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Scientometric Study of Poultry Industry Research Publications: A Global Perspective

Jisha Antony[1], S. Raja[2] and P. Dhanya[3]
[1&3]Research Scholar, Department of Library and Information Science, [2]Assistant Librarian, Central Library
[1,2&3]Alagappa University, Karaikudi, Tamil Nadu, India
E-Mail: jishaputhenveettil@gmail.com, lisraja1979@gmail.com, dhanyalib05@gmail.com

Abstract **- This study analysis 'Publication output of Poultry industry' in the Scopus database during the period 2008 to 2017. The analysis revealed that the total4248 documents indexed in the database during the selectedperiod of study. The highest productive year is 2017 with 610 publications (14.36%) and the lowest is 2008 with 268 publications (6.31%). 77.87% of publications are scholarly articles. The most prolific author is S.C. Ricke. With 25(0.59%) papers followed by K. Dhama with 22 (0.52 %/) papers. The most productive country is the UnitedStateswith1071 publications. The famous Journal in this field is 'Poultry science' with 255 publications (6%) and the journals 'World S Poultry Science Journal' with 115 publications (2.71%) and 'Avian Diseases' with 113 publications (2.66%) occupies the second and third ranks respectively. From the institutional output, the United States Department of Agriculture, Washington DC dominates the other institutions with the output of 138 articles (3.25%). The poultry industry is a multidisciplinary subject and it includes articles with different areas and the main subject areas are found to be Agricultural and Biological Sciences having 2168 documents followed by Immunology and Microbiology with 988 documents. This study also analysis Annual Growth Rate, Relative growth rate, doubling time.**

Keywords: **Scientometric, Bibliometric, Citation, Poultry, Authorship pattern, Indexing, AGR- Annual Growth Rate, AAGR-Average Annual Growth Rate, RGR- Relative Growth Rate, Dt.-Doubling time**

I. INTRODUCTION

The poultry industry is one of the rapidly growing agricultural sub-sectors at the global level. This industry deals with farming of birds like ducks, chickens, geese and turkeys for the requirement of meat andegg. Among these chickens being the most numerous. Poultry makes a significant contribution to food and nutrition, by supplyingproteins, energy, and micro-nutrients to humanbeings with short production cycle and the ability to convert a wide range of wastesas well as Agri-foodby-products into meat and egg, which are consumable by humans. The global poultry industry is expected to continue to growsince it needs for meat and eggs areinfluenced by growing population and rising incomes. It is the most common animal food consumed at a global level. When its role in nutrition is identified, it also used a threat to human health, mainly for infectious diseases because of its role in antimicrobial resistance. So, scientists across the globe are doing a lot of research associated with poultry. In this context, this study evaluates the global scientific output of the poultry industry from the Scopus database during the period from 2008 to 2017.

II. REVIEW OF LITERATURE

Gupta, B. M., Ahmed, K. M., Gupta, R., and Tiwari, R. (2015) has been carried out world camel research: a scientometric assessment, 2003-2012.The objectives of the study were to analyze global research output, its growth, citation impact, international collaborative publication output of most productive countries etc. as indexed in the Scopus database. Baby, K., and Kumaravel, J. P. S. (2012) conducted a study on relative growth rate and priority index of the journal of clinical microbiology during 2006-2010. This study evaluates the month wise growth, subject-wise distribution, relative growth rate, doubling time, authorship pattern, the degree of collaboration, priority and specialization index etc. Singh, Manvendra Kumar (2017) examined the authorship pattern and collaboration coefficient of India in Biotechnology research during 2001-2016 based on Scopus database. Jeyasekar, J. John and Saravanan, P. (2015) were done Impact of collaboration on Indian forensic science research: a scientometric mapping from 1975 to 2012.The study focused to find out the degree of collaboration, collaborative index, collaborative coefficient, modified collaborative coefficient and affinity index, based on Scopus database. Vivekanandhan, S., Sivasamy, K., and A. L, Bathri Narayanan (2016) were examined pollution control research output in India from Scopus database: a Scientometric analysis between the years 2003 to 2014.This analysis mainly covered year wise growth of literature, international collaborative papers, top 15 authors, and publication efficiency index.

III. OBJECTIVES OF THE STUDY

1. To study global publication growth from 2008 to 2017 in the field of Poultry industry as indexed in the Scopus database and to measure its Annual growth rate
2. To find out Relative growth rate and Doubling time of publications
3. To analyze different types/forms of publication
4. To identify prolific authors based on a number of papers published.
5. To analyze the authorship pattern of publications.
6. To examine geographical distribution of the publication.

7. To identify the top journals publishing on the Poultry industry.
8. To analyze different subject areas of this field.
9. To understand the language distribution of publications.
10. To study the publication productivity of leading institutions.

IV. METHODOLOGY

A total 4248 publications output of Poultry industry research publications from the period 2008 to 2017 were selected from the Scopus online database and exported to CSV excel file. Exported data sorted out and tabulated in MS-Excel. Relevant statistical tools were used for measuring and analyzing the downloaded data.

V. ANALYSIS AND RESULTS

A. Global publication growth and Annual Growth rate during 2008-2017

Total 4248 papers were published during the period of 2008 to 2017. From the table, it is found that the number of publications increased year by year, but some decrease in growth is found in the years 2013 and 2015.

TABLE I GLOBAL PUBLICATION GROWTH AND ANNUAL GROWTH RATE DURING 2008-2017

S. No.	Year	No. of Documents	Percentage	Annual Growth Rate (%)	AAGR
1	2008	268	6.31	----	
2	2009	317	7.46	18.28	
3	2010	341	8.03	7.57	
4	2011	343	8.07	0.59	
5	2012	430	10.12	25.36	
6	2013	395	9.30	-8.14	10.30%
7	2014	495	11.65	25.32	
8	2015	468	11.02	-5.45	
9	2016	581	13.68	24.15	
10	2017	610	14.36	4.99	
	Total	4248	100	92.66	

Most numbers of papers are published in the year 2017 with 14.36% and the least number of publications are found in the year 2008 with 6.31%. But the annual growth rate is found to be highest in the years 2012 and 2014 with 25.36% and 25.32% respectively. It is interesting to notice that the annual growth rate is found to be only 4.99% in the highest productive year 2017. Average annual growth rate during the period is 10.3%.The decrease in growth can be seen in the years 2013 and 2015.

B. Relative Growth Rate and Doubling Time

The relative growth rate is the increase in the number of publications per unit time.

Relative growth rate R can be calculated from the formula suggested by Mahapatra (1985);

$$R = \frac{W2 - W1}{T2 - T1}$$

Where R = Mean relative growth rate of the specific period of the interval;
W 1 = ln w2 (Natural logarithm of the initial number of publications);
W 2 = ln w1 (Natural logarithm of the final number of publications);
T1 = Initial time
T2 = Final time

Doubling time is the time required to double the number of poultry industry research publication. If the number of publications of this field doubles during a given period, then the difference between the logarithm of the numbers at the beginning and at the end of the period must be the natural logarithms of the number 2, i.e., 0.693. Thus, corresponding doubling time for a specific period of the interval can be calculated from the formula,

$$\text{Doubling time, (Dt)} = \frac{0.693}{R}$$

Where R is the Relative growth rate per unit of publications per unit of time.

Here, from Table II one year is taken as the unit of time.RGR is highest in the year 2009with the value 0.781and it is found to be gradually decreasing throughout the next couple of years and reached the value0.155 in the year 2017.However, it can see fluctuations in the years 2014 and 2016. The meanRGR of Poultry industry publications is found to be 0.31.Whilethe relative growth rate decreased the time required to double the publication is found to be increased and it is detected that doubling time is lowest in the year 2009 with the value 0.89 and in the subsequent years it is increased and reached highest in the year 2017 with the value 4.47.Similar to the relative growth rate here also can see variations in the years 2014 and 2016. The whole study period records themean doubling time value of 2.91.

TABLE II RELATIVE GROWTH RATE AND DOUBLING TIME

S. No.	Year	Number of documents	Cumulative no. of Publications	W1	W2	RGR	Dt.=$\frac{0.693}{R}$
1	2008	268		-----	5.591	-----	------
2	2009	317	585	5.591	6.372	0.781	0.888
3	2010	341	926	6.372	6.831	0.459	1.509
4	2011	343	1269	6.831	7.146	0.315	2.199
5	2012	430	1699	7.146	7.438	0.292	2.375
6	2013	395	2094	7.438	7.647	0.209	3.315
7	2014	495	2589	7.647	7.859	0.212	3.266
8	2015	468	3057	7.859	8.025	0.166	4.171
9	2016	581	3638	8.025	8.199	0.174	3.983
10	2017	610	4248	8.199	8.354	0.155	4.471
	Total	4248				2.763	26.176
					Mean	0.307	2.908
						≈0.31	≈ 2.91

C. Forms of Publications

The different types of publications of poultry industry research documents are tabulated in the table.

TABLE III FORMS OF PUBLICATIONS

S. No.	Document Type	No. of documents	%
1	Journal Article	3308	77.87
2	Review	435	10.24
3	Book Chapter	202	4.76
4	Conference Paper	181	4.26
5	Book	47	1.11
6	Note	33	0.78
7	Letter	15	0.35
8	Short Survey	9	0.21
9	Editorial	8	0.19
10	Article in Press	5	0.12
11	Conference Review	4	0.09
12	Retracted	1	0.02
		4248	100

In a total of 4248 publications 3308 (77.87%) are journal article and it is the most preferred form of publication by the poultry industry researchers in the selected study period and the other forms of publications are 435 reviews; 202 book chapter; 181 conference papers; 47 books; 33 notes; 15 Letters; 9 short stories; 8 editorials; 5 articles in press; 4 conference reviews; and 1 retracted.

D. Prolific Authors

The study revealed that Ricke, S.C is the most prolific author in this field with 25 papers (0.59%) followed by Dhama, K. with 22 papers (0.52 %/). Based on the number of publications, indexed in the Scopus database the top 16 productive authors are listed below.

TABLE IV PROLIFIC AUTHORS

S. No.	Author Name	No. of articles	%
1	Ricke, S.C.	25	0.59
2	Dhama, K.	22	0.52
3	Liu, X.	21	0.49
4	Ding, C.	18	0.42
5	Quandt, S.A.	17	0.40
6	Arcury, T.A.	16	0.38
7	Yu, S.	16	0.38
8	Lillehoj, H.S.	14	0.33
9	Gao, Y.	13	0.31
10	Grzywacz, J.G.	12	0.28
11	Hafez, H.M.	12	0.28
12	Moore, R.J.	12	0.28
13	Mora, D.C.	12	0.28
14	Owens, C.M.	12	0.28
15	Qi, X.	12	0.28
16	Wang, X.	12	0.28

E. Authorship Pattern

Single authorship pattern of this subjectis only 2.13 %,but they published 10.12%of total number of articles. It is observed that author participation is highest for ten authorship patterns with 13.75 % but they contributed only 6.52% of articles.

In terms of article output, three authorship patterns dominate the other authorship patterns with 14.45% of the total article and 9.15 % of author participation.

TABLE V AUTHORSHIP PATTERN

S. No.	Number of authors	Number of Articles	Total Number of Authors	Percentage of articles	Percentage of authors
1	Single	430	430	10.12	2.13
2	Two	567	1134	13.35	5.63
3	Three	614	1842	14.45	9.15
4	Four	602	2408	14.17	11.96
5	Five	524	2620	12.34	13.01
6	Six	459	2754	10.81	13.67
7	Seven	319	2233	7.51	11.09
8	Eight	242	1936	5.70	9.61
9	Nine	164	1476	3.86	7.33
10	Ten	277	2770	6.52	13.75
11	Eleven & +	49	539	1.15	2.68
12	Without author	1	0	0.02	0.00
	Total	4248	20142	100	100

F. Geographical Distribution of Publications

USA is the most productive country with 1071 publications followed by China 632and Brazil 311. India occupies the fifth rank with 264publications at the highest international level. The top 15 countries that produced the number of 2017are listed in the following table.

TABLE VI GEOGRAPHICAL DISTRIBUTION OF PUBLICATIONS

S. No.	Country/Territory	No. of documents
1	United States	1071
2	China	632
3	Brazil	311
4	United Kingdom	268
5	India	264
6	Canada	191
7	Australia	169
8	Iran	158
9	Germany	122
10	South Korea	115
11	Egypt	105
12	Italy	103
13	Pakistan	101
14	France	92
15	Netherlands	90

G. Most Productive Journals

Most productive journal in this subject is Poultry Science with 255(6%) articles followed by World Poultry science Journal with 115 articles (2.71%) and Avian Diseases with 113 articles (2.66%).

TABLE VII MOST PRODUCTIVE JOURNALS

S. No.	Source Title/Journal Title	No. of documents	%
1	Poultry Science	255	6.00
2	World S Poultry Science Journal	115	2.71
3	Avian Diseases	113	2.66
4	Plos One	100	2.35
5	Journal of Applied Poultry Research	80	1.88
6	Avian Pathology	58	1.37
7	Veterinary Microbiology	58	1.37
8	International Journal of Poultry Science	55	1.29
9	Journal of The Science of Food and Agriculture	49	1.15
10	Vaccine	38	0.89
11	Archives of Virology	31	0.73
12	Foodborne Pathogens and Disease	31	0.73
13	RevistaBrasileira De CienciaAvicola	31	0.73
14	Journal of Food Protection	29	0.68
15	Virology Journal	28	0.66

VI. SUBJECT AREAS OF POULTRY INDUSTRY RESEARCH PUBLICATIONS

Poultry Industry is a multidisciplinary subject. It covers 27 subject areas during the study period. The main subject area in this field is Agricultural and Biological Sciences with 2168 papers followed by Immunology and Microbiology with 988 papers; veterinary with 887 papers; Medicine- 772 papers; Biochemistry, Genetics and molecular biology -711 papers; Environmental science-435 papers; Engineering-301papers; Chemistry- 160 papers; Pharmacology,

Toxicology and Pharmaceutics-149 papers; Chemical engineering-142 papers. These top10 subject wise shares are illustrated in the diagram.

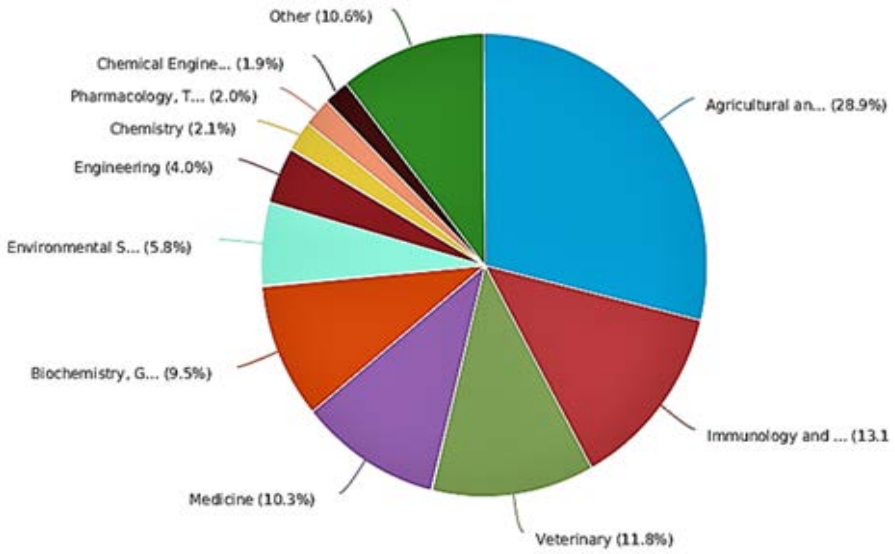

Fig. 1 Subject Wise Shares

A. Language Distribution

The study revealed that the most preferred language of publication of the Poultry Industry is English. Of the total, 4005 papers are published in this language. Some papers are published in more than one language. Language distribution in this field of publication during the analysis period is depicted below.

TABLE VIII LANGUAGE DISTRIBUTION

Language	No. of documents	Language	No. of documents
English	4005	Hungarian	4
Portuguese	78	Italian	3
Chinese	64	Korean	3
Spanish	43	Croatian	2
German	23	Serbian	2
French	18	Czech	1
Persian	11	Danish	1
Russian	9	Japanese	1
Polish	8	Malaya	1
Turkish	5	Slovak	1

B. Most Productive Institutions

Most 10 productive institutions which produce the greatest number of research output in the area of the Poultry industry are demonstrated in the table below. It is found that Scientists of United States Department of Agriculture, Washington D.C. provided highest research output of 138 (3.25%) publications, followed by Chinese Academy of Agricultural Sciences with 96 articles (2.26%).

TABLE IX PRODUCTIVE INSTITUTIONS

S. No.	Affiliation	No. of documents	%
1	United States Department of Agriculture, Washington DC	138	3.25
2	Chinese Academy of Agricultural Sciences	96	2.26
3	University of Arkansas - Fayetteville	86	2.02
4	China Agricultural University	77	1.81
5	Ministry of Agriculture of the People's Republic of China	75	1.77
6	The University of Georgia	69	1.62
7	Iowa State University	57	1.34
8	Universidade de Sao Paulo - USP	55	1.29
9	University of Guelph	55	1.29
10	Yangzhou University	53	1.25

VII. CONCLUSION

Major findings of the study in the field of poultry industryduring the period 2008 to 2017 is that the highest productive year is 2017 with 610 publications; Annual growth rate is found to be highest in the year 2012 (25.36%); Mean RGR is 0.31 and means doubling time is 2.91. A most preferred form of publication selected by the researchers of this area is Journal article (77.87%) and the leading journal is Poultry Science. The most prolific author is Rick, S, C. The Uppermost inventive institution is found to be United States Department of Agriculture, Washington DC with 138 publications. English is a prominent medium of communication. The USA is found to be the most productive country. Analysis revealed that multi-authored papers dominate single authored paper and an average

degree of collaboration is 0.89 during the study period. Three authorship patterns dominate the other authorship patterns. The significant subject area in this field is Agriculture and biological sciences.

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