

Growth and Impact of Research Output in the Field of Livestock (1999-2010): A Case Study

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Abstract - This study describes the growth, contribution and impact of research carried out by the scientists in the field of Livestock during the period 1999-2010. The study indicates the growth of literature, pattern of authorship, Indian collaboration with other countries, share of major collaborative partner countries and contribution of various subject fields, etc. It studies the extent of concentration and scattering of their research output in different journals and describes the share and characteristics of select highly cited papers and the top productive authors. Web of Science database has been used to retrieve the data on publication output in Livestock for the study period.

Keywords: Bibliometric Study, Livestock, Research Output

I. INTRODUCTION

Livestock is a domestic animal such as cattle or horse, raised for home use or for profit, especially on a farm [1]. Livestock sector plays a critical role in the welfare of India's rural population. It contributes 9% to Gross Domestic Product and employs 8% of the labour force. This sector is emerging as an important growth leverage of the Indian economy. As a component of agricultural sector, its share in gross domestic product has been rising gradually, while that of crop sector has been on the decline. In recent years, livestock output has grown at a rate of about 5% a year, higher than the growth in agricultural sector. This enterprise provides a flow of essential food products, draught power, manure, employment, income, and export earnings. Distribution of livestock wealth is more egalitarian, compared to land. Hence, from the equity and livelihood perspective it is considered an important component in poverty alleviation programmes [2].

Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature. Researchers may use bibliometric methods of evaluation to determine the influence of a single writer, for example, or to describe the relationship between two or more writers or works. One common way of conducting bibliometric research is to use the Social Science Citation Index, the Science Citation Index or the Arts and Humanities Citation Index to trace citations [3].

M. Amudha and C. Muthusamy studied the Scientometric Evaluation of Research Output on Computer Communication [4]. A.Senthamilselvi and R. Srinivasa Ragavan studies the scientometric analysis on Power Electronics. Among the various publishers the IEEE placed in the top list with large number of publications [5].

II. OBJECTIVES OF THE STUDY

Some of the objectives of the study are:

- To study the distribution of papers published year-wise;
- To study the top 10 countries in Livestock publications;
- To study the language-wise distribution of publications;
- To study the bibliographic form;
- To study the authorship pattern;
- To study the relative growth rate and doubling time;
- To study the top 10 Indian Institutions;
- To study the top 10 Journals of the Indian's contribution;

III. METHODOLOGY

This study was based on the Indian publication data in Livestock, retrieved from the Web of Knowledge database for 12 years (1999-2010). The research output of other countries had been retrieved for the study.

ISI Web of Knowledge is an academic citation indexing and search service, which is combined with web linking and provided by Thomson Reuters. Thomson Reuters Web of Knowledge is a research platform that gives access to objective content and powerful tools to search, track, measure and collaborate in the sciences, social sciences, arts, and humanities. This intelligent research platform provides access to the world's leading citation databases, including powerful cited reference searching, and over 100 years of comprehensive back file and citation data. The database includes Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI).

IV. RESULTS AND DISCUSSION

The year 2010 has recorded highest number of publications (13.69%) followed by 13.15% in 2009. The lowest numbers of publications (4.77%) are in 2000.

Table II shows the country-wise distribution of the articles and reveals that 29.44% of the total articles were contributed by the authors from USA, followed by England (9.38%), Australia (6.90%) and Germany (5.94%) respectively. Only 4.15% of articles are contributed by authors in India and ranked 7th among top 10 countries.

TABLE I YEAR-WISE DISTRIBUTION OF PUBLICATIONS

S.No.	Year	No. of Publications	%	Cumulative	Cumulative %
1	1999	728	5.05	728	5.05
2	2000	688	4.77	1416	9.82
3	2001	782	5.43	2198	15.25
4	2002	824	5.72	3022	20.97
5	2003	1006	6.98	4028	27.95
6	2004	977	6.78	5005	34.72
7	2005	1175	8.15	6180	42.87
8	2006	1247	8.65	7427	51.53
9	2007	1475	10.23	8902	61.76
10	2008	1643	11.40	10545	73.16
11	2009	1896	13.15	12441	86.31
12	2010	1973	13.69	14414	100.00
Total		14414	100.00		

TABLE II COUNTRY-WISE DISTRIBUTION OF PUBLICATIONS

Sl.No.	Countries	No. of Publications	%	Cumulative	Cumulative %
1	USA	4243	29.43	4243	29.43
2	England	1352	9.37	5595	38.81
3	Australia	995	6.90	6590	45.71
4	Germany	856	5.93	7446	51.65
5	Canada	776	5.38	8222	57.04
6	France	708	4.91	8930	61.95
7	India	598	4.14	9528	66.10
8	Scotland	553	3.83	10081	69.93
9	Spain	546	3.78	10627	73.72
10	Netherland	524	3.63	11151	77.36
11	Others	3263	22.63	14414	100
Total		14414	100		

It can be seen from Table III that maximum number of articles are published in English language (94.46%) For non-English language articles the title is given in both original

language and in English. The other language in which papers has been indexed was German (1.35%), French(1.33%), etc. It is interesting to note that the scientific communication in the field of livestock is mainly in English Language.

TABLE III LANGUAGE-WISE DISTRIBUTION OF PUBLICATIONS

Sl. No.	Language	No. of Publications	%	Cumulative	Cumulative %
1	ENGLISH	13615	94.46	13615	94.46
2	GERMAN	195	1.35	13810	95.81
3	FRENCH	192	1.33	14002	97.14
4	PORTUGUESE	132	0.92	14134	98.06
5	UNSPECIFIED	99	0.69	14233	98.74
6	SPANISH	82	0.57	14315	99.31
7	JAPANESE	25	0.17	14340	99.49
8	DUTCH	14	0.10	14354	99.58
9	HUNGARIAN	11	0.08	14365	99.66
10	POLISH	9	0.06	14374	99.72
11	ITALIAN	8	0.06	14382	99.78
12	KOREAN	8	0.06	14390	99.83
13	TURKISH	7	0.05	14397	99.88
14	CROATIAN	4	0.03	14401	99.91
15	RUSSIAN	4	0.03	14405	99.94
16	CZECH	3	0.02	14408	99.96
17	CHINESE	2	0.01	14410	99.97
18	LITHUANIAN	2	0.01	14412	99.99
19	ESTONIAN	1	0.01	14413	99.99
20	SLOVAK	1	0.01	14414	100
Total		14414	100		

Table IV shows that maximum number of publications are articles (79.27%). This is followed by proceedings paper (1310) and review (1100).

TABLE IV BIBLIOGRAPHIC FORM OF PUBLICATIONS

Sl. No.	Bibliographic Form	No. of Publications	%
1	Article	11426	79.27
2	Proceedings Paper	1310	9.09
3	Review	1100	7.63
4	Meeting Abstract	157	1.09
5	News Item	140	0.97
6	Editorial Material	137	0.95
7	Book Review	60	0.42
8	Letter	37	0.26
9	Book Chapter	27	0.19
10	Correction	17	0.12
11	Reprint	3	0.02
Total		14414	100

Data was analyzed to determine authoring pattern which indicates the distribution of single as well as multiple authored publications.

The extent of collaboration in research can be measured with the help of multi authored papers using the formula given by Subramanyam (1982).

$$\text{Degree of collaboration } C = Nm/Nm+Ns$$

C = Degree of collaboration

Nm = Number of Multiple authors

Ns = Number of Single authors

TABLE V YEAR-WISE AUTHORSHIP PATTERN AND DEGREE OF COLLABORATION

Year	Single Author	Two Authors	Three Authors	Four Authors	Five Authors	More than Five Authors	Total	DC
1999	181	177	132	94	69	75	728	0.75
2000	167	136	144	111	49	81	688	0.76
2001	151	194	137	118	67	115	782	0.81
2002	154	169	163	132	88	118	824	0.81
2003	183	211	218	149	89	156	1006	0.82
2004	183	177	218	145	90	164	977	0.81
2005	178	244	244	196	128	185	1175	0.85
2006	189	212	244	218	132	252	1247	0.85
2007	160	266	301	278	170	300	1475	0.89
2008	160	286	319	293	222	363	1643	0.90
2009	209	317	345	325	213	487	1896	0.89
2010	205	279	364	326	257	542	1973	0.90
Total	2121	2670	2832	2389	1579	2838	14414	0.85

Table V shows that out of 14,414 publications, 2,121 publications are contributed by single authors and 12,293 publications are by joint authors such as two, three, and four and above. The authorship pattern clearly shows that most of the papers are the product of collaborative research and shows the increase in degree of collaboration from the year 1999 to the year 2010. This shows the importance of the collaborative research.

The degree of collaboration in the field of livestock of the top 10 countries have been computed and presented in Table VI as a whole is 0.85. For Spain, Netherland it shows high i.e. 0.95 and 0.94 respectively. In India and Scotland it is 0.92 followed by Canada and France shows 0.91.

The Relative Growth Rate (RGR) is the increase in number of articles / pages per unit of time. This definition is derived from the definition of relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany, which in turn, had its origin from the study

of the rate of interest in the financial investment. The mean Relative Growth Rate (R) over the specific period of interval can be calculated from the following equation.

$$1 - 2^{-R} = \frac{\text{Log}_{e2}W - \text{Log}_{e1}W}{2^T - 1^T}$$

A. Doubling Time (Dt)

There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles/pages of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula:

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

TABLE VI COUNTRY-WISE AUTHORSHIP PATTERN AND DEGREE OF COLLABORATION

Country	Single Author	Two Authors	Three Authors	Four Authors	Five Authors	More than Five Authors	Total	DC
USA	591	854	840	665	469	821	4240	0.86
England	170	204	241	189	152	391	1347	0.87
Australia	133	178	205	180	104	190	990	0.87
Germany	126	139	150	134	93	214	856	0.85
Canada	72	122	160	147	99	171	771	0.91
France	65	89	104	133	86	228	705	0.91
India	50	126	154	122	52	90	594	0.92
Scotland	42	75	87	86	76	183	549	0.92
Spain	27	60	87	93	84	191	542	0.95
Netherland	29	78	97	111	66	139	520	0.94
Others	816	745	707	529	298	220	3300	0.75
Total	2121	2670	2832	2389	1579	2838	14414	0.85

TABLE VII RELATIVE GROWTH RATE AND DOUBLING TIME

Year	No. of Publications	Cumulative	W1	W2	RGR	Doubling Time
1999	728	728	0	6.5903	6.5903	0.1052
2000	688	1416	6.5903	7.2556	0.6653	1.0417
2001	782	2198	7.2556	7.6953	0.4397	1.5760
2002	824	3022	7.6953	8.0137	0.3184	2.1767
2003	1006	4028	8.0137	8.3010	0.2874	2.4117
2004	977	5005	8.3010	8.5182	0.2172	3.1911
2005	1175	6180	8.5182	8.7291	0.2109	3.2862
2006	1247	7427	8.7291	8.9129	0.1838	3.7703
2007	1475	8902	8.9129	9.0940	0.1812	3.8255
2008	1643	10545	9.0940	9.2634	0.1694	4.0915
2009	1896	12441	9.2634	9.4288	0.1653	4.1912
2010	1973	14414	9.4288	9.5760	0.1472	4.7078
Total	14414					

The top 10 Indian institution's based on number of publications are show in Table VIII. Indian Veterinary Research Institute holds the first position followed by Wildlife Institute, India. Based on citations and average citations National Conservation Foundation holds the first position.

It is observed from the Table IX that the number of publications of Indian contributions are in the Indian Journal of Animal Sciences and the impact of the journal "Field Crops Research" is high based on the citations.

V. CONCLUSION

In the field of Livestock in general, collaboration in authorship pattern is prevalent. In the present study on Livestock, literature was drawn from Web of Knowledge database and it was found that maximum number of records is covered. The percentage of year-wise coverage of the literature output in the field of Livestock shows a gradual increase although there are fluctuations. The degree of research collaboration on average comes to 0.85.

TABLE VIII TOP TEN INDIAN INSTITUTIONS

Sl. No.	Institutions	No. of Publications	No. of Citations	Average Citations
1	Indian Veterinary Research Institute	65	210	3.23
2	Wildlife Institute of India	23	231	10.04
3	National Conservation Foundation	22	273	12.41
4	National Dairy Research Institute	22	45	2.05
5	Indian Grassland And Fodder Research Institute	16	3	0.19
6	Govind Ballabh Pant University of Agriculture and Technology	15	19	1.27
7	GB Pant Institute of Himalayan Environment Development	14	136	9.71
8	Central Institute for Research on Goats	13	23	1.77
9	National Bureau of Animal Genetic Resources	13	23	1.77
10	The National Institute of Animal Nutrition and Physiology	12	32	2.67

TABLE IX TOP TEN INDIAN JOURNALS

S.No.	Name of the Journal	No. of Publications	No. of Citations	Average Citation
1	Indian Journal of Animal Sciences	119	108	0.91
2	Indian Veterinary Journal	60	19	0.32
3	Current Science	16	61	3.81
4	Asian Australasian Journal of Animal Sciences	13	74	5.69
5	Indian Journal of Traditional Knowledge	13	9	0.69
6	Range Management and Agro Forestry	12	2	0.17
7	Animal Nutrition and Feed Technology	9	11	1.22
8	Field Crops Research	8	79	9.88
9	Oryx	8	38	4.75
10	Tropical Animal Health and Production	7	11	1.57

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