

Scientometric portrait of Late Professor (Dr.) Hildrun Kretschmer : A renowned scientometrician of world repute

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This article presents a scientometric portrait of Late Professor (Dr.) Hildrun Kretschmer, a renowned Scientometrician of world repute. As the founder of the COLLNET network, COLLNET Journal of Scientometrics and Information Management, and WISE Lab, Dr Kretschmer significantly contributed for the development of scientific collaboration and knowledge dissemination. This study is based on the data available in the “The ‘Social Gestalt’ of Scientific Communications: Festschrift in the honour of Hildrun Kretschmer”. The paper examines her publication output and citation patterns, collaboration networks, and highly cited papers, providing insights into her scholarly impact and influence. She published nearly 68 papers during the year 1979-2021, and 2008 was her most productive year. The journal “Scientometrics” a publication of Springer Nature was the most preferred journal for her publications. The results highlight her pioneering role in shaping the field of scientometrics and collaboration. Her contributions will continue to inspire future research in this area.

Keywords: Hildrun Kretschmer, Scientometric portrait, Scientific collaboration, COLLNET.

1. Introduction

Kademani, Kalyane, and Kademani [1] and Kademani, Kalyane, and Kumar [2] suggested the term “Scientometric portrait” to establish a functional relationship between the biographical sketch and the bibliometric data elements of scholars. It replaced the terms ‘information profile’ and

'Bio-bibliometrics' used earlier by Sinha and Bhatnagar [3] as well as by Sen and Gan [4]. In the past, several studies have been reported that dealt with the development of Scientometric portrait of eminent scientists and Noble Laureates in different disciplines. These studies basically examined the scientific productivity and citation impact of research, and collaboration pattern of the researchers, along with the areas of their research, and the journals used for publishing the research results. The present paper provides below the details of the studies that dealt with the development of the scientometric portraits of different scientists.

Gupta [5] developed the scientometric portrait of Dr S. Chandrasekhar, who shared the Nobel Prize for Physics with William A. Fowler in 1983. The study was based on 401 papers authored by Dr Chandrasekhar. "The study found a strong correlation between quantity and impact based on citations, honours and awards". Kademani, Kalyane, and Jange [6], [7] reported the portrait of Dr. Dorothy Crowfoot Hodgkin, the Nobel Prize winner in Chemistry in 1964 and Sir C.V. Raman, the Noble Prize winner in Physics in 1930. Kalyane and Sen [8] analysed 422 papers published by the Nobel laureate Dr Pierre-Gilles de Gennes, a French Physicist during 1956 -1995. Authors observed that "the productivity of the scientist peaked in his 40's and his journal preference showed a distinct national bias". Munnoli, Pujar, and Kademani [9] analysed the publication productivity of Dr Harald zur Hausen, who won the Nobel Prize for his discovery of *Human Papilloma virus* causing cervical cancer in the year 1983. Angadi et al. [10] developed a scientometric portrait of Dr Anthony J. Leggett, the winner of Nobel Prize in physics in the year 2003. The study found that he published 194 papers during 1964-2004 in different sub-disciplines of physics like Superfluid ³He, Foundations of Quantum Mechanics, Dissipative Quantum Systems and Atomic Alkali Gases, etc. He published his first paper in 1964 at the age of 26 years and collaborated with 70 different authors. His highest number of papers was published in Physical Review Letters, the most prestigious journal of Physics. Other authors developed the Scientometric portrait of other eminent professionals from India and abroad. For instance, Kalyane and Sen [11] developed the scientometric portrait of Professor Tibor Braun, "an eminent analytical chemist and a Scientometrician of world repute and the founder editor of the International Journal "Scientometrics". Bhaskar [12] developed the portrait of Professor Lalji Singh, "an eminent Indian scientist in the field of genome analysis and DNA Finger printing". The study was based on 222 articles indexed in the Web of Science and Scopus. "Most of his articles were published during 1987-2011, when he served at the CSIR-Centre for Cellular and Molecular Biology, Hyderabad (India) and almost all his articles appeared in high-impact journals". Halevi [13] sketched the achievements and collaboration network as well as the impact of her work as seen by citations of Dr Judit Bar-Ilan in different disciplines through an analysis of her publications. Dutta [14] developed a scientometric portrait of Dr Bimal Kanti Sen, Indian librarian and information scientist of repute. Over a period of 55 years from 1964 to 2018, he contributed 184 research articles besides publishing popular articles, course material, books, and review articles. "His most notable research work was normalization of the Impact Factor and identifying Impact Factor of non-SCI journals". Scientometric portrait of Professor Wolfgang Glänzel, "an

expert in the field of scientometrics and the recipient of international Derek de Solla Price Award for remarkable contributions to the quantitative studies of science in 1999" was published by Gholampoura and Noruzib [15]. The study "portrayed the work of Professor Glänzel contributions of 37 years of scientific career from 1983 to 2020 during which he contributed 276 articles, individually or collaboratively". Currently, he is the Editor-in-Chief of the journal "Scientometrics" and the Secretary-Treasurer of the International Society for Scientometrics and Informetrics (ISSI). Gonzalez-Alcaide [16] developed a scientometric portrait of Prof Santiago Grisolia, who played a major role in the advancement of biochemistry and molecular biology, particularly in the field of enzymology in the metabolism of nitrogen related to the urea cycle and the impoverishment of pyrimidines. "The study found that the scientific productivity of Prof Santiago Grisolia was slow or moderate in the initial stage, followed by a fast exponential growth phase with a high level of productivity over a long period from 33 years to 72 years. The number of his collaborators increased progressively over time; and notable level of citations. He published in multidisciplinary as well as in specialized journals in his area of expertise". Vellaichamy and Amsan [17] developed the scientometric portrait of Prof Mike Thelwall, the recipient of the Derek de Solla Price Award in 2015. During the period of 2000-2015, he published 297 papers in different domains like Computer Science, Mathematics, Engineering, Medicine, Agricultural and Biological Sciences. The highest number of papers were published in the domain of computer science. Most of his papers were in co-authorship. The scientometric portrait of Dr. Hari Chand Sharma, "a renowned Indian agricultural scientist" was developed by Garg and Kumar [18]. "The study found that Dr. Sharma published 269 papers from 1976 to 2016, most of which were published in journals originating from the UK, the USA and the Netherlands in medium impact factor journals. Majority of his publications were published in collaboration with other scientists and he had collaborated with more than 1,000 authors, as was found by high value of collaboration coefficient. The high value of citations per paper indicates that the research outputs of Dr. Sharma were part of the main stream science". The review of literature, to the best of our knowledge, indicates that the scientometric portrait of late Professor Hildrun Kretschmer has not been reported so far. Hence, the present investigation attempts to study the scientometric portrait of late Professor Hildrun Kretschmer.

2. Brief Biography of Prof Hildrun Kretschmer

Dr. Hildrun Kretschmer was born in a small town of Hohen Neuendorf near Berlin (Germany) in an educated family. She had her higher education from Humboldt University (Germany). Later she taught and worked as research scholar in the Academy of Sciences of the German Democratic Republic (GDR) East Germany. After the German unification, she received her "*Venia Legend*" from Freie University at Berlin. Later, she joined Centre for Science and Technology Studies (CWTS), Leiden University, the Netherlands, where she undertook basic research on "Collaboration in Science". After the basic research on collaboration at CWTS and inspired by the seminal work of Prof D. de B. Beaver and Prof

D. J. de Solla Price and others scholars on scientific collaboration, she started her research on scientific collaboration in science and technology at national and international level [19]. “One of her favourite research topics was the comparative study of social stratification in co-authorship networks of invisible colleges and institutionalized communities, where she could benefit from her knowledge in the area of social psychology as well”.

She was the first president of the International Society for Scientometrics and Informetrics (ISSI) which was founded in 1993 in Berlin at the fourth International Conference on Bibliometrics, Informetrics and Scientometrics and was formally incorporated in 1994 in the Netherlands (<https://www.issi-society.org/>). She was a very well-known scientist in the area of Scientometrics and Informetrics. She was Honorary Professor at Henan Normal University, China and visiting professor at Dalian University of Technology, China. She established the COLLNET (Collaboration in Science and Technology) and started the “COLLNET Journal of Scientometrics and Information Management”, and developed WISE Lab in the Peoples Republic of China. She left for her heavenly abode in November 2024 after a protracted illness.

3. Data Source and Research Methodology

The data for the present study was obtained from the book published in her honour entitled “The ‘Social Gestalt’ of Scientific Communications: Festschrift in the honour of Hildrun Kretschmer” (here after referred as Festschrift) [20]. Authors have extracted data from the contents provided in chapter 2 (from the annals of COLLNET) and chapter 5 which listed the contributions of Prof Hildrun Kretschmer as author and editor. A database in MS-Excel was created by the authors which contained name of the contributor(s), year of publication and name of the journal where the paper was published, and number of authors who contributed to the publication, affiliation of authors, and the citations received by each paper. The data so obtained was analysed to elaborate the pattern of her contributions in different international conferences and papers in national and international journals along with their citation impact. Citation data for each record was obtained from Google Scholar in January 2025. The data was analysed to meet the objectives mentioned below.

4. Objectives

The basic objective of the study is to develop a scientometric portrait of Professor (Dr.) Kretschmer. The portrait is based on the following facets of her life:

- As founder of COLLNET and her role in organizing conferences and meetings in different parts of the globe;
- As founder of *COLLNET Journal of Scientometrics and Information Management*;
- The Development of WISE Lab at Dalian University of Technology (Peoples Republic of China);

- As an editor of papers presented at different conferences;
- Scientific productivity and the impact of the output. The facets to be examined are chronological distribution of publication output, communication behaviour, authorship pattern and collaborative research pattern and the value of collaboration coefficient, number of citations received, and identification of highly cited papers.

5. Results and analysis

5.1 *As Founder of COLLNET network*

The idea of COLLNET (the Global Interdisciplinary Research Network for the Study of all aspects of Collaboration in Science and in Technology) was conceived by her in September 1999 and it was formally launched on January 1, 2000 under the leadership of Prof Hildrun Kretschmer with Berlin (Germany) as its virtual centre, together with Dr Liming Liang (China) and Dr Ramesh Kundra (India). COLLNET helped in establishing bilateral cooperative relations between Germany and India as well as Germany and China in international context. The COLLNET community has proliferated continuously over the last two decades due to the efforts of Prof Kretschmer and other COLLNET members. The network comprises prominent scientists working in the field of quantitative studies of science, coming from 15 different countries of America, Asia, Australia and Europe. The COLLNET members, having the initial expertise in the area of scientometrics and bibliometrics, have now proliferated to other areas of expertise like computer science, knowledge organization or artificial intelligence. After foundation of COLLNET, Prof Kretschmer organised 22 conferences under the banner of COLLNET. Of these 22 conferences, two conferences were held in the years 1998 and 1999 in Berlin. The remaining 20 COLLNET conferences were held from 2000 to 2019. These 20 conferences were held in 10 different countries. These countries are India (5), Germany (3), China (3), and France (2). Australia, Estonia, Macau, Sweden, South Korea, Turkey and the UK hosted one conference each. Thus, “the COLLNET community at its conferences provided excellent opportunities to scholars from different countries to discuss the phenomena of collaboration in science, their impact on productivity, and innovation outcomes for individuals, institutions, and economies worldwide” [20].

5.2 *As Founder of COLLNET Journal of Scientometrics and Information Management*

“COLLNET Journal of Scientometrics and Information Management” was started as “Journal of Information Management and Scientometrics” in the year 2003. Professor Shabahat Hussain of the “Department of Library and Information Science of the Aligarh Muslim University, Aligarh (India) was the First editor of the journal”. It completed its third volume in December 2006. Professor Shabahat Hussain observed that during 2003-2006, about 80% of the articles published in the journal were related to the area of Scientometrics. Due to an increasing demand from authors and subscribers, the editor decided to make the journal online. In view of the above and other unavoidable

circumstances in printing and publishing of the journal, it was decided to restart and revamp the journal as an organ of COLLNET under a new title “COLLNET Journal of Scientometrics and Information Management” in print as well as online from 2007, through TARU Publications, New Delhi, with publication frequency of two issues per year and with an enlarged international editorial board. The maiden issue of the journal was launched on the eve of the 8th COLLNET meeting/conference held in New Delhi during 6-9 March 2007, with Professor Shabahat Hussain as its founder editor and Prof Hildrun Kretschmer as Associate Editor and COLLNET Co-ordinator [21]. Besides publishing original articles submitted by scholars from different parts of the globe, the journal has also published a number of select articles presented at COLLNET conferences held in different countries. The journal publishes original research articles, survey articles, and book reviews with multidisciplinary research and is of interest to both theoretical and applied researchers of scientometrics, information management and multidisciplinary areas. The journal also welcomes special issue proposals on timely and cutting-edge research areas. Presently the journal is being edited by Dr. Bharvi Dutt, as its Chief Editor formerly at CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR), New Delhi. The journal is indexed by Emerging Sources Citation Index (ESCI) of Clarivate Analytics (formerly Thomson Reuters). Besides this, the journal is being indexed in several other bibliographic databases. For scholarly communication landscape of the journal since its publication, readers can refer to Garg and Bebi [22].

5.3 As Founder of WISE Lab

As the first president of ISSI, she visited China in 2005. As a platform for future exchanges with the international scientometrics community, she established WISE Lab (Webometrics-Informetrics-Scientometrics-Econometrics) Lab with Prof. Liu Zeyuan as its co-founder on September 25, 2009. She delivered several talks at the Institute of Science of Science and S&T Management (ISSSTM) and encouraged Chinese academicians to integrate with the world in the field of Scientometrics. She played an important role to promote cooperation between the School of Humanities and Social Sciences at Dalian University of Technology (DUT) and the Berlin School of Library and Information Science (IBI) at Humboldt-University, Berlin (HUB). She delivered several lectures at WISE Lab and invited several international scientists to visit WISE Lab. On the invitation of Prof Kretschmer, several scientists of international repute visited WISE Lab. These included Prof Martin Myer (SPRU, UK), Prof M. Heinz (Humboldt University, Germany), Prof Jean Charles Lamirel (CNRS, France), Prof Ronald Rousseau (Antwerp University, Belgium), Prof Bernd Markscheffel (Technische Universität Ilmenau, Germany), Prof Li Xuemei (University of Wolverhampton, UK), Prof Wolfgang Glänzel (KU Leaven, Belgium), and Prof Liwen Vaughan (University of Western Ontario, Canada) [23]. WISE Lab hosted COLLNET 2009 and 20th COLLNET meeting in 2019. These conferences and meetings were attended by more than 100 registered participants from different regions of the globe, which included USA, UK, Germany, Russia, China, and India.

5.4 As an Editor

Prof Kretschmer, with fellow professionals, edited the papers presented at different international conferences on Bibliometrics, Informetrics and Scientometrics and International workshops on Webometrics, Informetrics and Scientometrics and COLLNET meetings. Selected papers, presented in these conferences, were published in reputed international journals, which have been described below.

Selected papers, presented at the fourth international conference on Bibliometrics, Informetrics and Scientometrics, Berlin, held on 11-15 September 1993, were published in special issues of *Research Evaluation* 2(3)1992 and 3(1) 1993, *Scientometrics* 30(1)1994, *Science and Science of Science* 5(3)1994, *Journal of the International Society of Scientometrics and Informetrics* 1(2)1995 and 1(3-4)1995. Selected papers, presented at the Second Berlin workshop on Scientometrics and Informetrics/Collaboration in Science and Technology and first COLLNET meeting, Berlin (Germany), September 1-4, 2000, were also published in a special issue of *Scientometrics* 52(3)2001. Besides these, 16 proceedings have been published in book form.

5.5 As an Author

As an author of scientific articles, her productivity has been examined using the papers she presented at national /international conferences as well as papers published in national and international journals. The details are described in hereunder.

5.5.1 Papers presented at conferences

From the year 1980 to 2019, she presented 57 papers at different international conferences held in Germany (13), India (12), China (7), France (6), Korea (4) and 12 other countries, namely Australia, Canada, Estonia, Israel, Italy, Macau, Mexico, the Netherlands, Spain, Sweden, Turkey and the UK. Of the 57 papers presented at different conferences, 36 papers were presented at the "International Conferences/workshops on Webometrics, Informetrics, Scientometrics and Econometrics" & COLLNET Meetings held at different locations during 2000-2019. Of the remaining 21 papers, nine papers were published at the conferences organized by "International Society for Scientometrics and Informetrics (ISSI)" in different parts of the globe. Remaining papers were presented at "IEEE International Conference on Digital Information Management" (Bangalore, India), CALIBER 2004 (New Delhi, India), "International conference on Science and Technology Indicators" (Germany), Joint EC-Leiden Conference on "Science and Technology Indicators" (the Netherlands), Madras Library Association (Chennai, India), "International Workshop on Emerging Trends in Science & Technology Indicators" (New Delhi, India), "Triple Helix Conference" (Italy), "S&T Policy and Management & International Forum on Science Studies and Scientometrics" (China), "XXII International Congress of Psychology" (Germany), "All-China Annual Meeting for Scientometrics and Informetrics" (China) and Fulda Proceedings (Berlin, Germany).

5.5.2 Papers published in Journals

5.5.2.1 Chronological distribution of output from 1979-2021

During the period of 43 years from 1979 to 2021, Dr. Kretschmer published 68 papers in national and international journals on different aspects of scientific collaboration excluding four papers related to psychology. Thus, the average productivity of Prof Kretschmer is 1.6 paper per year. Fig. 1 depicts the chronological distribution of publication output. It indicates that during the period of 43 years, she did not contribute any paper in 18 years namely 1981-1982, 1984, 1989, 1991-1992, 1995, 2000, 2011, 2016, and 2018-2020. In the remaining years, she published one or more papers. Data presented in Fig. 1 indicate a highly fluctuating trend of output, as in the years 1979-1980, 1985-1998, 1987, 2003, 2010, and 2021 she contributed one paper each year. In the remaining 20 years, she published two or more papers. The highest number of papers were published in the year 2008 followed by number of papers in the year 2006 and 2007 (five papers each) and four papers each in the years 1994, 1999, 2001, and 2004. In the remaining years, she published either two or three papers.

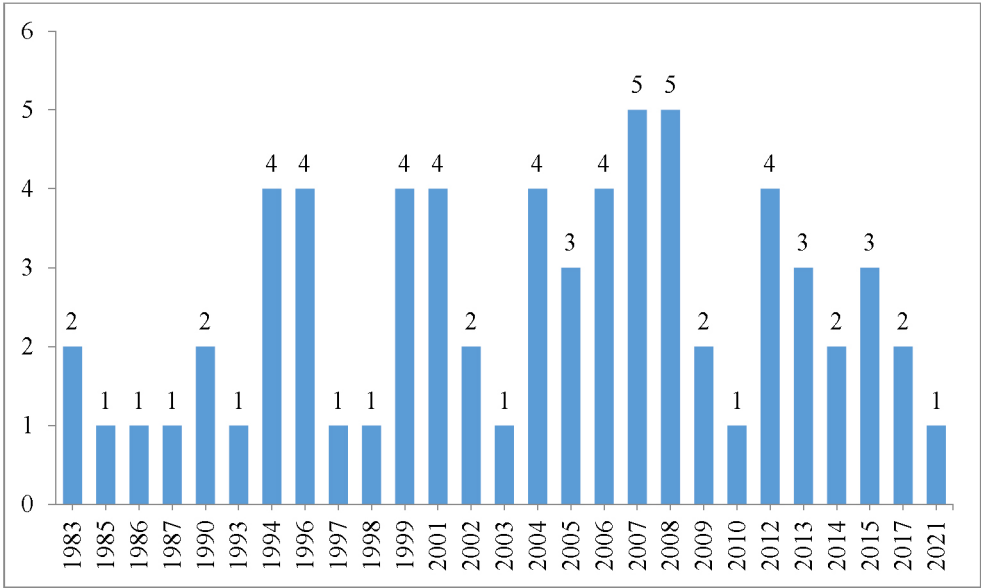


Figure 1
Chronological distribution of output during 1979-2021

5.5.2.2 Communication pattern of Dr. Kretschmer

Table 1 lists 18 journals where she published 68 papers with the name of publishing country of the journal and the impact factor of the journals. The 18 journals where she published her papers originated from six different countries. More than half (52.2%) of the papers were published in journals that originated from the Netherlands followed by 35.8%

papers in journals that originated from India. Thus, about 88 per cent of papers were published in the journals that originated from these two countries. Remaining 12 percent papers were published in journals that originated from Czechoslovakia, Russia, the UK and the USA. The details of publishing country of two papers published in Science and Science of Science were not available. Distribution of output by impact factor has been depicted in Table 2 below. It indicates that about half of the papers were published in journals with high and very high impact factor. Based on the pattern of publication of the papers, it can be concluded that the research output of Dr. Kretschmer is a part of main stream scientometrics, as half of the papers were published in journals that originated from advanced countries of the West with high impact factor.

Table 1
Distribution of publication output with respect to publishing country and Impact Factor

#	Title of the Journal	Publishing Country	Impact Factor (2024)	Number of papers
1.	Scientometrics	The Netherlands	3.5	29
2.	COLLNET Journal of Scientometrics and Information Management (CJSIM)	India	1.0	13
3.	Journal of Information Management and Scientometrics (now CJSIM)	India	0.0	4
4.	Journal of Informetrics	The Netherlands	3.4	3
5.	Czechoslovak Journal of Physics	Czechoslovakia	0.0	2
6.	Information Processing & Management	The Netherlands	8.6	2
7.	International Forum on Documentation	Russia	0.0	2
8.	International Library Movement	India	0.0	2
9.	Science and Science of Science	Not Available	0.0	2
10.	IASLIC Bulletin	India	0.0	1
11.	International Information Communication & Education	India	0.0	1
12.	Journal of Biomedical Discovery & Collaboration	UK	0.0	1
13.	Journal of the American Society for Information Science and Technology	USA	2.4	1
14.	Journal of the International Society of Scientometrics and Informetrics (JISSI)	India	0.0	1
15.	Library Trends	USA	0.3	1
16.	Research Evaluation	UK	2.9	1
17.	Social Network	The Netherlands	2.9	1
18.	SRELS Journal of Information management	India	0.0	1
Total				68

Table 2
Distribution of papers by impact factor

Range of IF	No. of Papers	Percent
Impact factor NA	17	25.0
≤1 (Low)	14	20.6
>1 ≤ 3 (Medium)	3	4.4
≥3 ≤ 4 (High)	32	47.1
> 4 (Very high)	2	2.9
Total	68	100

5.5.2.3 Calculation of Collaboration Coefficient

Pattern of her collaboration in research has been examined using Collaboration Coefficient (CC) [24]. The calculation of CC is made by using fractional productivity, as defined by Price and Beaver [25]. The formula used to calculate CC is explained below:

$$CC = 1 - \frac{\sum_{j=1}^k (1/j) f_j}{N} \tag{1}$$

Where f_j denotes the number of j authored papers, N is the total number of research papers published and k is the largest number of authors per paper.

According to the authors, “CC tends to zero as single authored papers dominate and to $1-1/j$ as j -authored papers dominate. This implies that the higher the value of CC, the higher is the probability of papers with multi or mega authors. Papers authored by 3 or 4 authors are termed as multi-authored and papers with more than four authors has been denoted as mega authors. However, inclusion of authors as multi or mega can be changed according to nature of data available for analysis.

Using the formula given above in [1], the value of CC was calculated and it was found to be 0.42. Based on the value of CC, it can be concluded that a large number of papers produced by Prof Kretschmer is not multi or mega authored papers. This is also indicated by raw analysis of data which indicates that out of the 68 papers, 21 (31%) papers were single authored and almost the same i.e. 22 (32.3%) papers were two authored and only 25 papers were three or multi-authored. Calculation details are shown below.

$$\begin{aligned} &1/1*21 + 1/2*22 + 1/3*16 + 1/4*9 \\ &= 21.0 + 11.0 + 5.4 + 2.3 = 39.7/68 = 0.58 \end{aligned}$$

Hence $CC = 1-0.58 = 0.42$

5.5.2.4 Pattern of Domestic and International collaboration

Collaboration is a significant issue in science. For example, readers can refer to Chaudhary and Mukherjee [26] for scientific collaboration in academic institutions in India and Jabeen, Imran, and Badar [27] et al for collaboration in library and information science research in China.

5.5.2.4.1 Papers published in Domestic Collaboration:

Of the 68 papers published by Prof Kretschmer, 21 papers were single authored published by Prof Kretschmer herself. Hence, only 47 papers were published in domestic and international collaborations. Analysis of data indicates that out of 47 papers authored in collaboration, 13 papers were published in domestic collaboration. Of these, nine papers were published in collaboration with her husband Prof Theo Kretschmer, and one paper each with Prof Stegmaan, J of Lofarma (Germany), Prof Havemann F and Prof Heinz M of Humboldt University (Germany), Prof Hoffmann U of IKP University (Germany) and one paper with her daughter - Prof (U. Kretschmer) working at Charite University of Medicine (Germany).

5.5.2.4.2 Papers published in international collaboration

Prof Kretschmer published 34 papers in international collaboration with 41 authors located in 20 different institutions, scattered in 10 different countries, namely in Belgium,

Table 2
Institutions with international collaborative links

#	Institution (Country)	Number of papers	Number of authors
1.	DUT WISE Lab (China)	9	11
2.	CSIR-NIScPR (India)	8	3
3.	Williams College (USA)	7	1
4.	Henan Normal University (China)	3	2
5.	CINDOC (Spain)	3	1
6.	University of Jaume (Spain)	3	1
7.	University of Wolverhampton (UK)	3	2
8.	University of California (USA)	2	2
9.	University of Applied Sciences (Switzerland)	2	1
10.	*Other 11 institutions	9	17
	Total	**49	41

*Czech Technical University (Czechoslovakia), Bangalore University (India), National Physical Laboratory, Documentation Research and Training Centre (India), Institute of Marine Biology (Russia), KHBO, KU Leuven and Universiteit Antwerpen (Belgium), Thomson Reuters (USA), University of Copenhagen (Denmark), Russian Academy of Sciences (Russia).

**34 papers have inflated to 49 as some articles had collaborative links with multiple authors and countries.

China, Czechoslovakia, Denmark, India, Russia, Spain, Switzerland, UK and USA. The number of papers in international collaboration has inflated to 49 as some articles had collaborative links with multiple authors and countries. Table 2 lists nine different institutions having two or more papers in collaboration. It indicates that highest number of papers in international collaboration were authored with researchers from the WISE Lab of the Dalian University of Technology (DUT, China) followed by CSIR-NIScPR (Erstwhile CSIR-NISCAIR, India) and Williams College (USA). Remaining papers were published in collaboration with Spain (6), three each with CINDOC (Spain) and University of Jaume (Spain). Further analysis of data indicates that Prof Kretschmer published eight papers with Prof De. B. Beaver (Williams College, USA) followed by Prof R. Kundra of CSIR-NIScPR, New Delhi (Erstwhile CSIR-NISCAIR) with six papers, and Prof Liu Zeyuan (DUT WISE Lab, China).

Citations distribution and highly cited articles:

The count of citations has been utilized to measure the impact of each publication. “Citation counts assess impact, visibility, and significance of a publication. High citations count to a publication is the criterion of its visibility, influence, impact and significance”. The distribution of citations of papers published by Prof Kretschmer during 1979-2021 is depicted in Table 3. Of the 68 papers, 15 (22 %) papers didn’t get any citation. Further exploration of data shows that remaining 53 papers were cited one or more times. Of these, 14 papers were cited more than 50 times. Table 4 lists papers that were cited 50 or more times. These 14 papers received 1754 (77%) of all citations. Of these, nine papers were published in the most reputed journal “Scientometrics” published by Springer Nature from the Netherlands with an impact factor of 3.5. Remaining five papers were published in Information Processing and Management (2), and one each in Journal of the American Society for Information Science and Technology, and COLLNET Journal of Scientometrics and Information Management.

Table 3
Distribution of citations

Number of Citations	No. of Articles	Total Citations
0	15	0
1	3	3
2	5	10
3	3	9
4	4	16
5	0	0
6-10	7	58
11-15	3	37
16-20	5	87

Contd...

21-30	3	83
31-49	6	221
≥ 50	14	1754
Total	68	2278
Citation per paper = 2278/68 =33.5		

Table 4
Highly Cited papers

Bibliographic Details	Total Citations
Hou H, Kretschmer H and Liu Z. The structure of scientific collaboration networks in Scientometrics. <i>Scientometrics</i> , 75,2008 189-202.	403
Li-Chun Y, Kretschmer H and Hanneman R A, et al. Connection and stratification in research collaboration: An analysis of the COLLNET network. <i>Information Processing & Management</i> , 42(6), 2006, 1599-1613.	228
Kretschmer, H. Author productivity and geodesic distance in bibliographic co-authorship networks, and visibility on the Web. <i>Scientometrics</i> , 60, 2004, 409-420.	216
Kretschmer H and Aguillo I F. Visibility of collaboration on the Web. <i>Scientometrics</i> , 61(3), 2004, 405-426.	159
Kretschmer H. Co-authorship networks of invisible colleges and institutionalized communities. <i>Scientometrics</i> , 30(1), 1994, 363-369.	155
Kretschmer H. Patterns of behaviour in co-authorship networks of invisible colleges. <i>Scientometrics</i> , 40, 1997, 579-591.	93
Bhattacharya S, Kretschmer H and Meyer M. Characterizing intellectual spaces between science and technology. <i>Scientometrics</i> , 58(2), 2003, 369-390.	92
Kretschmer H and Rousseau R. Author inflation leads to a breakdown of Lotka's law. <i>Journal of the American Society for Information Science and Technology</i> , 52(8), 2001, 610-614.	78
Kretschmer H and Aguillo I F. New indicators for gender studies in Web networks. <i>Information Processing & Management</i> , 41(6), 2005, 1481-1494.	58
Kretschmer, H. Cooperation structure, group size and productivity in research groups. <i>Scientometrics</i> , 7(1-2), 1985, 39-53.	58

Contd...

Kretschmer H and Kretschmer T. A New Centrality Measure for Social Network Analysis Applicable to Bibliometric and Webometrics Data. <i>COLLNET Journal of Scientometrics and Information Management</i> , 1(1), (2007), 1-7	50
Frank H, Heinz M and Kretschmer H. Collaboration and distances between German immunological institutes – A trend analysis. <i>Journal of Biomedical Discovery and Collaboration</i> , 1(6), 2006, 1-6.	54
Kretschmer H, Kundra R, Beaver deB D and Kretschmer T. Gender Bias in Journals of Gender Studies. <i>Scientometrics</i> , 93(1), 2012, 135-150.	54
Ozel B, Kretschmer H and Kretschmer T. Co-authorship pair distribution patterns by gender. <i>Scientometrics</i> , 98, 2014, 703–723	56
Total	1754

5.6 Discussion

The present paper offers a valuable biographical and Scientometric account of Dr. Hildrun Kretschmer, a key figure in the field of scientometrics and informetrics. Based on the description provided above in the text, it can be stated that Dr. Kretschmer was a multi-faced personality as she played several important roles during her life time to develop the field of scientometrics and informetrics. She was the first President of the International Society of Scientometrics and Informetrics (ISSI), founder of COLLNET, COLLNET Journal of Scientometrics and Information Management (CJSIM), and the founder of Webometrics, Informetrics, Scientometrics and Econometrics (WISE) Lab (China), editor of several proceedings of conference papers and author of several research articles which she presented at different international conferences and published in reputed journals in the discipline of Scientometrics. During the period of 1979-2021, she published 68 papers on different aspects of scientific collaboration in journals besides presenting 57 papers at different international conferences held in different parts of the globe. The highest number of papers were presented in conferences held in Germany followed by India. Highest number of papers were presented at the International Conferences/workshops on Webometrics, Informetrics and Scientometrics & COLLNET meetings held at different locations followed by papers at the conferences organized by International Society for Scientometrics and Informetrics (ISSI) in different parts of the globe. Of the 68 papers published by her in the journals, about half of these were published in journals with high impact factor journals. The most preferred journal used for publishing research results was “Scientometrics” published by Springer Nature with an impact factor of 3.5. More than two-third (70%) of the papers were published in collaboration. However, the value of the collaborative coefficient is low because about 61% papers were either single or two authored. She collaborated with 41 authors from 20 different institutions scattered in 10 different countries. She published highest number of papers in collaboration with Prof Donald de B Beaver (USA), Prof R. Kundra (India) and Prof Liu Zeyuan (China). Of the 14

highly cited papers, nine were published in the journal "Scientometrics" like the pattern of highly cited papers of Professor Wolfgang Glänzel, Scientometrician of world repute. Based on the pattern of publication of the papers it can be concluded that the research output of Dr. Kretschmer is a part of mainstream Scientometrics as half of the papers were published in journals that originated from advanced countries of the West with high impact factor and a high value of citations per paper (33.5).

5.7 Conclusion

This study highlights the major aspects of the role played by Prof Kretschmer as the founder of COLLNET, COLLNET Journal of Scientometrics and Information Management and WISE Lab, organizer of several conferences under the banner of COLLNET and a prolific author in the discipline of Scientometrics. Based on the above discussion, it can be concluded that she played a major role in the development of different aspects of scientific collaboration. Such type of studies may be useful to the future scholars of scientometrics and informetrics. With her passing, the Scientometric and Informetric community has lost one of its great scholars.

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Dedication

The paper is dedicated to the Extraordinary contributions of late Professor (Dr) Hildrun Kretschmer.

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