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

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

Keywords: **Bibliometrics, Research impact, Collaborative Pattern, Authorship Pattern, Career Longevity Study**

I. INTRODUCTION

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

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

II. OBJECTIVES OF THE STUDY

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

III. HYPOTHESES

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

IV. REVIEW OF LITERATURE

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

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

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

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

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

V. METHODOLOGY

Data were collected extensively from annual report details, the databases like Indian Science Abstracts, Indian Citation index, Scopus, Web of Science, Scientists' profile of the BSI website were also browsed to develop the comprehensive Meta data to suit the development of the institutional repository of BSI. The search term "Botanical Survey of India" was used in the affiliation/address field of the citation databases to retrieve and compare the records with the annual reports of BSI. A total of 1241 research contributions were out of collaborative work with other research centres by BSI Scientists during the research period 1954-2012.

VI. RANK LIST OF THE COLLABORATIVE CENTRES

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

TABLE I TOP 15 RANK LIST OF THE COLLABORATIVE CENTRES

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

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

VII. AUTHORSHIP PERCAPITA ANALYSIS

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

Per Capita Authorship = Number of items / Number of authors

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

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

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

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

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

Pearson's coefficient correlation = 0.96

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

TABLE II CENTRE WISE AUTHOR CAPACITY ON PUBLICATION

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

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

A. Centre wise Quantum of Pages per Contribution

There were 1307 BSI authors have contributed 120768 (117887+2881) pages. BSICNH-HQ has produced 43825 pages which was followed by BSISRC with 19453 pages but the per capita authorship shows that BSISRC author capacity ratio was high when compared to BSICNH-HQ. BSINRC has contributed 11962 pages and obtained third position. Pearson's Correlation coefficient was used to study the relationship between the number of BSI authors alone (X) and the total number of pages (Y) produced by each centres. It shows a strong positive correlation exists, revealing that the increase of number of contributors will have positive effect on the production of number of pages.

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

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

TABLE III CENTRE WISE AUTHOR CAPACITY ON PAGES

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

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

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

Pearson coefficient correlation = 0.96

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

B. Subject Wise Contribution on Pages

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

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

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

C. Prolific Authors on Various Factors

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

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

TABLE IV SUBJECT WISE CONTRIBUTION BY NUMBER OF PAGES

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

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

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

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

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

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

TABLE V RANK LIST OF THE AUTHORS ON VARIOUS FACTORS

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

CNPA - Contributions in non primary authorship position

D. Impact of Career Longevity of BSI Researchers

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

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

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

As far as the research article concerns those who have published with and above 15 articles were all considered for the impact assessment. Further, it was observed that those who have contributed below 15 were mostly the research scholars with below 10 years of research career longevity associated with BSI and not been assessed in this particular impact.

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

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

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

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

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

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

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

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

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

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

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

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

r=0.46

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

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

VIII. FINDINGS AND CONCLUSION

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

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

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

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

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

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