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Authorship Pattern and Research Collaboration of Journal of Informetrics

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Abstract

The study highlights the authorship pattern and research collaboration in the area of Informetrics based on 420 scholarly communications appeared in the Journal of Informetrics during 2007 to 2013. Study illustrates various significant aspects like –types and trends of authorship, author productivity, degree of collaboration, collaborative index, geographical diffusion and institutional diversification of authorship. Findings suggest tangible growth of Informetrics literature over the years with predominantly multi-authored contributions. Result also show that Informetric research is unevenly scattered among 251 institutions from 38 countries around the globe.

KeyTerms: Informetrics, Authorship, Author Collaboration, Collaborative Index, Collaboration Trend, Lotka's Law, Journal of Informetrics

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Introduction

With the inception of Philosophical Transactions of the Royal Society in England and Le Journal des Savans in France, sharing of researcher's tacit knowledge (in the form research communication) with peer communities became formalize and published research communications has become the bedrock of human intellectual superiority[1].Since then authorship of research communications has been a premier bibliographic descriptor which provides an objective measure of persons conducting research in a subject specialty. However, 'authorship' of a published communication, is generally attributed to someone "who has made substantive intellectual contributions and having important academic, social and financial implications in the long run". In humanities and literature, author is simply someone who creates new written material. Here concept of authorship more intrinsically related with creativity rather than the act of writing. According to Cronin, authorship is 'undisputed coin of the real in academia and 'absolutely central to the operation of the academic reward system[2]'.

Concept of authorship actually emanated from the anonymity of scholarly communications as, research communications were validated based on the merit of the content and positioned within an anonymous and coherent conceptual system of established truths[3]. In today's highly competitive market place authorship attribution has become even more significant, as it is the currency of research credit and primary basis for academic evaluation and reward system like promotions, tenure, and salarydetermination[4]. Study of authorship across the disciple, thus becomes an issue that has frequently been persuaded in bibliometrics. Therefore, present study is extension of the very consensus, ventured in the active and specialized sub-domain of information science – 'Informetrics'.

Informetrics is a rapidly growing interdisciplinary field at the conjunction of library& information science, sociology of science and information retrieval, formally introduced by Prof. Otto Nacke. Informetrics research traditionally investigates empirical regularities (methods, models and analogies) from mathematics, computer science, physical science, mathematical linguistic and other quantitative sciences attempts to develop models and theories for better understanding of information processes thereof.

Literature Review

A decent literature on the genesis and evolution of informetrics was provided by Galyavieva[5], subsequent growth of the field has shown by Bar-Ilan[6] in her review. Being a generic term, it encompasses both biblio and scientometrics and deals with all quantitative aspects of information flow regardless of its form. Stock & Weber[7] after analysing different definitions of Brookes[8], Tague-Sutcliffe[9], Egghe[10]suggested that, Informetrics includes all quantitative research in information science and encompasses areas like –

- Information itself including general (descriptive & normative informetrics), special (scientometrics, patentometrics, news informetrics, etc.), and web information (webometrics, blogometrics etc.).
- Information users and information usage.
- Information systems (evaluation of retrieval, functionality, performance etc.).

Ever since bibliometrics studies came into practice, authorship has been a central element for quantitative evaluation. It has been the basis of majority of bibliometric studies from the time of Lotka's investigation. Probably, the earliest review of authorship literature was done by Olsgaard & Olsgaard[11]and then more comprehensively by Nisonger[12]. Naturally, good number of studies has been conducted in different dimensions to analyze and interpret authorship properties and research collaboration in various disciplines[13-26]. Thus literature of authorship is quite diversified and well documented and out of the scope of the study.

Scope

Present study attempts to portrait the basic bibliometric elements like authorship, research collaboration in the field of informetric based on the most authoritative channel - Journal of Informetric (JOI). The study is confined to the publications appeared in the inaugural issues of JOI during 2007 to 2013. The study is conducted based on the research communications (viz. articles, short communications and letter to editors, etc.) appearing in the first 28 issues of this scholarly journal. Research queries persuaded in the study are: the number and type of authored items published during the period, authorship pattern and trend, collaboration i.e. the number of communications written by more than one author, author productivity i.e. the number of contributions made by individual authors, institutional and geographical affiliations and diversities of contributors.

Objectives

Specific objectives of the study are as follows:

- To examine and analyses the nature of authorship in the Informetrics literature;
- To determine the authorship collaboration among the contributors, affiliated institutions and countries;
- To deduce degree of collaboration, collaborative index among the authors;
- To enumerate ranking of prolific authors and their affiliated institutions;
- To identify the most productive country and institution;
- To ear-mark various issues quantitatively to assess the significance of Informetrics research.

Data Collection And Methodology

Keeping in view of the aforesaid objectives, primary data for the study has been extracted from the journal website[27]. For data collection, bibliometric scrutiny method is largely employed. In order to gauze the authorship character accurately so as to map tangible contribution to the field, bibliographic information of each contribution of the JOI was transcribed as accurately as possible. Complete searching has yielded 420 unique records that are considered reasonable sample for the purpose of this study. Rank lists of prolific contributors and their affiliated institutions have been prepared based on the fractional counting method[28] and normal counting method respectively. In addition, degree of collaboration (DC) has been estimated using Subramanyan's formula[29]. Generalized Lotka's law[30] is tested using full productivity of authorship. Thus, systematic analysis of collected data has been worked out in different dimensions using various mathematical and statistical techniques.

Data Analysis

Analysis of collected data has revealed many interesting findings which signify the authorship and collaborative attributes of the Informetrics literature.

❑ Year Wise Distribution of Contributions

Table1shows chronological distribution of types of items published in the journal during the study period. Total 420 communications appeared during 2007 to 2013, of which 366 (87.1%) were scholarly articles and rest of 54 communications belonged to short communications (SC), letter to editors (L to E), and editorials in negligible portion. So, research articles were found to be the most predominant form of communications in field of Informetrics. It is also evident that, research communications became more than thrice during seven years period - clearly indicates steady growth of Informetric literature.

Table 1: Year wise Distribution of Items

Items	2007	2008	2009	2010	2011	2012	2013	Total	% age
Articles	32	32	31	62	55	65	89	366	87.1
SC	-	2	2	2	6	4	4	20	4.76
Editorials	1	-	1	1	-	-	-	3	0.71
L to E	-	-	2	4	6	7	9	28	6.67
Others	-	-	-	-	-	2	1	3	0.71
Total	33	34	36	69	67	78	103	420	100

❑ Authorship Pattern

Table 2 represents the authorship pattern identified in the Informetrics literatures appeared during 2007-2013. Analysis shows a total of 420 communications were contributed by a total

of 975 authors in different authorship positions, thus average authorship per communication was found 2.32. Noteworthy is the fact that reported average authorship for the Scientometrics literature[31] was quite identical (2.29). It was also observed that though single-authored contributions were significant (30%), two-authored contributions(33%) were found to be most predominant, followed by three authors (23%), four authors (10%) and rest of the communications were in collaborations ranging from five to even nine authors. So, the study opined the prevalence of team research over solo research in the field of Informetrics.

Table 2: Authorship Pattern of JOI

Year	Total Comm.	Authorship									Total Auth.	Avg. Auth.
		Single	Two	Three	Four	Five	Six	Seven	Eight	Nine		
2007	33	13	9	5	4	2	-	-	-	-	72	2.182
2008	34	14	13	4	3	-	-	-	-	-	64	1.882
2009	36	10	13	5	4	1	2	1	-	-	91	2.528
2010	69	22	29	10	5	3	-	-	-	-	145	2.101
2011	67	13	22	22	7	1	-	-	1	1	173	2.582
2012	78	19	25	24	6	1	1	1	1	-	191	2.449
2013	103	35	26	25	13	2	-	1	1	-	239	2.320
Total	**420**	**126**	**137**	**95**	**42**	**10**	**3**	**3**	**3**	**1**	**975**	**2.321**
% age		30	32.62	22.62	10	2.38	0.71	0.71	0.71	0.24		

❑ Ranking of Prolific Authors

Table 3 enumerates the ranking of contributing authors of Informetrics based on their weighted value of total contributions during the study period. Ranking of contributors have been calculated using fractional counting method to produce distinctive listing of contributors so as to remove anonymous ranking what so ever. Results show a total of 521 unique authors having 975 occurrences (in different positions) of Informetrics literatures during the study period. It is also observed that top ten ranks were occupied by eminent bibliometricians. It is also evident from the list that most of the productive (in terms of contribution)authors are senior academician in allied fields of Informetrics. Similar incidents also noticed by Young[32] and Tiew et. al.[33] in their respective studies. However, in the rank list (particularly in lower positions) individual names and authorship distribution of contributors belongs in the same rank were not mentioned for those who have received weighted score≤1 to avoid longer listing. Little surprisingly, most of the productive contributors were associated with the active institutions of Informetric and allied research.

Table 3: Ranking of Prolific Authors

Rank	Author Name	Authorship in Contributions									Freq.	Total Weight
		One	Two	Three	Four	Five	Six	Seven	Eight	Nine		
1	Bornmann, Lutz	3	16	9	3	-	1	-	-	-	32	14.917
2	Egghe, Leo	12	1	1	-	-	-	-	-	-	14	12.833
3	Leydesdorff, Loet	3	13	5	2	-	-	-	-	-	23	11.677
4	Kosmulski, Ma rek	10	-	-	-	-	-	-	-	-	10	10 .00
5	Rousseau, Ronald	2	9	8	1	-	-	-	-	-	20	9.417
6	Schreibe, Michael	7		1	-	-	-	-	-	-	8	7.333
7	Waltman, Ludo	1	6	3	1	2	-	-	-	-	13	5.65
8	Burrell,Quentin L.	5	-	-	-	-	-	-	-	-	5	3 x 5 .00
	Vanclay, Jerome K.	5	-	-	-	-	-	-	-	-	5	
	Daniel, Hans -Dieter	-	6	4	2	-	1	-	-	-	13	
9	Abramo, Giovanni	-	-	13	-	-	-	-	-	-	13 each	2 x 4.333
	D Angelo, Ciriaco Andrea	-	-	13	-	-	-	-	-	-		
10	Glänzel, Wolfgang	2	3	1	1	1	-	-	-	-	8	4.283
11	van Eck, Nees Jan	-	5	3	1	2	-	-	-	-	11	4. 15
12	Sangwal, Keshra	4	-	-	-	-	-	-	-	-	4	4.00
13	Thelwall, Mike	-	5	4	-	-	-	-	-	-	9	3.833
14	Frandsen, Tove Faber	2	3	-	-	-	-	-	-	-	5	3.5
15	Mutz, Rüdiger	-	3	5	1	-	-	-	-	-	9	3.417
16	Ding, Ying	2		1	3	1	-	-	1	-	8	3.408

17	Moed, Henk F.	2	1	1	1	-	-	-	-	-	5	3.083
18	Franceschet, Massimo	2	2	-	-	-	-	-	-	-	4	4 x 3 .00
	Gangan Prathap	3	-	-	-	-	-	-	-	-	3	
	Vinkler, Péter	3	-	-	-	-	-	-	-	-	3	
	Cicero, Tindaro	-	-	9	-	-	-	-	-	-	9	
19	Chen, Dar -Zen	-	-	8	1	-	-	-	-	-	9	2.917
20	Serenko, Alexander	1	3	-	1	-	-	-	-	-	5	2 x 2.75
	Ye, Fred Y.	-	3	3	1	-	-	-	-	-	7	
21	de Moya -Anegón, Félix	-	2	3	2	1	-	-	-	-	8	2.7
22	Ruiz -Castillo, Javier	-	2	4	1	-	-	-	-	-	7	2.583
23	Gagolewski, Marek	2	1	-	-	-	-	-	-	-	3	3 x 2.5
	García -Pérez, Miguel A.	2	1	-	-	-	-	-	-	-	3	
	Franceschini, Fiorenzo	-	4	-	2	-	-	-	-	-	6	
24	Bar -Ilan, Judit	2	-	1	-	-	-	-	-	-	3	2.333
25	Guan, Jiancheng	-	4	-	1	-	-	-	-	-	5	2.25
26	Sarabia, José María	1	-	2	2	-	-	-	-	-	5	2.167
27	Jarneving, Bo	2	-	-	-	-	-	-	-	-	2	10 x 2
	Ma gnone, Edoardo	2	-	-	-	-	-	-	-	-	2	
	Perc, Matja	2	-	-	-	-	-	-	-	-	2	
	Quesada, Antonio	2	-	-	-	-	-	-	-	-	2	
	Rons, Nadine	2	-	-	-	-	-	-	-	-	2	
	Tol, Richard S.J.	2	-	-	-	-	-	-	-	-	2	
	Woeginger, Gerhard J.	2	-	-	-	-	-	-	-	-	2	
	Schubert, András	1	2	-	-	-	-	-	-	-	3	
	Huang, Mu -Hsuan	-	-	6	-	-	-	-	-	-	6	
	Maisano, Domenico	-	3	-	2	-	-	-	-	-	5	
28	Wu, Jiang	1	-	2	-	-	-	-	-	-	3	1.667
29	Larivière, Vincent	-	2	1	1	-	-	-	-	-	4	1.583 x 2
	Radicchi, Filippo	-	2	1	1	-	-	-	-	-	4	
30	Liang, Liming	-	2	1	-	1	-	-	-	-	4	1.533
31	Kosto ff, Ronald N.	1	1								2	6 x 1.5
	Lafouge, Thierry	1	1								2	
	Guns, Raf	-	1	3							4	
	Liu, Yuxian	-	1	3							4	
	Nicolaisen, Jeppe	-	3	-	-	-	-	-	-	-	3	
	Opthof, Tobias	-	3	-	-	-	-	-	-	-	3	
32	Aguillo, Isidro	-	2	-	1	1	-	-	-	-	4	1.45
33	Marx, Werner	-	2	-	1	-	1	-	-	-	4	1.417
34	Schneider, Jesper W.	1	-	1	-						2	8 x 1.333
	Albarrán, Pedro		2	1							3	
	Gingras, Yves		2	1							3	
	Ortega, José Luis		2	1							3	
	Ort no, Ignacio		2	1							3	
	Prabowo, Rudy		2	1							3	
	Rodriguez, Marko A.	-		4	-						4	
	Wolfram, Dietmar	-		4	-						4	

35	Milojevi , Sta a	1	-	-	1	-	-	-	-	-	2	1.25 x 3
	Bontis, Nick	-	2	-	1	-	-	-	-	-	3	
	Castellano, Claudio	-	2	-	1	-	-	-	-	-	3	
36	Norris, Michael	-	2	-	-	1	-	-	-	-	3	1.2 x2
	Oppenheim, Charles	-	2	-	-	1	-	-	-	-	3	
37	Abbasi, Alireza	-	1	2	-	-	-	-	-	-	3	1.167
38	Wagner, Caroline	-	2	-	-	-	-	-	1	-	3	1.125
39	Zhang, Lin	-	1	1	-	1	-	-	-	-	3	1.033
40	30 Authors having each	1	-	-	-	-	-	-	-	-	1	30 x 1
41	16 Authors having each	-	2	-	-	-	-	-	-	-	2	16 x 1
42	Bollen, Johan	-	-	2	-	1	-	-	1	-	4	0.992
43	Huang , Mu -Hsuan	-	-	2	1	-	-	-	-	-	3	0.917
44	van Raan, Anthony F.J.	-	1	-	-	2	-	-	-	-	3	0.9 x 2
	Visser, Martijn S.	-	-	-	2	2	-	-	-	-	4	
45	Rafols, Ismael	-	1	-	1	-	-	-	1	-	3	0.875
46	2 Authors having each	-	-	1	2	-	-	-	-	-	3	10 x 0.833
	8 Authors havin g each		1	1	-	-	-	-	-	-	2	
47	Börner, Katy	-	1	-	-	1	-	-	1	-	3	0.825
48	6 Authors having each	-	1	-	1	-	-	-	-	-	2	9 x 0.75
	3 Authors having each	-	-	-	3	-	-	-	-	-	3	
49	Plume, Andrew M.	-	1	-	-	1	-	-	-	-	2	0.7
50	8 Authors having each	-	-	2	-	-	-	-	-	-	2	8 x 0.667
51	van Leeuwen, Thed N.	-	-	-	1	2	-	-	-	-	3	0.65
52	Boyack, Kevin W.	-	1	-	-	-	-	-	1	-	2	0.625
53	2 Authors having each	-	-	-	2	-	-	-	-	1	3	2 x 0.611
54	4 Authors having each	-	-	1	1	-	-	-	-	-	2	4 x 0.583
55	Wang, Xianbing	-	-	-	-	-	-	4	-	-	4	0.571
56	He, Bing	-	-	1	-	1	-	-	-	-	2	0.533
57	83 Authors having each	-	1	-	-	-	-	-	-	-	1	93 x 0.500
	8 Authors having each	-	-	-	2	-	-	-	-	-	2	
	2 Authors having each	-	-	1	-	-	1	-	-	-	2	
58	5 Authors having each	-	-	-	1	1	-	-	-	-	2	5 x 0.4 5
59	Schier, Hermann	-	-	-	1	-	1	-	-	-	2	0.417
60	112 Authors having each	-	-	1	-						1	112 x 0.333
61	Yu, Daren	-					2	-	-	-	2	0.333
62	Tanga, Jie	-				1	-		1	-	2	0.325
63	5 Authors having each	-						2	-	-	2	0.286

64	Wang, Fang	-						2	-	2	0.250
66	78 Authors having each	-			1	-				1	78 x 0.25
67	22 Authors having each	-				1	-			1	22 x 0.2
68	10 Authors having each	-					1	-		1	10 x 0.1676
69	7 authors having each	-						1	-	1	7 x 0.143
70	15 Authors having each	-							1	-	1	15 x 0.125
71	7 authors having each	-								1	1	7 x 0.111
521 unique authors		126	274	285	168	50	18	21	24	9	975	420

❑ Author Productivity and Lotka's Law

Considerable research has been carried out on the empirical validation of Lotka's law and its subsequent derivations. Number of studies has reported that Lotka's law is applicable for the productivity distributions of well-recognized disciplines including LIS. Some disciplines follow the Lotka's law in its original form with exponent value 2 while some other investigations found the value of exponent varies around 2, instead of exact 2.

Lotka's empirical law of scientific productivity states that y number of authors each credited with x number of papers is inversely proportional to x, which is the output of each individual author. Mathematically these can be summarized as,

$$x^n \alpha \frac{1}{y} \quad \text{or} \quad x^n y = C \quad \ldots\ldots\ldots\ldots \text{(i)} \quad [\text{n and C are two constants}]$$

Therefore, generalized form of Lotka's law (referred to inverse power law) as presented by Bookstein[34] could be useful to study the productivity as follows,

$$a_n = \frac{C}{n^\alpha} \quad \text{for n} = 1, 2, 3 \ldots \text{and C} > 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

Where a_n represents the probability of authors producing n contributions each; C and α are two constants to be estimated for specific set of data. The value of productivity constant (α)can be determined by considering the values of n (1, 2, 3…) applying mathematical method.

Here an attempt has been made to test the applicability of Lotka's law for Informetrics authors. Table 4 shows the author productivity using full production of authorship, where 364 contributors have one paper each, 80 authors produced two papers each, 33 authors contributed three papers each, and another 14 authors have four papers each to their credit and so on. Maximum number of papers that have been credited to an individual author is found to be 32. Now considering the observed data (364 authors have produced 1 paper each), one can easily derive the value of constant (C) from the equation (ii) as follows:

$$a_n = \frac{C}{n^\alpha} \quad \text{or,} \quad 364 = \frac{C}{1^\alpha} \quad \text{or,} \quad C = 364$$

Subsequently, taking the expected value of α as 2 and putting the derived value of C for n= 1, 2, 3, 4,….. in the above equation, corresponding values of expected authors (a_n) are obtained. Result shows (Table 4) considerable variations in the expected values when compare to observed values. So, the Law does not fit in this case and violation is clearly observed. It is also evident from the table, when the value of productivity parameter (α) approximated to 2.19 (instead of 2) then the expected values of authors (Col.7) quite resembles to observed values of authorship (Col.2).Since,

$$a_n = \frac{C}{n^\alpha} \text{ or } n^\alpha = \frac{C}{a_n} \text{ or } \log n^\alpha = \log \frac{C}{a_n} \text{ or } \alpha \log n = \log \frac{C}{a_n} \text{ or, } \alpha = \frac{\log \frac{C}{a_n}}{\log n} \text{ or } \alpha = \frac{\log \frac{364}{80}}{\log 2}$$

$$[\text{C}=364 \ , \ a_n = 80, \ n = 2] \ , \text{or} \ \alpha = \frac{0.65800}{0.30103} = 2.186 \text{ or, } \quad \alpha = 2.19$$

So, considering C = 364 and $\alpha = 2.19$, we can easily derive the values of a_n (expected authors) from the Equation (ii) for n = 1, 2, 3, 4……. as follows,

$$(a_n)_1 = \frac{C}{n^\alpha} = \frac{364}{1^{2.19}} = 364 \ ; \quad (a_n)_2 = \frac{C}{n^\alpha} = \frac{364}{2^{2.19}} = 80$$

$$(a_n)_3 = \frac{C}{n^\alpha} = \frac{364}{3^{2.19}} = 33 \ ; \quad (a_n)_4 = \frac{C}{n^\alpha} = \frac{364}{4^{2.19}} = 17$$

Similarly, $(a_n)_5 = 11$ $(a_n)_6 = 7$ $(a_n)_7 = 5$ $(a_n)_8 = 4$ $(a_n)_9 = 3$

$(a_n)_{10} = 2$ $(a_n)_{11} = 1$ $(a_n)_{13} = 1$ $(a_n)_{14} = 1$ $(a_n)_{20} = 0.5$

$(a_n)_{23} = 0.3$ $(a_n)_{32} = 0.2$

Table 4 reflects that productivity distribution data partially fits the Lotka's law with a calculated value of exponent (α) 2.19 and the number of papers does not exceed five. The law holds good up to this point. Thus the demonstration indicated that generalized Lotka's law is applicable to this specialty with a slightly higher α value. Worthy to mention that the higher the value of α, the greater is the gap between the productivity of individual groups of authors contributing number of papers each. Practically, a higher value of α implies the proportion of highly productive authors is decreased[35]. The result of present study therefore reinforced previous inference that Lotka's law is applicable in the field of LIS with much higher values of compared to the exactsciences[36].

Table 4: Author Productivity

No of Papers (A)	Observed Authors (B)	(%age)	Authorship (A x B)	(%age)	Expected Authors(when (α = 2)	Expected Authors (α= 2.19)
1	364	69.87	364	37.33	364	364
2	80	15.36	160	16.41	91	80
3	33	6.33	99	10.15	40.44	33
4	14	2.69	56	5.74	22.75	17
5	8	1.54	40	4.10	14.56	11
6	2	0.38	12	1.23	10.11	7
7	2	0.38	14	1.43	7.43	5
8	4	0.77	32	3. 96	5.69	4
9	4	0.77	36	3.28	4.49	3
10	1	0.19	10	1.02	3.64	2
11	1	0.19	11	1.02	3	1
13	4	0.77	13	1.33	2.15	1
14	1	0.19	14	1.45	1.42	1
20	1	0.19	20	2.05	0.91	0.5
23	1	0.19	23	2.35	0.69	0.3
32	1	0.19	32	3.28	0.36	0.2
Total	521	100	975	100	573	530

❑ Author Collaboration

Collaboration is an intense form of interaction fostering effective communication as well as sharing of competence and other resources in search of new knowledge. Research collaboration is very much common and highly practiced especially in multidisciplinary domains. Literature shows that research collaboration is discipline dependent and generally higher in the experimental fields of science and technology but lower in the fields of humanities. Degree of collaboration (DC) - a proxy measure for research collaboration among the contributors was derived by using Subramanyam formula, as the ratio of the number of collaborative contributions to the total number of research contributors published in the discipline during a certain period of time. Mathematically it can be expressed as,

$$DC = \frac{N_m}{N_m + N_s} \; or, (DC) = \frac{294}{294 + 126} = 0.700$$

Where N_m refers to the Collaborative communications and N_s denote the number of single-authored communications published in a particular communication channel during certain period of time.

Table 5 : Degree of Collaboration (DC) and Collaboration Index (CI)

Year	Single (N_s)	%age	Collaborative (Nm)	%age	DC	Total authors in multi-authored Communications	CI
2007	13	3.10	20	4.76	0.606	59	2.95
2008	14	3.33	20	4.76	0.588	50	2.50
2009	10	2.38	26	6.19	0.722	81	3.12
2010	22	5.24	47	11.2	0.681	123	2.62
2011	13	3.10	54	12.9	0.806	160	2.96
2012	19	4.52	59	14.00	0.756	172	2.92
2013	35	8.33	68	16.2	0.660	204	3.00
Total	126	30.13	294	69.87	0.700	849	2.87

Table 5 reveals the collaboration scenario of the Informetrics authors during 2007- 2013. Out of total 420 communications, 294(70%) were collaborated by multiple authors ranging from two to nine and rests were non-collaborative. Table also shows the degree of collaboration of Informetrics contributors varies inconsistently from 0.588 to 0.806 during the study period. Average degree of collaboration is impressive (0.7) but not overwhelming. Variations of Collaboration Index (CI) i.e. year-wise mean number of contributors per multi-authored communication was also shown in the table. Average CI was derived to be 2.87, implies the prevalence of team research of 2 and 3 authors among the Informetrics community, i.e. scientists working in this field prefer to conduct research in groups of 2 to 3 researchers.

❑ Geographical Diffusion of Informetrics Contributors

Table 6 shows the geographical diffusion of contributing authors of Informetrics during the study period. Country names of the contributors have been identified from the corresponding affiliations as found in respective publications of the journal. Tabulated data shows that, contributors from 38 countries of 6 continents across the globe were associated in producing 420 communications of JOI. Out of which European countries contribute most (58%), followed by Asia (21%), North America (15%), Oceania (2.67%) and South America (2%) and Africa (0.51%). A rank list of contributing countries has been prepared on the basis of affiliations of the contributions from various countries, applying normal counting method. Pro China produces highest portion of authors(12.41%) by affiliating 121 occurrences, followed by USA (12%), Spain (11%), The Netherland (9%), Italy (8%), Belgium (7%), Germany(5.23%), etc. It has also found that top five countries were producing about 52% of the total authors, indicating a high concentration of Informetrics researchers. So, it is evident from the study that, though Informetrics research dominates in the European countries it is prevalent among countries across world.

Table 6: Geographical Diversity of Informetrics Authors

Rank	Country Name	Regions	Frequency of Author Occurrence	%age	Cumulative %age
1	PRO China	Asia	121	12.41	12.41
2	USA	North America	116	11.90	24.31
3	Spain	Europe	106	10.87	35.18
4	The Netherland	Europe	86	8.82	44.00
5	Italy	Europe	75	7.69	51.69
6	Belgium	Europe	69	7.08	58.77
7	Germany	Europe	51	5.23	64.00
8	UK	Europe	50	5.13	69.13
9	Switzerland	Europe	44	4.51	73.64
10	Taiwan	Asia	38	3.90	77.54
11	Canada	North America	30	3.08	80.62
12	Brazil	South America	21 each	2.15 x 2	84.92
	Australia	Oceania			
13	Poland	Europe	18	1.85	86.77
14	Iran	Asia	14	1.44	88.20
15	Denmark	Europe	12	1.23	89.44

16	France	Europe	9 each	0.92 X 2	91.28
	Sweden				
17	Finland	Europe	8	0.82	92.10
18	Portugal	Europe	7 each	0.72 X 5	94.97
	Hungary				
	India	Asia			
	Malaysia				
	Republic of Korea				
19	Slovenia	Europe	6	0.62	95.69
20	Mexico	North America	5 each	0.51 X 3	97.85
	Austria	Oceania			
	Greece	Europe			
21	Israel	Asia	4	0.41	98.26
22	Japan	Asia	3 each	0.31 x 2	98.56
	South Africa	Africa			
23	Tunisia	Africa	2 each	0.21 X 4	99.69
	Turkey	Asia			
	Ireland	Europe			
	Norway	Europe			
24	Czech Republic	Europe	1 each	0.10 X 3	100.00
	Romania	Europe			
	Slovakia	Europe			
Total	38 Countries		975	100	100

❑ Institutional Affiliation of *JOI* Contributors

Table 7 depicts the distribution of institutional affiliations of the Informetrics contributors as appeared in the data source. Enumerated data shows that 975 contributors of Informetrics were affiliated to 251institutions across the globe. A rank list of affiliated institutions of the contributors has been prepared based on the aggregated value of the contributions from respective institutions. It is observed from the table that Indiana University, Bloomington (USA) has appeared on the top; followed by K U Leuven (Catholic University of Leuven) Belgium, Leiden University - CWTS (The Netherlands). It is also evident from the table that top ten positions in the list were occupied by 14 institutions and have contributed about 38% of total Informetrics contributions during the study period. Results also showed that majority of contributors were affiliated to the universities and research institutes of developed countries. Active participation of institutions across geographical boundaries implies the research this scientific specialty is not confined to a particular geographical boundary; rather distributed unevenly across the globe. Noteworthy is the fact that, majority of the affiliated institutions found in the study was also in the list of similar study made on the journal Scientometrics.

Table 7: Institutions Affiliations of Informetrics Contributors

Rank	Institute Name - Country	Frequency	%	Total	Cumu. Total
1	Indiana University (Bloomington) - USA	42	4.31	4.31	4.31
2	K U of Leuven (Catholic University of Leuven) Belgium	40	4.10	4.10	8.41
3	Leiden University (CWTS) - The Netherlands	39	4.00	4.00	12.41
4	Swiss Federal Institute of Technology Zurich (ETH) - Switzerland	32	3.24	3.28	15.59
5	Max Planck Society (Max Planck Inst. for Solid State Research) - Germany	28	2.87 x 3	8.61	24.31
	University of Rome (Tor Vergata) - Italy				
	National Taiwan University - Taiwan ROC				
6	University of Amsterdam - The Netherland	26	2.67	2.67	26.98
7	Dalian University of Technology - China	24	2.46	2.46	29.44
8	Institute of Scientific &Technical Information of China - China	19	1.95x2	3.90	33.34
	Universidad Carlos III de Madrid- Spain				
9	University of Wolverhampton, Wolverhampton- UK	15	1.54	1.54	34.87
10	Lublin University of Technology, Lublin - Poland	14	1.44x2	2.88	37.75
	University of Granada, CITIC-UGR , Granada- Spain				
11	Universiteit Hasselt (UHasselt), Campus Diepenbeek- Belgium	13	1.33x3	3.99	41.75
	University of São Paulo, São Paulo - Brazil				
	Zhejiang University, College of Public Administration, - China				
12	Politecnico di Torino (Polytechnic University of Turin) - Italy	12	1.23x2	2.46	44.21
	Spanish National Research Council (CSIC) - Spain				
13	Wuhan University, PR China - China	11	1.13	1.13	45.43
14	University of Antwerp - Belgium	9	0.92x3	2.76	48.10
	National Research Council of Italy,(IASI -CNR) - Italy				
	University of Sussex, Belgium - UK				
15	University of Quebec (Université du Québec à Montréa) Canada	8	0.82x2	1.64	49.75
	University of Cantabria, Santander- Spain				
16	Harvard-Smithsonian Center for Astrophysics - USA	7	0.72x4	2.88	52.62
	Hungarian Academy of Sciences, 1525 Budapest- Hungary				
	Harbin Institute of Technology - PR China				
	Loughborough University, Loughborough - UK				
17	Twelve (12) Institutions having Six(6) contributions each	6	0.62 x 12	7.44	60.06
18	Seven (7) Institutions having Five (5) contributions each	5	0.51 x 7	3.57	63.59

19	Seventeen (17) Institutions having Four(4) contributions each	4	0.41 x 17	6.97	70.57
20	Twenty Seven (27) Institutions having Three (3) contributions each	3	0.31 x 27	8.37	78.87
21	Forty-seven (47) Institutions having Two (2) contributions each	2	0.21 x 47	9.87	88.52
22	One Hundred Twelve (112) Institutions having Single (1) contribution each	1	0.10 x112	11.20	99.72
	Total 251 Institutions			**100**	

Conclusion

Present study demonstrated some general inferences on the basic bibliometric attributes like authorship, research collaboration of the Informetric literature. Steady increase of publications over the years, signifies tangible growth of the literature; which was largely attributed due to the steady growth (88%) of scholarly article. Informetrics being trans-disciplinary domain semantically accommodate expositions not only from immediate field but also from broader disciplines - thus produces substantial (70%) multi-authored communications. Moreover, diversity of authorship across the countries and institutions reflects – recognition and exposure of the scientific specialty as an active research domain of information science. With respect to author productivity, present study shows partial compliance with Lotka's generalized inverse square law with higher value of productivity parameter (n) only in a limited range. Moreover, increasing collaboration among the researchers has been observed in the Informetrics community. The degree of collaboration was estimated to 0.7, of which double and triple-authored contributions were prominent. Average Collaborative Index (CI) and average authorship per contribution were found 2.87 and 2.32 respectively; indicates predominance of research group among 2 to 3 scholars in this scientific specialty. Though China, an Asian country has produced maximum contributors followed by USA, institutions from European Union countries like Belgium, Germany, Netherlands, Spain, Italy clearly dominated in Informetric research.

In summary, it may be concluded that findings of the study would certainly provide the-state-of-the-art of informatics research, thus helping researchers and policy makers to have the panorama of this specialty. There are, of course, still many unexplored areas such as - inter & intra disciplinary and institutional collaboration; cause of uneven authorship distributions, bibliographic coupling at the regional and international level, citation analysis, etc.

References

1. Nwagwu, W. E. (2007). Patterns of authorship in the biomedical literature Nigeria. *LIBRES: Library and Information Science research electronic Journal,* 17(1), 1-28.
2. Cronin, B. (2001). Hyper authorship: a postmodern perversion or evidence of a structural shift in scholarly communication practices? *Journal of the American Society for Information Science and Technology,*52, 558-569.
3. Foucault, M. (1977). What is an author? In D.F. Douchard (Ed.), *Language, counter memory, practices: Selected essays and interviews.* Ithaca, New York: Cornell University Press.
4. Wager, E. (2009). Recognition, reward and responsibility: why the authorship of scientific papers matters. *Maturitas,* 62, 109 – 112.
5. Galyavieva, M. S. (2013). On the formation of the concept of informetrics (Review). *Scientific and Technical Information Processing,* 40(2), 89-96, DOI: 10.3103 / S014768821 302007X
6. Bar-Ilan, J. (2008). Informetrics at the beginning of the 21st century: a review, *Journal of Informetrics,* 2(1), 1-52.
7. Stock, W.G. & Weber, S. (2006). *Facets of informetrics, Information - Wissenschaft und Praxis,* 57(8), 385–389.
8. Brookes, B. C. (1990). Biblio-, scientic-, Informetrics??? What are we talking about? In L. Egghe & R. Rousseau (Eds.), *Informetrics,* 89/90, 31-42. Amsterdam: Elsevier.
9. Tague-Sutcliffe, J. (1992). An introduction to Informetrics. *Information Processing and Management,* 28(1),1-3.
10. Egghe, L. & Rousseau, R. (1990).Introduction to informetrics: Quantitative methods in library, *Documentation and Information Science,* Amsterdam: Elsevier Science.
11. Olsgaard, J. N. & Olsgaard, J. K. (1980). Authorship in five library periodicals. *College & Research Libraries,* 41(1),49 - 53.
12. Nisonger, T. E. (1996). Authorship in Library Acquisitions: Practice & Theory, *Library Acquisitions: Practice & Theory,* 30(4),395 - 419.
13. Amsaveni, N. & Vasanthi, R. (2013). Authorship pattern and collaborative research in the field of NetworkSecurity. *Indian Journal of Applied Research,* 3(1), 52-54.
14. Arora, J. & Pawan, U. (1995). Collaborative research and authorship patterns in Immunology: correlation between multiple authorship and citedness. *IASLIC Bulletin,* 40(2), 73-83.
15. Arya, C. (2012). Authorship trends and collaborative research in the field of Veterinary medicine. *International Journal of Information Dissemination & Technology,* 2(1), 50 – 52.
16. Elango, B. & Rajendran, P. (2012). Authorship trends and collaboration pattern in the marine sciences literature: a scientometrics study. *International Journal of Information Dissemination and Technology,* 2(3), 166-169.
17. Farahat, H. (2002). Authorship patterns in agricultural sciences in Egypt. *Scientometrics,* 55(2), 157-170.
18. Gupta, D. K. (1989). Scientometric study of Biochemical literature of Nigeria, 1970-1984. *Scientometrics,* 15(3-4), 171-179.

19. Khaparde, V. & Pawar, S. (2013) Authorship pattern and degree of collaboration in Information Technology. *Journal of Computer Science & Information Technology,* 1(1), 46 – 54.

20. Kumbar, H., Harinarayana, N. S. & Tejaswani, T. (2004). Authorship trend and collaborative research in agricultural science, *ISALIC Bulletin,* 50(4) 241 -248.

21. Goyal, V., Gupta, G.K. & Kumar, A. (2013). Authorship patterns and collaborative research trends in the field of chemical sciences. *International Journal of Information Dissemination and Technology,* 3(3), 184-186.

22. Rana, M. S. & Agarwal, S. (1994). Authorship trends in Indian wildlife and fisheries literature: a bibliometric study. *Annals of Library Science and Documentation,* 41(1), 13-18.

23. Vijay, K. R. (2005). Bibliometric study of research publication trend among Indian food scientists and technologists. *Annals of Library and Information Studies*, 52(3), 77-81.

24. Vimala, V. & Pullareddy, V. (1996). Authorship pattern and collaborative research in the field of Zoology. *Malaysian Journal of Library & Information Science,* 1(2), 43-50.

25. Weltzin, J.F. et. al. (2006). Authorship in Ecology: attribution, accountability, and responsibility. *Frontiers in Ecology and the Environment, 4*(8), 435 – 441.

26. Zafrunnisha, N. & Pullareddy, V. (2009). Authorship pattern and degree of collaboration in Psychology. *Annals of Library and Information Studies,* 56(4), 255 - 261.

27. http://www.journals.elsevier.com/journal-of-informetrics/

28. Van-Hooydonk, G. (1997). Fractional counting of multi authored publications: consequences for the impact of authors. *Journal of the American Society for Information Science and Technology,* 48(10), 944 – 945.

29. Subramanyam, K. (1983). Bibliometric studies of research in collaboration: a review, *Journal of Information Science,*, 6(1), 33-38.

30. Lotka, A. J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Science,* 16, 317-323.

31. Chen, Y., Fang, S. & Börner, K. (2011). Mapping the developments of Scientometrics: 2002- 2008. *Journal of Library Science in China,* 3, 131 – 146.

32. Young, A. P. (2006). Library Quarterly 1956-2004: an exploratory bibliometric analysis. *Library Quarterly,* 76(1), 10-18.

33. Tiew, W.S., Abdullah, A. & Kaur, K. (2002). Malaysian Journal of Library and Information Science 1996-2000: a bibliometrics study. *Malaysian Journal of Library and Information Science,* 6(2), 43-56.

34. Bookstein, A. (1976). The bibliometric distribution. *Library Quarterly,* 46(4), 416-423.

35. Gupta, D. K. (1995). Authorship trend and application of Lotka's law: early literature of computer based storage and retrieval of geoscientific data and information, *IASLIC Bull,* 30(1), 13-22.

36. Sen, B. K. et al, (1996). Library and information science literature and Lotka'a law. *Malaysian Journal of Library and Information Science,* 1(2), 89-93.