

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

---

Library Philosophy and Practice (e-journal)

Libraries at University of Nebraska-Lincoln

---

August 2020

## Bibliometric Analysis of Indian Optics Research: Identifying Knowledge Domain

Mallikarjun Kappi

*Kuvempu University*, [mkmallikarjun@gmail.com](mailto:mkmallikarjun@gmail.com)

B S Biradar Dr.

*Kuvempu University*, [bsbbiradar53@rediffmail.com](mailto:bsbbiradar53@rediffmail.com)

Follow this and additional works at: <https://digitalcommons.unl.edu/libphilprac>



Part of the [Library and Information Science Commons](#)

---

Kappi, Mallikarjun and Biradar, B S Dr., "Bibliometric Analysis of Indian Optics Research: Identifying Knowledge Domain" (2020). *Library Philosophy and Practice (e-journal)*. 4132.

<https://digitalcommons.unl.edu/libphilprac/4132>

# **Bibliometric Analysis of Indian Optics Research: Identifying Knowledge Domain**

**Mr. Mallikarjun Kappi<sup>1</sup>**

Research Scholar

Dept. of Studies in Library and Information Science

Shimoga University, Shankarghatta, Shimoga

Email: mkmallikarjun@gmail.com

<https://orcid.org/0000-0003-1964-3498>

**Dr. B. S. Biradar<sup>2</sup>**

Professor

Dept. of Studies in Library and Information Science

Shimoga University, Shankarghatta, Shimoga

Email: bsbiradar53@rediffmail.com

<https://orcid.org/0000-0001-6952-7036>

## **Abstract**

*Optics is a significant research area both for its scientific importance and industrial solicitations. This study examines the optics research activities of India during 2015– 2019, based on the total publication output, its growth rate, quality of papers published and growth rate of India in the international perspective. Patterns of international collaborative research output and the major partner institutions of India are also deliberated. This study also evaluates the research performance of different types of Indian research institutions and the features of published literature in Indian and overseas journals. The data has been retrieved by using SCOPUS database. Total number of 5318 publications as indexed in SCOPUS database during 2015-2019. The results show that there insignificant growth in optics literature published from India. It may be researcher, institutions or India's collaboration with other countries, in all aspects considerable growth can be observed. Quality research in India is grossly insufficient and needs strategic planning, investment and resource support.*

## **Key words:**

Optics Research; India; Bibliometric Analysis; Scopus database; Knowledge Domain

## **1. Introduction**

Research in optics features a protracted and prominent history, courting returned even additionally than the work of Galileo and Newton. In recent decades, optics studies has blossomed with the invention of the laser, an growing interaction between optics and electronics, the development of recent substances with particular optical properties, and other first-rate advances. This is a time of splendid exhilaration for all optics researchers, whether or not in universities, industry, or government laboratories.

Opportunities for research in optics have the capacity for great advantage to society in the subsequent decade. Many new trends, with a high leverage for return on the funding of increasingly more scarce research bucks, are identified. However, research through its nature returns advantages on a portfolio of the many possible avenues of investigation. Some examples of the numerous regions of studies in optics that show promise and offer high leverage for destiny return are offered on this section. It is impossible to hide all areas of research with in the extensive and multidisciplinary areas of optics.

Bibliometric techniques are increasingly being used as an analytical tool to display the growth and effect of studies and overall performance assessment in a given field of study. The intend of the study is to analyses the growth pattern of literature and research impact in terms of annual growth, most productive country, institution and journals, most often cited articles, multidimensional research growth using keyword analysis, impact of research in terms of citation (Chaman, Dharani, & Biradar, 2019)

## 2. Literature Review

**Bhattacharya, Sujit and Shilpa (2011)** examines mapping nanotechnology research and innovation in India via bibliometric and different innovation indicators (standards, products/tactics advanced), the articles taken from Web of Science, Science Citation Index-Expanded (SCI-E) and records of US patent office accessed from Delphion Patent database for the duration of 2000 to 2009 studied. Increase of publications, key phrases analysis, pattern of authorship, patenting activity of research has been analysed. Those findings are mentioned inside the context of china's pastime during this area.

**Garg, K. C. and Adhi, P. P (2002)** analysed 952 publications published with the help of Indian scientists and abstracted by Journal of Current Laser Abstracts during 1970-1994 shows that laser studies in India picked up at some stage in 1978-1994 and reached its peak in 1980. Laser studies completed in India progressed substantially during 1985-1994 compared to 1970-1984 as visible by unique impact indicators such as citation per paper, proportion of high quality papers, and publication effective index. The publication productivity is focused amongst few institutions and there is a similarity with in the activity and attractively profile of the distinctly efficient institutions. India's citation rate per paper for highly productive authors is at par with the world citation rate per paper. The look at indicates that the share of mega authored papers comprehensive during 1990-1994 and therefore the global collaboration is especially with the USA.

**Rajendiran, Ramesh Babu and Gopalakrishnan (2005)** analysed the global productivity of "fiber optics" studies. Articles covered within the Ei-Tech index database within the period of 1999-2003 are studied. Growth of literature by year wise, country wise, authorship pattern, bibliographic forms, ranking of core journals and nature of research were analysed.

**Ram, S. (2018)** quantitative literature analysis was carried out on learning disorder - dyslexia from 1967 to 2016 (50 yr) for assessing the global studies traits. The bibliographic had been retrieved from the Scopus database. There have been 13455 articles on Dyslexia in SCOPUS, distributed in 9 record types and 28 languages. This literature had been grown at 6 % yearly. Of ninety eight nations, America shared maximum contribution. India ranked 20<sup>th</sup> in terms of total publication. The foremost of the research areas focused toward psychology, getting to know capability and linguistics.

**Sakata, I., & Tashiro, H (2012)** studied the words “Power Grid” within the title, keywords or summary has been extracted from a database (Social Science Citation Index (SSCI) and (Arts & Humanities Citation Index (AHCI)). As an outcome, 5,634 papers from 1992 to 2012 had been extracted. Subsequent, those data had been used to construct a network the use of respective papers as nodes and citation relationships as links. In this manner, the largest document group (largest connected component) connecting citation relationships were 1,314 papers. Then thirdly, clustering changed into conducted by means of applying a Newman method to those results.

**Chaman, Dharani, & Biradar, (2019)** analysed the Indian publications output in marketing research during 1990-2018 on numerous parameters. The Web of Science citation database has been used to retrieve the information for 28 years (1990 - 2018) with the aid of searching the keywords “Marketing Research” in combined Title, Abstract and Keywords discipline. The arena output 55,466 and the Indian publications output in marketing research consisted of 633 papers all through 1990– 2018 and which increased from 261 papers in 2008 to 969 papers in 2016, which decreased from 652 at some stage in 2017 & 318 in the course of to 2018. The proportion of Indian overall marketing research changed into 11.56% for the duration of 2003-12, which elevated from 10. 43% for the duration of 2003-07 to 12.18 % at some point of 2008-12. Indian research out put on marketing research is quite low in the worldwide context.

### **3. Objectives**

1. Year wise publications growth rate and distributions
2. To identified highly prolific authors and co authorship
3. To identified forms for communicating
4. To identify the lead institutions
5. To identify the international collaboration
6. To identify the most used keywords

### **4. Methodology**

The bibliographic data of an optics were retrieved from the Scopus database from 2015 to 2019. Scopus is becoming one of the reliable sources of biographic indexing and abstracting database which is now being used for various benchmarking activities such as Times Higher Ranking, QS Ranking, NIRF Ranking etc. along with literature and bibliometric analysis. The search criteria used for retrieving data is as follows. (TITLE-ABS-KEY (optics) AND PUBYEAR > 2014 AND PUBYEAR < 2020 AND (LIMIT-TO (AFFILCOUNTRY,"India"))). In addition MS-Excel for the purpose of data analysis, collaboration networks have been generated by using VOSviewer software.

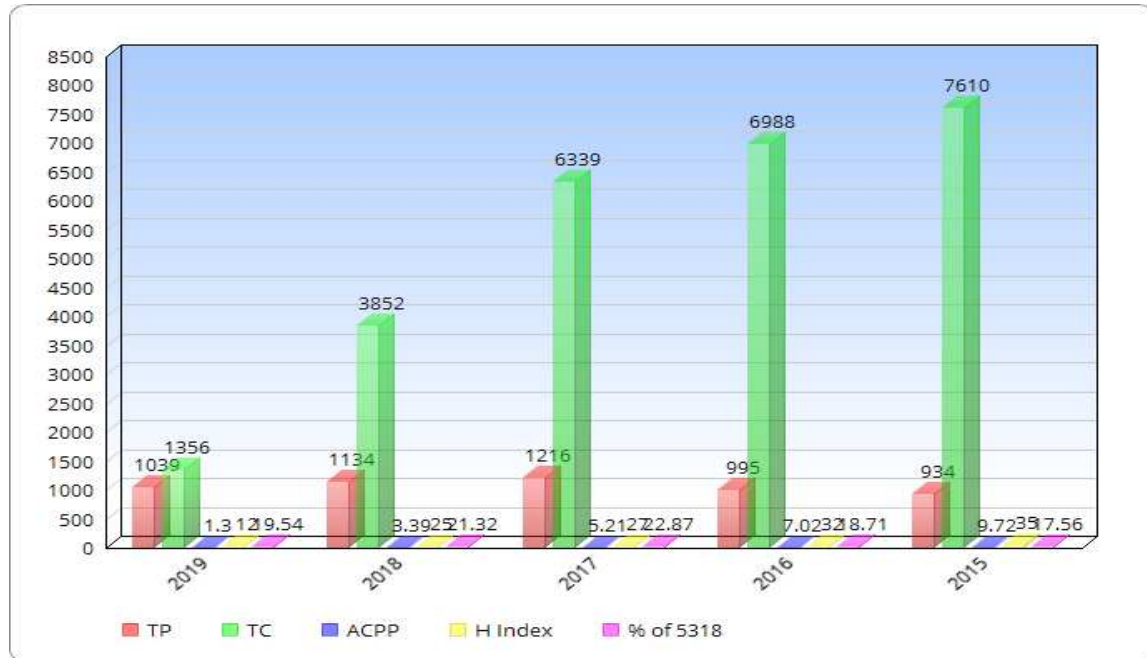
## 5. Data analysis

### 5.1. Chronological Growth rate of Publications

Table 5.1 and figure 1 shows there were 5,318 articles on Optics during the study period (2005 – 2019). The Optics literature in Scopus has grown at the rate of average 20% per year. The no. of citations that researcher’s papers have received. The above data shows that there is an absolute increase in papers as well as citations over the years. Citation reception is to an extent a function of time, i.e., dates of publication. So keeping this in contention, researcher’s papers in later years seem to capture attention more quickly, i.e., receiving citation in a short period after publication. More detailed analysis will however clarify this picture further.

**Table: 5.1 Contributions of Optics Research Publications by Year Wise**

YEAR	TP	TC	ACPP	H Index	% of 5318
2019	1039	1356	1.3	12	19.54
2018	1134	3852	3.39	25	21.32
2017	1216	6339	5.21	27	22.87
2016	995	6988	7.02	32	18.71
2015	934	7610	9.72	35	17.56



*Figure 1: Optics Research Growth rate (2015 – 2019)*

### 5.2. High Prolific Authors and Co-Authorship Analysis

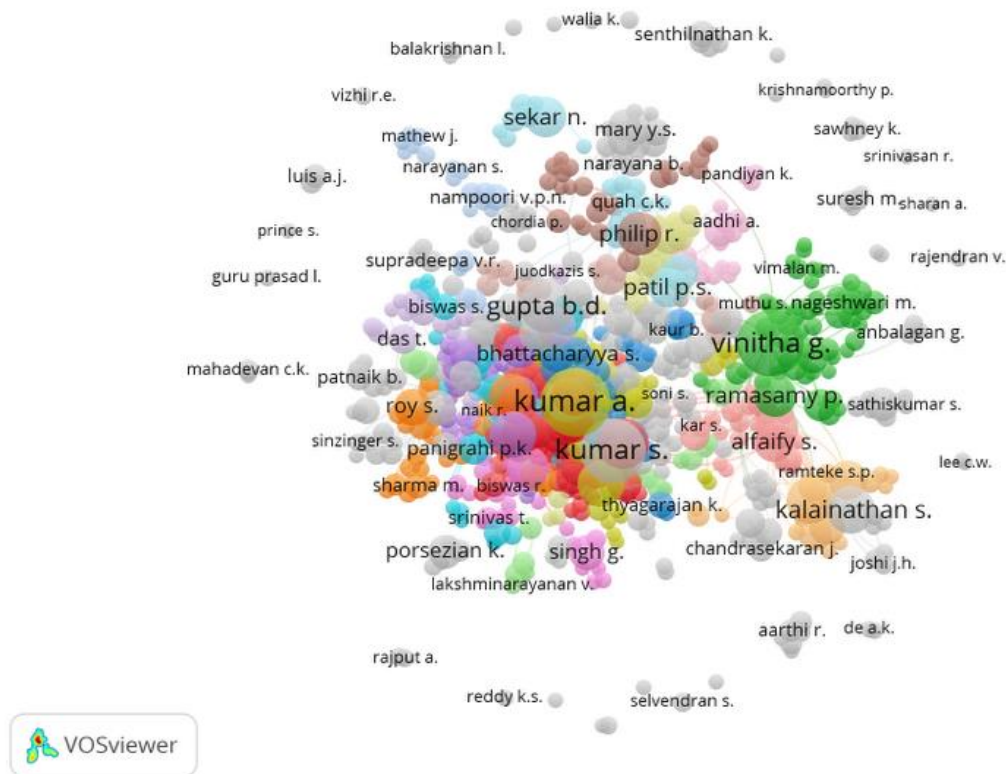
Table 5.2 and figure 2 presents The pinnacle ten efficient authors in accordance to the number of research papers they have published in the study period 2015 – 2019.

The most productive authors is Vinitha, G. (85 articles; TGCS 526; h-index 13) secondly Gupta, B.D. (60 articles; TGCS 926; h-index 19) and followed by Kalainathan, S. (45 articles; TGCS 399; h-index 12). The high TGCS and h-index have got by Gupta, B.D. (TGCS 926; h-index 19) followed by Anis, M., with ( TGCS 736; h-index 18) and Muley, G.G., with ( TGCS 544; h-index 18) which represent they have received the high authority based on their publications published in the selected field. The publications h-index value varies 19 – 09 for the above authors.

**Table: 5.2 High Prolific Authors and Co-Authorship Analysis**

Author Name	TP	% of 5318	TGCS	h-index
Vinitha, G.	85	1.60	526	13
Gupta, B.D.	60	1.13	926	19
Kalainathan, S.	45	0.85	399	12
Anis, M.	42	0.79	736	18
Philip, R.	39	0.73	414	12
Shkir, M.	36	0.68	473	14
Sekar, N.	33	0.62	289	11
Muley, G.G.	32	0.60	544	18
Patil, P.S.	32	0.60	430	13
Ramasamy, P.	31	0.58	262	09

*TGCS: Total Global Citation Score*



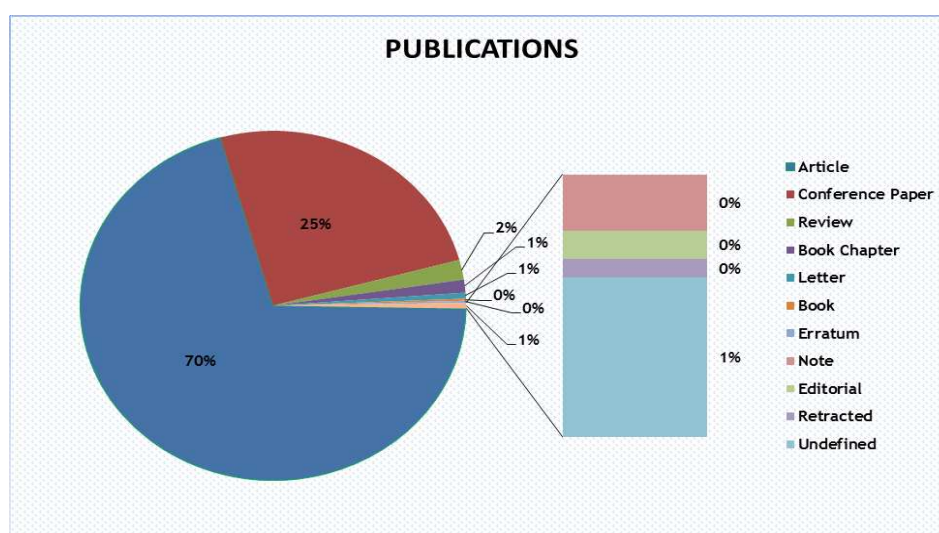
**Figure 2: High Prolific Authors and Co-authorship analysis with VOSviewer**

### 5.3. Forms Used for Communicating

Table 5.3 and Figure 3 illustrates the forms used for communicating of optics research, these includes articles published in the scholarly journals, conferences and seminars proceedings, reviews, editorial materials, book chapters, meeting abstracts etc.. The study observed that a total of 5318 publications in optics research output from India it has been observed from table ten are many communicating channels are used by authors to publish their research articles are used by Indian optics research literature. The majority of publications are published in Journal Articles i.e. 3739 (70.31%) followed by Conference papers 1341 (25.22%) publications, 97 (1.82%) publications published in Review Papers, 64 (1.20%) publications are published as book Chapters, 29 (0.55%) publications are published as Letters, 10 (0.19%) publications published as Books reviews and Erratum, 6 articles are published in Note publications and also observed from the data that more than 99% of articles published in English language.

**Table: 5.3 Forms Used for Communicating Optics Research**

Document Type	Publications	% of 5318
Article	3739	70.31
Conference Paper	1341	25.22
Review	97	1.82
Book Chapter	64	1.20
Letter	29	0.55
Book	10	0.19
Erratum	10	0.19
Note	6	0.11
Editorial	3	0.06
Retracted	2	0.04
Undefined	17	0.32



**Figure 3: Forms used for communicating agriculture research**

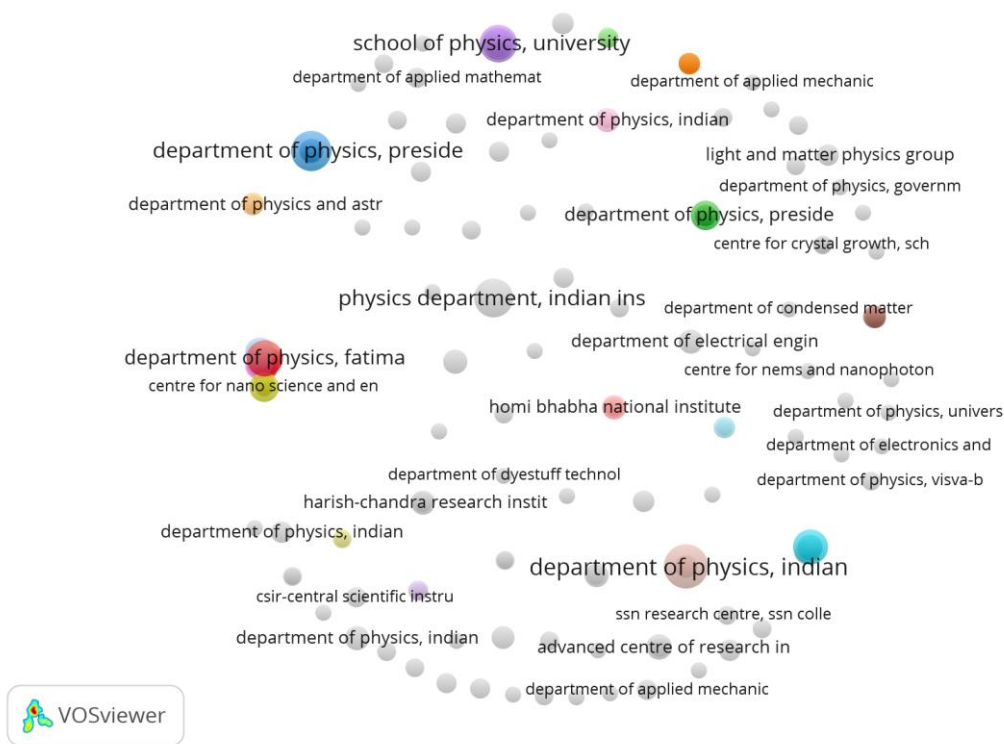
#### 5.4. Organisational/ Institutional wise Collaboration in Optics research

Table 5.4 and Figure 4 expose the top research organizations of India based on their highest research articles. According to the Scopus database Indian Institute of Technology Delhi contributed the highest publications to the field i.e. 209 publications with 3.93%, followed by Indian Institute of Science, Bengaluru with 157 publications (2.95%), Vellore Institute of Technology, Vellore with 149 publications (2.80%), Indian Institute of Technology Madras with 140 publications (2.63%), Indian Space Research Organization with 125 publications (2.35%), Indian Institute of Technology, Bombay with 119 articles (2.24%) and University of Hyderabad with 112 (2.11%) publications, Vellore Institute of Technology, Chennai with 102 (1.92%) publications, Anna University with 101 (1.90%) publications, Indian Institute of Technology Kharagpur with 88 (1.65%) publications and Presidency College, Chennai contributed 85 (1.60%) publications, Raja Ramanna Centre for Advanced Technology with 83 (1.56%) publications published.

**Table: 5.4 Organisational Collaboration**

<b>S N</b>	<b>Affiliation</b>	<b>TP</b>	<b>% of 5318</b>
1	Indian Institute of Technology Delhi	209	3.93
2	Indian Institute of Science, Bengaluru	157	2.95
3	Vellore Institute of Technology, Vellore	149	2.80
4	Indian Institute of Technology Madras	140	2.63
5	Indian Space Research Organization	125	2.35
6	Indian Institute of Technology, Bombay	119	2.24
7	University of Hyderabad	112	2.11
8	Vellore Institute of Technology, Chennai	102	1.92
9	Anna University	101	1.90
10	Indian Institute of Technology Kharagpur	88	1.65
11	Presidency College, Chennai	85	1.60
12	Raja Ramanna Centre for Advanced Technology	83	1.56
13	Indian Institute of Technology Indian School of Mines, Dhanbad	81	1.52
14	Indian Institute of Technology Kanpur	81	1.52
15	Raman Research Institute	79	1.49
16	Indian Institute of Technology Guwahati	77	1.45
17	Bharathidasan University	76	1.43
18	University of Calcutta	73	1.37
19	Bhabha Atomic Research Centre	68	1.28
20	Council of Scientific and Industrial Research India	67	1.26
21	Tata Institute of Fundamental Research, Mumbai	64	1.20
22	Homi Bhabha National Institute	64	1.20
23	Mangalore University	61	1.15
24	Manipal Academy of Higher Education	61	1.15
25	SSN College of Engineering, Kalavakkam	60	1.13
26	Indian Institute of Technology Roorkee	59	1.11
27	National Institute of Technology, Tiruchirappalli	55	1.03





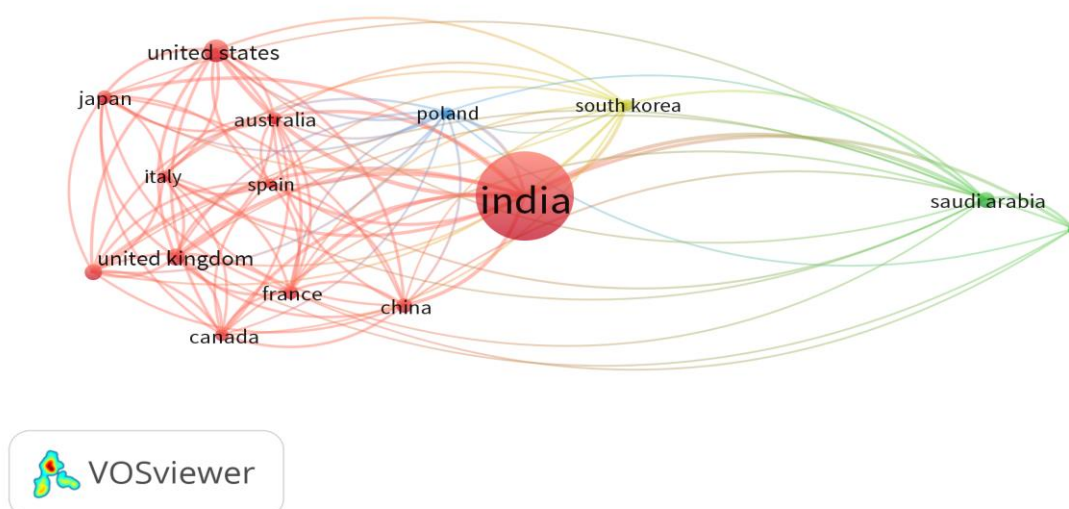
**Figure 4: Organisational Collaboration Analysis with Vosviewer**

### 5.5. International linkages of Indian optics research

Due to the interdisciplinary growth of subject, the universe of knowledge is very dynamic and is ever-growing. An increasing number of specializations in the topics completed by the authors, which is a result of increased participation of group of researchers of different expertise. It's been determined from in advance studies that collaboration in research varies from area to subject and for the equal field from time to time and from one country to another (Sangam, 2011). The international distributions of articles are presented in Table 5.5, which gives the country wise-distribution of contributions. Out of total 5318 research articles, USA contributed the highest number of research article contributing 235 publications with followed by United Kingdom contributed 121 publication of total share, Saudi Arabia published 106 publications with share, Germany contributed 102 publications, China contributed 88 publications, France 77 publications, Japan 72 publications, Japan 72 publication, Canada 65 publications and other countries contributed 605 publications. Many countries are contributed with below 0.5% share with India in optics research during 2015 to 2019.

**Table: 5.5 International Linkages of Indian Optics Research**

Country	Publications
United States	235
United Kingdom	121
Saudi Arabia	106
Germany	102
China	88
France	77
Japan	72
Canada	65
Australia	61
Italy	50
Poland	48
South Korea	48
Malaysia	44
Spain	41
Belgium	37
Russian Federation	37
Taiwan	32
Czech Republic	31
Singapore	30



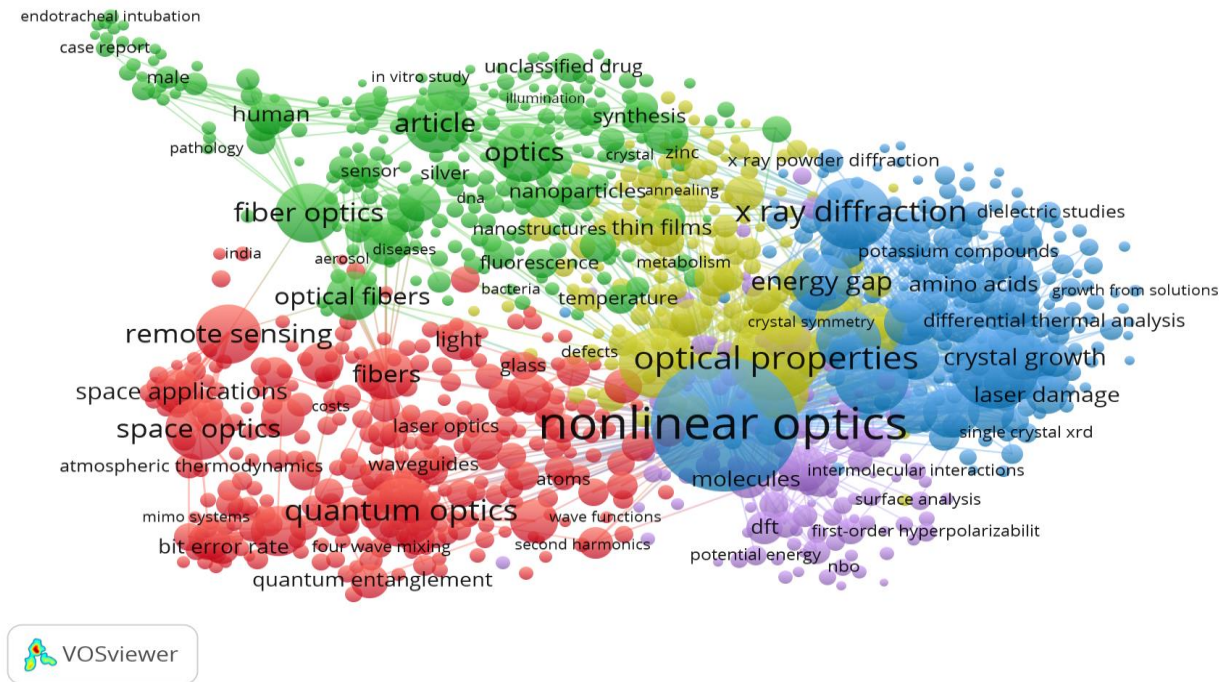
*Figure 5: International linkages of Indian optics research analysis with VOSviewer*

## 5.6. Subject analysis based on keywords

The subject keywords that seemed inside the articles from 2015 to 2019 have been ranked with the aid of frequency of use within the article. The most often used keyword for all intervals became “Nonlinear Optics” as it was also the keyword used as 2008 search term. The most frequently used keywords during the study period has been classified as Optical Properties, Single Crystals; X Ray Diffraction, Refractive Index; Quantum Optics, Harmonic Generation, Space Optics. Based on the frequency of use the hotspot research areas in Nonlinear Optics centred around the keywords focussed on the category of disease includes ‘dyslexia’ 2008, ‘Optical Properties’ 773, ‘Single Crystals’ 703, ‘X Ray Diffraction’ 577, and ‘Refractive Index’ 561. The key-word ‘Spectrum Analysis’ lowest used key-word. (Table.6)

**Table: 5.6 Subject analysis based on keywords**

<b>Keyword</b>	<b>No Of Times App</b>
Nonlinear Optics	2008
Optical Properties	773
Single Crystals	703
X Ray Diffraction	577
Refractive Index	561
Quantum Optics	533
Harmonic Generation	503
Space Optics	436
Fiber Optics	401
Crystal Structure	398
Remote Sensing	395
Optics	389
Article	381
Energy Gap	369
Non-linear Optical Properties	313
Fibers	308
Optical Materials	306
Optical Communication	282
Optical Fibers	272
Density Functional Theory	238
Neodymium Lasers	231
Crystal Growth	223
Space Applications	223
Fourier Transform Infrared Spectroscopy	222
Spectroscopic Analysis	221
Quantum Theory	218
Spectrum Analysis	211



*Figure 6: Key word ranking of Indian optics research analysis with VOSviewer*

## 6. Research findings

1. It is revealed from the study that, out of 5318 contributions, the highest number of articles i.e., 209 (6.73%) were contributed by Indian Institute of Technology Delhi during the study period.
2. Highest publications published in the year of 2017 i.e. 216 (22.87%) publications. And lowest publications published in the year of 2015 i.e. 934 (17.56%) publications.
3. Majority of the articles are published in the English language 5317 publications, one publication published in the Portuguese language and Russian language.
4. It can be noted that out of 5318 research output, majority 3739 (70.31%) of publication is in the form of articles in the journals.
5. Country wise distribution of the articles reveals that out of ten nations, United States is leading with 235 of the articles.
6. Most prolific author in the field of Agricultural and Biological Sciences is Vinitha, G. and got the first rank by contributing 85 articles and h index is 13 in the last five years.
7. Highest 85 articles are published on Agricultural and Biological Sciences.
8. Nonlinear Optics keyword holds the first rank with 2008 and published the majority number of articles compared to any other used keyword in the field of study.

## 7. Conclusion

The study shows the need to improve both domestic as well as global linkages. The domestic linkages ought to go no longer most effective to enhance the effect of research however additionally to increase programmes which might also supplement understanding among theoretical, experimental and packages of Optics research. In case of international linkages, attempts should be made to expand the collaborative partners through more number of institutions and countries. Optik ranked first in terms of publications i.e. 278 publications with total publications and followed by 38th Asian Conference on Remote Sensing Space Applications Touching Human Lives Across 2017 contributed 212 publications. Out of total 5318 research articles, USA contributed highest number of research article contributing 235 publications share, followed by United Kingdom contributed 121 publications. The result of the study helps the librarians in selection and in acquisition of journals in the field of Optics research. It also helps them in proper organisation and management of this literature for better use by the scholars in the field of study. In general, the study reveals the growth and trend in optics field during last five years.

## Acknowledgments

The author thank to Dr. Chaman Sab M, Librarian, S.B.C. First Grade College for Women and Athani P.G. Centre, Davanagere, for providing necessary facilities and resources for completing this article. This research no received specific grant from any funding agency.

## References:

1. Bhattacharya, S., & Shilpa, S. (2011). Mapping Nanotechnology Research and Innovation in India. *DESIDOC Journal of Library & Information Technology*, 31(5), 349–358. doi: 10.14429/djlit.31.5.1191
2. Bagalkoti, V. T., & Hosamani, S. C. (2014). Mapping of the Indian Research Productivity of Biochemistry and Molecular Biology: A Scientometric Analysis. *Journal of Advances in Library and Information Science*, 3(3), 249-256.
3. Chaman, S., Dharani, K., & Biradar B. (2018). Medicine Research in India: A Scientometric Assessment of Publications during 2009–2018. *Library Philosophy and Practice (e-journal)*, 2186.
4. Chaman, S., Dharani, K., & Biradar B. (2019). Marketing Research in India: A Scientometrics Study. *Webology*, 16(2), 172-186. Retrieved from <http://www.webology.org/2019/v16n2/a197.pdf>
5. Garg, K. C., & Padhi, P. (1999). Scientometrics of laser research literature as viewed through the Journal of Current Laser Abstracts. *Scientometrics*, 45(2), 251–268. doi: 10.1007/bf02458436
6. J. VLACHY, World trends, publication output, research fronts and highly cited papers in optics, lasers and quantum electronics, *Czech. J. Phys.*, B37 (1987) 257–272.
7. Kappi, M., & Biradar, B. S. (2020). Overview of trends in Indian Optics Research (2008–2018). *Library Philosophy and Practice*, 1-17.

8. Noruzi, A., & Abdekhoda, M. (2014). Scientometric analysis of Iraqi-Kurdistan universities' scientific productivity. *The Electronic Library*, 32(6), 770-785.
9. Rajendiran, P, Ramesh Babu B and Gopalakrishnan, S. (2005). Bibliometric Analysis of "Fiber Optics" literature. *Annals of Library and Information Studies*, 52 (3): 82-85.
10. Ram, S. (2018). "Word Blindness" (Optics): A Bibliometric Analysis of Global Research in Last Fifty Years. *DESIDOC Journal of Library & Information Technology*, 38(4), 286. doi: 10.14429/djlit.38.4.12791
11. Sakata, I., & Tashiro, H. (2012). Bibliometric analysis of power grid research: Identifying knowledge domain. *2012 IEEE International Conference on Industrial Engineering and Engineering Management*. doi: 10.1109/ieem.2012.6838073
12. Sangam, S. L. (2011). The concept of scientometrics. Scientometric studies. In *Conference Proceedings, National Workshop on Scientometrics* (pp. 1-9).
13. Sangam, S. L. (2000, September). Collaborative research in Psychology in India: a scientometric study. In *Collaboration in science and technology. Proceedings of the 2<sup>nd</sup> Berkin workshop on Scientometrics and Informetrics* (pp. 177-183).