- **Genetic Engineering:** Adding, removing or repairing part of genetic material, thereby changing the phenotype of organism as desire[2].

About the Department: Lucknow University establishes in 1921 saw the golden dawn on the horizon of Lucknow as the city of Nawabs was gifted Lucknow University and Botany Department. Right from its beginning the Department had devotional patronage of luminary like Professor Birbal Sahni. At present this Department has a very strong faculty comprising of 10 Professors, 13 Readers and 2 Lecturers, representing nearly all the specialties of Botany. The Department offers B.Sci, M.Sci, M.Phil and Ph.D. course in Botany. The Ph.D programme is extended to Lucknow based research institutes of the CSIR, DST, ICAR, and the ICGEB at New Delhi and the IRRI, Manila .The department also offers Refresher Courses for in-service teachers of Botany from different Universities and their associated colleges. In 1979, the Department was identified as UGC Department for special Assistance. The Department is now identified as the DST-FIST sponsored Department of Botany. The research output has been published in international and national repute journals.

Today the department occupies a proud position for evolving a unique blend of the traditional and modern Botany/Life Science teaching and research.

Objectives of the Study: The following objectives of this study:

- To examine the year wise distribution of the theses in Botany department
- To find out the subject area in which the contributions have been made.
- To determine the total contribution of the Lucknow University in Botany research.
- To find out the most used Botany branch for research.

Literature Review:

Nandi & Bandyopadhyay (2013) carried a Scientometric dimension of research productivity of the Botany department produced 739 articles with during 1976-1980 with 160 doctoral theses. Among the

top ranking journals publishing the papers are from India with 373 (50.47 %) publications followed by Germany with 61(8.29 %) publications, china with 53 (7.17 %) publications and Netherlands with 45(6.09 %) publications. **Suma & Pillai (2013)** studied 914 research papers have been published by 137 Ph.D scholars during the period 2001-2010. That majority of the theses 107 were in chemistry and analyzed maximum numbers of theses 21 were submitted under the guidance of Dr. G.Vijay **Olatokum (2009),** reveled citation from 40 doctoral theses submitted between 2000 and 2007. This study discovered that most of the cited sources were journals-well over 50% of the total citations for PhD works were to journals. Another striking agreement of this study is that only about 12 to 13 titles were needed to cover 50% of the journal citations. This study shows that about 80% of the total journals cited were actually from the basic sciences. **Kumar & Shah (2007)** analyzed 1429 research papers comprising 1117 articles and 312 short notes published in fifteen volumes, published for the year 1989-2003 in Indian journal of entomology. They analyzed year wise distribution, length of articles, authorship pattern and calculate collaboration coefficients and most prolific contributors. **Vial & Reddy (1996)** studied the trend in authorship pattern and collaborative research in zoology with a sample of 19,323 journal citations; It is observed that the proportion of single authorship is likely to be insignificant after the year 2030. The degree of collaboration in research is 0.75 in zoology as a whole. **Maheswarappa & Lal (1993)** reported the results of a Bibliometric analysis of 4136 citations of articles published in the Indian journal of genetics and plant breeding and prepared a rank list of the 60 most cited primary periodicals. He has also illustrated the contribution of Indian and foreign theses and the authorship pattern revealing that multi authored papers were more in practice. **Maheswarappa & Prakash (1982)** analyzed 2726 references from fifteen doctoral theses in botany during 1973-1980. They found out the bibliographic forms used, ranked list of core journals, self citation pattern, obsolescence, etc. the average self-citation rate was 3.22%. The median number of references per document was 52 (99% CI 47-55); the median percentage of journal articles cited was 55%, with a median age for journal references of 9 years.

Methodology: With the objective in hand the information is collected from Botany department and the research section of Tagore Central Library, Lucknow University. The information regarding research Scholars and the topic were gathered from the Botany department. Each thesis was analyzed thoroughly in terms of the demographic characters, year of submission, subject area, and guide, geographical area etc covered. The data gathered were analyzed using descriptive statistics, **statistical method, tables and percentages.**

Analysis and Interpretation of Data:

Table-1: Decade wise distribution of theses submitted in Botany Department from - 2007- 1921

Years		Total No. of Thesis	Percentage
2007-1998		93	42 %
1997-1988		34	15 %
1987-1978		44	20 %
1977-1968		29	13 %
1967-1958		18	8 %
1957-1948		04	2 %
1947-1938		01	0 %
1937-1928		01	0 %
1927-1921		0	0 %
TOTAL		**224**	**100 %**

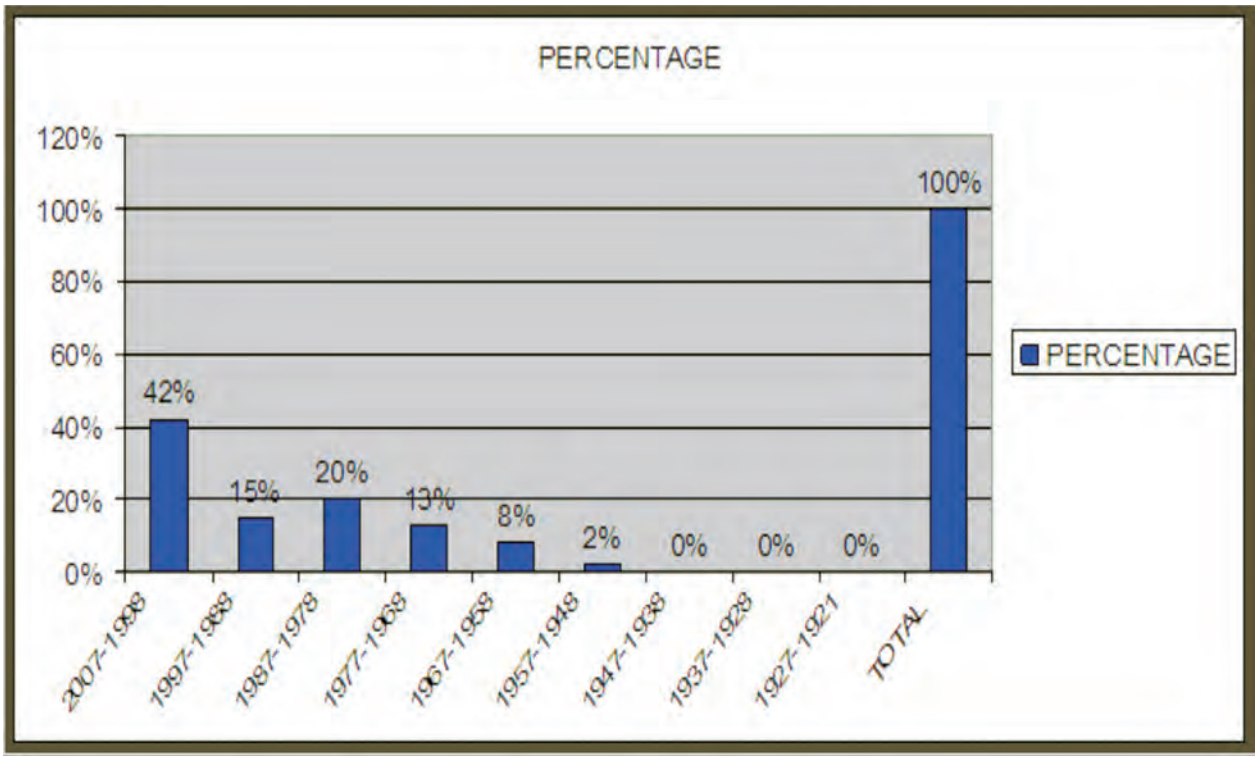

Fig.1 Growth of Research Productivity

From 2007 to 1921 a total 224 thesis has been submitted. Maximum number of thesis submitted in 2007 -1998 decade that is 93 and there is no thesis has been submitted in 1927-1921 and in 1997 -1988 is 34 thesis and 1987 -1978 is 44 thesis,1977 -1968 is 29 thesis 1967 -1958 is 18 thesis 1957 -1948 is 4 thesis 1947 -1938 is 1 thesis ,1937 -1928 is 1 thesis has been submitted.

Table: 2 Year wise distribution of thesis submitted from - 2007- 1998

Table: 2 Year wise distribution of thesis submitted from - 2007- 1998

Years	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	TOTAL
Frequency	0	8	23	14	11	13	5	7	7	5	93
%	0	9	24	15	12	14	5	8	8	5	100

In this decade maximum number of thesis submitted in 2005 i.e. 23. There is no thesis submitted in 2007.

Table-3 Year wise distribution of Thesis submitted from -1997- 1988

Years	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	TOTAL
Frequency	6	2	2	1	4	3	5	5	2	4	34
%	17	6	6	3	12	9	14	15	6	12	100

In this decade maximum number of thesis submitted in 1997 that is 6 and in 1994 only one thesis has been submitted.

Table-4 Year wise distribution of Thesis submitted from 1987-1978

Years	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	TOTAL
Frequency	3	2	1	5	8	2	4	9	6	4	44
%	7	5	2	11	18	5	9	20	14	9	100

In this decade maximum number of thesis submitted in 1980 that is 9 and in 1985 only one thesis has been submitted.

Table-5 Year wise distribution of Thesis submitted from 1977-1968

Years	1977	1976	1975	1974	1973	1972	1971	1970	1969	1968	TOTAL
Frequency	5	1	2	4	4	0	2	4	4	3	29
%	18	4	7	14	14	0	4	14	14	11	100

In this decade maximum number of thesis submitted in 1977 that is 5 and there is no thesis has been submitted in1972.

Table-6 Year wise distribution of Thesis submitted from 1967-1958

Years	1967	1966	1965	1964	1963	1962	1961	1960	1959	1958	TOTAL
Frequency	3	3	4	3	2	2	1	0	0	0	18
%	17	17	21	17	11	11	6	0	0	0	100

In this decade maximum number of thesis submitted in 1965 that is 4. There is no thesis has been submitted in 1960, 1959, and 1958.

Table-7 Year wise distribution of Thesis submitted from 1957-1948

Years	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	TOTAL
Frequency	0	2	0	0	1	0	0	1	0	0	4
%	0	50	0	0	25	0	0	25	0	0	100

In 1956 two thesis, 1953 and 1952 one thesis has been submitted and rest of
The year there is no thesis has been found

Table-8 Year wise distribution of Thesis submitted from 1947-1938

Years	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	TOTAL
Frequency	0	1	0	0	0	0	0	0	0	0	1
%	0	100	0	0	0	0	0	0	0	0	100

In this decade only one thesis has been submitted in 1946.

Table-9 Year wise distribution of Thesis submitted from 1937-1928

Years	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	TOTAL
Frequency	0	0	0	0	1	0	0	0	0	0	1
%	0	0	0	0	100	0	0	0	0	0	100

In this decade only one thesis has been submitted in 1933.

Table-10 Year wise distribution of Thesis submitted from 1927-1921

Years	1927	1926	1925	1924	1923	1922	1921	TOTAL
Frequency	0	0	0	0	0	0	0	0
%	0	0	0	0	0	0	0	0

During this period there is no thesis has been submitted.

Table-11: Distribution of Theses (Subjects Analysis over different time Period)

Subjects	Number Of Thesis
Anatomy	26
Cell Biology	12
Ecology	29
Embryology	20
Genetics	34
Molecular Botany	22
Morphology	20
Paleobotany	26
Physiology	25
Taxonomy	10

Maximum number of thesis on genetics has been found 34 and as comparison to other subjects, there is less researches in taxonomy 10.and other branch in Anatomy 26, Cell Biology is 12, Ecology is 29, Embryology is 20, Molecular Biology is 22, Morphology is 20, and Paleobotany is 26, physiology is 25.

Fig.2 (subject analysis) subject wise theses

Table: 12. Analysis by Botany Subject "Branch"

Table-12.1 Thesis Submitted in Anatomy from 2007-1921

Decade	2007-1989	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	7	7	7	2	2	1	0	0	0	26
%	27	27	27	8	8	4	0	0	0	100

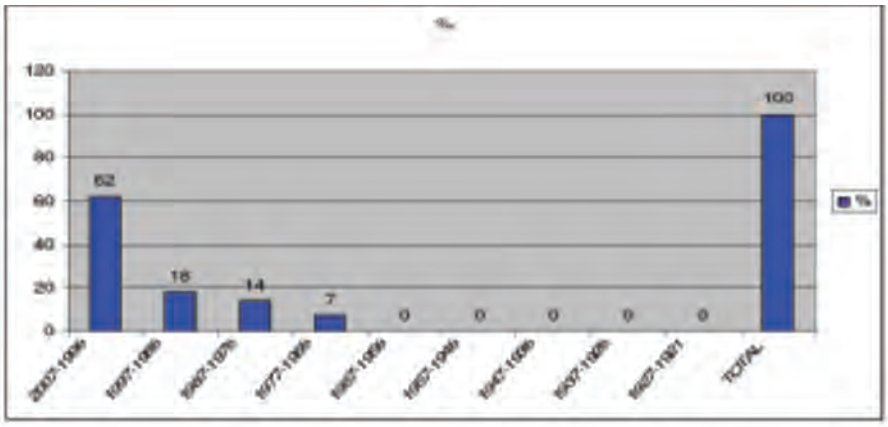

Fig. 5 shows theses submitted in Ecology

Maximum thesis submitted Ecology in 2007-1998 is 18 and in decade 1997 to 1998 is 5, and 1987-1978 is 4, 1977-1968 is 2 theses. There is no thesis has been submitted in 1967 to 1921.

Table-12.4 Thesis Submitted in Embryology from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	8	3	6	2	1	0	0	0	0	20
%	40	15	30	10	5	0	0	0	0	100

In all decade total no of thesis submitted in Embryology is 20 from 2007 to 1921

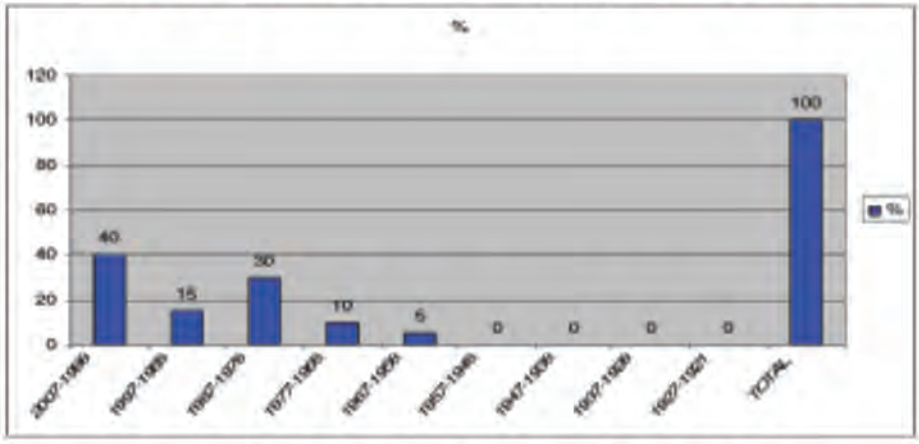

Fig. 6 shows theses submitted in Embryology

In this subject maximum number of thesis submitted in Embryology in 2007-1998 is 8 and 1977-1988 is 3, 1987 -1978 is 6 and 1977-1968 is 2, 1967-1958 is 1 thesis submitted .There is no research in 1957-1921.

Table-12.5 Thesis Submitted in Genetics from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	22	11	0	5	3	0	0	0	0	34
%	65	12	0	15	9	0	0	0	0	100

In all decade total no of thesis submitted in Genetics is 34 from 2007 to 1921

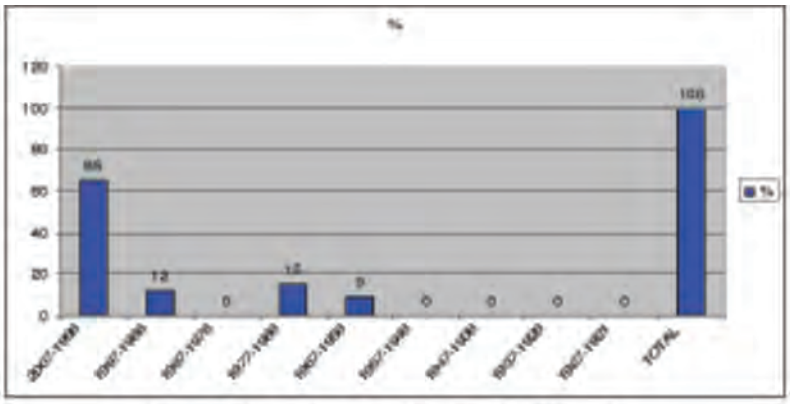

Fig. 7 shows theses submitted in Genetics

In this subject maximum number of theses submitted in Genetics in 2007-1998 is 22 in 1997-1988 are 11 and 1977-1968 is 5, 1967-1958 is 3 theses submitted. Maximum number of thesis submitted in Genetics in all decade.

Table-12.6 Thesis Submitted in Molecular Biology from 2007-1921.

DECADE	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	7	4	2	5	4	0	0	0	0	22
%	32	18	9	23	18	0	0	0	0	100

In all decade total no of thesis submitted in Molecular Biology is 22 From Year 2007-1921

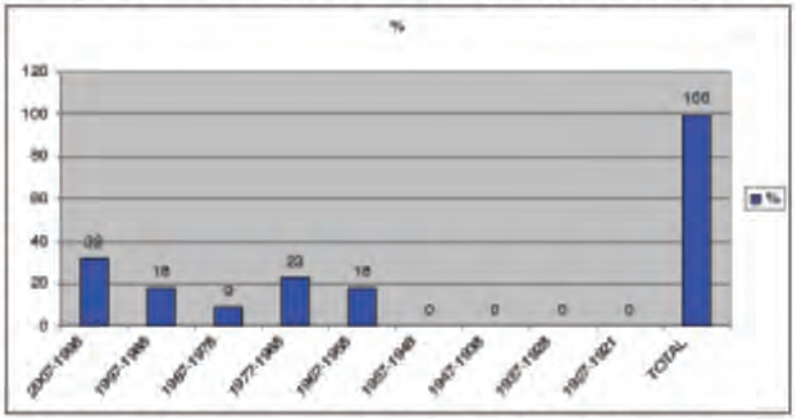

Fig. 8 shows theses submitted in Molecular Biology

In Molecular Botany maximum no of thesis submitted in 2007-1998 that is 7 and in 1997-1988 is 4 , 1987 -1978 is 2, 1977-1968 is 5 , 1967 -1958 is 4 thesis submitted .there is no thesis submitted in 1957-1921.

Table-12.7 Thesis Submitted in Morphology from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	9	4	5	0	1	0	0	1	0	20
%	45	20	25	0	5	0	0	5	0	100

In all decade total no of thesis submitted in Morphology is 20 From Year 2007-1921.

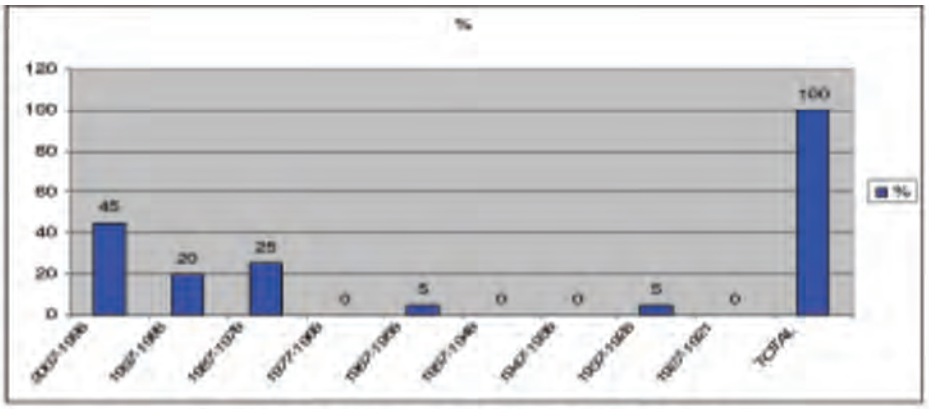

Fig. 9 shows theses submitted in Morphology

In Morphology maximum number of research in the decade 2007-1998 is 9 and in 1997-1988 is 4, 1987 -1978 is 5, 1977-1921 only 2 theses have been submitted.

Table-12.8 Thesis Submitted in Paleobotany from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	7	1	9	4	3	2	0	0	0	26
%	27	4	35	15	11	8	0	0	0	100

In all evade total thesis Submitted in Paleobotany is 26 From Year 2007-1921

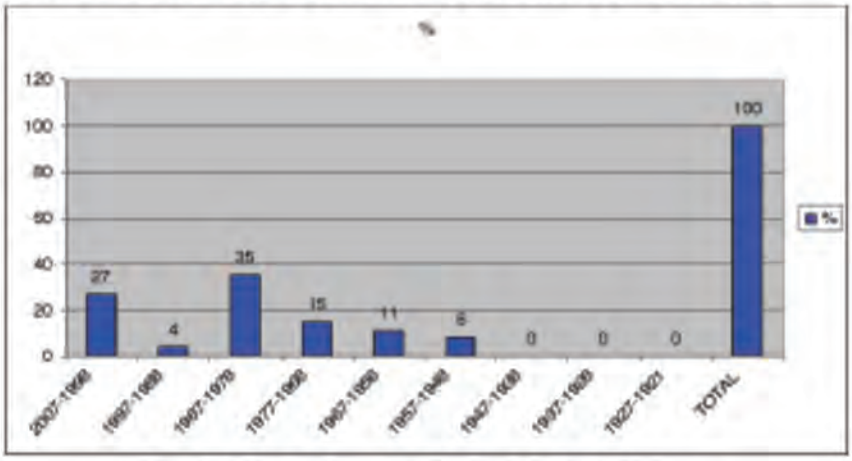

Fig. 10 shows theses submitted in Paleobotany

In Paleobotany maximum number of thesis submitted in 200-1998 that is 7 and in 1997-1988 is 1 , 1987 -1978 is 9, 1977-1968 is 4 , 1967 -1958 is 3 , 1957-1948 is 2 thesis submitted .there is no thesis submitted in 1947-1921.

Table-12.9 Thesis Submitted in Physiology from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	11	6	5	2	1	0	0	0	0	25
%	44	24	20	8	4	0	0	0	0	100

In all decade total no of thesis submitted in Physiology is 25 from year 2007-1921

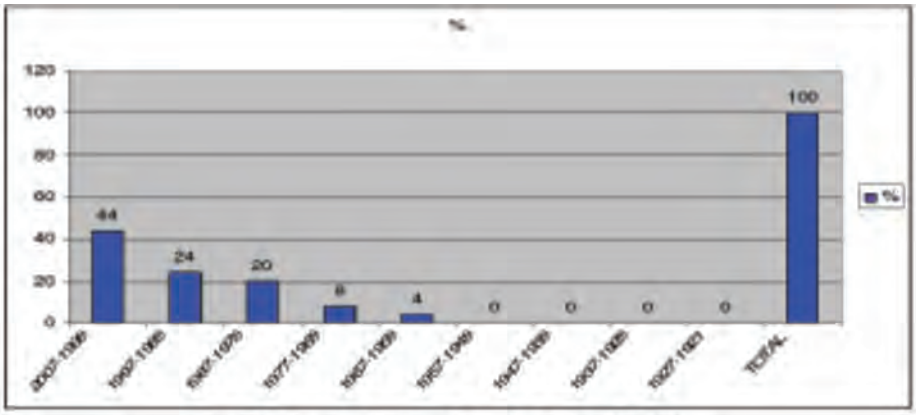

Fig. 11 shows theses submitted in Physiology

Maximum number of thesis submitted in Physiology in 2007-1998 that is 11and in 1997-1988 is 6, 1987 -1978 is 5, 1977-1968 is 2, 1967 -1958 is 1 thesis submitted .there is no thesis submitted in 1957-1921.

Table-12.10 Thesis Submitted in Taxonomy from 2007-1921.

Decade	2007-1998	1997-1988	1987-1978	1977-1968	1967-1958	1957-1948	1947-1938	1937-1928	1927-1921	TOTAL
Frequency	2	0	2	4	1	0	1	0	0	10
%	20	0	20	40	10	0	10	0	0	100

In all decade total no of thesis submitted in Taxonomy is 10 From Year 2007-1921

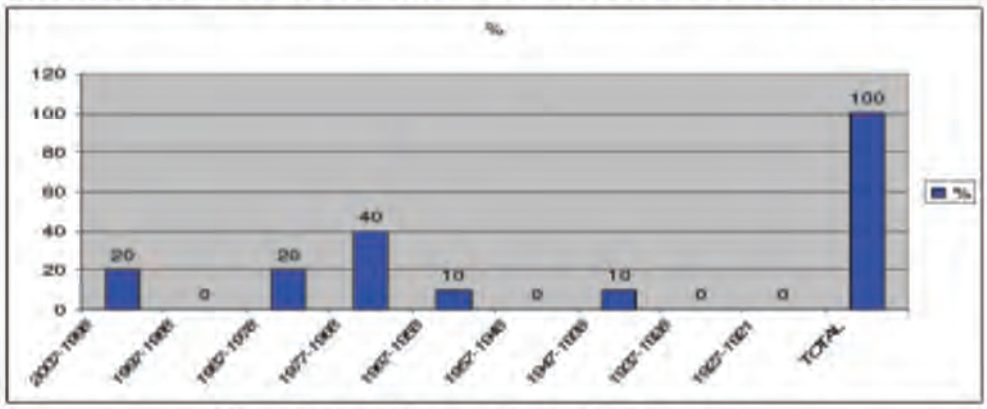

Fig. 12 shows theses submitted in Taxonomy

In Taxonomy maximum no of thesis submitted in 1977-1968 that is 4 and in 2007-199 and, 1987 -1978 is 2, 1967 -1958 is 1, 1947-1938 is 1 thesis submitted .there is no thesis submitted in 1957-1948 and 1937-1921.

Findings: The major findings of the study are as under:

- Maximum number of thesis 93 (42%) submitted in 2007- 1998.
- A maximum of 23 theses have been submitted in the year 2005.
- Only one thesis has been submitted from 1947 -1938.
- A maximum research 34 thesis have been submitted in Genetics branch of Botany in 2007 -1998.
- Maximum number of thesis on Genetics has been found and as rather than other subjects, there is less researches in Taxonomy.
- There is no thesis has been submit that is year -2007,

1972,1960,1959,1958,1957,1956,1954,1952,1951,1949,1948,1947,1945,1944,1943,1942, 1941,1940,1939,1938,1933,1942,1940,1941,1939,1938,1937,1936,1935,1934,1933,1932,19 31,1930,1928,1927,1926,1925,1924,1923,1922,1921.

Conclusion: With all results concluded that the academic output of this Department has brought laurels, reputation and excellence. The rich traditions and strongly knitted academic fabric as laid down by late Professor Sahni in 1921 was nurtured further by his successors Professor: Prof. S.N. Das Gupta (1949-61), Prof. C. Chatterjee (2002-2003) and many others. Researcher spared speedily and do maximum research in Genetics branch of Botany, so present day Genetic branch is most predominant field and spread rapidly new techniques as like human clone ,text tube baby, D.N.A finger printing etc. Present time research is to explore new dimension and discipline but it has seen that majority of thesis have been found concentrations of research are in the branches of modern Botany and only a few researchers have chosen to work in the classical field.

Suggessions: The following suggestions are put forth for future augmentation:

- A comprehensive bibliography should be compiled on the subject including each and every thesis and bibliography should be provided for researcher users through Library or online services;
- The work should be done at national and state level and the bibliography complied;
- Proper attention should be at the time of approval of topic so duplication may be avoided.
- Institutional repository should be developing at University level.

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