



Authorship Pattern and Collaborative Research in the Field of Network Security

KEYWORDS

Network security; Authorship pattern; Collaborative research, degree of collaboration

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ABSTRACT

This study reveals the trend in authorship pattern and collaborative research in network security with a sample of 8051 articles downloaded from the database of web of knowledge during 2002 to 2011 (one decade) with 5343 LCS and 44721 TGCS measured. The growth trend is booming taken the sample duration in this field research output. The study also indicates that multi-authors productivity is dominant, single research also exists. The degree of collaboration in research is 0.95 in network security research productivity.

INTRODUCTION

Collaborative research is a well-recognized feature of modern science, and there has been a consistent trend towards increased collaboration in all branches of science during the present century. The main reason for collaborative research can be attributed to the interdisciplinary nature of investigations, escalating cost of instrumentation, laboratory facilities and common interest of scientists in the same field. A large number of studies have been conducted to analyse and interpret the trends in collaborative authorship in different disciplines.

Karisiddappa et al. (1990) analysed the authorship pattern in psychology and found that the proportion of single authored papers has fallen to 39.43% in 1988 when compared to 84% in the 1920's indicating the trend towards multiple authorship. The present study is undertaken to elucidate the authorship pattern and the degree of collaboration in the field of network security and changes thereof as a function of time.

OBJECTIVES OF THE STUDY

The specific objectives of the study are:

- to examine the nature of authorship pattern
- to determine the proportion of single vs. multi-authored papers

- to determine the degree of collaboration and average number of authors per paper.

DATA AND METHODOLOGY

There are various sources contributing to the research output in the field of network security research by the scientists all over. The necessary data were collected from the Science Citation Index (SCI) and Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (A CHI) which are available on the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). The study period 2002 to 2011 is selected as the database is available. A total of 8051 records were downloaded and analyzed by using the Histcite software application as per the objectives of the study.

RESULTS AND DISCUSSION

1. Authorship pattern

Table 1 presents the authorship pattern in the field of Network Security. Two-authored papers comprised the highest percentage (37.5%) of the total 8051 papers, the authorship pattern has explained. Year wise productivity has given by the number of authors contributing, like solo research and collaborative research.

Table 1: Showing authorship patterns of Network Security

Years		Single	double	triple	four	five	six	seven	eight	Nine	10 & above	Total	Mean
2002	Articles	86	89	74	30	15	10	5	4	3	-	316	3.92
	Authors	86	178	222	120	75	60	35	32	27	-	835	3.31
2003	Articles	76	121	112	56	38	12	3	2	2	4	426	5.29
	Authors	76	242	336	224	190	72	21	16	18	50	1245	4.93
2004	Articles	104	187	195	86	37	22	5	1	3	8	648	8.04
	Authors	104	374	585	344	185	132	35	8	27	93	1887	2.56
2005	Articles	100	222	234	133	54	23	7	2	-	3	778	9.66
	Authors	100	444	702	532	270	138	49	16	-	42	2293	9.08
2006	Articles	99	253	268	164	69	41	8	6	3	5	916	11.38
	Authors	99	506	804	656	345	246	56	48	27	75	2862	11.34
2007	Articles	94	212	198	118	68	33	10	5	3	6	747	9.28
	Authors	94	424	594	472	340	198	70	40	27	80	2339	9.26
2008	Articles	94	226	216	140	61	37	15	2	4	12	807	10.02
	Authors	94	452	648	560	305	222	105	16	36	163	2601	10.30
2009	Articles	122	264	243	192	96	36	13	4	4	15	989	12.28
	Authors	122	528	729	768	480	216	91	32	36	232	3234	12.81
2010	Articles	133	253	327	184	106	48	24	12	5	9	1101	13.67
	Authors	133	506	981	736	530	288	168	96	45	104	3587	14.21
2011	Articles	138	347	348	249	140	53	18	7	7	16	1323	16.43
	Authors	138	694	1044	996	700	318	126	56	63	231	4366	17.29
Total	Articles	1046	2174	2215	1352	684	315	108	45	34	78	8051	
	Authors	1046	4348	6645	5408	3420	1890	756	360	306	1070	25249	
	CI	0.13	0.54	0.83	0.67	0.43	0.23	0.09	0.04	0.03	0.13	3.14	

Totally 1046 single authored contribution is only 4.14 percent; remaining 95.86 percent of articles were from the collaborative authored. Two authored articles is 2174, four authored articles are 1352 were high. Remaining collaborative authored articles are very lowest. Three authored collaboration is 6645, four authored collaboration is 5408, two authored collaboration is 4348, five authored collaboration is 3420, six authored collaboration is 1890 and remaining authors' collaboration is below 1000 articles except 10 and more than authors' productivity. Totally we observed from the above analysis, number of authors is more than the number of articles. Three authors contribution is very high by seeing

authors and articles. 2011, 2010, 2009 and 2008 years are large number of authors were contributed.

2. DEGREE OF COLLABORATION

Table 2 indicates authorship pattern and degrees of collaboration in Network security research output. Here the authors are classified according to the number of research contributions. In this aspect single author (7.35%) contributed papers are taken into the purview of this study. It could be noted that out of 2107 research papers predict in the study, the triple and four authors contributed papers are occupied the rank first and second in the order which is calculated 780 (37.01%) and 688 (32.65%) respectively.

Table 2: Status of authors in Network Security research output

Year	No. of Author	%	No. of Article	%	No. of non - collaborative author			No. of collaboration			CI	AAPP	DC
					NA	CS	CR	NA	CS	CR			
2002	835	3.31	316	3.92	86	622	1997	749	4762	4915	0.10	2.64	0.89
2003	1245	4.93	426	5.29	76	708	2298	1169	5034	7378	1.55	2.92	0.94
2004	1887	7.47	648	8.05	104	836	2783	1783	5868	10834	0.23	2.91	0.94
2005	2293	9.08	778	9.66	100	731	2363	2193	6625	13282	0.28	2.94	0.96
2006	2862	11.34	916	11.38	99	520	2658	2763	6472	18300	0.36	3.12	0.97
2007	2339	9.26	747	9.28	94	295	2430	2245	5824	17836	0.29	3.13	0.96
2008	2601	10.30	807	10.02	94	402	3392	2507	4100	20829	0.32	3.22	0.96
2009	3234	12.81	989	12.28	122	302	4026	3112	3844	25177	0.40	3.27	0.96
2010	3587	14.21	1101	13.68	133	247	5115	3454	2068	30057	0.45	3.26	0.96
2011	4366	17.29	1323	16.43	138	45	5615	4228	759	38094	0.54	3.30	0.97
Total	25249	100	8051	100	1046	4708	32677	24203	45356	186702	3.14	3.14	0.95

Note: NA – No. of authors; CS – Citation Scores, CR – Cited references, CI – collaborative index, AAPP – Average number of authors per paper

The CI value is 0.10 at 2002 and it risen 0.54 at 2011. The CI value for universal level is 3.14 which show that collaborative research pattern than solo research and collaborative author's productivity is more than single contribution.

The year of 2002 is 8.22 percent and 2011 is 13.19 percent for single authored contributing level. Same for multi authored contribution at 2002 is 3.09 percent it rises to 17.47 percent at the year of 2011. Total authored values at 2002 is 3.31 percent and it is risen to the year of 2011 is 17.29 percent.

Only 4.14 percent of single authors were contributed in this research productivity and 95.86 percent of them are published under the joint venture of publication in Network security research. Based on this study, the result of the degree of collaboration $C = 0.95$. i.e., 95 percent of collaborative authors' articles published during the study periods.

3. MODELING CONTRIBUTION OF SINGLE-AUTHORED PUBLICATIONS

Table 4 shows the predominance of multi-authored papers (95.86%) over single-authored papers 4.14%). The selected regression models have been estimated for the proportion of single authorship. The values of R2, F test and T test were expressed in below table.

Table 4: Fit Statistics derived from the Growth Models of Single-authored Contributions

Types of growth models	Fit statistics		
	R2	F	T test
Linear model	0.721	20.675	4.547
Logarithmic model	0.714	19.941	4.469
Inverse model	0.695	18.245	-4.271

Quadratic model	0.721	9.057	0.265
Growth model	0.721	20.646	4.544
Exponential model	0.686	20.646	4.544
Logistic model	0.721	20.646	7.159

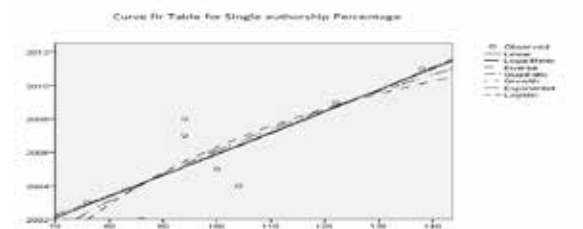


Fig1: Fitness Of Statistics For Single Authorship

4. VARIOUS STATUS CONTRIBUTION OF NETWORK SECURITY RESEARCH

The researcher has taken the categories of all authors (25249), first authors (7521), non-collaborative authors (1046) and co-authors (15726). Overall authors' contribution is following facts; 47.46 percent of single contributions, 16.57 percent of them are two times contribution and more than two time contributors are very less number of authors. First authors also 52.53 percent of them are single contribution, 21.96 percent of them are two time contribution and more than two time contributors are very less number of authors. Non collaborative authors 82.02 percent of authors were only one time contributing, 11.09 percent of them are two time contributing, and more than two time contributors are very less number of authors in network security. 53.10 percent of co-authors were contributes at single time, 15.6 percent of them are two times contribution in this selected area and less number of percent values are highest number of contributions.

Table 5: Variation between the Single, First and Co-authors contribution

No. of contribution (X)	All authors (y) N= 25249		First authors N = 7521		Non – collaborative authors N = 1046		Co authors N = 15726	
	No. of authors	author-ship	No. of authors	author-ship	No. of authors	author-ship	No. of authors	author-ship
1	11984	11984	3951	3951	858	858	8351	8351
2	2092	4184	826	1652	58	116	1227	2454
3	693	2079	204	612	11	33	438	1314
4	386	1544	104	416	5	20	206	824
5	245	1225	51	255	1	5	115	575
6	126	756	34	204	-	-	71	426
7	77	539	13	91	-	-	43	301
8	49	392	9	72	-	-	31	248
9	39	351	8	72	-	-	21	189
10	24	240	4	40	-	-	9	90
11	24	264	6	66	-	-	13	143
12	23	276	2	24	-	-	8	96
13	9	117	1	13	-	-	6	78
14	10	140	-	-	1	14	2	28
15	9	135	1	15	-	-	4	60
16	3	48	-	-	-	-	1	16
17	6	102	1	17	-	-	5	85
18	4	72	-	-	-	-	3	54
19	7	133	-	-	-	-	-	-
20	4	80	-	-	-	-	2	40
21	1	21	1	21	-	-	1	21
22	2	44	-	-	-	-	3	66
23	1	23	-	-	-	-	1	23
24	4	96	-	-	-	-	3	72
25	2	50	-	-	-	-	-	-
26	1	26	-	-	-	-	2	52
28	3	84	-	-	-	-	2	56
31	-	-	-	-	-	-	1	31
32	3	96	-	-	-	-	-	-
33	1	33	-	-	-	-	1	33
36	1	36	-	-	-	-	-	-
37	1	37	-	-	-	-	-	-
42	1	42	-	-	-	-	-	-

It conclude from this analysis, all type of authors' categories were contributed in highest number in single time, followed by two times and three times and very less number of contributions in highest number of times. So less number of authors was contributing highest number of articles in the selected area of network security.

CONCLUSION

The following conclusions are drawn from the study.

- 8051 articles were produced by 25249 of authors during 2002 to 2011. Highest number of publications in the year of 2011.
- Multi-authored papers are maximum accounting the sample, 50064 TLCS and 219379 of times were CR by other researcher.
- After 2005, the research trend has been highest in collaborative trend.
- The DC value is 0.95 as a whole, so collaborative productivity is high.
- Less number of authors was contributing highest number of articles in the selected area of network security.

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