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Website- www.aarf.asia, **Email** : editoraarf@gmail.com

MAPPING OUT SALAMI SLICING OF SCHOLARLY RESEARCH OUTPUT 1989-2019: AN ANALYTICAL STUDY

Dr.V.Kalaiappan
Assistant Librarian & Library i/c
Taramani Campus Library
University of Madras
Chennai -600113

Dr.V.Rajasekar
Assistant University Librarian
University Library
Anna University
Chennai -600 025.

Nimmala Karunakar
Assistant Professor
Dept. of Library and Information Science
Central University of Himachal Pradesh
Himachal Pradesh-176 215.

Abstract

Research productivity plays significant role in all disciplines. The paper shows the distribution of salami slicing of research publications, most productive institutions, Language distribution, Growth rate of the literature,top journals, subject areas of the literature, document types of the literature and most prolific author. The objectives and distribution of various parts of area like productivity density, growth and so on.

Keywords : **S**alami Slicing – Citation – Collaboration- Literature Growth – Prolific Author

Introduction

In recent years, there has been a tremendous growth of research output in all disciplines. The advent of information technology has facilitated to access the inputs for research output. Generally, the academic achievement of scholars is being evaluated by the quantity rather than quality of research output they produce. The former sometimes referred as redundancy or duplication of publication which implies that similar datasets are used for multiple papers (Norman and Griffths, 2008)[1]. Salami Slicing or Salami Publication referred to inappropriate fragmentation of data into many smallest publishable units (US Health Dept, 2008; Henly, 2014)[2]. This practice is detrimental to the both knowledge development and society (Jamrozik, 2004; ICMJE, 2014; Smolcic, 2013; Johnson, 2006)[3-4].The reflectivity of our research program could be detrimental for future studies which would have been published by journals having a lower impact factor. If we want the research to be visible to a wide audience, selection of journal and the content that would be published is certainly very important. Besides, by creating multiple studies, many

researchers would not be able to arrive at a study's significance, and thus would avoid citing the study in their literature reviews. If a major research is so wide that it involves several research groups through various disciplines, it is justified that there are multiple research articles to convey the overall impact of the research. For example, impact of a drug, multiple studies could be published detailing with the synthesis of the drug, biochemical mechanisms, and side effects of the drug on different animal models and so on. Thus, dividing the data into multiple studies will leads the implications to the right audience. In fact, rather than implying that encouraging "salami slicing," because research couldcertainly published in high impact factor journals because of its impact. Sometimes, these research papers are called Least Publishable Units (LPU) due to the fact that they are the smallest amount research work can feasibly be published. In this paper, the evolution of salami slicing has been studied based on literature published in Web of Science (WOS) portal. For the study, the information of 116 articles published in Web of Science during the year 1989-2019 was considered.The study purports the following elements:

1. Top authors of salami slicing
2. Geographical distribution of salami slicing productions
3. Most productive institutions
4. Language distribution of salami slicing literature
5. Growth rate of the literature ,top journals ofsalami slicing
6. Subject areas of the literature
7. Document types of the literature

Review of related Literature

In this section, earlier studies pertaining to salami slicing have been discussed. Santos et al (2019) describe that systematic review of the literature was conducted considering three major scientific database: Scopus, web of science and science direct provide an over view of the literature on data mining (DM) and machine Learning (ML) in the field of public health and service as a starting point for beginner and experienced research in this topic[5]. Zhaopeng (Xing) et al.(2019) studied bibliometric analysis, social network analysis, and term co-occurrence analysis for the screened records.The study results suggest a need to improve collaboration among public and private sectors and health care organizations in research and patent activities[6]. Maria (Pinto) 2019 reveal that publish literature in this field,authors' average productivity and identify the most productive,co-occurrence word analyses of the titles and the keywords used to index papers. The results of this research provide a snapshot of the literature on Mobile Information Literacy that highlights the most relevant journals, authors, and trending keywords[7].MuratKocak et al (2019) encourage researchers to help identify perhaps the most influential studies and combine detailed evidence into study-considered higher education.. It is clear that this paper helps researchers who study the neuroscience to recognize significant changes and trends in the literature of neurosciences[8].Gefei (2019)describe the conclusion that bibliometric analysis indicated that studying the field of medical malpractice was poor during 1975-2018. United States was the most prolific country, and B. Madea published more documents in the field. The studies in Medicine, Legal mostly focused on the claims, appraisement methods, and causes of medical malpractice. In

the future, forensic scientists should pay more attention to medical malpractice[9]. Maria et al (2019) reveal that an integral part of research evaluation methodology, helps us to identify the subject's evolution over the period studied and its aim identify the most relevant journals, calculate the authors' average productivity, discover the most significant trends in this academic field. The results of this research provide a snapshot of the literature on Mobile Information Literacy that highlights the most relevant journals, authors, and trending keywords[10].Tsai-Feng, et al (2019)describes the concluding study the China Medical University in Taichung, Taiwan, was the most active educational institution in Taiwan in terms of acupuncture-related research. Professor Lin Jaung-Geng was the leading acupuncture-related researcher, having the most publications, citations, and the highest h-index value. These results provided a context for examining the assets of the existing research and informing future plans for further studies[11]. Jose et al (2019) explainthe present article shows potentially important information that allows understanding of the past, present, and future of research in integrative and complementary oncology. It is a useful evidence-based framework on which to base future research actions and academic directions[12].Hyun Woo and Jae-Joon(2019)conducted a systematic literature search via the Web of Science database for articles in Science Citation Index (Expanded) journals, on TB, and published by researchers based in Korea, from inception to 2017. Total articles were analyzed by publication year, publishing journal, article type, study design, research institutes, and research funds. Final observationsarticles on TB, especially those on clinical aspects, and published by researchers based in Korea have been increasing rapidly since 1979[13].Gang (2019) reveal that with basic and recognized methodology administered in this study, it provided a relative broad view to evaluate the scientific research capacity of forensic anthropology and explore the worldwide tendency in this field[14].

Salami Slicing

Salami slicing is a technique or strategy is now adopted for analytical purpose in all areas of study. In this study also salami slicing techniques has been used. When an author uses similar methodology in a series of studies, it is natural that some methodological description may well be common to several papers; Salami slicing for one editor might be seen as programmatic research by others (Eva 2017).The selection of journals and the contents of the articles are more important factor or otherwise if it gets published on journals having lower impact factor and ultimately it will not be accessed by more number of researchers. Further the researcher undertaking too many studies and at one stage they are unable to complete it. Due to this the researchers unable to arrive the significance of their studies. It is one of the reasons to avoid citing their study in the literature review.

Table 1: Year Wise Distribution of Publications

Year	Articles	Citations	H Index	Growth Rate	ACCP
1989-1993	3	8	2	-	2.67
1994-1998	5	275	5	66.66667	55
1999-2003	6	212	5	20	35.33
2004-2008	24	689	14	300	28.71
2009-2013	20	357	12	-16.6667	17.85
2014-2018	44	435	11	120	9.89
2019-2020*	14	20	3	-68.1818	1.33
Total	116				

*Till January, 2020

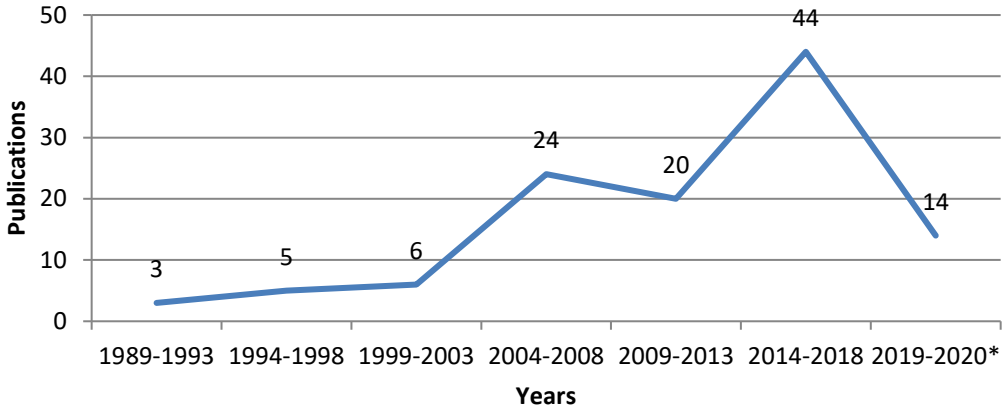

Figure 1. Growth of Publications

It is evident from table1 and figure 1, during 2014-2018 the highest number of publications i.e.44 research papers, followed during 2004-2008 with 24 research papers. A total of 14 research papers were published during 1989-2003. It reveals the fluctuating trends in the research contribution.

Table 2: Distribution of Most Prolific Authors

Sl.No.	Author	Articles	Citations	H Index	ACCP
1.	Ryseret	5	117	4	35.4
2.	Luchansky JB	3	149	3	49.67
3.	Sheen S	3	91	3	30.33
4.	Todde CD	3	172	3	57.33
5.	Anonymous	2	5	1	2.5
6.	Ayhan	2	12	2	6.00
7.	Beaufils	2	13	2	6.5
8.	Bowman D	2	1	1	0.5
9.	Boxman ILA	2	32	1	16.00
10.	Bragheri A	2	16	1	8.00

Table 2 shows the top 10 most prolific authors in the research field. A total of 102 authors were involved in the research publications in which an average number of authors per article is 0.9 which is approximately equals to 1. From table 2, it is apparent that Ryseret hold the first position with 5 articles with h-index value of 4, followed by LuchanskyJB , Sheen S and Todde CD with 3 articles each. While 2 articles was published by Anonymous,Ayhan, Beaufils, Bowman D, Boxman ILA and Bragheri A respectively.

Average Citation per Publications

Quality of publications is measured using average citation per publications. Average citation per publication varied from 0.5 to 57.33, with average citation impact of 21.22. Toddle Cd with ACCP of 57.33 followed by Luchansky JB with ACCP of 49.67, Ryseret with ACCP of 35.4 and Sheen S with 30.33 respectively.

H-index

The h-index of 10 most prolific authors in research filed varied from 1 to 4 with average h-index of 2.1. Four authors have got more than the average h-index of all authors. Ryseret with h-index 4, followed by Luchansky JB, Sheen S and Todde CD with h-index of 3 respectively.

Table 3: Subject-Wise Distribution

Sl.No.	Title	Articles	Percentage	Citations	H Index	ACCP
1.	Food science Technology	47	40.52	1101	22	2343
2.	Biotechnology applied microbiology	14	12.07	544	12	38.86
3.	Microbiology	11	9.48	293	8	26.64
4.	Surgery	8	6.90	149	4	18.63
5.	Healthcare science	6	5.17	161	5	26.83
6.	Multidisciplinary	6	5.17	105	4	17.5
7.	Psychiatry	6	5.17	28	2	4.67
8.	Public environmental occupational Health	6	5.17	134	4	22.33
9.	Nursing	5	4.31	61	4	12.2
10.	Orthopaedics	4	3.45	21	3	5.25
11.	Chemistry Analytical	3	2.59	8	2	2.67

Table3 shows the subject wise distribution of research articles. Results shows that the subject Food science Technology has more number of articles, i.e., 47 (40.52%) followed by Biotechnology applied microbiology with 14 (12.07%) articles, Microbiology with 11 (9.48%) articles, Surgery 8 (6.90%) articles, Healthcare Science , Multidisciplinary, Psychiatry and Public environmental occupational Health with 6 (5.17%). While subjects such as Nursing with 5 (4.31%) articles, Orthopaedics with 4 (3.45%) articles and Chemistry Analytical with 3 (2.59%) of articles respectively.

Table 4:Distribution of Research Papers with Highest Number of Authors

Sl. No.	Title	No.of Authors
1.	Evaluation of the Thermo Scientific (TM) SureTect (TM) Listeria monocytogenes Assay	13
2.	Evaluation of the Thermo Scientific (TM) SureTect (TM) Listeria species Assay AOAC Performance Tested Method(SM)	10
3.	Antilisterial Activity of Polypropylene Film Coated with Chitosan with Propolis and/or Bee Pollen in Food Models	10
4.	Perspectives from early career researchers on the publication process in ecology - a response to Statzner&Resh (2010)	8
5.	Cross-contamination between processing equipment and deli meats by Listeria monocytogenes	7

Table 4 shows the maximum number of contributions of authors. Maximum of 13 authors has contributed for one research paper which is the highest followed by 10 authors in two different research papers. 8 authors have contributed in one research paper and 7 authors have contributed in 4 different research papers.

Table 5: Distribution of Research Papers with Highest Number of Citations

Sl.No.	Title	No.of Citations
1.	Redundant surgical publications: Tip of the iceberg?	101
2.	Transfer of Listeria monocytogenes during mechanical slicing of turkey breast, bologna, and salami	97
3.	Cross-contamination between processing equipment and deli meats by Listeria monocytogenes	95
4.	Evidence-based medicine has been hijacked: a report to David Sackett	80
5.	Effect of incorporation of dietary polyunsaturated fatty acids in pork backfat on the quality of salami	70

Table 5 gives the top 5 research papers with highest citations. Research paper entitled “Redundant surgical publications: Tip of the iceberg?” has the maximum number (110) citations,closely followed by “Transfer of Listeria monocytogenes during mechanical slicing of turkey breast, bologna, and salami” with 97 citations, “Cross-contamination between processing equipment and deli meats by Listeria monocytogenes” with 95 citations, “Evidence-based medicine has been hijacked: a report to David Sackett” with 80 citations and “Effect of

incorporation of dietary polyunsaturated fatty acids in pork backfat on the quality of salami" with 70 citations.

Table 6:Distribution of Research Papers with Average Number of Citations

Sl.No	Title	Average No. of Citations
1.	Evidence-based medicine has been hijacked: a report to David Sackett	20
2.	Researchers' Individual Publication Rate Has Not Increased in a Century	8
3.	Transfer of Listeria monocytogenes during mechanical slicing of turkey breast, bologna, and salami	6.79
4.	Cross-contamination between processing equipment and deli meats by Listeria monocytogenes	6.79
5.	Data dredging, salami-slicing, and other successful strategies to ensure rejection: twelve tips on how to not get your paper published	6.17

Table 6 shows the top 5 research papers with highest average number of citations during the period 1989-2020. Research Paper entitled "Evidence-based medicine has been hijacked: a report to David Sackett" has the highest 20 average number of citations, followed by research paper "Researchers' Individual Publication Rate Has Not Increased in a Century" with 8 average number of citations. Research papers titled "Transfer of Listeria monocytogenes during mechanical slicing of turkey breast, bologna, and salami" and "Cross-contamination between processing equipment and deli meats by Listeria monocytogenes" with 6.79 average number of citations. And paper titled "Data dredging, salami-slicing, and other successful strategies to ensure rejection: twelve tips on how to not get your paper published" with 6.17 of average number of citations.

Table 7: Distribution of Research Papers with Total Number of Citations

Year	Total Number of Citations	Year	Total Number of Citations	Year	Total Number Number of Citations
2019	200	2009	62	1998	5
2018	194	2008	51	1996	3
2017	191	2006	42	1995	1
2015	173	2004	28	1992	1
2016	162	2005	26	1997	0
2014	147	2003	25	1994	0
2013	124	2002	19	1993	0
2011	104	2000	16	1992	0
2012	93	1999	15	1991	0
2010	87	2001	15	1990	0
2007	64	2020	9	1989	0

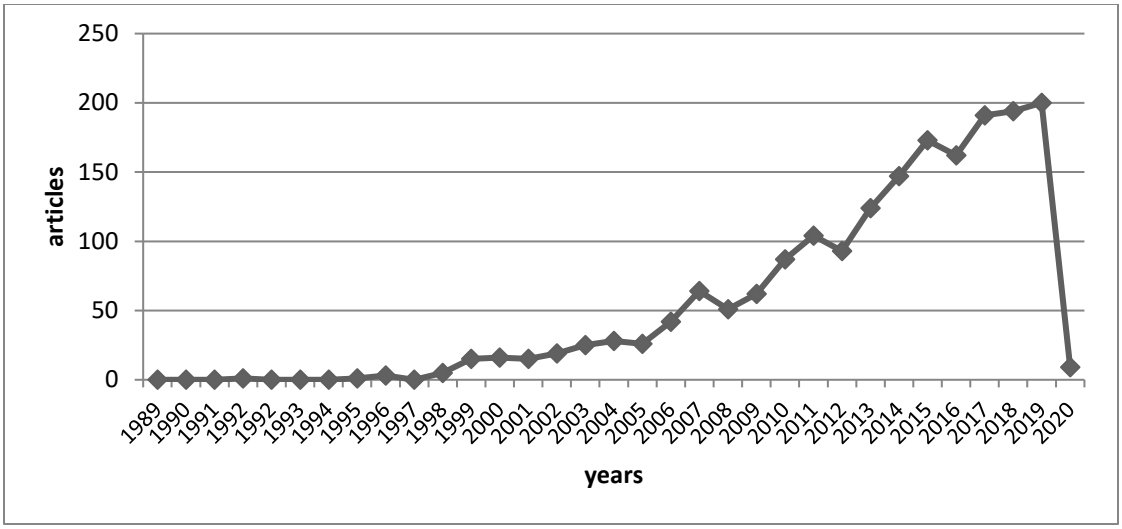

Figure 2. Distribution of Research Papers with Total Number of Citations

From figure 2 it is evident that during the years 1989-1998 there tend to be an equal amount of average citations of research papers, while after 1998 there is a raise in the average number of citations. After the year 2005, there tend to be a sudden rise in average citations of research papers, year 2019 reported the maximum number of 200 average citations of research papers.

Table 8: Degree of Collaboration

No. of Single author articles (NS)	No. of Multiple author articles (NM)	Total no. of articles (NS+NM)	Degree of Collaboration C=NM/(NM+NS)
23	93	116	0.80

Above table shows the degree of author collaborations.
It was calculated using Subramanian's formula:
C = NM / (NM + NS)
Where C = degree of collaboration,
Nm=Number of multi-authored works,
Ns= Number of single-authored work

Table 8 shows the degree of collaboration in the research field. Out of 116 articles, the total number of single authored articles are 23, and number of multiple authored articles are 93. By using Subramanian's formula to calculate degree of collaboration, the resulted value is 0.80, which suggest that in this field of study collaborations are preferred rather than single authored works.

Table 9:Distribution of Type of Document

Document Type	Articles	Percentage	Citations	H Index	ACCP
Article	81	69.83	1706	25	20.8
Editorial material	31	26.72	288	10	9.29
News item	2	1.73	0	0	0
Letter	1	0.86	2	1	2
Proceedings paper	1	0.86	24	1	24
Total	116	100			

Analysis done on the type of document available in web of science reveals that (69.83%) 81 of the records are of article type followed by 26.72% of the documents are of editorial materials, a very few of the document types are News item of 1.73%, while Proceedings paper and letter format documents are of 0.86%.

Table 10:Distribution of Countries /Productive of Geographical Regions

Countries/ Regions	Articles	Total number of citation to all items	H Index	ACCP
USA	29	922	17	31.79
England	12	218	7	18.17
Canada	9	137	6	15.22
Italy	9	92	5	10.22
Australia	8	57	5	7.13
Spain	5	39	3	7.8
Brazil	4	59	4	14.75
Germany	4	51	3	12.75
Belgium	4	51	3	12.75
Sweden	4	119	4	29.75

Table 10 shows the top 10 most productive countries in the research field. Analysis shows that USA tops the list with 29 articles, followed by England with 12 articles, Canada and Italy with 9 articles, Australia with 8 articles, Spain with 5 articles, Brazil, Germany, Belgium, and Sweden with 4 articles each.

Table 11: Distribution of Organizations

Organization	Articles	Total number of citation to all items	H Index	ACCP
Michigan state university	5	181	4	36.2
United states department of agriculture usda	4	137	4	34.25
University of Wisconsin Madison	4	151	3	37.75
University of Wisconsin system	4	151	3	37.75
Colorado state university	3	51	2	17.00
Universidad de saopaulo	3	55	3	18.33
University of Copenhagen	3	59	3	19.67
Bcchildrens hospital	2	21	2	10.5
Centre national de la recherché scientifiquecnrs	2	46	2	23.00
Kantonsspitalaarauagksa	2	26	2	13

Table 11 shows the organizations contributions where, Michigan State University holds the first position with 5 articles, closely followed by UnitedStatesDepartment ofAgriculture (USDA), University of Wisconsin, Madison and University of Wisconsin system with 4 articles.

Table 12: Distribution of Languages

Language	Articles	Total number of citation to all items	H Index	ACCP
English	**110**	1980	28	17.84
German	**4**	5	1	1.25
French	**1**	2	1	2
Spanish	**1**	9	1	9

Analysis was done to find out the language differences in the research articles. Results shows that English language with 110 articles published, followed by German language with 4 articles, French and Spanish language each with 1 article respectively.

Table 13: Web of Science Index

Citation Index	Articles	Total number of citation to all items	H Index	ACCP
Science Citation Index (SCI)	85	1979	28	17.67
Social Science Citation Index (SSCI)	27	260	9	10.4
Arts and Humanities Citation Index (A&HCI)	3	31	1	15.5
Conference Proceeding Citation Index Science (CPCI-S)	1	24	1	24

Table 13 explains about the number of articles indexed in Web of Science. A total of 85 articles were indexed in Science Citation Index (SCI) while 27 articles were indexed in Social Science Citation Index. 3 articles were indexed in Arts and Humanities Citation Index and 1 article was indexed in Conference Proceeding Citation Index Science.

Table 14: Open access

Description	Articles	Total number of citation to all items	H Index	ACCP
All open Access	80	391	12	9.54
DOAJ Gold	22	124	6	10.33
General Articles	14	79	4	11.29

Table 14 shows the details of articles in the form of their access. Out of 116 articles, 80 articles are open access, 22 articles are DOAJ Gold access and 14 articles are in general.

Concluding Remarks

This study expose that the publication outline in too to depending up on the literature periodicals pattern, authorship and quality of research. Conceivably, the research publication during the period from 1989-2019.The subject wise distribution of research articles. Results shows that Food science Technology has more number of articlesResearch Paper entitled “Evidence-based medicine has been hijacked: a report to David Sackett” has the highest 20 average number of citations, followed by research paper “Researchers' Individual Publication Rate has not increased in a Century” with 8 average number of citations. Maximum of 13 authors has contributed for one research paper which is the highest.During the period 2014-2018 very high research output has 45 and very low 1989-1993. Further the study shows the English is preferred language by most of authors. Contribution of two authors has very high. Very high number of authors in the title,Evaluation of the Thermo Scientific (TM) SureTect (TM) Listeria

monocytogenes Assay has 13. This study may useful to the further research and establish the future direction.

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