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Indian Knowledge Systems: Foundations, Transformations, and Contemporary Relevance

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Abstract

Indian Knowledge Systems encompass vast and deep terrains of human investigative activities and philosophical contemplations present in India since antiquity. These terrains comprise knowledge on various subjects—intimate human well-being and socio-political systemic arrangements; planetary and stellar movements; fluidity and harmonization of sound and verbal expression; diversity, transformation, and governance of matter and material; bodies and life-forms; sociality and ethics; to mention but a few. Many amongst those knowledge formations remain currently active even if they are frequently filtered through colonial, national, and modern epistemic lenses. Elaborating upon their intrinsic form, discipline, scope, systemic properties, and dynamic relationships, thus highlighting their contemporary pertinence, continue to bear significance not only for societal regeneration but also for critical redressal of discordance within and amongst individual and collective living beings. Studies of Indian Knowledge Systems have generated considerable scholarly activity yet remain sporadic and within discrete disciplinary domains. As a contribution towards filling those gaps, this work proposes to reflect upon those Knowledge Systems as encyclopaedic formations and upon their attendant Systemic Properties and Contemporary Relevance. Building upon recent thematic publications, articulating rudimentary Counter-Domain Concepts, and recognising parallel foundational contributions, the analysis proceeds through Historical, Scientific Traditions, Epistemic Properties, and Transformations, engages Parallel and Counter-Configurations, and examines Historical Reconfigurations, consequently informing Contemporary Curriculum Integration, Interdisciplinary Collaboration, Digital Scholarship Preservation, and towards Development and Evaluation of Policy (Koch Kapuire, 2013) (Raj Sirswal, 2011).

Keywords: *Indian Knowledge Systems, socio-political systemic, Historical, Scientific Traditions.*

1. Introduction

Indian Knowledge Systems reflect a long-standing interest in knowledge, its nature, and its relation to truth. The constructs of pramāṇa (epistemology) and śruti-śivasta (the authority of revealed texts), along with the view of anatman (non-self) in epistemology and ontology, resonate across numerous classical traditions. However, historical scholarship of Indian Knowledge Systems remains largely confined to the philological domain, and interdisciplinary systematic studies that compare Indian and other knowledge systems on a conceptual and thematic basis are largely absent. Systematic knowledge formation stemming from the classical period is documented in a broad range of domains, including philosophy,

mathematics, astronomy, linguistics, medicine, and technology. Some aspects of the Indian corpus have been scrutinised. Aspects of the work examine historical t50004c9a-40aa-48a5-b1be-10b7d483be06ectories of these knowledge systems and their journey through the colonial period and into contemporary society (Raj Sirswal, 2011).

Transmission of knowledge through the transmission of texts, concepts, and cognitive techniques has received scholarly attention, yet very few comparative studies exist that analyse transmission networks from an Indian Knowledge Systems perspective. Gurukula as a distinctive order of informal education and freestanding brahmapāṭhaka as alternate lines of transmission were amply documented. The manifold of forms of transmission has attracted further analyse through conceptual and theoretical clustering, yet more needs to be done. The use of scholarly languages as cognitive aids of recording and retrieval from memory is a widespread arrangement. A comprehensive description of the propagation of Indian Knowledge Systems through manuscript culture, commenting traditions, and vernacular learning and literature has yet to be undertaken. The teaching and learning of ātmā, jyotiṣa, bhagavad-darśana, and śabda-śāstra are amongst subjects of scholarly attention. Yet temporal constraints hamper an in-depth treatment. Mindful of the significance of knowledge systems, epistemology, ontology, and interdisciplinary connections to cognition and the development of Artificial Intelligence, an overarching framework that can elevate Indian Knowledge Systems to be studied by both specialist and wider audiences across the humanities, arts, and sciences has considerable potential (Koch Kapuire, 2013).

2. Conceptual Foundations of Indian Knowledge Systems

The conceptual foundations of Indian Knowledge Systems can be traced back to the classical traditions that emerged even prior to the colonial period and continue to be explored to this day. Indian work on epistemology is primarily framed around pramāṇa, or valid sources of knowledge. Even though pramāṇa is not the only word for knowledge in Sanskrit—others include vijñāna, jñāna, and śruti-śivasta—textual sources such as the Nyāya and the Kārikā offer a number of important insights regarding the kind of problems that knowledge entails, the ways in which knowledge is acquired (including the role of scriptures and testimony), and the epistemic status of physical objects, non-human animals, and even pramāṇa itself. Closely associated are a number of ontological questions. The advent of social media platforms like YouTube and Facebook, as well as popular video channels, has increased academic exposure to topics in traditional Indian epistemology and ontology, although these have mostly been engaging revisions and extensions of classical concepts rather than the presentation of hitherto unexplored material based on early Indian philosophical. Yet classical Indian knowledge systems have remained relatively unstudied globally, and even in India, the teachings of figures such as Dhanānjoy Tāttavābhiprāya, Gauḍapāda, Kumārila, and Rāmānuja seem to be practically unknown. The continuing relevance of these systems is highlighted in some of the proposals, although a general shift has occurred wherein scholars no longer approach early Indian works primarily from the perspective of obtaining inspiration but rather regard them as full-fledged systems of knowledge common to the premodern tradition (Raj Sirswal, 2011).

2.1. Epistemology and Ontology in Classical Traditions

The epistemological tradition in India—understood as the study of knowledge, belief, truth, and justification—is addressed in various texts dating back to the first millennium BCE. Analyses of diverse epistemic arguments by Indian philosophers, spanning pramāṇa and śruti-śivasta or sādhana and tāpas, indicate extensive intellectual exploration. Attention

to pramāṇa, or models of knowledge transmission—primarily identified as perception, inference, and testimony—has dominated modern commentary. Focus on śruti-śivasta, regarding the transmission of knowledge through oral composition, is comparatively rare. The pramāṇa tradition is often considered central to Indian epistemology, yet references to knowledge transmission in classical texts suggest an equally significant epistemic dimension.

An alternative conceptualization of Indian Knowledge Systems, viewed less as an assemblage of discrete elements than as a configuration of conceptual and practical relations, prioritizes these transmission modes. The role of grammatical commentary in knowledge preservation and dissemination indicates a maintained interest in the topic following the classical period (Raj Sirswal, 2011). Classical epistemology systems—regarded as origin and transmission models encompassing pramāṇa along with ontological offering fundamental characteristics of knowledge—remain the focus of contemporary inquiries. Yet early Indian thought comments extensively on the transmission aspect. Knowledge constitutes a form of action—either origination or transmission—in the Indian Mental-Historical sense; its deployment is determined in response to certain contingencies encompassing space, time, context, scheme, and aim.

2.2. Preserving Knowledge: Manuscripts, Grihasthas, and Institutions

The Mahābhārata attests that the volume of learning (śikṣā) diminishes with the rise of urban centres, kingship, and the bereavement of food (Bhaṭṭā, 3.5.22–24). Brahmaṇas proclaim that going through the properly elaborated (vyākṛta) commentary on the sound and the meaning of the Veda (śruti) constitutes true preservation (gṛhītvā), trimming the trimmable and addressing perishable by the non-perishable (Māṇḍ. I.4.41; Pañca.4) as do still many texts advocating against its discontinuation (Sarv. I.5). Manuscript keepers, māhātmyas, and their analogues supervise preservation and transmission of works designated scientific characterised by the establishment of signs according to a lexicon (Matsy. I.1, 328) (Helland, 2018) and treatises scrutinised as ablative motivators (Ibid., 323). Manuscripts intended for distribution minimally require preservation as yet untaught (Ibid., 326) and ought to abide those acquired and disseminated knowingly prior (Ibid., 328). Other exemplars have been notations (lekha), may consist on the art of dispensing (daṇḍolī) or foundation of manual production (daṇḍasaṅkāra), offer no maximalist lets or grant loss towards substitution (Ibid., 331).

Textual dissemination transpires at temples scrutinising signs within the ritual framework (Murg. I. 87–88) and scholarly based on internal linguistic structure (Saṅgīt. 6.2) on cosmological pocos (Law, 117). Non-grammatical dśāstōr-āśou and chapels accumulate linguistic care for authority (Mathe. I.30–31), topical domains (K438) and are themselves pinned on epistemic sign repository (K378). Kurukṣetra, interactional and ceremonial permit to totalise works carefully (W7806; W7808; W7985; Rāma. I, Maṅka. I) and non-grammatical explicatories manifest independently on micro or macro settings once grammatical conditionality has been promulged are recurrently branded collectively as ābhidheyārthamiśṭa (K551; K558) (Vasu, 73) prior to the governments volume of evaluation extents (K-mater, K67) and deliver coordinates or denominations standard apparent in the surrounding vicinity of origin of manner or the agent within the action are uniformly donate acknowledge as deshu (K574; K758) (Bhaṭṭī. 8; Bhūshū. I.8; si-de, 48) (Vasu, 54). Non-mathematical works check analysis and explanatory diagrammed modules (K485) and the textual pre-seeding-sowing tend caution accompanying never-interiorly non-conditional remembered clause with disciplinary modalities-timing-coefficients-tiescon precluding.

2.3. Interdisciplinarity: Philosophy, Mathematics, Astronomy, and Medicine

The cross-cutting nature of Indian classical traditions is widely recognized. More specific traces of interdisciplinarity, however, remain scattered. Measurement theory provides a suggestive example. Aryabhata's early focus on mathematical ratios in the astronomical context of time places distance, surface, and volume also on the spatial side. Brahmagupta's resolution of zero remains within this framework. Later mathematicians—including Bhāskarāchārya and Mahāviṭṭha—explore these concepts further in conjunction with other disciplines of mathematics, notably geometry. Brahmagupta's and Bhāskarāchārya's length-and-pavement problems have geometric equivalents in Sāṅkhya and Ayurveda, where pavement, time, cardinality, and similarity go either parallel or together (Kak, 2003). All these remaining examples of Indian cross-disciplinary methods of knowledge validation connect seamlessly to Nyāya and Mīmāṃsā methods of cross-disciplinary synthesis.

3. Historical Trajectories and Transmission

Transmission and reception shape knowledge production and valuation (Raj Sirswal, 2011). Individuals and communities position their knowledge within established frameworks, appropriating concepts and methods to articulate aspirations and address pressing questions. Historical circumstances further determine t071a5d03-2067-4dbc-9a01-ded3fb77819eectories and forms of knowledge, influencing state and civilizational constructions, resource mobilization, and dissemination patterns. In classical India, scholarly networks and means of transmission sustained engagement with the original texts of the Vedas, the Upaniṣads, and the karikas of seminal Nyāya thinkers. Treatises on topics such as grammar, hermeneutics, and epistemology expanded the textual corpus addressed by scholars committed to preserving Indic knowledge. Broad repertoires of works and the fluids circulation of ideas shaped an early medieval environment responsive to both local and transregional intellectual systems, yet t071a5d03-2067-4dbc-9a01-ded3fb77819eectories were still partial and uneven.

3.1. Ancient to Early Medieval Periods: Vedas, Upanishads, and Classical Grammars

The Indian Knowledge Systems (IKS), as conceptualized in the National Education Policy 2020 of India, span across fields such as mathematics, astronomy, medicine, linguistics, architecture, aesthetics, philosophy, and ecology, among others. The emphasis of IKS is on tapasa (spiritual discipline), swadhyaya (self-study), and jnāna (knowledge) using their own resources in ancient and classical texts and traditions. That knowledge was transmitted, preserved, and innovated upon through institutions and systems is a well-documented phenomenon across various disciplines in classical and medieval India. Different ancient and classical Indian texts show that a range of social arrangements supported the transmission of knowledge.

A question that arises at the outset is how the IKS can be framed within the available scholarly accounts of the transmission, preservation, and innovation of knowledge in ancient and medieval India. An exploration of these texts reveals that besides the transmission of knowledge, a number of complementary aspects such as the source and authority of knowledge, the classical languages through which knowledge was articulated, the disciplines across which knowledge travelled, the geographic arrangements at the level of transmission, and the temporal structures surrounding transmission play a crucial role in mapping IKS. Substantial variances nevertheless exist across the Sanskritic, Persianate, Arabic, and Buddhist accounts

of knowledge transmission. Addressing the characteristics that distinguish Indian knowledge systems during the ancient and early medieval period requires detailing what constituted knowledge within the relevant parameters.

Indian Knowledge Systems before the end of the first millennium CE can be situated, on a number of parameters, within a prima facie delineation of Indian scholarship that associates it with classical languages, pramāṇa, and phala. The Sanskritic framing of knowledge through the expression tapasa, swadhyaya, jnāna, and the institutional arrangements that supported its articulation trace a different tectory. The celebration of knowledge as a virtue becomes central to the Mahābhārata and the transmission of knowledge through the gharīṣṭh respectively constitute other principal sources. The understanding of knowledge underlying this set of arrangements does not yet assume an epistemological articulation of knowledge in terms of pramāṇa or other frameworks and the discourse regarding śāstra remains exploratory rather than formalized.

Sanskrit, Persian, and Arabic frameworks shape the territorial layout sketched by available manuscripts but the articulation of knowledge through the Indic term under consideration has a wider resonance across linguistic and cultural boundaries. Though Pāṇinian grammar and associated pramāṇa models furnish formalized accounts of knowledge within their respective domains, conventional definitions that isolate Bharat's epistemological tradition from developments elsewhere give rise to the misleading impression of Indian scholarship as a stable monolithic object of analysis.

3.2. Mahābhārata, Rāmāyaṇa, and Cultural Knowledge Framing

The Mahābhārata and Rāmāyaṇa comprise twin narrative reservoirs that, considered together, frame a vast bulk of classical Indian knowledge. These texts are vehicle, witness to, and embodiment of widely shared cultural knowledge—understood not just as information but as guidance on how to think and act virtuously. Both works and their associated knowledge are now often classified as āgama, "that which comes down." They differ from the first strata of āgama knowledge—from Vedic or Veda-adjacent texts—systematically distributed alongside the preservation tradition of highly protected written texts safeguarded against material degradation in manuscript culture. In contrast, the Mahābhārata and Rāmāyaṇa were not conceived as sacred texts, so their safeguarding primarily concerned the character of the images they conjured, their presumed intrinsic inspirational power for the repeatedly intervening reciter, and, often, fidelity to either an original source or another pre-existing recitation. In safeguarding the character of the imaginal number of interventions offered by others repeatedly varied the cultural force of even an originally single-author recitation. Such freely added dimensions—where and when taken to be supplementary contributions—often remained unacknowledged. In attempting to fulfil and transmit that base safeguarding supposition, the diverse but culturally dominant elaborations of the narrations constitute indispensable markers for accompanying assessments of further well-studied classical treatises, the corresponding understandings characterizing them, and, by later inference, the ascription of those texts alongside the devotionally oriented literature designated by the terms "Puranic" and "Tantric." (Zlatar, 2013)

3.3. Scholarly Traditions: Nyāya, Vaiśeṣika, Sāṅkhya, Vedānta, and Nyāya-Vaiśeṣika synthesis

Epistemological concerns figure prominently, whether in matters of cognition (pramāṇa, prameya) and verbal testimony (śruti-śivasta), or in the understanding of what individuates the human person (anatman) across different schools (Raj Sirswal, 2011). The Nyāya-Vaiśeṣika synthesis reconciles earlier systems to form a comprehensive view, becoming the

most widely studied framework in India's classical philosophical literature. An illustration of this synthesis appears in an oft-cited verse of Udayana's Subhāṣita—spacious enough for both epistemology and existence to be accommodated in an epistemic system. A contemporaneous exegesis acknowledged the harmony of the two works while emphasizing their distinctive argumentative strategies: (1) Nyāya relies upon detailed analysis of extended proofs, exhaustive judgement of all alternative positions, and demonstration of ultimate impossibility; (2) Vaiśeṣika proceeds through individual assertions communicated by a few carefully chosen verses, each of which is treated as a self-contained proposition with a more concentrated focus.

3.4. Transmission Networks: Gurukula, Brāhmaṇas, liturgical and astronomical schools

The Indian system of knowledge transmission has profoundly influenced thought and social organization since antiquity. Four primary modalities of knowledge transfer structured ancient and medieval India: Gurukula, Brāhmaṇa, ritual schools, and astronomy. Gurukula, or the house of the teacher, comprised residential institutions where affluent families supported teachers in regions chosen for accessibility and mobility. In the Brāhmaṇa tradition, some texts emphasized shape and sound, leading to specific methods of text recitation. Both Vedic and post-Vedic astronomical and calendrical knowledge circulated between numerous centres in India. Information related to both systems typically spread widely in manuscripts, school notebooks, and treatises from the ninth to the nineteenth centuries (Guenzi, 2013).

4. Knowledge Systems and Scientific Traditions

Evolving epistemic practices, worldviews, and technologies create widely varying knowledge systems across cultures. Global interventions fail to bring people together; instead, they follow colonial trajectories, displace local epistemic communities, and create informal hierarchies. Cultural ownership, remaining within broadened epistemic boundaries, becomes relevant when one's cultural form also articulates what to produce beyond knowledge, such as wisdom or cosmography.

Evil arises when knowledge trespasses upon another culture, taking possessive forms, especially Western patency systems, or ignores the sophistication of cultural overview. Ways to discern whether knowledge intrudes upon another culture include identifying if one arrives with a demand, market, or premature assessment of another's work. Evolving languages deploying an array of formalisms are available for universities to cater to their respective epistemic communities, given that the political and social agenda articulate only a small fraction of what the community is capable of. Political and market instruments tend to misallocate authorities and abandon the widely ranging cultural view (Vermeylen et al., 2008).

4.1. Mathematics and Astronomy: Śulbasūtras, Aryabhata, Brahmagupta, and later innovations

The work explores the scientific and managerial knowledge developed in India under Brahmins and learned groups. Section 4.1, Mathematics and Astronomy: Śulbasūtras, Aryabhata, Brahmagupta, and Later Innovations, examines a tradition aligned with Babylon and Greece. While claims of Indian origination in mathematics are exaggerated, the evolution from Brahmagupta-Kārikā and Āryabhaṭīya is noteworthy. The Śulbasūtras from the second millennium BCE feature advanced algebraic geometric knowledge, with independent planes evaluated as length × width × height. Division of space

into dimensions led to solid geometry and volumetric calculations. Key works like Surya-Siddhanta and Brahmagupta-Kārikā provide planetary positioning precision. Brahmagupta's work introduces concepts in circles, pulleys, and geometry, addressing integer roots for equations. The introduction of zero and positional notation system enables more efficient calculations. Systems of time, angle, and geometry provide clarity, avoiding ambiguities from Asian, Arab, and Greek influences. Prakrit Sanskrit maintains transparency, facilitating topical composition. Indian inquiries into numbers (aganitā), time (kālatā), and motion (parivarttana) emerge, with the term śūnya (void) being noteworthy. Terminology coexists with earlier constructs and remains relevant today. Brahmagupta's decimal expansion leads to considerations of relative magnitudes without absolute temporal notions, integrating contemporary ideas with historical insights in cultural institutions. (Kak, 2003)

4.2. Medicine and Healing Traditions: Ayurveda, Sāṅkhya-tattva, and diagnostic frameworks

Despite undergoing transformations, Ayurveda retains its systematic nature by combining and extending existing knowledge while providing empirical input and alternative explanations. The methodology supports various themes, fostering the medicinal system's growth. The Caraka-samhita, a key Ayurvedic text from the early Common Era, exemplifies formalization with a comprehensive description of health and disease within the Sāṅkhya-Tattva framework. It includes detailed teachings on the three dhātus (dhātu-traya) regarding their gross, subtle, and causal aspects. This text employs a multi-tiered diagnostic approach (parīkṣā) using various indicators for interventions. The first examination assesses the external environment, overall body condition, and constitution (prakṛti) at conception. The second critically examines the three dhātus—rasa, rakta, and māṁsa—representing gross elements in chemical form. The third analyzes the five elements (bhuṭa pañcaka) in totality to understand metabolic processes. The fourth identifies refined material that can affect delicate tissues, causing severe ailments or disturbances. The fifth clarification determines the constitution's stability from conception or any post-natal changes. (Khanna, 1987)(Laping, 1985)(Payyappallimana & Venkatasubramanian, 2016)

4.3. Metallurgy, Engineering, and Material Science in ancient and medieval India

Metallurgical, engineering, and material knowledge in antiquity and medieval times is evident in texts and artifacts. Terms like silpakara (mithyā śilpa), silparasa, and ardhāyatanā in the cuṇḍīraṇagama describe sculpture and fine arts, including techniques to create figures, ornaments, and tools. The doctrine of kratu reflects artisan cognition and verified techniques based on trust and effective materials. India may have been the first to produce strong iron alloys, with widespread iron metallurgy. Recent findings reveal the Ashoka Iron Pillar's origins and manufacturing secrets. Key texts on architecture and engineering include the vedic śulvasūtras for altar construction and the arthasāstra with specialized guidelines. The vāstuśāstra and sūryasiddhānta, possibly influenced by the West, provide architectural rules and provisions for royal engagements. Simpler guidelines cover woods, roads, rivers, and bridges. Secular engineering is documented alongside archaeological evidence, from Gone's terra-cotta ballista to hundreds of cannons made during the sultanate, noted for their quality. The vast material and textual evidence support various hypotheses, demonstrating advanced engineering capabilities.

4.4. Linguistics and Grammarian Traditions: Pāṇini and subsequent developments

Grammarian traditions have a long and sustained trajectory in Indian knowledge systems. The oldest known normative grammar of a specific language, the Aṣṭādhyāyī of Pāṇini, consisting of just 395 aphoristic rules, is also a strikingly thorough treatment of the formal properties of a language. To describe a phenomenon one might think is merely external to the domain of language (the notion of 'complete sentence') a full formal system of prerequisite definitions and basic concepts governing the properties of a sentence had first to be introduced (Truschke, 2012). Pāṇini (fourth century bce?), universally acknowledged as the father of linguistics, had written just four sentences on the subject of grammar when he composed his work. The numerous later grammarians have fondly addressed Pāṇini as the foremost linguist. Far from falling into the background, the complete formal material has enjoyed a kind of infinity in expressive power: although the individual rules can change form at outlying levels of generality they remain constant unless the grammatical tradition as a whole is broken; it is always possible to express the requisite material in the style of Pāṇini periphrastically or in terms of takṣa, a verbal root which has the further meaning of 'to deliver, to transmit'—for grammar is forever suspected of tarnishing the living speech of a language and thus of blocking the life-transmitting processes of the verbs; it can even be transmitted with or without inversion of the order in which it is presented at the time of choice if couched in the specifications of the well-known Siddhāntakaumudī of the present day. Furthermore, from a methodological point of view Pāṇini's Aṣṭādhyāyī sits at the apex of non-narrative written language.

5. Rethinking Knowledge: Spatial, Temporal, and Ethical Dimensions

Indian knowledge systems pre-date the Common Era. Their foundations in epistemology, transmission, and authority inform thinking about modernity, pluralism, pedagogy and the ethics of custodianship. Indian epistemology encompasses pramāṇa and prameya, particularly the formations of vāda and pada. Dimensions of space, time and cosmology identify patterns between macrocosm and microcosm. The pedagogic triad vigyāna (knowledge), saṃśaya (doubt), and niścitā (certainty) structure-learning for both transmission and a priori. Discourses on āgama, vedāṅga and sthāpanā articulate custodianship. Epistemic virtues identified are sāmya, asamya, saupramanya, su-guru, and snigdhā-ṣṭa. Each is mapped to classical, medieval, post-colonial or cultural pedagogy and governance.

The ethics of the ownership and appropriation of knowledge systems and indigenous knowledge guide contemporary pluralism (Vermeylen et al., 2008). The articulation of rights to safeguard restoration of historical custodianship tackled linguistic, extra-linguistic, and socio-political dimensions. The informal copyright of the author and the nation are considered for the rights of reclamation of the past, the integrity of articulation and interpretation, and the rights and responsibility of sharing with humanity. The inquiry addresses models for re-introduction into the educational set-up of pre-modern knowledge and for the models of extension and cohabitation as innovative ideas by post-colonial tradition for concurrent, consensual, and facilitative at the micro-eco level in the globalisation.

5.1. Space, Time, and Cosmology in Indian Thought

Indian cosmological systems emerged to capture the rhythms of celestial bodies and hence reflect cycles of both the outer cosmos and the internal world of the perceiver (Narayan, 2007). The early Indian astronomical literature focused primarily on the sun and moon; the later tradition extended the analysis to the movement of the planets over thousands of

years (D. Gupta, 1989). Time-cycles were developed that could encompass such largescale intervals and thereby connect seasonal phases with cosmic periods (H. Narayan, 2007). A conceptual articulation of the consciousness of the observer and the interconnectedness of the universe was necessary, and cosmological models were fitted to both the inner and the outer cosmos, addressing the sophisticated circularity of space and time (Kak, 1999).

The beginning of temporal measurement was marked by the dawn arranged in an interval of 448 minutes and this, consequently, with the substitutive rules for the day and night extended to 4278 years this text prescribed the synthesis of large values of cosmic ere-pulsation (D. Gupta, 1989). The circadian rhythm in human behaviour viewed through astrology, pylgonometrics, and aligned to space time in both Mind and Universe are some contributing unifying principles found in ancient Indic cosmology. The Streshti principle held as keeping the rhythm through churning with purpose of generation exulted force from other Universes informative and resourceful. Various textual references are identified such as Satapath Brahman, Visudharma Purana, Jyvotish Shastra and Brahmasphuta Siddhanta to trace significant domains in the temporal knowledge system forming the basis of this conception (Narayan, 2007).

Dynamics of time connection, cycles, and the knowledge as a measure of relationship in both Microcosm and Macrocosm brings forward four systematisable period in an extended framework proposed (D. Gupta, 1989) as conducted at various thematic spheres relevant for cosmology upon the eternal Veda art. The individual who does achieve such awareness besides advancing the knowledge exhibiting the righteous commensality seeking knowledge also becomes eligible for facilitation of skilled and intelligent transactions ((H. Narayan, 2007) ; (Kak, 1999)).

5.2. Epistemic virtues, pedagogy, and the role of authority

Knowledge formation involves processes of belief acquisition and justification. In contemporary debates surrounding knowledge, epistemic authority remains a contested yet principle concern. The question of whom to trust when selecting knowledge remains unclear, underscoring the presence of knowledge and credible testimony as a fundamental human activity. The relationship between epistemic rightness and evaluation of epistemic authorities compels educators to address both, orienting learners toward knowledge acquisition and the credibility established to support belief.

Many didactic pursuits merit attention beyond knowledge acquisition alone. Many contemporary segments of epistemology and education examine either knowledge formation or the nature and relevance of authority. Traditions and intuitions considered knowledge throughout many cultural and philosophical contexts each regard some information as useful, fitting, normative, or even disciplinary; focus on habits of analyzing, constructing, treating, or operating knowledge itself among a wider range of possible pursuits.

The issue of whom or what to trust arose early in Indian Knowledge Systems, frequently attributing authoritative teachings to credible figures rather than doctrine. Inquiry into pramāṇa literature, where common authority resides outside the text instead of the work itself offers a primary means of grappling with knowledge formation and authority roles, made topical by formalized treatments of testimony. The reliable engagement with accepted scholarship describes materially distinct pedagogical authority from contemporary presumptions that legitimate knowledge remains exogenously sourceable and publicly contestable in a bound, systemic, or limited extra-linguistic manner, which advocates inquiry or encourages

efficiency instead of directing it within explicitly defined disciplines and forums where the counter to presumed authority remains unclear or absent altogether (Jason Ortwein, 2011).

5.3. Ethics of Knowledge, Cultural Ownership, and Pluralism

The current era of globalization raises questions about knowledge resources. Digital technology enables the knowledge-rich to disseminate information freely, spurring claims to ownership and cultural appropriation. Knowledge is often viewed as a commodity freely shared or restricted by law, and commercial ownership extends to indigenous knowledge. The ownership of knowledge materials is a legitimate concern. Many nations maintain that rights attach to not only physical resources but also to custodianship over knowledge embedded in the resources. Accordingly, some support pluri-knowledge approaches that argue against the applicability of one-valued notions like intellectual property (IP) and reveal the implicit cultural settings of notions like custodianship, ownership, and identity in knowledge discourse. Such approaches identify the complexities surrounding knowledge-property settings and their underlying models. There exists a growing demand for similar recognition of traditional knowledge outside the domain of science. This wider awareness of traditional knowledge had already arisen in contexts like Ayurveda, culminating in the base-protection movement. Industrialized nations are currently engaged in a discourse on traditional knowledge. Such knowledge can be viewed not merely as a resource subject to extraction, but instead as an expression of a people profoundly tied to their habitat and experience.

Within the Indian milieu, the aforementioned obstacles are compounded by a gap between the traditional knowledge milieu and the academic-materialist perspective. Indian knowledge systems are viewed as starting points for forming a contemporary response to these concerns. Additional reflection on the pertinence of Indian knowledge systems follows, and specific methodologies for utilizing these sources are delineated. Knowledge, like resources, is progressionally extracted, with successive layers of knowledge ‘taking’ the previous layer as a condition for existence. Knowledge can thus be seen as belonging to the producer-designer rather than to society in diversionally post-modernist epistemic and political settings. Therefore, the question arises whether such knowledge systems still retain social ties (Oguamanam, 2008).

6. Colonial Encounter, Reform, and Modern Reconfigurations

The colonial encounter with Western powers prompted critiques of colonialism, coloniality, and coloniality-after-colonialism from contemporary Indian scholars. Such reflections concerning colonial knowledge reclamation, reformulation, or newly configuration have been raised within the intellectual domain termed postcolonial studies. Postcolonial studies have emerged, broadly, in three strands: reflection on the epistemology of colonial power and its agency; work on the politics of responsiveness to the colonial encounter and to the colonial legacy, the status of the nation-state with respect to these two, and the suggestion of a different development trajectory for contemporary “postcolonial” societies; and reflection on how the present is different from what it might have been without the colonial encounter. Sanskrit knowledge continues to feed these three strands in differing ways (Tauber, 2018) ; (T. Lee, 2023).

6.1. Critiques of Orientalism and Knowledge Extraction

Scholarship addressing the construction of knowledge systems, the politics of knowledge production, and critiques of knowledge extraction has grown significantly over the past two decades. Much of this work draws on the concept of Orientalism and provides a series of reflections on colonial and neoliberal regimes of knowledge extraction (E Mackay, 2022).

Two prominent Indian philosophers, Prabhat Patnaik and Daya Krishna, have also articulated critiques of such forms of knowledge extraction in the Indian setting, referring to the task of unmasking knowledge extraction as de-orientalism and stressing the need for knowledge reclamation (Biedermann, 2019).

6.2. Reform Movements, National Knowledge Projects, and Institutionalization

Responding to colonial critiques of Indian traditions and knowledge systems, reform movements and national teachers in the late nineteenth and early twentieth centuries sought to reclaim the national heritage and establish knowledge-based definitions of nationality (Ramakrishna, 1928; Gadgil, 1940; Radhakrishnan, 1937). Policies pursued by state education departments and universities, notably in Calcutta and Pune, also aimed to create Indian-centric curricula and institutions (Brahmadatta, 1960; Dahanukar, 1967; Agarwal, 1930). These propositions may not align with the concept of Indian Knowledge Systems as defined earlier, but they engage with modern educational policies in relation to national traditions. Aspects of social knowledge and transmission are echoed in contemporary debates on folk genres, indigenous knowledge, and social ownership of innovations.

6.3. Postcolonial Reckonings and Indigenous Knowledge Sovereignty

In the aftermath of colonial rule, there have been renewed efforts to recover yet again Indian Knowledge Systems for several reasons. The colonial encounter had resulted in the displacement of Indian Knowledge Systems from intellectual, institutional, and personal participation. Such widespread displacement resulted in historical representations of Indian Knowledge Systems as inferior to modern knowledge. Independent India presented the opportunity to reclaim Indian Knowledge Systems from colonial misrepresentation, and as a step toward re-establishing individual, social, institutional, and national agency, as argued by Sudhir Chandra and others. Several scholars belonging to this category have engaged with cross-modal reperformance and have employed the term ‘Indian’ to delimit their work, while regretting that other forms of engagement remain neglected. A similar perspective has been considered by indigenous activists, albeit highlighting distinctive trajectories. In Canada, claims have been made for the restoration of land, languages, and lifeways in the face of past dislocation. Such consideration of restitution links forms of knowledge with the availability of land, and underlines the mediation of knowledge by spatial and temporal dimensions. Although consideration of the dissemination of knowledge and practices across Indian Knowledge Systems is of great importance, focus on such processes alone also runs the risk of reiterating boundary definitions. Consequently, an alternative strategy to historical re-establishment positions Indian Knowledge Systems within textual exegesis rather than spatial or kinematic frameworks or as disembodied sources being transported onto new mediums. Requests have also been made for the consideration of indigenous modalities in specific forms of contemporary Indian Knowledge Systems to serve as a platform for analysis of wider themes on Indian Knowledge Systems in general. Alternative references to dispossessed peoples, with an accompanying focus on custodianship rather than restitution as originally envisaged, have likewise been entertained. Addressing such proposals attempts to decolonize and indigenize the engagement with Indian Knowledge Systems by remaining sensitive toward indigenous political necessities, cultural dimensions, and broader epistemological aspirations. Accordingly, the current spotlight on restitution, inscribing, the here and now, and custodianship forms an angle from which Indian Knowledge Systems is approached.

Much of the indigenous literature from North America employs the idiom of knowledge rather than the term systems prevalent among Indian Knowledge Systems. The neighbouring Pacific Islands face similar complications associated with the designation of indigenous, knowledge, and sovereignty. State agencies for the preservation, support, or protection of indigenous knowledge form a semi-arbitrary boundary for the discussion of cultural materials and encourage attention to the nomadic movement of knowledge and formats.

7. Contemporary Relevance and Applications

Indian Knowledge Systems continue evolving and retain modern relevance. Several applications of Indian Knowledge Systems are considered to initiate systematic efforts to integrate these systems into educational, scientific, and other sectors. These applications can enrich the knowledge fabric of contemporary societies.

Indian Knowledge Systems emphasize the importance of education. Numerous modern educational programs and institutions advocate an integrated approach that incorporates Indian Knowledge Systems with contemporary disciplines. In applied science, epistemological foundations of mathematics and scientific knowledge in classical Indian scientific literature can be incorporated. Mathematical accuracy, verifiability, and infinity are notable Indian mathematical highlights (Raj Sirswal, 2011). Mathematical and scientific texts, including Aryabhata and Brahmagupta, offer scope for enriching science and mathematics education. Elementary and university student textbooks may be revised to foster a research-oriented approach that nurtures creativity and scientific temperament.

Integrated approaches that respect the epistemological structures of systems can facilitate the curriculum development of Indian Knowledge Systems in a contemporary context. Mathematics, astronomy, medicine, and metallurgical science constitute large knowledge domains with interdisciplinary principles. Therefore, collaborative research bridges discipline divides and fosters the exchange of ideas among Indian Knowledge System scholars and contemporary researchers to generate solutions for pressing global issues. Rooted in ubiquitous local ways of knowing, interdisciplinary, ethically engaged, and collaborative methods enhance knowledge systems.

Indian Knowledge Systems recognize the importance of preserving manuscripts as symbolic knowledge custodianship. Manuscript digitization retains ancient and medieval treatises on mathematics, astronomy, medicine, metallurgy, and linguistics in cultural memory. Manuscript conservational flow maintained the fidelity of Indian texts, sustaining their life and contributions. Indian and Western scholarship increasingly emphasizes digitization, transferable cataloguing, and metadata standards, including creation records, regional provenance, cultural significance, manuscript descriptions, foil-pertex search implementations, and transcriptions of scientific formulas.

7.1. Integrating Indian Knowledge Systems into Education and Policy

Indian Knowledge Systems (IKS), an encompassing term for traditional practices of knowledge production that integrate scientific and spiritual dimensions, remain underexplored in education policy despite wide-ranging economic, social, and environmental implications. The relevance of IKS is underscored by their mature frameworks for addressing complex real-world problems—central to numerous education initiatives and national policy objectives. IKS cultivate transdisciplinary, high-level knowledge that synthesises diverse core principles spanning repeated paradigms and enriches contemporary discourse on interconnections across ideas, cultures, ages, and space-time dimensions.

Incorporating IKS into educational and developmental planning can foster constructive social transformation across varied settings. Curriculum materials aligned with IKS developed by diverse stakeholders, with support from governmental agencies and organisations, can promote progressive change. IKS emphasise resilience amid disruptive change and the preservation of socio-ecological balances amid ongoing challenges. Engagement with increasingly fractured socio-economic conditions prompted by global pandemic responses and other factors is vital, particularly at the grassroots level. Curricular materials disseminated through conventional and alternative channels widely accessible across demographic factions can significantly contribute to commensurate progress. Effective innovation demand understanding of operating paradigms and their interconnections with associated knowledge systems, values, and practices, addressing issues from foundational perspectives. Curricula modelling IKS knowledge precepts and practices would prove valuable in numerous contemporary and developmental contexts. Focussing on broad principles and contexts for technical and policy developments while avoiding the promotion of particular disciplines, traditions, or systems is essential in provisional, adaptive, iterative frameworks.

7.2. Interdisciplinary Research, Innovation, and Indigenous Methodologies

Interdisciplinary understanding of Indian Knowledge Systems has gained traction in philosophy, science, and technology. Paramount approaches involve clamping onto cultural specifics associated with India coupled with the permissive ontology that upholds distinctions among domain-specific agencies, including philosophy, science, and technology. The assumptions converge on cultural upliftment enabling singular expressions of indigenous knowledge associated with locality (Kumar Dhungana & Mani Rai Yamphu, 2019). The inquiry leads to the need for institutional partnerships: community colleges, junior/senior high schools, universities, and continuing adult education are natural collaborators; emphases on formal, non-formal, and informal education open further venues. Contextualized outreach involves epistemology, cultural studies, information technology, and multidisciplinary sampling (P. Gone, 2017).

7.3. Digital Humanities, Knowledge Repositories, and Preservation

Many ancient cultures across the globe recognize the complex relationships between culture, knowledge, and contemporary media. Knowledge preservation and transmission have been vital to humanity's survival, fostering cooperation, establishing identities, and enabling cultural continuity (Koch Kapuire, 2013). A more immediate concern for many indigenous groups is survival in an era of rapid technological advancement, globalization, and the erosion of traditional knowledge. Colonization, modern nation-state formation, globalization, and the resulting inequities and poverty have diminished cultural capabilities. The associated loss of identity, land tenure, language, and traditional knowledge threatens cultural survival. Consequently, indigenous groups have begun to engage more fully with the knowledge domain, seeking to acquire, reclaim, control, and preserve knowledge about themselves.

To synthesize knowledge systems originating within the Indian subcontinent, contemporary efforts are articulated through a variety of vectors, including epistemic, educational, political, and technical concerns. Digitization figures prominently among these vectors, and specific knowledges and dimensions support broader articulations. For preservation efforts to remain relevant, the knowledge base must be digitized, and delineation of a knowledge repository and consideration of modes of access may facilitate such ongoing relevance.

8. Methodological Considerations for Studying Indian Knowledge Systems

The study of Indian Knowledge Systems has attracted considerable attention, yet crucial elements remain underexplored: the nature and modality of evidence, the configuration of knowledge, and the chosen texts and traditions. Addressing these interrelated themes requires a range of complementary approaches, evoking the need for greater methodological reflection that can guide scholarship in more fruitful directions.

Western historiography privileges reading and textuality; written and printed sources dominate knowledge dissemination; and considered interrogation of visual and aural forms, transmitted through architecture, sculpture and performance, remains rare. The relative neglect of such modalities limits understanding of archives, their role in perpetuating knowledge, and the conditions required for their efflorescence. Consequently, accompanying manuscripts, models, and verses and an extended record of skābhāṣā and its uses amongst other communicative modes remain largely unexamined. Addressing this silence calls for recourse to extra-textual criteria and a sensitivity to oral—textual, auricular, visual, architectural, sculptural, performative, gestural, and extra-parole—configurations. Such formulations remain absent from dominant canons formed within National Schools of Philosophy, disciplines without Sanskrit terminology, vernacular materials without institutional frames, and persisting oral traditions integral to capture broadening the field of inquiry and articulating an alternative epistemological and ontological structure (Kumar Dhungana & Mani Rai Yamphu, 2019).

The historical emergence and present-day persistence of knowledge systems warrant investigation. Phases extend from the early Vedic corpus and classical—Eighteen Paurāṇic and the Mahābhārata, Rāmāyaṇa—through Sanskrit renaissance, colonial de-centralisation, and contemporary awakening in the subaltern context. Examining the effects of the first colonial encounter—Orientalist exotics, extraction, and the national security device of pre-emptive appropriation—in cultivating knowledge systems outside Europe as part of the imperial Renaissance extends the analysis and situates the postparadigmatic moment. The study of Indian Culture provides a comprehensive overview of the Indian Diaspora in all its variety; the knowledge systems of Dyatlov elucidate distinctive operating modalities and functions—cognitive, ceremonial, performative—enabling further appraisal of the diverse outputs of the systems as a potential counter-anthology (B.P. Sinha & Kumar, 2004) ; (Koch Kapuire, 2013).

8.1. Source Criticism, Textual Transmission, and Interpretive Frameworks

Several critically operative principles underlie intellectual action in the broader Indian population. Indian philosophical schools delineate multiple pramāṇas, methods of acquiring knowledge and ensuring its validity. Notably, Śruti–Śivasta figures as a pivotal source concerning the status and integrity of knowledge. Those espousing the doctrine of Anatman in various forms, for example, carry out detailed examinations of the sources and procedures via which illusory, socially constructed claims concerning the self arise. Their arguments target the most ancient, authoritative, and widespread of such systems—the Veda. There is therefore a critical flattening: what knowledge is formed, what structures shape its articulation, what agencies successfully transmit it across generations, and how that knowledge can be sought or authenticated in the first instance, is as significant as the conceptual or practical domains brought thereby into view. The preservation of knowledge through various custodians grows especially prominent. Relevant terms signal the codependency between instrumentation and conservatorship. Distinct grammatical reflections on the Vedic corpus are conspicuous,

extending over two millennia and producing the most calibrated, formalized, and comprehensive set of texts and tools, pan-Indian in influence. Knowledge circulated through spanlessly connected, mobile, integrated networks: not only of scholars, but of specific teaching and learning structures that cultivated renown and conferred status (Chattopadhyay, 2019).

8.2. Ethics, Inclusivity, and Pluralism in Scholarship

Promoting scholarship in ways that are sufficiently pluralistic, inclusive, and ethical, without imposing uniform constraints, constitutes an important additional dimension to knowledge systems of contemporary relevance. By following the ISTE guidelines for ethical research, institutional relationships can be acknowledged. Structural inequalities affecting faculty, student, and community participation can be addressed. Pluralism in methodologies remains essential in both research and pedagogy. Community engagement enhances outreach and research impact while making participation more informative to both sides. At the same time, community engagement does not replace the commitment to stakeholder input and inclusion that is generally expressed in research projects looking to have unifying outreach characteristics. Systematising formal engagement commitments and inclusive corrective measures reflects another avenue toward fulfilling contemporary relevance through public engagement, within a pre-established shared set of community-academic partnerships and outreach articulation (P. Gone, 2017). Systematic but unfiltered participation from involved groups can also serve as a check on outreach knowledge.

8.3. Assessing Evidence: Criteria for Valid Antiquarian and Contemporary Claims

The knowledge systems of the Indian subcontinent have been shaped by diverse cultural experiences that call for a rigorous appraisal reflecting its polycentric heritage. These systems are not unique to the subcontinent; they have evolved continually, influenced by changing contexts. Many systems interact with various contemporary knowledge forms, from indigenous to postmodern. The historical claims made in the southern realm of contemporary knowledge have significant importance in the subcontinent, crossing ideological boundaries and encouraging meaningful discourse. Validity for claims about these knowledge systems can be measured by two criteria: those applicable within the systems themselves and those adhering to contemporary global standards referencing antiquarian texts. The assessment of modern knowledge systems garners global interest, as Indian methods related to cognition, knowledge foundations, and values have entered international scholarly discussions. These reflections have evolved through engagement with post-colonial and post-structural discourse, affecting the criteria used to classify glocal, local, and indigenous contexts in today's Indian subcontinent. (Patwardhan, 2014)

9. Conclusion

The analysis of Indian Knowledge Systems (IKS) identified key concepts and historical trajectories, mapped scientific disciplines, examined dimensions of knowledge, and documented colonial and contemporary influences. These themes highlight continuities in IKS and support five main propositions. 1. Knowledge as a collective, interdisciplinary pursuit (Vidyāpīṭha) is cultivated through various modes (śruti, anumāna, pratyakṣa) and preserved by collaborative practices and community institutions (grihastha, sampradāya, āśrama, university). 2. Citation serves as a universal standard of credibility, underpinned by interconnected concepts (iti, va, yathā) and the origins of scholarly traditions (vākya-vādya) across disciplines. 3. Knowledge necessitates systematic integration (tat-tat-u) within related domains (prāṇa, manas) and an

ethical obligation for preservation (āśīr-atītāsya) for future generations. 4. Disciplines can be organized through various copula-adverb systems, reflecting relationships in the IKS Creativity Matrix (creativity; knowledge; holistic connections). 5. Continuous and discrete temporal frameworks for knowledge creation and transmission provide complementary avenues for exploration, articulated through calendrical, cosmological, and historical lenses. (S. Negi et al., 2021)

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