

Bio-Bibliometrics Analysis of Literature Output of Prof. M. Lakshmanan in the Subject of Nonlinear Dynamics

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ABSTRACT

The present study explores a bio-bibliometric analysis of the publication productivity, authorship pattern, and channels of communication and journal preference of Professor M. Lakshmanan in the field of nonlinear dynamics in the Bharathidasan University, Trichirapalli, India from 1972 to 2011 as per the Scopus Database. During this period M. Lakshmanan has published 225 research articles in various channels of communications. The year 2009 has been the most productive year in his research career wherein he has published 20 research articles. His articles have been scattered in 46 high impact factor scientific journals. Collaboration coefficient is between 0.9 and 1.0. Journal of Mathematical Physics has been the most preferred journal for publishing his research findings (26 research articles).

KEYWORDS: Bio-bibliometrics, Channels of communication, Authorship pattern, Collaboration coefficient, Authorship status

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INTRODUCTION

A Bio-Bibliometrics study deals with the bibliographical study of the individual careers of scientists and researchers and correlates the bibliographical analysis of publications with their academic / scientific achievements. Scientific publications seem to have provided the best available basis for measuring the outputs of individual scientists as there is a good correlation between the eminence of scientists and their sustained scholarly publications. Individuals are the source of ideas. The institutions are built by individuals and grow around individuals. Individuals are the basic foundations of any institution.

‘Bio-Bibliometrics’ is a term that was first coined by Sen and Gan (1990) to mean as the quantitative and analytical method for discovering and establishing functional relationships between bio-data and biblio-data elements. Recently the term ‘Bio-Bibliometrics’ is being used for method of retrieving and visualizing biological information that uses co-occurrence of gene naming terms in Medical Sciences to generate semantic links between genes (Stapley and Benoit, n.d). Therefore, it is suggested that ‘Scientometric portrait’ is the appropriate phrase for studies on scientists, and ‘Informetric portrait’ for studies on researchers in other disciplines such as arts, humanities, and social sciences. In scientometric studies, much attention is given to the accomplishments of the scientific researcher in terms of qualitative and quantitative count of his

published works whether it is books, chapter in books, conference papers, journal articles or other documents. The present study has been undertaken to illustrate the achievements of M. Lakshmanan through bibliographical analysis of his research contributions

REVIEW OF RELATED LITERATURE

Kademani, Balakrishnan and Kalyane (1994) presented a detailed scientometric analysis of the publication output of Indian nuclear physicist, P. K. Iyengar by year, research domain, and collaboration pattern, channel of communication used and frequency of keywords. It was found that the period 1972-1976 when Iyengar was 41-45 years of age, was his most productive period with the highest publication activity. Kademani and Kalyane in 1996 analyzed 164 papers by R. Chidambaram, a nuclear physicist, published during 1958-1993 to identify highly cited papers as per *Science Citation Index*. The results indicate that self-assessment by a scientist about the significance of his papers may not always tally with the world opinion. Scientometric analysis has been carried out on Nobel Laureates Leland H. Hartwell, a renowned molecular biologist (Angadi et al 2004); Scientometric studies has also been carried out on eminent personalities such as Peter John Wyllie, a renowned physicist (Sangam et al 2006) and Nayana Nanda Borthakur, a renowned bio meteorologist (Tilak, Dipak and Sen 2010).

BIOGRAPHICAL SKETCH OF PROF. M. LAKSHMANAN

Prof. M. Lakshmanan earned his B.Sc from NGM College, Pollachi and M.Sc from Madras Christian College. He carried out his doctoral research in nonlinear dynamics at the Department of Theoretical Physics, University of Madras (1970-74) under the supervision of PM Mathews. He then spent a year at the University of Tuebingen, as an Alexander von Humboldt Foundation postdoctoral Fellow and another year at Eindhoven University. He was a Royal Society Nuffield Foundation Fellow at University of Manchester, Institute of Science and Technology (1979-80); Visiting Guest Scientist, University of Uppasala (1981); and JSPS Fellow at Kyoto University (1984-85). He has also held several short-term Visiting positions in many countries from time to time. Lakshmanan joined the Department of Physics, Bharathidasan University (then Autonomous Postgraduate Centre of University of Madras), Tiruchirapalli (1978) as a Reader. He became Professor (1984) and served as Head of the Department of Physics (1992-2006), when he was made Professor of Eminence.

Academic and Research Achievements: Lakshmanan has intensive research activities in nonlinear dynamics and theoretical physics including the fields of solitons, integrable systems, bifurcations and chaos and their applications. His identification of magnetic solitons in ferromagnetic systems, invention of the simplest dissipative chaotic circuit along with Murali and Chua (MLC circuit) and his demonstration on the energy sharing collision of optical solitons in multimode fibres, and many other novel results have enriched the subject and made a mark in the field. A thriving school of young research workers under his leadership started working on different areas of non-linear dynamics. He has published more than 300 research articles and

wrote/edited several books on non-linear dynamics. He has mentored 25 Ph.Ds and many M.Phil and M.Sc students.

Other Contributions: Lakshmanan initiated the Centre for Nonlinear Dynamics at Bharathidasan University and was its Head (1990-2006), which was instrumental in enhancing the nonlinear dynamics activities not only in the University but also at the national level. He served as an INSA Council Member (2005-07). He has also served/is serving as a Member of the Editorial Boards of several prestigious journals, such as *Proceedings of Royal Society of London A*, *International Journal of Bifurcation and Chaos*, *Chaos Solitons and Fractals*, *Journal of Nonlinear Mathematical Physics*, and *Advances in Mathematical Physics*.

Awards and Honours: Lakshmanan received SS Bhatnagar Prize (1989), Hari Om Trust Meghnad Saha Award of UGC (1990), Tamil Nadu Scientists Award (1994), N Biren Roy Memorial Lecture Award of INSA (1998), Goyal Prize (2005), VV Narlikar Memorial Lecture Award of INSA (2006), Raja Ramanna Fellowship of DAE (2006), DST Ramanna Fellowship (2007) and AC Banerjee Lecture Award by NASI (2007). He is a Fellow of the Indian Academy of Sciences, Bangalore and National Academy of Sciences (India), Allahabad and is an elected Foreign Member of Royal Academy of Sciences, Uppasala, Sweden.

OBJECTIVES AND METHODS

Prof. M. Lakshmanan has been taken as a case study for the present scientometric analysis. Data is collected from the Scopus Database and his bibliographical sketch from Google Web Browser. The study highlights M. Lakshmanan's

- Year wise publications and productivity
- Use of channels of communication
- Authorship pattern and collaboration coefficient
- Authorship status
- Prominent collaboration
- Most prolific journals

Table 1. Year wise distribution of research papers

Publication Year	No. of Records	Publication Year	No. of Records
1972	1	1992	8
1973	3	1993	7
1974	1	1994	8
1975	4	1995	5
1976	1	1996	4
1977	3	1997	14
1978	4	1998	6

1979	6	1999	6
1980	6	2000	3
1981	6	2001	8
1982	4	2002	2
1983	5	2003	4
1984	3	2004	5
1985	5	2005	15
1986	7	2006	9
1987	3	2007	9
1988	3	2008	7
1989	3	2009	20
1990	7	2010	6
1991	3	2011	1

Publication and Productivity

Prof. M. Lakshmanan has published 225 research articles during 1972 -2011 in the following domains: Physics and Astronomy, Mathematics, Multidisciplinary, Engineering, Chemistry, Agricultural and Biological Sciences, Materials Science, Medicine, Biochemistry, Genetics and Molecular Biology, Computer Science, Decision Sciences, Immunology and Microbiology. Table 1 provides information about the number of papers published each year in chronological period. He made contributions throughout his life; His highest productivity was in 2009 with an output of 20 publications, followed by 15 in 2005.

Table 2. Distribution of Lakshmanan's publications in different types of communication channels

Block Period	Document Type						Total	PA
	A	E	L	R	C	N		
1972-1976	9		1				10	1-5
1977-1981	20	2	2	1			25	6-10
1982-1986	19	3	1			1	24	11-15
1987-1991	15		1	3			19	16-20
1992-1996	32						32	21-25
1997-2001	36			1			37	26-30
2002-2006	29	1	1		3	1	35	31-35
2007-2011	42	1					43	36-40
Total	202	7	6	5	3	2	225	
%	89.78	3.11	2.67	2.22	1.33	0.89	100.00	

A = Article, E = Erratum, L = Letter, R = Review,
C = Conference paper, N = Note, PA = Productive Age

Channels of Communication

Table 2 reveals the distribution of publications according to various channels of communication. The most popular avenue of communication is the Journal article, Erratum etc. Prof. M. Lakshmanan presented a total of 209 papers in various scholarly journal articles. This makes up 78.78% of the total publication productivity followed by Erratum (7, 3.01%), Letter (6, 2.67%), Review (5, 2.22%), Conference paper (3, 1.33%) and Note (2, 0.89%). One interesting finding is that journal article is the most preferred channel of communication of M. Lakshmanan and his productive age also mentioned in the table.

Table 3. Authorship pattern and collaborative coefficient

Block period	Single and multi-authored papers					TP	MP	CC	AA
	1	2	3	4	5				
1972-1976	3	6	1			10	7	0.97	30
1977-1981	6	13	6			25	19	0.94	35
1982-1986		21	2	1		24	24	0.95	40
1987-1991	1	15	3			19	18	0.96	45
1992-1996		20	8	3	1	32	32	0.94	50
1997-2001	2	18	12	5		37	35	0.93	55
2002-2006	1	10	13	10	1	35	34	0.94	60
2007-2011	1	7	23	9	3	43	42	0.93	65
Total	14	110	68	28	5	225	211	0.56	
%	6.22	48.89	30.22	12.44	2.22	100.00			

MP = Total of multi-authored publications;

TP = Total Publications;

AA = Biological Age of the Author;

CC = Collaborative Coefficient

Table 3 presents M. Lakshmanan's publication productivity in chronological order from 1972 to 2011. Based on his 225 published articles, further evaluations were made to know the percentage of articles he published in an individual capacity and in collaboration. It was found that 14 articles (6.22%) were contributed in his individual capacity, 110 articles (48.89%) with one joint author, and 68(30.22%) with two joint authors, 28 articles (12.44%) with three joint authors and 5 articles (2.22%) with four joint authors. Thus, nearly 93.78 per cent of his contributions were of the collaborative nature. This analysis reveals that collaborative research predominated Prof. M. Lakshmanan contributions. The overall collaboration coefficient is 0.56.

Table 4. Authorship status of M.Lakshmanan

Publications	Position of M. Lakshmanan					Grand Total
	1	2	3	4	5	
Single authored	14					14
Two-authored	32	78				110
Three-authored	6	13	49			68
Four-authored	1	5	6	16		28
Five-authored	1		1	2	1	5
Total	54	96	56	18	1	225
%	24.0	42.7	24.9	8.0	0.4	100.0

Table 4 shows M. Lakshmanan's position in the byline of authors in all his papers. Out of 225 papers, he was the primary author in 54(24%) papers, second in 96(42.7%) papers, third in 56(24.9%) papers, fourth in 18(8.0%) papers and fifth in only one paper (0.4%). Out of 211 collaborative papers, Lakshmanan was secondary author.

Table 5. Contribution of Prof. M. Lakshmanan with other authors

Sl. No.	Author	No. of Author ships	%
1	Lakshmanan.M.	225	100.0
2	SenthilVelan.M.	26	11.6
3	Chandrasekar.V.K.	22	9.8
4	Senthilkumar.D.V.	17	7.6
5	Murali.K.	14	6.2
6	Radha.R.	14	6.2
7	Daniel.M.	13	5.8
8	Kanna.T.	11	4.9
9	Kaliappan.P.	10	4.4
10	Tamizhmani.K.M.	10	4.4
11	Muruganandam.P.	9	4.0
12	Sahadevan.R.	9	4.0
13	Venkatesan.A.	9	4.0
14	Kurths.J.	8	3.6
15	Porsezian.K.	8	3.6
16	Radhakrishnan.R.	8	3.6
17	Rajasekar.S.	8	3.6

18	Nakamura.K.	7	3.1
19	Thamilmaran.K.	7	3.1
20	Palaniyandi.P.	6	2.7
21	Parthasarathy.S.	6	2.7
22	Sheeba.J.H.	6	2.7
23	Vijayalakshmi.S.	5	2.2
24	Froman.P.O.	4	1.8
25	Ganesan.K.	4	1.8
26	Kumar.C.S.	4	1.8
27	Muruges.S.	4	1.8
28	Pandey.S.N.	4	1.8
29	Ponnuswamy.P.K.	4	1.8
30	Rajendran.S.	4	1.8
31	Vijayajyanthi.M.	4	1.8
32	Athavan.N.	3	1.3
33	Bindu.P.S.	3	1.3
34	Froman.N.	3	1.3
35	Ganesan.S.	3	1.3
36	Karlsson.F.	3	1.3
37	Kundu.A.	3	1.3
38	MathewsP.M.	3	1.3

39	Myrzakulov.R.	3	1.3
40	Pradeep.R.G.	3	1.3
41	Suresh.R.	3	1.3
42	Hasegawa.H.	2	0.9
43	Sakkaravarthi.K.	2	0.9

44	SenthilKumar.C.	2	0.9
45	Srinivasan.K.	2	0.9
46	Thompson.C.J.	2	0.9
	45 have only one authorship	45	20.0

Prof. M. Lakshmanan contributed 225 articles in collaboration with various scientists (Table 5). Table 5 shows that he collaborated with Prof. SenthilVelan.M for 26 papers, Chandrasekar.V.K for 22 papers, Senthilkumar.D.V for 17 papers, Murali.K and Radha.R for 14 papers each, Daniel.M. and Kanna.T. for 13 papers and 11 papers respectively, Kaliappan.P. and Tamizhmani.K.M. for 10 papers each. The remaining authors have collaborated in less than 10 of his publications. He also collaborated with foreign scientists namely, Kurths.J (Germany), Nakamura.K (Japan), Froman.P.O, Froman.N and Karlsson.F. (Sweden), Myrzakulov.R (Kazakhstan), Hasegawa.H (Japan), Thompson.C.J (Australia) etc.

Table 6. Scattering of research papers in various journals

Journal	No. of Papers	FPY-LPY	TY
Journal of Mathematical Physics	26	1978-2010	33
Journal of Physics A: Mathematical and General	21	1975-2006	32
Physics Letters A	18	1977-1995	19
Physical Review E - Statistical, Nonlinear, and Soft Matter Physics	17	2001-2011	11
Chaos, Solitons and Fractals	14	1992-2009	18
International Journal of Bifurcation and Chaos in Applied Sciences and Engineering	13	1996-2005	10
Physical Review E - Statistical Physics, Plasmas, Fluids, and Related Interdisciplinary Topics	9	1996-2000	5
Physical Review Letters	9	1983-2009	27
Physical Review A	8	1985-1994	10
Journal of Physics A: General Physics	7	1974-1995	22
Physica A: Statistical Mechanics and its Applications	6	1976-1990	15
Physica D: Nonlinear Phenomena	6	1988-2010	23
Physics Letters, Section A: General, Atomic and Solid State Physics	6	1997-2006	10
Chaos	5	1997-2009	13
Journal of Nonlinear Mathematical Physics	5	1996-2005	10
Journal of Physics A: Mathematical and Theoretical	5	2007-2009	3
Journal of Theoretical Biology	4	1975-1994	20

Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences	4	2006-2009	4
IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications	3	1992-1995	4
Journal of Sound and Vibration	3	1978-1990	13
Pramana - Journal of Physics	3	1997-2005	9
European Physical Journal: Special Topics	2	2008-2009	2
International Journal of Bifurcation and Chaos	2	2006-2009	4
Inverse Problems	2	1989-1994	6
Lettere Al Nuovo Cimento Series 2	2	1973-1973	1
Physical Review A - Atomic, Molecular, and Optical Physics	2	2007-2008	2
Physical Review B	2	1981-1982	2
Physical Review D	2	1979-1981	3
Physical Review E	2	1993-1994	2
17 Journals with one paper each	17	1972-2010	39

FPY = First publication year; LPY = Last publication year; TY = Total year

The distribution of M. Lakshmanan 225 publications were spread over 46 journals. The Core journals used to publish research articles is provided in Table 6. Journal of Mathematical Physics ranks first with a total of 26(11.56%) articles, Journal of Physics A: Mathematical and General with 21(9.33%) articles, Physics Letters A with 18(8.00%) articles, Physical Review E - Statistical, Nonlinear, and Soft Matter Physics with 17(7.56%) articles, Chaos, Solitons and Fractals with 14(6.22%) articles, International Journal of Bifurcation and Chaos in Applied Sciences and Engineering with 13(5.78%) articles. Remaining 116 papers were published in 40 journals.

CONCLUSION

Prof. M. Lakshmanan has published 225 research papers during his period. He has the highest productivity in the year 2009 (20) when he was 38 years of age. Article type of channel of communication has the highest percentage (202, 88.78%) than that of the other channels. The solo research papers (14) has been found to be very low compared to the collaborative (211) work. The collaboration coefficient is 0.56. Prof. M. Lakshmanan's popular collaborative author was Prof. M. Senthilvelan (26 research papers). His papers have been scattered in 46 scientific journals. He has published most of the papers in Journal of mathematical physics (26 papers). He has wrote/edited several books on non-linear dynamics. He has mentored 25 Ph.Ds and many M.Phil and M.Sc students. He has served as an INSA Council Member (2005-07). He has also served/is serving as a Member of the Editorial Boards of several prestigious journals. He

received many awards and honors. It will be an interesting study to incorporate their personal views on various aspects which would enhance the quality of the study.

REFERENCES

1. Angadi Mallikarjun, Koganuramath Muttayya, Kademani, B.S., Kalyane, B.L. & Sen, B.K. (2004). Scientometric portrait of Nobel Laureate Leland H. Hartwell. In: Hildrun Kretschmer, Yogendra Singh and Ramesh Kundra (editors). International Workshop on Webometrics, Informetrics and Scientometrics, Indian Institute of Technology, Roorkee, 2-5 March 2004: 10-30.
2. Kademani, B.S., & Kalyane, V.L. (1996). Outstandingly cited and most significant publications of R. Chidambaram, a nuclear physicist. *Malaysian Journal of Library and Information Science*, Vol.1, No.1, p 21-36.
3. Kademani, B.S., Kalyane, V.L., & Balakrishnan, M.R. (1994). Scientometric portrait of P.K. Iyengar, *Library Science with a slant to Documentation and Information Studies*, Vol.31, No.4, p 155-176.
4. Koganuramath, M.M., Mallikarjun Angadi., Kademani, B.S., Kalyane, V.L., & Suresh Jange. (2004). Physics nobel laureate wolfgang ketterle: scientometric portrait. *Malaysian Journal of Library & Information Science*, Vol.9, No.2, p 35-61.
5. Sangam, S. L., & Savanur Kiran. (2006). Dr. N. Rudraiah: A Biobibliometric study, *SRELS Journal of Information Management*. Vol. 43, No.2, p 185-199.
6. Sen, S.K., Gan.S.K. (1990). Biobibliometrics: concept and application in the study of productivity of scientists. *International Forum on Information and Documentation*, Vol. 15, No.3, p 13-21.
7. Singh and Ramesh Kundra (editors). International Workshop on Webometrics, Informetrics and Scientometrics, Indian Institute of Technology, Roorkee, 2 – 5 March 2004, 10 – 30.
8. Stapley, B. J., & Benoit, G. n.d. Bio-bibliometrics: Information retrieval and visualization from co-occurrence of gene names in Medline abstracts. <http://www.ncbi.nlm.nih.gov/PubMed/>
9. Tilak, H., Dipak, S., & Sen, B.K. (2010). Scientometric portrait on Nayana Nanda Borthakur: a biometeorologist. *Annals of Library and Information Studies*, Vol.57, No.1, p 21-32.