



Linking Contemporary Science with Traditional Knowledge Sources: A Scientometric Approach

Bhaskar Mukherjee

Professor, Department of Library and Information Science BHU, Varanasi, India

E Mail: mukherjee.bhaskar@gmail.com

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The intrinsic value of Indian traditional knowledge sources in modern sciences is examined by evaluating 2431 publications of the last 200 years culled from the Scopus database. The results showed growing interest among scholars and researchers from about 60 countries who have researched these knowledge sources. Although major publications belong to the fields of humanities and social sciences, researchers in the areas of computer science, engineering, medicine, and environmental science have shown research interests in these domains. A shift of research interest has been noticed as researchers in computational linguistics, semantics, cultural heritage, and sustainable development have identified emerging themes. The analysis of secondary sources showed that publications appeared between 1700 and 1950 on various traditional sources, mostly by non-Indic authors. This research concludes that the fusion of traditional knowledge in fields such as medicine, agriculture, and environmental sciences may be helpful for the study of contemporary problems, achieving sustainable goals, and enhancing both academic inquiry and practical applications. It is urged that the Governments in India should support researchers to work in the areas of social welfare using the Indian traditional knowledge sources.

Keywords: Indian Knowledge Sources, Mahābhārat; Ramayana; Dharmaśāstra, Upanishads, Vedas, Knowledge System – India, Scientometric analysis, Traditional knowledge sources

Introduction

Indian Knowledge System (IKS) is built on a rich and diversified domain of knowledge that has been generated through centuries by integrating traditional wisdom with contemporary problems. Our knowledge system's roots can be traced back to our traditional sources of knowledge, like the Vedas, Upanishads, and Puranas, which laid the foundation for subjects; philosophy, mathematics, astronomy, medicine, etc. However, this knowledge has often been devalued because of the favour of Western epistemologies, leading to a loss of Indigenous knowledge¹. With the advent of British rule in the mid-eighteenth century, the Indian intellectual dynamism began to dissipate². The Indian Knowledge System represents a dynamic interplay between traditional wisdom and current educational approaches. By recognizing its importance and integrating it into contemporary science, there is potential for IKS to contribute considerably to tackling current societal concerns while maintaining India's rich cultural heritage. To gain thorough insight into our traditional knowledge and to revive IKS, it is hoped to be integrated through the National Education Policy (NEP) 2020. The NEP emphasizes the importance of indigenous knowledge in curricula³, with a motto to make education more inclusive⁴ and reflective of India's

cultural heritage. It is hoped that the integration of IKS in the education system, mainly in the higher education system, will foster a sense of cultural identity among the next generation⁵.

Ancient Indian knowledge sources (commonly known as scriptures) are broadly divided into shruti (i.e., which was heard) and Smriti (i.e., which is remembered). Shruti is mainly the four Vedas - Rigveda, Samaveda, Yajurveda, and Atharvaveda. Vedas have four distinct sections- Samhita, Brahmanas, Aranyakas, and Upanishads. Samhita and Brahmanas are collectively called Karma Kanda, whereas Aranyakas and Upanishads are collectively called Gyan Kanda, which deals with knowledge of the world and beyond. Smriti is further divided into Dharma Shastra, Puranas, Itihas, Darshanas, Upa-veda, Vedangas, and Agamas or tantras. Dharma Shastra deals with four main items, i.e., Acara (individual's action/Practices), Vyavhara (action towards others), Prayascitta (remedial actions), and Danda (Punishment). Dharma Shastra includes Manusmriti, Yagyavalkya Smriti, Parashar Smriti, and Narad Smriti. Puranas are bhakti-related texts which include the Shiv Puran, Skanda Puran, etc. Itihas (History) includes two epics of the Hindu religion Ramayana and the Mahabharata. Darshanas are Samkhaya, Purva Mimansa, Uttar Mimansa,

Vaisheshika, Nyaya, and Yoga, these are collectively called “Shad (6) Darshan”. Vedangas are limbs of the Vedas, whereas Agamas deal with the creation of idols, temple construction, and rituals of Prayer.

This work intends to understand the intrinsic value and potential impact of Indian traditional knowledge sources on modern science by evaluating the publications (published work and cited work). Exploring how traditional knowledge that has been laid down in seminal sources like Āraṇyakas, Brāhmaṇas, dharmasāstra, Mahābhārata, Purāṇas, Rāmāyaṇa, Upanishads, Vedāṅgas and Vedas has so far been used in the current research domain may yield insightful findings. Acceptance and recognition of these traditional sources in modern science require an assessment of this knowledge. Therefore, the current work will establish a link between traditional wisdom and contemporary science, ensuring that the insights from Indian traditional knowledge continue to shape a more sustainable and culturally rich future.

Review of Literature

The present literature primarily discusses the pedagogical implications of Indian traditional knowledge in different areas of knowledge. Mostly they are holistic and showcase bidirectional relationships with the environment⁶, language⁷, medical science, health⁸, societal norms⁹, psychology¹⁰ and philosophical foundation¹¹ inherent in Indian culture.

A significant number of studies have also focused on traditional Indigenous practices. Mohanty⁸ observed, examining the electroencephalogram (EEG) signals, that the central and parietal areas of the brain experience a rise in alpha relative power when Maha-Mantra (*Hare kṛṣṇa hare kṛṣṇa kṛṣṇa kṛṣṇa hare hare rāma hare rāma rāma rāma hare hare*) is chanted, signifying that the brain has been calmed and rejuvenated. The investigation revealed abundant alpha, theta, and delta wave generation, which has been linked to hormone or neurotransmitter secretion that causes blood vessel dilation. This is further linked to improvement in mental health and a sense of relaxation and release, which lowers anxiety and depression.

Isser¹², using qualitative analysis of NEP 2020 documents and the literature on Indian Knowledge Systems (IKS), in particular the concept of Dharma, showed in the educational framework how Dharma can be infused to help Indian students' intellectual and moral development. The study showed national

educational reforms have taken into account many traditional Indian beliefs and values, but have fallen short in terms of implementing the Indian Knowledge System and the idea of Dharma in the curriculum.

The study of Vedic mathematics, by Kumar and Joshith¹³, investigated the application of relevant Vedic sutras in the fields of mathematics, science, engineering, and education throughout Asia and Europe. India and seen a sharp rise in the use of Vedic mathematical sutras. The Vedic mathematics sutras, particularly "Urdhvatiryakbhyam" and "Nikhilam NavatascaramanaDasastah," have been widely applied in mathematics and engineering at the higher education level. Other sutras had a very positive influence, which adds to the fact that Vedic mathematics can be useful in many fields where its applications are common.

Paranjpe¹⁴ explains that the distinction between Vidya and Avidya of the Indian knowledge system, as well as the distinction between natural and human sciences, serve as the backdrop against which aspects of yoga are examined from an Indian perspective. Four major trends in contemporary (Western) psychology—radical behaviorism, mainstream psychology, classical psychoanalysis, and humanistic/transpersonal—are examined within the context of the Indian and Western knowledge systems.

Bhatt¹⁵ highlights the many fundamental concepts and theories that modern quantum physics shares with the theory of Śūnyatā. By using the theory of Śūnyatā, various authors have attempted to overcome the "weird paradoxes" and "mysteries" of quantum physics. The Buddhist idea of Pratītyasamutpāda has been used to address the problem of non-separability or entanglement. Utilizing the Upanisadic idea of complementarity of the two opposites, the paradoxical position of "wave-particle duality" has been explained. "Schrodinger's cat" is a measurement problem that has been addressed using two different methods of probability computation. Studies have also been conducted on how the traditional Knowledge that exists in rural India can serve as a catalyst in transforming the urban world¹⁶ or how the Indian knowledge system in Higher education can improve the holistic development¹⁷. Overall, the literature surrounding the Indian knowledge system reflects a multifaceted understanding of traditional wisdom that has evolved over the centuries. However, to the best of our knowledge, there is a research gap that exists on characteristics of such research in terms of

quantity, players, importance, or what extent Indian knowledge sources are being used in emerging sciences. IKS has philosophical, epistemological potential, however, this work intends to measure the quantity and quality aspects of research that used Indian knowledge sources as a foundation, not to evaluate the philosophical potential or content analysis of existing seminal sources.

Objectives:

- To explore the characteristics of publications on various sources of the Indian knowledge system in terms of quantity over the years, country, funding agency, and institution involved in research production;
- To identify the subjects, lead terms, and emerging motor themes of published research on sources of the Indian knowledge system in contemporary knowledge structure; and
- To explore the top seminal/rare publications (published between 1700 and 1950) of these knowledge sources that are cited by contemporary researchers in various domains.

Methodology

An attempt is made to identify which researchers are showing interest in further research on using different sources of the Indian knowledge system and to what extent sources on the traditional knowledge system are in use in reference lists on different disciplines. The relevant sources of literature and references are downloaded from Scopus databases. Using two different tags: 'Title, Abstract, Keyword' and 'References', separately, searches were made. It was assumed that the words that appear in these, either in the Title, Keywords, or Abstracts of the article, and the author might have consulted as a Reference and citation while writing the article. These reference sources may or may not be indexed in Scopus. Scopus also terms these sources as 'Secondary Sources'. The search strategy for accessing sources used is:

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(TITLE-ABS-KEY ("mahabharata") AND TITLE-ABS-KEY ("Mahābhārata")) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "bk") OR LIMIT-T
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The sources, like 18 MahaPuranas, 4 Vedas, 3 Dharmashastra, 13 Upanishads, 12 Brāhmaṇas, along with Ramayana and Mahabharata, were used as

search terms separately. The logical operator OR was used if the terms have more than one form. The search was limited to 'Article', 'Conference Proceedings', 'Book', and 'Book Chapter' sources only. The downloaded results were mixed, and the duplicate results were removed. For instance, if any article was searched through two different source names, only a single place search articles were kept. The search was executed during the last weeks of December 2024. Since the number of results was quite less for the two sources, namely 'Āraṇyakas' and 'Vedāngas', results on these two sources were excluded in the final analysis.

To make data compatible with various software, data cleaning was executed thoroughly, and the data were completed by augmenting it by excavating the individual source. Open source software OpenRefine was used to clean the bugs in the data. To elucidate the data with relevant bibliometric and visual analysis, R-enabled Biblioshiny software was used. To excavate the seminal sources on the Indian knowledge system, the downloaded references were analysed by developing a Python code. Since the downloaded data contained a field of cited references, this field has been incorporated in Python to identify highly occurring sources along with their year of publication. By this program, the seminal/ rare sources were identified that were published between 1700 and 1950 with the number of times that source was cited.

Results

Publications Characteristics

The general characteristics of the papers published are presented in Table 1. It shows that the Mahābhārata, Rāmāyaṇa, and Purāṇas are the three seminal sources that are being used as areas of research in different fields. Research on Purāṇas and Upanishads received more citations than the other two. The number of cited references, where it was cited at least once in the article, was also noticed to be highest in the Mahabharata, followed by the Ramayana and the Vedas. Solo authorship is more predominant than collaborative research. Scopus has identified a few pieces of research on these sources which date back to the nineteen or early twentieth century, and a major portion of research has appeared since 2000. Except for the USA and the UK, authors from Australia, Canada, and Indonesia have also published research in these areas, and international funding agencies like the European Research Council

Table 1 — General Characteristics of Publications on Indian Sources of Knowledge

| | Brāhmaṇas | Dharmaśāstra | Mahābhārata | Purāṇas | Rāmāyaṇa | Upanishads | Vedas | Total |
|--|-----------|--------------|-------------|---------|----------|------------|--------|-------|
| Published Papers | 141 | 107 | 769 | 464 | 515 | 214 | 221 | 2431 |
| Citation/ paper | 2.37 | 3.67 | 3.23 | 9.28 | 4.06 | 7.09 | 4.35 | 4.86 |
| Cited References | 1578 | 1242 | 3180 | 1205 | 2719 | 1728 | 1812 | 13464 |
| Solo: Joint authorship | 120:21 | 100:7 | 621:148 | 328:136 | 358:157 | 49:165 | 163:58 | |
| By Year | | | | | | | | |
| 1800-1850 | 0 | 0 | 1 | 3 | - | - | - | 4 |
| 1851-1900 | 2 | 0 | 2 | 2 | - | - | 5 | 11 |
| 1901-1950 | 0 | 0 | 2 | 5 | 6 | - | 3 | 16 |
| 1950-2000 | 16 | 5 | 41 | 44 | 21 | 14 | 30 | 171 |
| 2001 onwards | 123 | 102 | 723 | 410 | 488 | 200 | 183 | 2229 |
| Country [Top 10] (n=60 countries) | | | | | | | | |
| United States | 23 | 55 | 154 | 135 | 104 | 45 | 40 | 556 |
| United Kingdom | 10 | 5 | 83 | 27 | 38 | 11 | 7 | 181 |
| Canada | 9 | 3 | 35 | 18 | 17 | 5 | 1 | 88 |
| Australia | 2 | 6 | 14 | 17 | 10 | 4 | 1 | 54 |
| Indonesia | 5 | 1 | 21 | 4 | 39 | 1 | 1 | 72 |
| Russian Federation | 2 | 5 | 13 | 4 | 8 | 6 | 9 | 47 |
| Germany | 4 | 2 | 9 | 9 | 4 | 3 | 16 | 47 |
| Netherlands | 1 | 0 | 7 | 10 | 4 | 1 | 6 | 29 |
| France | 3 | 1 | 10 | 1 | 6 | 1 | 7 | 29 |
| Italy | 5 | 4 | 9 | 11 | 1 | 1 | 10 | 41 |
| Japan | 1 | 1 | 5 | 7 | 2 | 2 | 7 | 25 |
| Non-Indic Funding Source [Top 10] (n=86 funding agency) | | | | | | | | |
| European Research Council | - | 1 | - | 4 | - | - | - | |
| Japan Society for the Promotion of Science | 1 | - | 2 | 3 | - | 1 | 1 | |
| Brown University | - | - | 3 | - | 2 | - | - | |
| European Commission | - | 1 | 1 | 3 | - | - | 1 | |
| Fordham University | - | - | 1 | - | 1 | 1 | - | |
| Horizon 2020 | - | 2 | 1 | 2 | - | - | 1 | |
| Russian Science Foundation | - | - | - | 1 | - | 2 | 3 | |
| National Office for Philosophy and Social Sciences | - | - | 1 | - | 1 | 1 | 1 | |
| Fordham University) | - | - | 1 | - | 1 | 1 | - | |
| National Office for Philosophy and Social Sciences, China | - | 1 | 1 | - | 2 | - | 1 | |
| Non-Indic Institutions contributed [Top 10] (n=554 institutes) | | | | | | | | |
| University of Oxford | 4 | 3 | 21 | 11 | 6 | 4 | 4 | 53 |
| The University of Texas at Austin | 0 | 18 | 3 | 4 | 4 | 2 | 1 | 32 |
| University of California, Berkeley | 1 | 1 | 4 | 8 | 11 | 1 | - | 26 |
| SOAS University of London | - | - | 8 | 3 | 10 | - | - | 21 |
| University of Hawai'i at Mānoa | - | - | 13 | - | 6 | 1 | - | 20 |
| Yale University | 7 | - | - | 7 | 2 | 1 | 1 | 18 |
| National Academy of Sciences of Ukraine | 1 | 1 | 3 | 7 | - | 3 | 2 | 17 |
| Universiteit Leiden | - | - | 2 | 5 | 3 | - | 5 | 15 |
| University of Cambridge | 1 | 2 | 3 | 3 | 2 | 3 | 1 | 15 |
| A.Yu. Krymsky Institute of Oriental Studies of the National Academy of Sciences of Ukraine | - | - | 3 | 6 | - | 3 | 2 | 14 |

or Japan Society for the Promotion of Science provided financial assistance to the researchers for these areas. Interestingly, researchers from the University of

Oxford, the University of Texas at Austin, the University of California, Berkeley, etc., have conducted research in these Indian knowledge sources.

It was noticed from Table 1 that many countries and non-Indic organizations are engaged in research in various sources of Indian knowledge. What extent Indian organizations are engaged in researching IKS is shown in Fig. 1. In this three-field diagram, along with organization, and keywords/terms, sources show to what extent individual keywords/terms were engaged with various countries and organizations.

From Figure 1, it is clear that Ayurveda is an area of research in Jadavpur or Y.D. Patel University, whereas the University of Delhi has published research on the Mahabharata, Hinduism, dharma, culture, etc. In India, institutes like Jawaharlal Nehru University, Delhi University, Goa University, Indian Statistical Institute, Ahmedabad University, IITs, and Aligarh Muslim University are also engaged in doing research in these traditional knowledge sources. The subject of publication (DE), along with sources (SO), also indicates the area of research of these universities.

Subject of Research

Table 2 displays the Scopus Subject categories under which all the publications and references appeared. The number of publications is beyond the total, because one title may be classified in Scopus under more than one Scopus subject due to its multiple manifestations.

Table 2 shows using Indian knowledge system sources 27 disciplines on which research has been conducted in the whole world. The majority of

research areas are arts and humanities, social sciences, but the use of traditional knowledge sources for research in disciplines like Computer Science, Economics, Econometrics and Finance, Energy, Engineering, Environmental Science, Physics and Astronomy, Psychology is increasing. Among the seven sources, the Vedas are the most used sources of knowledge in medicine (28), Ramayana in engineering (33), Upanishads in business and commerce (27), Puranas in earth and planetary sciences (82), Mahabharata in computer science (30) and earth science (33).

Lead terms in Science, Arts & Social Sciences

Table 2 showed 27 disciplines where researches were conducted on sources of Indian transitional knowledge systems. It was made to explore the specific areas in science and social science, and in the arts where such researches were conducted. In Table 3, the details are presented.

Table 3 reveals that although the occurrence of social and humanities terms is more than the scientific terms, however, it is clear that Indian traditional knowledge sources are predominantly used as reference sources for scientific research fields like geology, agriculture, medicine, ayurveda, computational linguistics, biodiversity, psychoanalysis, etc. In the subjects of social and humanities science, these sources were used for research in religious ideology, law, ethics, yoga, human rights, various epics, etc.

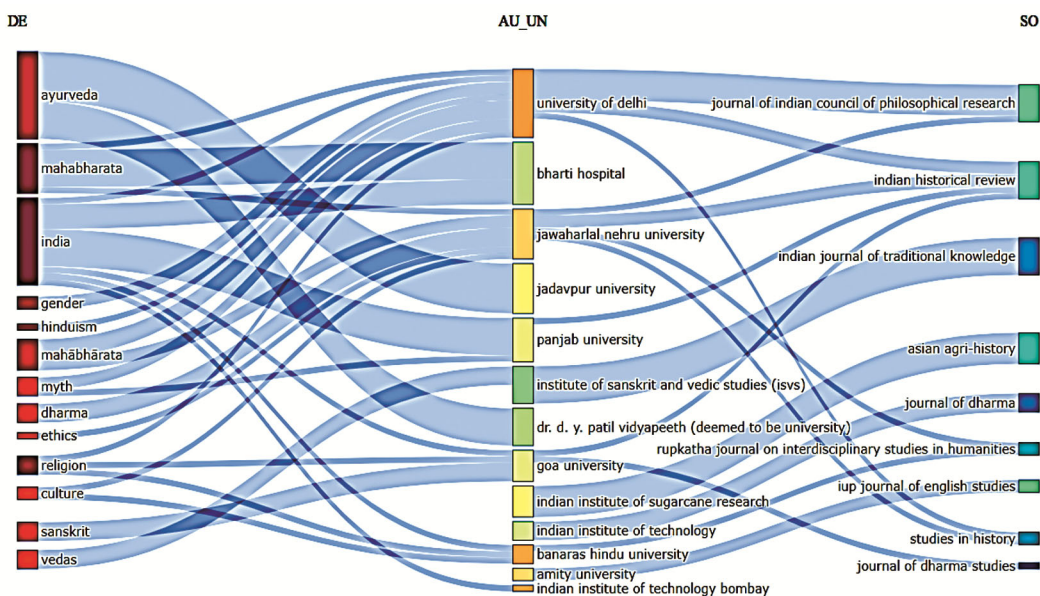


Fig. 1 — Three fields (Author’s Affiliation (AU_UN) Journal (SU) and Keywords (DE))

Table 2 — Broad subject of Research based on Sources of Indian Knowledge System

| Subjects | Brāhmaṇas | Dharmaśāstra | Mahābhārata | Purāṇas | Rāmāyaṇa | Upanishads | Vedas |
|---|-----------|--------------|-------------|---------|----------|------------|-------|
| Humanities | | | | | | | |
| Arts and Humanities | 114 | 95 | 605 | 289 | 373 | 142 | 152 |
| Social Sciences | | | | | | | |
| Social Sciences | 71 | 46 | 377 | 175 | 248 | 76 | 124 |
| Business, Management, and Accounting | 2 | - | 29 | 4 | 29 | 27 | 4 |
| Economics, Econometrics, and Finance | 4 | 7 | 13 | 6 | 10 | 11 | 1 |
| Psychology | - | - | 22 | 7 | 12 | 16 | 4 |
| Sciences | | | | | | | |
| Agricultural and Biological Sciences | 1 | 4 | 22 | 35 | 33 | 7 | 16 |
| Biochemistry, Genetics, and Molecular Biology | - | - | 3 | 9 | 7 | 3 | 9 |
| Chemical Engineering | - | - | 1 | - | - | - | 1 |
| Chemistry | - | - | 3 | 1 | 3 | - | 5 |
| Computer Science | 2 | - | 30 | 5 | 19 | 9 | 11 |
| Decision Sciences | - | - | 4 | 3 | 4 | 3 | - |
| Dentistry | - | - | - | 1 | - | - | - |
| Earth and Planetary Sciences | 2 | - | 19 | 22 | 18 | 3 | 7 |
| Energy | - | - | 5 | 2 | 4 | - | 1 |
| Engineering | 1 | - | 33 | 14 | 33 | 11 | 14 |
| Environmental Science | 5 | 1 | 16 | 20 | 12 | 5 | 2 |
| Health Professions | 3 | - | 2 | 3 | 2 | 3 | 2 |
| Materials Science | - | - | 7 | 1 | 4 | 3 | - |
| Mathematics | 2 | - | 9 | 2 | 1 | 6 | 4 |
| Medicine | 7 | - | 23 | 16 | 15 | 10 | 28 |
| Multidisciplinary | - | - | 4 | - | 5 | 2 | - |
| Neuroscience | - | - | 1 | 2 | 1 | 2 | 2 |
| Nursing | - | - | 1 | 1 | 1 | - | - |
| Pharmacology, Toxicology, and Pharmaceutics | - | - | - | 1 | 3 | 1 | 8 |
| Physics and Astronomy | 3 | - | 10 | 7 | 5 | 2 | 5 |
| Veterinary | - | - | - | 3 | - | - | - |

Table 3 — Number of Occurrences of Lead Terms in Published Titles

| Social & Humanities Science | No. Occ. | Natural & Applied Science | No. Occ. |
|-------------------------------------|----------|---|----------|
| Hinduism/Jainism/Buddhism | 86 | Agricultural history/ cultural anthropology/ cultural geography/ social history | 36 |
| Hindu law/Hindu ethics/Hindu rights | 62 | zircon/binary alloys/carbonate | 32 |
| yoga/bhakti/dharma | 52 | history of medicine/ botany/ ayurveda/ medicinal plant/phytotherapy | 31 |
| sita/feminist/ravana/women/kali | 48 | Soil studies/ancient metal/cosmography | 29 |
| human rights/law | 38 | computational linguistics | 22 |
| Sanskrit epics/Indian epic/ Valmiki | 37 | Computer-aided instruction | 19 |
| Ramayana/narratives | | | |
| caste/gender | 22 | Algorithm/deep learning | 18 |
| BhagavataPurana | 18 | biodiversity/Hemiptera/ | 17 |
| tradition/violence | 14 | Dharwad craton/dike swarm | 17 |
| moral leadership | 13 | psychoanalysis | 12 |

Through Fig. 2, attempts were made to show how, over the period, the knowledge as depicted in our traditional knowledge sources is being used in different domains. Although medicine is a discipline where Indian knowledge sources have been used for a long time up to the present decades, in areas like deep learning, natural language processing, human-computer interaction, and computational linguistics,

these knowledge sources are being used as a foundation.

Evolving/Declining Themes

Fig. 3 shows the ‘Basic’, ‘Motor’/‘Niche’, and ‘Emerging’ themes of our dataset as identified in Biblioshiny. Biblioshiny plots 2X2 map of domains in four themes by analyzing centrality and density of

keywords in a research field. Such 2X2 visualizes the relationships between different themes and their development and importance within a domain. Here, "motor theme" refers to a research topic that has matured over time, has high density, and is central to the research area. These themes may be considered as a well-established and crucial theme within the field. On the other hand, emerging/declining themes are those that are either newly developing with low research activity or experiencing a decline in attention.

While the philosophical aspect of research on these sources was a field of interest a few years back,

considerable research has already appeared in fields like human history, medicinal plants, computer-aided instruction, women's studies, Asia, etc. A shift in interest in research fields has been noticed as researchers in fields like computational linguistics, semantics, cultural heritage, and sustainable development are identified under the emerging theme. A few niche themes [meaning a specialized research topic within a broader field, characterized by high internal density but limited connections to other major themes] are also identified, like named entry recognition, deep learning, text processing, etc.

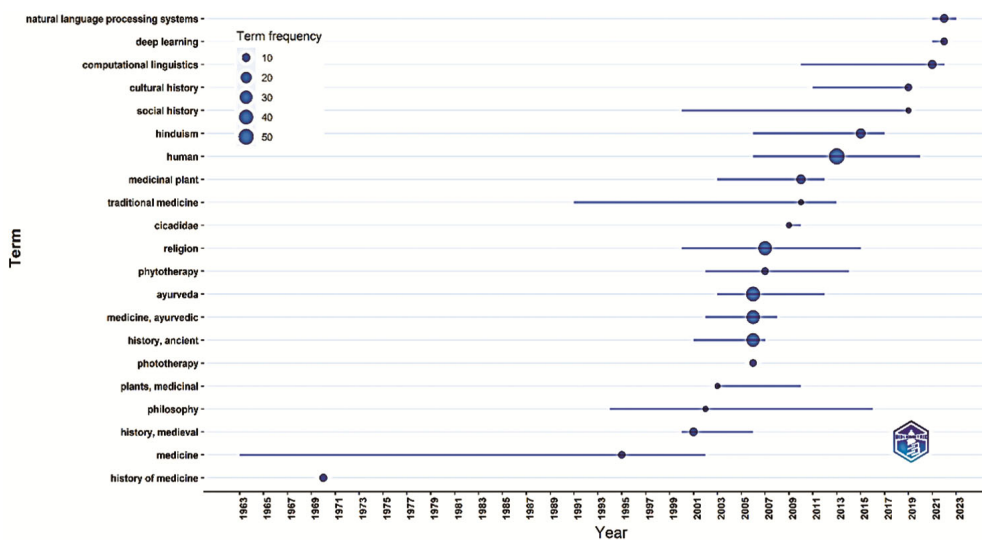


Fig. 2 — Lead research areas over time

| item | freq | year_q1 | year_med | year_q3 |
|-------------------------------------|------|---------|----------|---------|
| history of medicine | 9 | 1970 | 1970 | 1970 |
| medicine | 8 | 1963 | 1995 | 2002 |
| history, medieval | 10 | 2000 | 2001 | 2006 |
| philosophy | 7 | 1994 | 2002 | 2016 |
| plants, medicinal | 7 | 2003 | 2003 | 2010 |
| ayurveda | 40 | 2003 | 2006 | 2012 |
| medicine, ayurvedic | 35 | 2002 | 2006 | 2008 |
| history, ancient | 34 | 2001 | 2006 | 2007 |
| phototherapy | 8 | 2006 | 2006 | 2006 |
| religion | 37 | 2000 | 2007 | 2015 |
| phytotherapy | 8 | 2002 | 2007 | 2014 |
| cicadidae | 7 | 2009 | 2009 | 2010 |
| medicinal plant | 13 | 2003 | 2010 | 2012 |
| traditional medicine | 7 | 1991 | 2010 | 2013 |
| human | 53 | 2006 | 2013 | 2020 |
| hinduism | 14 | 2006 | 2015 | 2017 |
| cultural history | 8 | 2011 | 2019 | 2019 |
| social history | 7 | 2000 | 2019 | 2019 |
| computational linguistics | 11 | 2010 | 2021 | 2022 |
| natural language processing systems | 10 | 2021 | 2022 | 2023 |
| deep learning | 8 | 2021 | 2022 | 2022 |

Freq-frequency, year_q1-1sy Year of Publication, year_med-Median Year, year_q3- Last year of publication

Seminal Sources on the Indian Knowledge System

An attempt is also made to identify some rare/seminal sources that were written on seven identified knowledge sources and are being used in further research because of their importance. It was very difficult to identify such sources since the data in the Reference field was not well structured to that extent in Scopus to incorporate into any software. A flexible Python code, keeping in mind the differences in the data structure of our source data, was developed. Table 4 shows the title and author of

such seminal works that were published between 1700 and 1950, along with the number of times those sources have received citations until now. In addition, the areas where these works are cited are mentioned in column 5. The numbers in the brackets in the first column indicate the total number of seminal secondary publications that our program identified on a given source, the number of publications that appeared between our time frame (1700 to 1950), and the oldest publication year under that category.

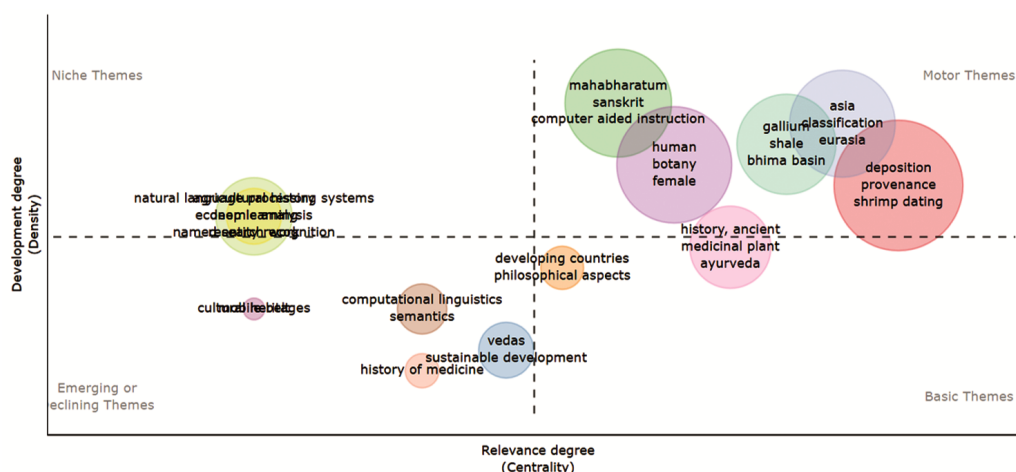


Fig. 3 — Thematic Map of published papers in the science domain

Table 4 — Highly cited seminal literature on traditional knowledge sources (Limit: 1800 to 1950)

| Source | Title & other details | Year | CA | Areas of Research were cited |
|--|---|------|-----|--|
| Brāhmaṇas (288/1578) oldest 1848 | Rigveda Brahmanas: The Aitareya and Kausitaki Brahmanas of the Rigveda by Keith, A.B. | 1920 | 85 | Buddhism, sociology, violence in Hinduism, human rights, Sanskrit literature, architecture, European linguistics |
| | A Sanskrit Grammar, including both the classical language and the older dialects of Veda and Brahmana by Whitney, W.D. | 1879 | 47 | Phonology, Hermeneutical issues, Polish comparative, Indo-European languages |
| | Pañcaviṃśa Brahmana by Caland, W. | 1931 | 42 | Scientific debates, study of goddesses, philosophy, rituals, |
| | Vorwissenschaftliche Wissenschaft. Die Weltanschauung der Brāhmana-Texte by Oldenberg, H. | 1919 | 34 | Ritual Mystification, Interpretive Puzzle, Indian philosophy, religion, Text Segmentation, epic drama |
| | Jaiminiya-Upanisad-Brāhmana by Oertel, H. | 1896 | 23 | stone sculpture, drama, epic |
| Dharmaśāstra (215/1242) oldest 1825 | History of Dharmasastra by Kane, P.V. | 1930 | 291 | Hindu law, jurisprudence |
| | Dharmaśāstra and Arthaśāstra by Winternitz, M. | 1925 | 5 | Probability, statistics, pilgrims, cultural studies, Hinduism, Buddhist philosophy |
| | Ṭoḍarānandam. An encyclopedic work on Dharmaśāstra compiled under the patronage of Rājā Ṭoḍar Mal By Vaidya, P.L. | 1948 | 2 | Land and law, legal studies, area studies |
| | Manusaradhammathat, the only existing Buddhist Law Book, compared with the Brahminical Manu dharmasastra by Fuhrer, A.A. | 1882 | 1 | Hindu law, Buddhism, Oriental Linguistics, |
| | Mānava-Dharmaśāstra with the Commentaries of Medhātithi, Sarvajñanārāyaṇa, Kullūka, Rāghavānanda, Nandana, and Rāmachandra by Mandlik, V.N. | 1886 | 1 | Indian philosophy, Sanskrit, concept of karma, rebirth |

(Contd.)

Table 4 — Highly cited seminal literature on traditional knowledge sources (Limit: 1800 to 1950) — (Contd.)

| Source | Title & other details | Year | CA | Areas of Research were cited |
|---|---|------|--|--|
| Mahābhārata (309/3180) oldest 1795 | The Mahabharata by Ganguli, K.M. | 1833 | 35 | Social network analysis, social studies, caste, and gender politics |
| | The Mahabharata: An Ethnological Study by Held, G.J. | 1935 | 29 | ethnolinguistics, social system, area studies, anthropology, gender studies |
| | VierPhilosophischeTexte des Mahābhārata by Deussen, P., Strauss, O. | 1906 | 15 | Philosophy, culture |
| | Das Mahābhārataals Epos und Rechtsbuch: Ein Problem ausAltindiensCultur- and Literaturgeschichte by Dahlmann, J. | 1895 | 12 | German Indology, politics & diplomacy, religion, women studies |
| Purānas (133/1205) oldest 1812 | Comparative Studies in Vaishnavism and Christianity With an examination of the Mahabharata Legend About Narada's Pilgrimage to Svetadvipa and an Introduction to the Historico-Comparative Method by Seal, B. | 1899 | 9 | Indian renaissance, intercultural philosophy, Indian philosophy, cultural studies, |
| | The Vishnu Purana: A System of Hindu Mythology and Tradition by Wilson, H.H | 1840 | 97 | Theosophical evolution, dramatic fiction, Hinduism, cultural studies |
| | The Purana Text of the Dynasties of the Kali Age by Pargiter, F.E. | 1913 | 47 | Ancient history, social studies, Buddhism, Aryan studies, anthropology |
| | Das PurānaPancalaksana. VersuchEinerTextgeschichte by Kirfel, W. | 1927 | 36 | German Indology, Hindu mythology, science fiction, language |
| Rāmāyana (217/2719) oldest 1803 | MarkandeyaPurana by Pargiter F.E. | 1904 | 26 | Yoga, motherhood, handloom weaving, mythology, |
| | Essays on the Puranas by Wilson H.H. | 1839 | 3 | Hindu mythology, gender studies, |
| | Das Ramayana Geschichte und Inhalt, NebstConcordanz der GedrucktenRecensionen by Jacobi, H. | 1893 | 17 | Historical studies, Health, education, governance, ancient epic |
| | The Rāmāyana of TulsiDāsby Growse F. S. | 1883 | 11 | Religious studies, Hinduism, social beliefs, Feminism, Indo-Fijian music, folklore |
| Upanishads (327/1728) oldest 1799 | On the adbhuta–ramayana by Grierson, G.A. | 1926 | 7 | Hindu tradition, women's studies, cultural poetry, mental illness |
| | The Riddle of the Ramayana by Vaidya C.V. | 1906 | 7 | Social studies, feminism, cross-cultural studies, Hindu epic, bhakti |
| | Linguistic archaisms of the Rāmāyana by Michaelson, T. | 1904 | 5 | Linguistic studies, Sanskrit epic, |
| | The Thirteen Principal Upanishads by Hume, R.E. | 1931 | 205 | Ethics, Buddhist philosophy, Judaism, handicraft, |
| Vedas (324/1812) oldest 1799 | The Upanishads by Müller, M. | 1879 | 47 | Religion, cyberculture, Buddhism, historiography, Indian philosophy, folklore |
| | Isha Upanishad by Aurobindo, S. | 1900 | 13 | Mental health, quantum mechanics, psychology, philosophy, spiritualism |
| | The Katha-upanishad by Whitney, W.D. | 1890 | 10 | Cosmology, ethics, textual criticism, music |
| | Dreikritischgesichtete und übersetzte Upanishad miterklärendenAnmerkungen by Böhtlingk, O. | 1890 | 9 | Language, social studies, philosophical criticism, salvation, Buddhism |
| Vedas (324/1812) oldest 1799 | WörterbuchZum Rig-Veda by Grassmann, H. | 1873 | 207 | Indo-European Language, cultural studies, mythology, women studies, Mahayana Buddhism, |
| | Atharva-Veda Samhita by Whitney, W.D. | 1905 | 142 | Indo-Iranian tradition, Onomatopoeic Poetry |
| | Die Religion des Veda by Oldenberg, H. | 1894 | 106 | Religion, Philosophy |
| | The Veda of the Black Yajus School Entitled TaittiriyaSanhita by Keith, A.B. | 1914 | 101 | Food, cultural studies, south-Asian literature, Hinduism, kinship |
| Hymns of the Atharva-Veda by Bloomfield, M. | 1897 | 93 | Food, psychology, medicine, social relationships, classical Hinduism | |

The results in the Table are self-explanatory. While publications on Vedas are mostly being used in Language, literature, medicine, psychology, etc., publications on Upanishads are being cited in ethics, Buddhist philosophy, textual criticism, etc. Publications on Ramayanas mostly received citations from fields like religious studies, Hinduism, and

women's studies, and publications on Puranas mostly received citations from research on cultural studies, yoga, Hindu mythology, science fiction, language, etc. Research based on the Mahabharata was mostly in the areas of ethnolinguistics, social system, area studies, etc., and research based on Dharmashastra is on Hindu law, Buddhism, Oriental Linguistics, and

for Brahamanas it was on Scientific debates, the study of the goddess, philosophy, phonology, etc.

Discussion

The present study was intended to determine the extent to which our traditional sources of knowledge are becoming fields of interest among researchers throughout the world. In this context, the Scopus database was explored for published literature on the nine sources of the Indian knowledge system, out of which seven were selected for final analysis since the number of results under Āraṇyakas and Vedāṅgas was below 10.

Our results show that there is a notable increased interest in research in these domains since the year 2000, which is an indication of a renewed interest by researchers in ancient texts and their relevance in modern studies. This resurgence with a desire to reconnect India's rich heritage and philosophical foundations with contemporary issues helps address challenges in social ethics, good governance, and spirituality. The study showed that several Universities and academic institutions throughout the world are doing research in the Indian Knowledge System. This will encourage the deeper exploration of the identified sources.

There is a growing interest among researchers in fields like agricultural and biological sciences, computer science, medicine, engineering, physics & astronomy, environmental sciences, and earth and planetary sciences, by using Indian knowledge sources. This may be because the concepts found in Veda, Puranas, and Upanishads, such related to cosmology, consciousness, and human rights, align with the findings of quantum physics, environmental science, etc. The recognition of the Vedic chanting as part of the Intangible Cultural Heritage of Humanity in 2008 by UNESCO (<https://ich.unesco.org/en/RL/tradition-of-vedic-chanting-00062>) has further spurred the interest. Likewise, a major portion of the literature in Dharmashastra belongs to social science, which includes issues like morality, ethics, and values. The growing interest in research on natural language processing, computational linguistics, and using traditional knowledge may be to build more nuanced and accurate systems that can understand and interact with natural language in a culturally semantic manner.

The National Education Policy (NEP) 2020 acknowledges the importance of IKS in educating young learners with a motto to inculcate our rich tradition to the next generation. The results of this

study indicate that computational linguistics, semantics, cultural heritage, and sustainable development are a few emerging fields where more research can be done by using seminal knowledge sources. Universities, policy institutions, therefore, can adopt courses on these areas, or funders can enhance their funding opportunities to expand research bases in these fields. Further research can be conducted on how Vedic mathematics can improve the thinking process of machines most simply, or how AI can be used to organize, analyze and process huge seminal data in IKS sources in such a coherent manner so that learners can easily understand and adopt such knowledge.

Like other studies, this study also has limitations. One of the major limitations of this study is its data. Since we have used only Scopus databases, non-indexed publications are therefore excluded from the analysis, in spite those sources may have potential value in this domain. Works written in non-English languages, like Sanskrit, Hindi, are also excluded because Scopus databases do not include non-English articles in their database.

Future research can be conducted for

Conclusions

Excavating seminal works on Indian traditional knowledge sources indicates that there was considerable interest among researchers from different countries to explore the contents of these sources. A major identified literature published between 1700 and 1950 by non-Indic authors shows how our knowledge sources were important on global scale. The number of citations received by these seminal sources also reflects their importance in contemporary fields.

Embedding traditional knowledge that lies in Yoga, Ayurveda, etc., into modern education, lifestyle, or society will not only help to preserve our rich cultural heritage but also foster international recognition. The fusion of traditional knowledge in fields such as medicine, agriculture, and environmental science may help resolve contemporary problems, achieve sustainable goals, and enhance both academic inquiry and practical applications. At the same time, the perception of knowledge that lies in our rich traditional sources through modern scientific principles and philosophies will make it more valid for wider acceptance as a proven form of science in society. The government should encourage various stakeholders to explore research on the traditional knowledge system.

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