Indian Research on Indigenous Knowledge Literature during 1994-2021: A Scientometric Mapping

Mithu Anjali Gayan [1] *, Maryam Emami[2] ,Manoj Kumar Verma [3]

[1]Assistant Professor, Department of Library and Information Science, Tripura University mithu.anjali@gmail.com, Tell.: +91 8133911232, Orcid ID : **0000-0002-8787-9673**, ***** **Corresponding author**
[2] Ph.D. in Library and Information Science, Kharazmi University (Sq., Shahid Beheshti Street, Karaj, Iran) emamim@ymail.com, Orcid ID: **0000-0002-2465-1903**
[3]Associate Professor, Department of Library and Information Science, Mizoram University
manojdlisbhu@gmail.com, Orcid ID: **0000-0002-3009-3258**

Abstract
Indigenous Knowledge was marginalised until 1960s. However, in the recent past, initiatives have been taken to document the valuable indigenous knowledge hold by different indigenous communities. This study tried to assess the indigenous knowledge published in India. The bibliographic dataset for the study was downloaded from Scopus database using phrase search. A total of 588 records were downloaded and analysed. The results reveal that multi-authorship is dominant in the area and journal is most preferred medium of scholarly communication. Maikhuri, R.K form G. B. Pant from National Institute of Himalayan Environment and Sustainable Development is found to be the top author, most documents belong to Agriculture and Biological sciences, Indian Journal of Traditional Knowledge is ranked 1st in the journal list and Indigenous Knowledge is found to be the most occurred keyword. The results of the study provide significant insights regarding the type of research done in the area, it's growth and impact.
Keywords: Indigenous Knowledge, Scientometric Mapping, VOSviewer, India

Introduction

Indigenous Knowledge (IK) is the kind of knowledge possessed by indigenous or local communities of a particular jurisdiction that is unique to only that group. IK is local knowledge that is unique to a certain culture or society (Warren,1991). Indigenous knowledge originates from a varied range of inhabitants and occupational groups, for example, pastoralists, traditional farmers, fishermen, and others whose knowledge is related to a definite place and is likely to be based on an extensive period of habitation spanning several generations (Anthropological Survey of India, n.d.). Indigenous knowledge refers to experience-based, locality-specific knowledge and practices of medicine and healing, hunting, fishing, gathering, agriculture, combat, education, and environmental conservation developed by indigenous people over the years (Ngulube, 2002). Indigenous knowledge, primarily, is communicated across generations by word of mouth, and unless it is recorded and documented it will always be vulnerable to getting lost (Ngulube, 2002). Until the mid-1960s, Indigenous Knowledge was not given its due credit; rather it was considered backward and unmodern. In the late 1960s, the marginalization of indigenous knowledge started to get reversed. So, documentation of these IK is a fairly recent phenomenon (Mistry, 2009). India has been home to many indigenous communities and the knowledge held by these communities has also been recorded and documented. A recent study conducted by Pathak and Bharati (2018) revealed that the Indian Journal of Traditional Knowledge (IJTK) covers 206 tribes of the world including tribes belonging to 27 Indian states.

Previous attempts have been made to measure IK research worldwide and in the African context (Sarkar, Roy, & Mazumder, 2020; Resenga Maluleka & Ngulube, 2019). A study was conducted to put focus on the importance of an IK-based Institutional Repository (IR) to preserve and disseminate IK in Indonesia (Toong Tjiek, 2006). A few studies have been done to measure the IK research published in the Indian Journal of Traditional Knowledge (IJTK) by different researchers during different periods in the last decade (Pathak &

Bharati, 2018; Shivakumaraswmay & Muthuraj, 2017; Gaikwad & Khokale, 2017). However, Indian output on IK research has not yet been measured. The increasing number of research in the field of IK published from India stresses the need for Scientometric mapping of this area with the applications of different Scientometric indicators so that the growth and impact of Indian IK research output can be quantified and the impact of these research can be understood. Scientometrics is the branch of study which concentrates on understanding different characteristics of science communication (*Scientometrics | Home*, n.d.).   The application of different Scientometric indicators helps in understanding the features of different disciplines as it provides great insightful data regarding publication patterns, growth of the field, authorship pattern, etc. Scientometric analysis can be performed by employing different statistical tools. The current study is an attempt to measure the Indian scholarly output in the area of Indigenous Knowledge.

Review of Literature

Several studies were conducted in the area of IK research as mentioned earlier. An earlier study on IK was conducted by Ngulube (2002) stressed that Information professionals must have an optimistic approach to managing society's knowledge resources and suggested that bibliographies of IK resources should be complied. He urged that standardized tools for indexing and cataloging IK systems must be developed to preserve IK. An early informetric analysis was conducted on IK literature published from 1990 to 2004 using bibliometric indicators available back then by Ocholla and Onyancha (2005) and they found that journal was the most dominating form of publication. AGRICOLA, ASP, ERIC, and C&CR databases were found to have published maximum IK research. Significant growth from 1997 to 2002 was observed. They revealed that single authors authored 58% of the IK documents, most of the IK documents were contributed by USA and India was ranked 7th on the list, most of the IK research was published in the Agriculture discipline. Another important study was conducted by Kwanya and Kiplang'at (2016) to measure

the IK research in the Kenyan context with a bibliographic dataset from Google Scholar published from 1957 to 2015. Unfortunately, the study revealed that IK was an under-researched topic in Kenya. Most of the IK research in Kenya was published during 2004-2009, Agriculture was the most prevalent theme (26%) that shows the significance of agriculture in the socioeconomic constructions in Kenya. Another interesting revelation of the study was that most of the authors researching Indigenous Knowledge were foreign nationals. "Indian Journal of Traditional Knowledge" is an important Indian publication that focuses on IK research and the publications from this journal were analyzed from 2002 to 2012 to know the publication patterns by Gaikwad and Khokale (2017). Basic bibliometric indicators such as year-wise, author-wise, length-wise, issue-wise indicators were applied, and the study showed the dominance of multiple authorship, a maximum of 853 articles were published from India, and from India maximum articles were contributed from Tamil Nadu. Ranjay K Singh was found to be the most productive author Aligarh Muslim University was the most productive institute. Another recent study by Resenga Maluleka and Ngulube (2019) analyzed the pattern of publications of IK research in Africa. They mentioned that IK had always been subjected to bias and African contribution to the IK body of knowledge was absent from formal education textbooks. For collecting the bibliographic records for this study Scopus, Web of Science (WoS), and Google Scholar were considered. Articles were found to be the most produced type of document, Journal of Ethnopharmacology was the most prolific journal, from the WoS, Environmental Sciences (664) yielded the highest number of publications while in Scopus, Social sciences (1902) yielded the most publications followed by Agricultural. This shows how the literature in IK is scattered in different disciplines. A more recent study on IK research from a citation analysis point of view was conducted on a WoS-based dataset of 2000 records published from 2015 to 2019 to understand global publication patterns of IK research by Sarkar, Roy, and Mazumder (2020). "Anonymous authors" were found to be cited most of the time ; 96.1% of documents were found to be journal articles and "Journal of Ethnobiology and Ethnomedicine" was found to

be the most productive journal in the IK field. However, this study focused only on four years of data and it was based on the global literature leaving scope for a more minute study on Indian IK research patterns.

Scientometric mapping studies have been conducted to display network visualizations in terms of Keyword Occurrences, co-authorship of authors, etc. However, these Scientometric mapping studies are done in other research areas such as Digital Libraries research, Nuclear Fuel research, and Distributed Vehicular Networks research (Borgohain, Zakaria, and Verma (2021); Sudarsana, Sai Baba (2019); Sood, Kumar, and Saini, (2021)). Yet, it's not been applied to IK research especially in the Indian context so far. Some of them are reviewed to see what type of visualization can be used in this study. All of these studies have applied VOSviewer application software invariably for the visualization purpose of their dataset.

Most datasets of IK-related studies were downloaded from WOS and Google Scholar and have not studied citation per paper, co-occurrence of keywords, subject-wise analysis of IK research, and funding agencies. Some of the studies were conducted years back and a longer period of the dataset was not considered. In this current study, these research gaps are addressed.

Objectives

The objectives of the study are

1. To examine the publication trends, authorship, and collaboration pattern, co-authorship network and AGR of Indian IK published literature between 1994 and 2021

2. To find out the most prolific authors, institutes, and funding agencies in the field of IK research in India

3. To identify the type of documents and most prolific journals used for IK scholarly communication

4. To discover the subject area-wise distribution of the IK documents and to visualize the Keyword co-occurrence network of IK research

Materials and Methods

The current study is an attempt to measure the publication pattern of Indigenous Knowledge Literature output in India from 1994 to the present. The bibliographic dataset for this study was downloaded from the Scopus database. The dataset was retrieved from the database between 22/06/2022 to 26/06/22022. To retrieve the dataset, phrase search was used under the TITLE-ABS-KEY search option. The detailed search strategy used is TITLE-ABS-KEY (*"Indigenous Knowledge"*) AND (LIMIT TO (AFFILCOUNTRY , *"India"*)). A total number of 588 records were retrieved using the above search strategy. For statistical analysis, Microsoft Excel 2019 and for visualization purposes, VOS viewer version 1.6.17 was used.

The formula used: Degree of collaboration (DC), Collaborative Coefficient (CC), Collaboration Index (CI), Annual Growth Rate (AGR)

Degree of collaboration (DC)

Subramanyam (1983) propounded the DC, a measure to calculate the proportion of single and multi-author papers and to interpret it as a degree. According to Subramanyam,

DC=Nm/(Ns+Nm)

Where,

Nm = the number of multi-authored papers

Ns = the number of single-author papers

DC varies from 0 when all the papers have a single author to 1 when all the papers have more than one author. It can be easily calculated and can also be easily interpreted.

Collaborative Coefficient

Ajiferuke, Burell, and Tague (1988) put forward the formula for collaboration coefficient (CC) as

$$CC = 1 - \frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)f_j}{N}$$

Fj denotes the number of j authored research papers

N denotes the total number of research papers published

It is detected by Ajiferuke, that the value of CC will be zero when single-authored papers are dominant. This implication shows that a higher value of CC means a higher probability of multi-authored papers.

Collaboration Index (CI)

Collaboration Index has been calculated by using the formula given by Lawani (1980). The CI is the simplest index presently used to explore the literature, which is to be interpreted as the mean number of authors per paper.

$$CI = \frac{\sum_{j=1}^{A} j f_j}{N}$$

Where, f_j is the number of J authored papers published in a discipline during a certain period and N is the total number of research papers published in a discipline during a certain period

Annual Growth Rate

Based on the annual growth rate (AGR) given by Santha kumar and Kaliyaperumal, (2015)

AGR= {(End Value – First Value)/ First Value} * 100

Visualization Technique

VOSviewer is a tool used for Scientometric mapping and creation of network maps of co-authorship of authors, keyword co-occurrences, the collaboration of countries, bibliographic coupling of citations, authors, and journals (Van Eck & Waltman, 2010). Previously, it is used by several researchers for network

visualization (Sudarsana & Sai Baba, 2019; Borgohain, Zakaria & Verma, 2021). In this study as well, VOSviewer is used to visualize the bibliographic networks.

Results

The analysed data is represented with tables and figures.
Table 1 represents the authorship pattern in IK research. From the table, it is clearly evident that multi-authorship is in dominance with 473 (80.44%) documents in the field of IK research.

Table 1: authorship pattern in Indigenous Knowledge research

Sl. No.	Pattern	Number	Percentage	DC
1	Single author documents	115	19.56	
2	Multi-author documents	473	80.44	80.44
			100.00	
	Total	588		

Table 2 shows the collaboration pattern in IK research. DC, CC, CI are calculated period-wise in equal clusters of 4 years each. To calculate it, formula a, b, and c mentioned in the methodology is used. The DC value ranges from 0.50 (lowest) to 0.88 (highest) for different periods. DC shows an increasing pattern from top to bottom. The highest DC is observed for the period 2010-2013 and the lowest for the period 1998-2021. CC shows an increasing trend from top to bottom. Lowest CC is observed for the period 1998-2001 and the highest is observed for the period 2014-2017. The Lowest CI of 2.25 is seen in the case of 1998-2001 and the highest is seen for 2014-2017.

Table 2: Collaboration pattern in Indigenous Knowledge research

Period	Total No. of papers	Single authored papers	Multi-authored papers	DC	CC	CI
1994-1997	4	1	3	0.75	0.479	2.50
1998-2001	16	8	8	0.50	0.332	2.25
2002-2005	35	12	23	0.66	0.408	2.29
2006-2009	96	26	70	0.73	0.453	2.52
2010-2013	132	16	116	0.88	0.571	2.99
2014-2017	137	23	114	0.83	0.574	3.74

2018-2021	168	29	139	0.83	0.559	3.76

The top 10 most productive authors in IK research are represented in table 3 with their affiliated institutes. Maikhuri, R.K from G. B. Pant National Institute of Himalayan Environment and Sustainable Development is ranked 1st with 15 (2.55%) contributions followed by Singh, R.K. from College of Horticulture and Forestry, Central Agricultural University, Pasighat with 13 (2.21%) contributions and Tamang, J.P. from Sikkim University having contributed 9 (1.53%) documents.

Table 3: Top 10 Most productive authors with Affiliated institute

| Author	Affiliated institute	Number	Percentage
Maikhuri, R.K.	G. B. Pant National Institute of Himalayan Environment and Sustainable Development	15	2.55
Singh, R.K.	College of Horticulture and Forestry, Central Agricultural University, Pasighat	13	2.21
Tamang, J.P.	Sikkim University	9	1.53
Rao, K.S.	Center for Inter-disciplinary Studies of Mountain and Hill Environment	8	1.36
Samal, P.K.	G.B. Pant Institute of Himalayan Environment and Development	8	1.36
Saxena K.G.	Jawaharlal Nehru University	7	1.19
Phondani, P.C.	G. B. Pant National Institute of Himalayan Environment and Sustainable Development	6	1.02
Tangjang, S.	Rajiv Gandhi University	6	1.02
Ayyanar, M.	A.V.V.M. Sri Pushpam College (Autonomous), Poondi, Thanjavur	5	0.85
Channal, G.	College of Rural Home Science, University of Agricultural Sciences (UAS), Dharwad	5	0.85
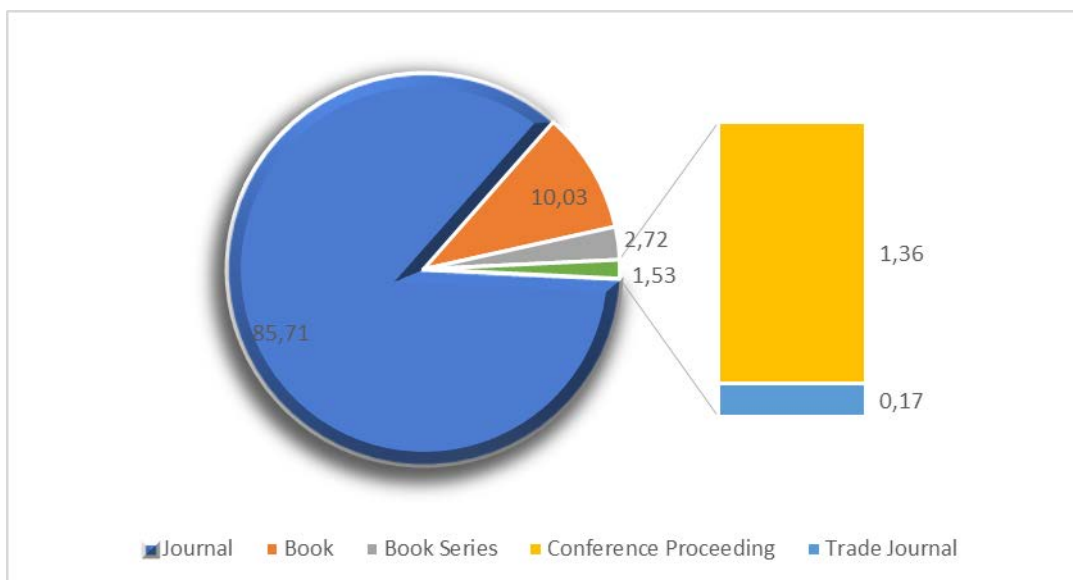
Figure 1: Type of documents used for IK scholarly communication

The type of documents published in IK research is portrayed in figure 1. It is found that a maximum of 504(85.71%) of the documents are in article form followed by Book 59(10.03%) and Book series 16 (2.72%).

Year-wise distribution of the publication and annual growth rate (AGR) are displayed in Table 1, figure 2, and figure 3. The highest number of publications was in the year 2020 (8.67%) followed by the year 2021 with 46 (7.82) and 2009 with 45 (7.65%). The Highest AGR of 150.00 was for the year 2002 followed by 2000 (AGR 133.33) and 2005 (AGR 120.00).

Table 4: Year-wise distribution and Annual Growth Rate of IK research

Period	Number of documents	Percentage	AGR
1994	1	0.17	
1995	0	0.00	-100.00
1996	1	0.17	0.00
1997	2	0.34	100.00
1998	2	0.34	0.00
1999	3	0.51	50.00

| 2000	7	1.19	133.33
2001	4	0.68	-42.86
2002	10	1.70	150.00
2003	9	1.53	-10.00
2004	5	0.85	-44.44
2005	11	1.87	120.00
2006	16	2.72	45.45
2007	12	2.04	-25.00
2008	23	3.91	91.67
2009	45	7.65	95.65
2010	33	5.61	-26.67
2011	41	6.97	24.24
2012	28	4.76	-31.71
2013	30	5.10	7.14
2014	39	6.63	30.00
2015	35	5.95	-10.26
2016	35	5.95	0.00
2017	28	4.76	-20.00
2018	28	4.76	0.00
2019	43	7.31	53.57
2020	51	8.67	18.60
2021	46	7.82	-9.80
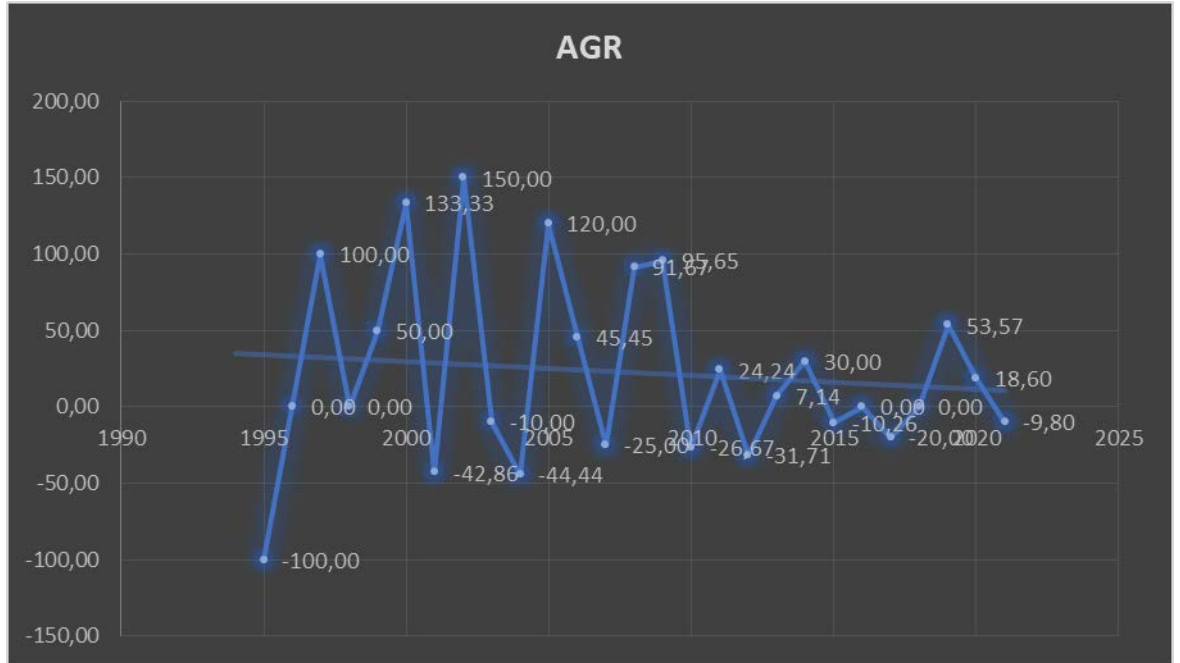
Figure 2: Annual Growth Rate of IK research
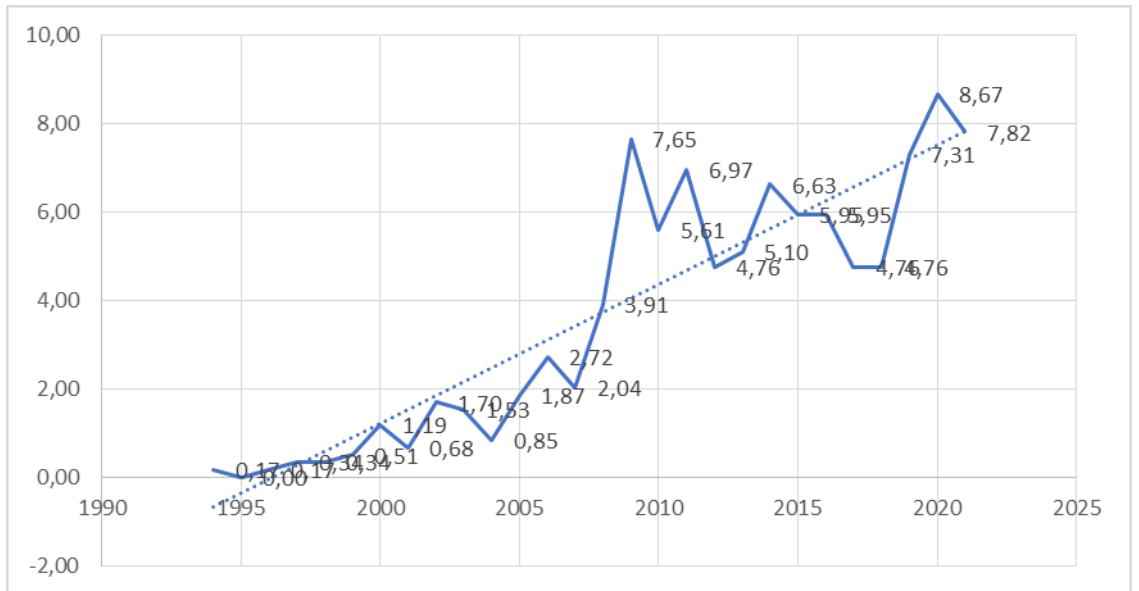
Figure 3: Year wise distribution of IK research with Linear trendline

Citation confirms the quantitative impact of a document. The indicator citations per paper (CPP) is used to measure the impact of the documents. Table 5 displays the citation impact of the documents in which, the highest publication was found in the period 2018-2021 (168), followed by 2014-2017 having 137 publications, and 2010-2013 having 132 publications. The highest citations were received during 2006-2009 (1565) followed by 2010-2013 (1560) and 2014-2017 (950). The highest CPP of 42.25 was observed during 1994-1997 followed by 2002-2005 (CPP 19.57) and 2006-2009 (CPP 16.30). An average CPP of 9.30 is observed in IK research.

Table 5: Citation impact of IK research publications

Year	TP	TC	CPP
1994-1997	4	169	42.25
1998-2001	16	257	16.06
2002-2005	35	685	19.57
2006-2009	96	1565	16.30
2010-2013	132	1560	11.82
2014-2017	137	950	6.93
2018-2021	168	282	1.68
			Avg. CPP
Total	588	5468	9.30

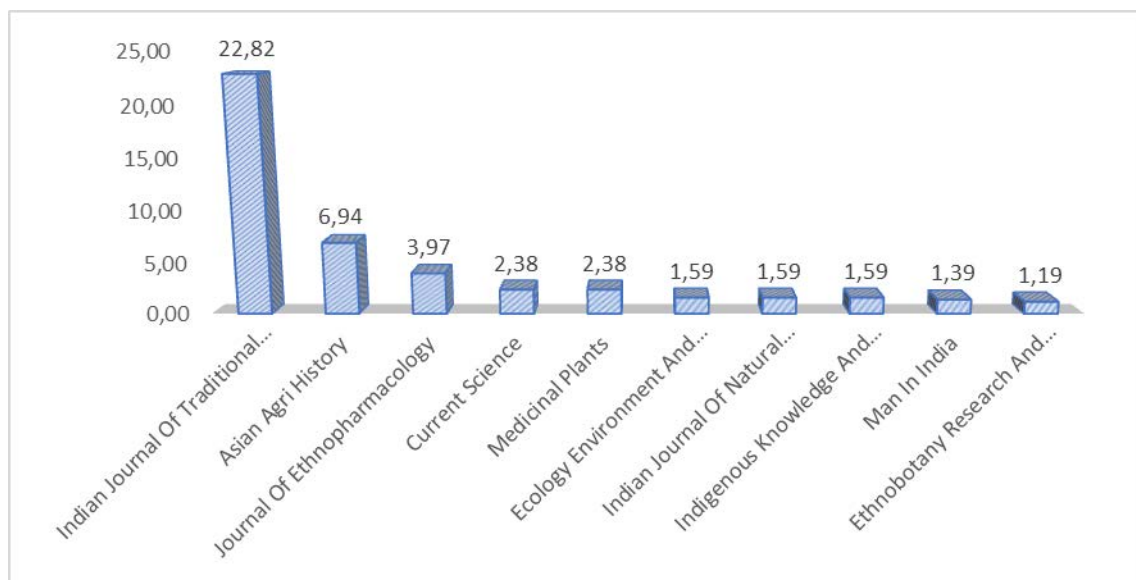(TP=Total publications, TC= Total Citation, CPP= Citation per paper).

Figure 4: Top 10 Most prolific journals

The top 10 most prolific journals in the area of IK are displayed in figure 4. Indian Journal of Traditional Knowledge is ranked 1st having 115 (22.820%) articles followed by Asian Agri History having 35 (6.94) articles and Journal of Ethnoph9armacology is on 3rd having 20 (3.97) documents.
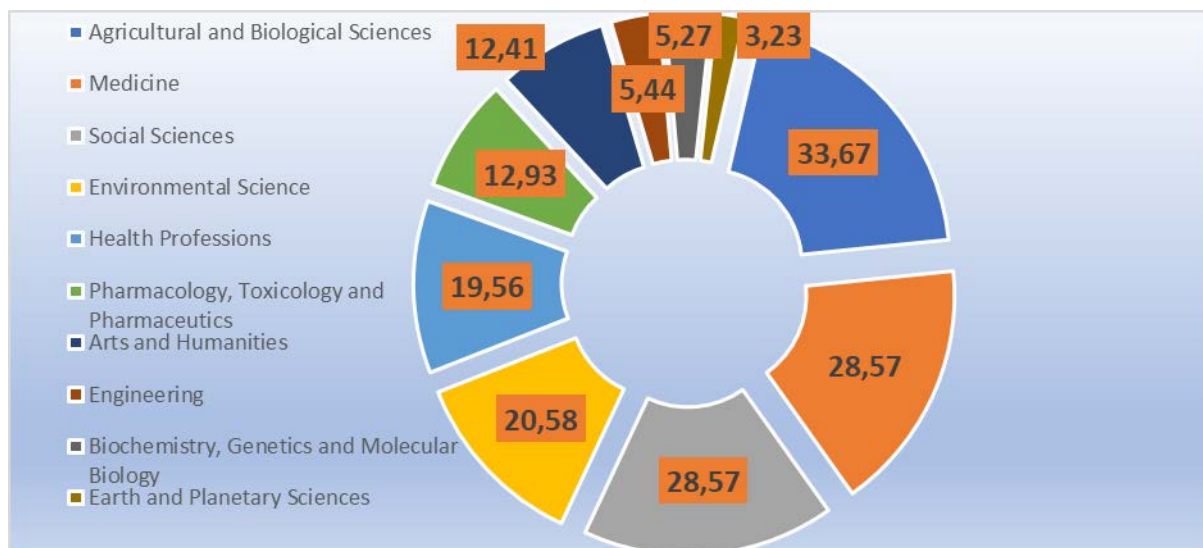

Figure 5: Subject wise distribution of IK research in India

Subject wise distribution IK research in India is portrayed in figure 5. Out of total records, 198(33.67%) belong to Agriculture and Biological Science followed by Medicine and Social Sciences having 168 (28.57%) documents each.
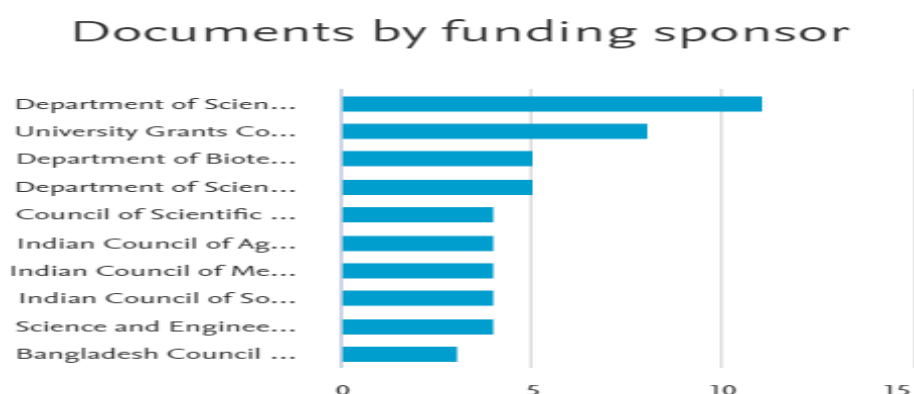

Figure 6: Documents by funding agencies of IK research

Figure 6 shows the funding agencies of IK research in India. Department of Science and Technology, Ministry of Science and Technology, India has funded 11 researches, University Grants Commission has funded 8 and Department of Biotechnology, Ministry of Science and Technology, India and Department of Science and Technology, Government of Kerala funded 5 researches each during 1994-2021.

Documents by affiliation ⓘ

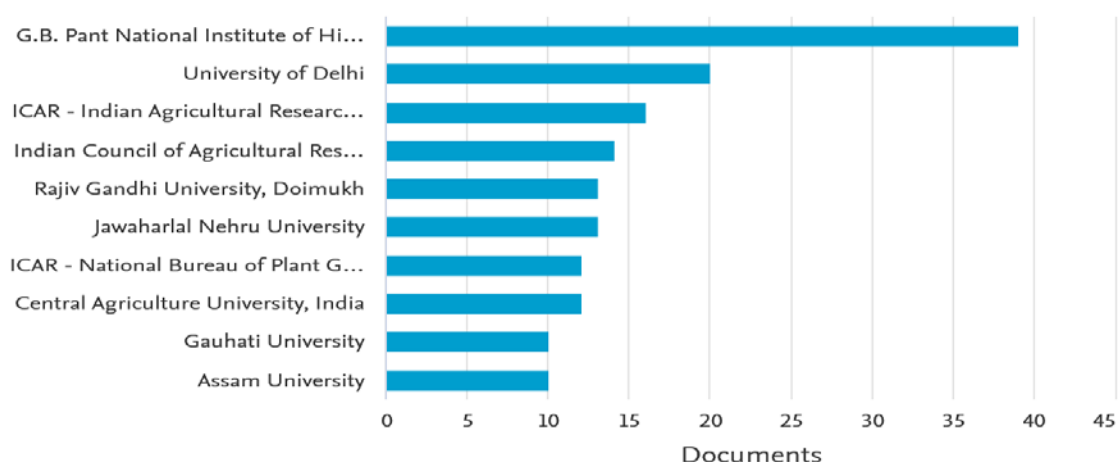Compare the document counts for up to 15 affiliations.

Figure 7: Documents by most productive Affiliated institutes of IK research

Top 10 Research institutes in India focusing on IK research is displayed in figure 7. Out of the top ten institutes, 6 of them are universities and 4 of them being research institutes. Highest number of documents from India in the area of IK research are produced by G.B. Pant National Institute of Himalayan Environment with 39 (6.63%) documents followed by University of Delhi with 20 (3.40%) documents and ICAR - Indian Agricultural Research Institute, New Delhi with 16 (2.72%) documents. It is also found that 3 out of the top 10 institutes are from North-East India region.

Table 10 lists the top 10 most occurred keyword used in Indian IK research. For each of the 243 keywords, the total link strength of co-occurrence links with other keywords has been calculated. "Indigenous knowledge" was the most occurred keyword with a frequency of 250 and a total link strength of 501followed by "India" with 172 occurrences and 962 total link strength and "Article" occurred 90 times with total link strength 765. "Medicinal Plant" and "Traditional Knowledge" stood 4th and 5th in the list.

Table 6: Top 10 most occurred keywords used in Indian IK research

Rank	Keyword	Occurrences	Total link strength
1	Indigenous knowledge	250	501
2	India	172	962
3	Article	90	765
4	Medicinal plant	84	689
5	Traditional knowledge	79	251
6	Human	74	665
7	Ethnobotany	70	464
8	Traditional medicine	62	569
9	Medicinal plants	53	315
10	Biodiversity	50	200
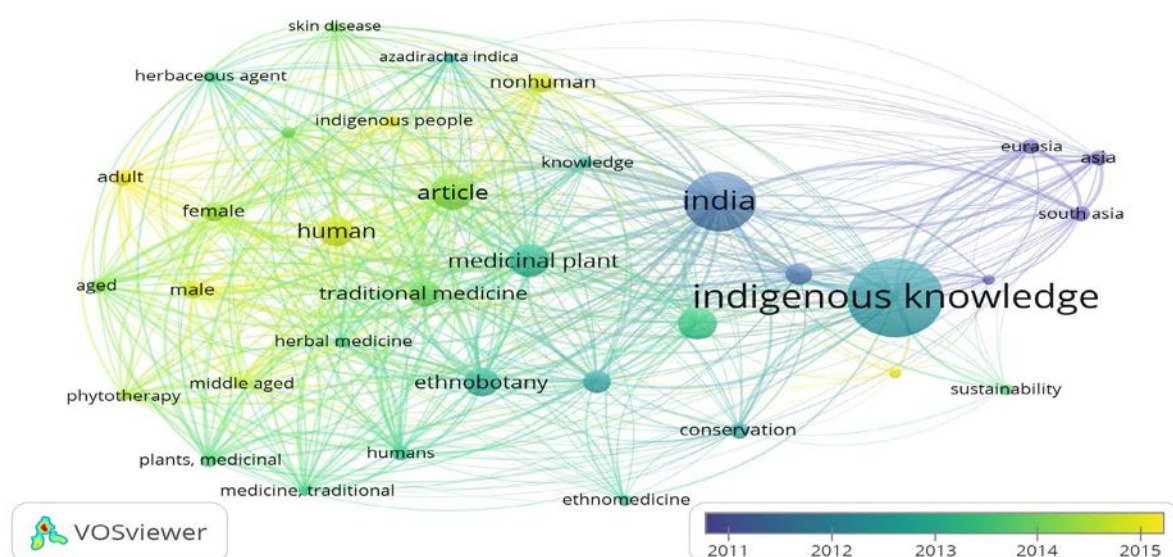
Figure 8: Overlay visualization of Co-occurrence of keywords

Keyword co-occurrence helps in identifying the research hotspot in a specific subject area. Research trends in a discipline can also be studied with it. Overlay visualization of co-occurrence of keywords is portrayed in figure 8. While the criteria on minimum keywords were set to 1, a total of 3996 keywords were

found. Out of 3996 keywords, 243 keywords occurred at least 5 times forming 6.08% of the total keywords. The overlay analysis shows the co-occurrence of keywords in a specified time frame. From the network, it is evident that IK research on Gender and different age groups has evolved recently.

Discussion

Indigenous Knowledge documentation, be it in any form, protects the indigenous communities' local and traditional knowledge for the future generation. In India, as well the process of Indigenous Knowledge documentation has started and a good number of researches have been produced. The current study portrays a Scientometric profile of IK research in India. This study examined the research trends in IK research in the Indian context analytically. The study shows that the number of Indian IK publications is increasing over the years as shown in table 2. An increasing trend in DC, CC, CI shows the increasing dominance of multi-authorship and highly collaborative research work. Journal of Ethnopharmacology was the most prolific journal in the IK field as found by Resenga Maluleka and Ngulube (2019) and in the current study, this journal is ranked 3rd. In their study (Pathak & Bharati, 2018), Central Agricultural University, Pasighat, Arunachal Pradesh was the most prolific institute and in the current study the 2nd most prolific author Singh, R.K. belonged to the College of Horticulture and Forestry, Central Agricultural University, Pasighat. In this study, Agriculture and Biological Sciences is found to be the most contributing discipline which corroborates the previous study by Ocholla and Onyancha (2005). Journals are found to be the most preferred media of scholarly communication in IK research. Similar result was revealed by Sarkar et al. (2020). Indian Journal of Traditional Knowledge is ranked 1st having 115 (22.820%) articles. The highest CPP was observed for the period 1994-1997. Onyancha (2022) found slow growth of literature in the field of Indigenous Knowledge in the initial years of its inception and have observed rapid growth of literature in the recent years. Similar results are corroborated in our study as rapid growth in Indian IK literature is seen in 2020 to 21.

Indigenous Knowledge, Traditional Knowledge and Sustainability were found to be some of most occurred keywords in a previous study by Syukron (2021). Likewise, these keywords occurred in Indian Indigenous Knowledge literature too (Table6, Figure 8). Ethnobotany is a prevalent keyword in Indian IK research (figure 8). Similarly, Malapane et al. (2022) found Ethnobotanical survey, Ethnomedicine, Ethnoveterinary to be ubiquitous keyword. In the current study, Singh, R.K. is ranked 2nd among the top authors (table 3). Mishra et al. (2021) conducted a study on the global literature on natural resources and Indigenous communities and found Singh, R.K. to be one of the top authors.

Conclusion

Until 1960s, only a small amount of research was done in the area of IK. However, in the recent past, initiatives have been taken to document the valuable indigenous knowledge hold by different indigenous communities. Our study shows that several government bodies in India are funding the research in the IK field. Three universities from Northeast region of India are ranked in the top ten most productive institutes showing IK research interest in the region. 3 authors among the top 10 most prolific authors belong to G. B. Pant National Institute of Himalayan Environment and Sustainable Development. The overlay visualization of keyword co-occurrences shows that areas such as Medicinal plant, Traditional medicine, Ethnobotany, Herbaceous agent and Azadirachta Indica are researched in India in IK field. It is also found that the IK documents are scattered over several areas of research raging from Social Sciences to Pharmacology. This study tried to assess the indigenous knowledge published in India. The results of the study provide significant insights regarding the type of research done in the area, it's growth and impact.

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