RECONCILING TRADITION AND MODERNITY: A COMPARATIVE LEGAL ANALYSIS OF THE PROTECTION AND INTEGRATION OF INDIAN KNOWLEDGE SYSTEMS IN ENVIRONMENTAL GOVERNANCE IN INDIA AND THE EUROPEAN UNION

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ABSTRACT

This article compares the integration of Indigenous Knowledge Systems (IKS) or Traditional and Indigenous Knowledge (TIK) into the environmental legal frameworks of India and the EU. India's participatory approach, anchored by the Biological Diversity Act, 2002, and Forest Rights Act, 2006, emphasizes community rights, decentralized governance, and Access and Benefit-Sharing (ABS) through Biodiversity Management Committees and People's Biodiversity Registers. However, implementation challenges like bureaucratic resistance hinder effectiveness. The EU, through the Biodiversity Strategy 2030, Common Agricultural Policy, and Regulation (EU) No. 511/2014 (Nagoya Protocol), adopts a centralized, compliance-driven model, promoting sustainability but often overlooking cultural nuances of TIK. Both systems recognize TIK's role in biodiversity and climate resilience, yet India prioritizes community ownership, while the EU focuses on regulatory uniformity. The article advocates cross-jurisdictional learning, urging inclusive legal frameworks, equitable ABS, and community participation to integrate TIK into sustainable environmental governance.

Keywords: Indigenous Knowledge Systems, Environmental Law, Access and Benefit- Sharing, Biodiversity Governance, Traditional Knowledge Protection

Research methodology

This paper adopts a doctrinal and comparative methodological approach to examine the role of Indigenous Knowledge Systems (IKS) within the environmental governance frameworks of India and the European Union (EU). Primarily, the methodology adopted involves an in-depth analysis of constitutional provisions, statutes, judicial precedents, policy documents, and institutional mechanisms related to the recognition, protection and promotion of IKS in both these distinct jurisdictions.

To uncover and contextualise the legal frameworks and the IKS systems, the study tends to examine interdisciplinary and diverse literature from the fields of law, anthropology, and developmental studies, thereby ensuring a more holistic and culturally sensitive understanding of IKS, rather than just a mere positivist textual interpretation. The secondary sources used in this study include peer-reviewed journals and internationally mandated benchmarks that both these legal systems try to incorporate into their functioning.

This comparative study focuses on tracing structural, procedural and philosophical divergences and convergences amongst these two legal systems, specifically regarding the treatment of IKS. Furthermore, the jurisdictions of India and the European Union were specifically selected due to their varying socio-legal positions and their stance regarding the pressing environmental challenges, also emphasis was placed on their respective stance regarding Sustainable Development Goals and their integration into the environmental governance framework of these respective jurisdictions. The study remains entirely neutral in its approach while comparing and critiquing both the existing legal systems on their efficacy and highlighting the scope for cross-jurisdictional learning. Additionally, the study goes on to suggest certain culturally sensitive and accommodating suggestions which, if employed, would benefit in the integration of IKS, and also aid in solving pressing environmental challenges at large.

Introduction

As a matter of day-to-day practice, most of us have encountered and experienced practices that are passed down from one generation to the next through stories, customs, rituals, and lived experiences, rather than conventionally through books. In many cultures and traditions, these practices are mostly inherited rather than taught. Though they may appear anecdotal, examples such as a grandmother's secret remedies of using everyday kitchen ingredients for their medicinal values, worshiping of forest groves that have been untouched for generations, or the precise analysis of the lunar cycles to decide the best time to sow the seeds, are all examples of ancient knowledge systems that are firmly rooted in ecological wisdom. These practices are part of the larger umbrella of the Indigenous Knowledge System (IKS), which communities have traditionally followed since time immemorial[1].

The IKS are tools of knowledge creation, transmission and application rather than merely historic cultural practices. In light of the current environmental crisis haunting the world, the ecological significance of IKS has grown more apparent and relevant. The present environmental challenges, including climate change, biodiversity loss, and ecosystem degradation, have exposed and brought forth the shortcomings of the blind application of the 'Modern Scientific' approach towards environmental conservation[2].

This paper tries to undertake a comprehensive legal analysis of two completely distinct jurisdictions, i.e. India and the European Union, in responding to the growing relevance and influence of IKS. The two systems have, in their respective different ways, tried to integrate IKS into their existing environmental governance frameworks, in order to tackle pressing modern challenges. However, throughout the length of the paper, the divergence in the approaches of these two jurisdictions is highlighted, along with a comprehensive analysis of each of them.

India's Legal System reflects a strong Statutory and Constitutional Framework, showcasing its strong commitment to Environmental Protection and Indigenous Rights. The Constitutional Provisions like Article 48A and 51A(g)[3], along with statutes like the Biological Diversity Act, 2000 and the Forest Rights Act, 2006, try to formally recognise, protect and promote the IKS.

[1] Vinod Upadhyay, Indian Knowledge Tradition and Environment, 4 Int'l J.L. Mgmt. & Hum. 106 (2021)
[2] Fiona Martin, Amanda Cahill, Emily Wright & Natalie Stoianoff, An International Approach to Establishing a Competent Authority to Manage and Protect Traditional Knowledge, 44 Alternative L.J. 48 (2019).
[3] INDIA CONST. arts. 48A, 51A(g)

Furthermore, these statutory provisions, when coupled with landmark judicial decisions like *Subhash Kumar v. State of Bihar*[4] try to institutionalise the system of Indigenous Knowledge and establish mechanisms to apply this faded knowledge into practical application. This approach tends to have a more participatory model, which recognises and appreciates the presence of varied cultures and communities in the jurisdiction. Though, due to implementation challenges caused as a result of bureaucratic reluctance, has resulted in a gap being formed between India's ambitious goals and the ground realities[5].

On the other hand, in contrast, the European Union has developed a highly structured and compliance-driven model which tries to promote uniformity. The EU has enacted legislations and policies like the Regulation (EU) No. 511/2014[6] and the EU Biodiversity Strategy for 2030[7], which acknowledge the relevance of Traditional Knowledge in promoting sustainability. However, these instruments take a very peripheral view of the entire subject matter, and they completely fail to treat IKS as a matter of participatory governance; rather, what it does in essence is to limit IKS as an object of mere administrative oversight. This approach leads to the cornering of cultural nuances, thereby disregarding the deeply embedded social and ecological context in which IKS is embedded.

This contrast in the two jurisdictions is not merely institutional but philosophical as well. The Indian model, despite the implementation challenges, on paper, reflects an attempt at legal pluralism by giving space and recognising existing customs and practices of the Indigenous people. The EU's model, on the other hand, pushes and strives towards regulatory and statutory uniformity, often at the cost of neglecting cultural diversity. As Martin et al. rightfully argue, the EU's centralised administrative mechanisms lack the cultural sensitivity required to engage meaningfully with Indigenous communities, especially those outside Europe.

This divergence in the approaches is further contextualised and substantiated by global research trends. Gondo's bibliometric study of IKS and climate change adaptation literature (1993–2023) reveals an exponential rise in scholarly interest, particularly in regions such as Africa, South Asia, and the Arctic. His study showcases the interest of the so-called '3rd world',

[4] *Subhash Kumar v. State of Bihar, AIR 1991 SC 420 (India)*
[5] *Id.*
[6] Regulation (EU) No. 511/2014 of the European Parliament and of the Council of 16 April 2014 on Compliance Measures for Users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization in the Union, 2014 O.J. (L 150) 59
[7] European Commission, EU Biodiversity Strategy for 2030: Bringing Nature Back into Our Lives (2020).

'Developing' or 'Underdeveloped Countries', towards IKS and its integration in Environmental Governance[8].

In light of this backdrop, the purpose of this paper is not to boost one jurisdiction above another. Rather, it provides a contextualised and critical comparative analysis. Furthermore, analysing institutional models used by both legal systems in their interactions with IKS. The paper strenuously argues that more is required than just legislative inclusion or policy reforms for IKS to be meaningfully incorporated into Environmental Law. Additionally, the paper demands that the law itself be rethought as an engaging, culturally sensitive tool that can accept various viewpoints and appreciate them. By doing this, this study seeks to highlight an imperative truth that is frequently overlooked, that the way to environmental sustainability may not only depend on new technologies or more stringent laws, but also on ancient wisdom that we have long disregarded, and now perhaps it's time to revive it.

IKS in India

Since time immemorial, India's relationship with nature has been more than merely extractive; it is spiritual, respectful, and symbiotic in nature. The strong civilizational ethos of the Indian population is visibly reflected in the wide range of Indigenous Knowledge Systems (IKS) that have developed, evolved, and coexisted within Indian culture. Whether elaborate and ahead of their time, elaborate water harvesting systems like the *johads* and *zings*, the sacred groves guarded by deeply embedded ritual taboos or the advanced techniques like mixed cropping and seed conservation, Indigenous communities have well developed, long-standing models of environmental governance based on sustainability, reciprocity and respect for Mother Earth. These practices are not merely outdated practices of the past; they are the key towards tackling the environmental challenges haunting us today.

Furthermore, these ecological practices are interwoven into India's cultural fabric. Long before the Environmental and Wildlife conservation laws were formally put in place, the Bishnoi community of Rajasthan have had a religious obligation of protecting the wildlife, which also happens to be the central point of controversy in the infamous Salman Khan Blackbuck poaching case. In a similar vein, the Apatani Tribe of Arunachal Pradesh have developed an extremely productive and environmentally sound wet rice and fish farming system that

[8] R. Gondo, Bibliometric Analysis of Indigenous Knowledge Systems and Climate Change Adaptation Literature, 1993–2023, IFLA J. (2025)

maintains soil fertility and biodiversity[9]. These Indigenous practices followed by communities offer situation specific and culturally sound solutions to pressing environmental problems, which are often missing in the 'Modern Scientific' approach.

Recognizing the need and relevance of IKS, the Indian state, over a couple of decades, has effectively developed a legal framework in order to institutionalise and formally recognise IKS. The most prominent piece of legislation in the array is the Biological Diversity Act, 2002[10], which aims to give legal protection and safeguards to local knowledge related to the environment and biodiversity through Access and Benefit Sharing Mechanisms (ABS). Furthermore, it also strives to establish local decentralised self-governing structures such as the Biodiversity Management Committees (BMCs). These BMCs are tasked with the responsibility of documenting community knowledge of flora, fauna and indigenous practices of protecting the environment, through the establishment of People's Biodiversity Register (PBRs)[11]. Another formidable piece of legislation in this regard is the Forest Rights Act, 2006[12]. By formally recognising the rights of forest-dwelling communities over land resources, it tries to affirm the custodianship of Indigenous Communities.

This approach of the legislature is further strengthened and validated by the landmark judicial pronouncements, which strengthen and protect the legitimacy of Indigenous Traditions and Practices. In *Samatha v. State of Andhra Pradesh*[13], the Hon'ble Supreme Court ruled that the transfer of tribal land to private mining companies in Scheduled Areas violated the Fifth Schedule of the Constitution, and hence, the Court upheld the autonomy of Indigenous communities over their land and resources. Furthermore, in the more recent decision of *Orissa Mining Corporation v. Ministry of Environment and Forests*[14], wherein the Hon'ble Supreme Court went a step further by recognising the Gram Sabha's authority to determine as to whether mining activities can be carried out in areas having sacred importance for the Tribal Communities. These judicial pronouncements, amongst various others, showcase that IKS is not merely a historical fact; rather, it is a cultural asset, i.e. entitled to legal recognition and protection.

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[9] B. Jasmine, Yash M. Onial & V.B. Mathur, Traditional Knowledge Systems in India for Biodiversity Conservation, 15 Indian J. Traditional Knowledge 304 (2016).
[10] Biological Diversity Act, No. 18 of 2003
[11] Upadhyay, V. (2021). Indian knowledge tradition and environment. *International Journal of Law Management & Humanities, 4*(5), 106–118.
[12] The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, No. 2, Acts of Parliament, 2007
[13] Samatha v. State of Andhra Pradesh, *AIR 1997 SC 3297*
[14] Orissa Mining Corporation Ltd. v. Ministry of Environment and Forests, *(2013) 6 SCC 476.*

India has also gone a step ahead of its counterparts and pioneered institutional mechanisms to protect and preserve IKS. One such mechanism is the Traditional Knowledge Digital Library (TKDL), managed by the Council for Scientific and Industrial Research (CSIR). The TKDL, through its systems, aims to prevent the misappropriation of codified and documented traditional knowledge by making it accessible and available to international patent examiners[15]. Another such significant initiative is the National Innovative Foundation (NIF)[16], which documents and supports grassroots innovations and startups which take inspiration and try to incorporate components of Traditional Knowledge into their business models. These institutional initiatives and efforts demonstrate an evolving and developing understanding within the Indian policy domains regarding the Traditional Knowledge paradigms, that it is not a threat or barrier to progress and modernity, rather it is a foundation for a more ecologically sound and equitable future. However, despite a legal and institutional framework which looks robust on paper, when applied in reality, it falls flat while painting a disappointing picture. Implementation of these policies remains a challenge owing to the bureaucratic unwillingness and a top-down administrative mindset that treats Indigenous Communities as second-class citizens and mere passive beneficiaries rather than active citizens of a sovereign nation. The reality in most parts of the country remains that many BMCs registered on paper do not exist in reality, and the others that do exist, lack training, financial resources, or legal literacy. Furthermore, ABS agreements are rare, and even when they are executed, the benefits seldom reach the communities due to the bureaucratic hurdles and prevalent mass corruption. Moreover, positive and welcome documentation efforts like PBRs are usually outsourced to consultants who are generally unfamiliar with the local context and, hence, have a very detached understanding of the entire situation.

Furthermore, while laws such as the Forest Rights Act aim to decentralise decision-making and grant autonomy to forest communities, the Forest Departments often exert excessive control, often sidelining the tribal communities, the original inhabitants of the forest. Additionally, the so-called regular Environmental Impact Assessments rarely account for specific impacts on certain areas. Moreover, the extensive commodification and commercialisation of natural resources have significantly accelerated the adverse impact on Traditional Knowledge[17]. The judiciary has often tried to step in to protect the rights of indigenous populations, but this

[15] Council of Sci. & Indus. Rsch. (CSIR), Traditional Knowledge Digital Library (TKDL) (2022).
[16] National Innovation Foundation - India. (2022). About NIF
[17] Martin, F., Cahill, A., Wright, E., & Stoianoff, N. (2019). An international approach to establishing a competent authority to manage and protect traditional knowledge. *Alternative Law Journal, 44*(1), 48–55.

happens seldom. Litigation is costly, time-consuming and remains only available to the privileged classes of the population and remains inaccessible to the very communities that the law vows to empower.

Owing to the aforementioned challenges, the gap between formal legal systems and Indigenous Traditional Knowledge also remains wide. While environmental statutes and judicial pronouncements increasingly recognise the value of traditional knowledge on paper, they fail to grasp it in its essence. Furthermore, Modern Law tends to compartmentalise knowledge into air-tight boxes, while, on the contrary, IKS views nature as an interconnected and integral part of life. The risk, therefore, is that the law, in its attempt to protect, might unconsciously distort or fragment the very systems that it tries to protect, preserve and promote in its essence.

This disjunction between the law and reality is not merely philosophical; rather, it has practical and visible implications on the lives of people as well. For example, the Indigenous Varieties of seeds, which have been protected by farmers across generations, are now increasingly facing challenges from modern hybrid varieties of seeds that yield better quality produce in less time and are at a lesser risk of suffering pest attacks or other illnesses. The downside of these varieties of seeds is that the nutritional profile of the produce is broken down and degraded due to the genetic profiling and tampering of the seeds in order to increase the yield. Despite the protective and well-provided provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001[18], these real-world challenges outsmart the legislation. Similarly, large-scale infrastructure projects (sometimes government-undertaken), like dams, continue to displace Indigenous communities from ecologically sensitive zones, eroding not only their habitats but also stripping the intangible cultural knowledge that is deeply rooted in those areas among those communities[19].

Nevertheless, amongst this chaos, there lie some signs of growing countercurrents which provide positive hope. Civil Society Organisations, Academic Institutions, and even some progressive and morally driven State Governments have begun a trend of engaging more meaningfully and positively with IKS and not merely as a gimmick. It is pertinent to take a look towards the integration of Agroecological Models into State farming policy in Andhra Pradesh. The policy builds upon and uses Indigenous Soil and Water Knowledge and implements it in the modern context[20]. Furthermore, the Forest Research Institute[21] and

[18] Protection of Plant Varieties & Farmers' Rights Act, No. 53 of 2001
[19] Tribals & IKS (2020). *Centre for Tribal Research and Development Report*
[20] Biodiversity News. (2021). National Biodiversity Authority
[21] FRI Dehradun. (2020). *IKS and Biodiversity Conservation in India*.

institutions like the Botanical Survey of India have undertaken extensive ethnobotanical studies, which reaffirm and substantiate the rigour of Tribal Medicinal practices, which completely rely on the forest[22]. Moreover, the overall international shift, post the Nagoya Protocol, signals towards a more inclusive policy framework, as a global mandate.

At this point, India's legal system stands at a critical juncture from which things can go either way. The Indian state has built an impressive skeletal framework for recognising and protecting IKS, but a mere skeleton without the flesh and blood is of no use. Without genuine implementation, political will, and administrative sensitivity, the impact that these laws and policies intend to bring remains unfulfilled and unachieved at large. There is an urgent and pressing need that the Indian State to reimagine governance in ways that do not merely take a peripheral view and try to accommodate IKS within pre-existing systems, but which actively try to have a more comprehensive approach and develop community-centered policies and legislations, which are sensitive and accommodating in the way they deal with the subject matter at hand.

IKS is not merely a piece of history from our pre-modern past; rather, it is the solution to our modern problems, and in this sense, it is forward-looking, adaptive and an ecologically grounded system of knowledge that is embedded in our culture. The power and usefulness of IKS do not lie merely in its capacity to conserve but in its ability to regenerate and revive degraded environmental components.

IKS in the European Union

Europe's past in relation to the natural environment has been influenced by a broad network of traditional systems of knowledge, commonly referred to as Traditional Knowledge (TK) or Indigenous Knowledge Systems (IKS), including local ecological management, farming practices, and cultural tradition handed down from generation to generation. In contrast to Indian Knowledge Systems' (IKS) strongly spiritual and synergistic relationship with nature, European TK is based upon the continent's multiple regional cultures, prioritizing pragmatic and sustainable interactions with the natural environment. From France's Cévennes National Park agroforestry systems to Bavarian regional specialty conservation, these knowledge systems exhibit a holistic, dynamic, and ecologically embedded methodology for resource management in close association with local milieux and community identity. This section

[22] Botanical Survey of India. (2023). *Annual Report*

discusses the scope and importance of IKS within the European perspective, its incorporation into contemporary environmental systems, the challenges encountered in its acknowledgment, and suggested remedies to guarantee its preservation and useful application. It also alludes to some of the main European environmental legislation, such as the EU Biodiversity Strategy 2030, Regulation (EU) No. 511/2014 (Nagoya Protocol), the Common Agricultural Policy (CAP), and the Aarhus Convention, and projects such as Portugal's sui generis law and Bavaria's specialty database, to highlight their potential to facilitate TK.

The dissemination of IKS in Europe is far-reaching, incorporating all sorts of practices that have maintained cultural heritage as well as biodiversity for decades. European TK consists of ancient farming practices, such as organic farming and crop rotation, and ecologic know-how in countryside communities, for instance, Alsace, France, tree management for a range of bird species or the protection of plant diversity in the Cévennes National Park, where there are over 2,000 animal and plant species[23]. Such practices, described by Tobias Kien as "holistic, inherently dynamic, and constantly evolving," are not fixed artifacts but evolving systems that adjust to local contexts, like India's johads or the Apatani wet rice and fish culture[24]. In the European context, TK is essential to managing natural resources, where it is employed to protect biodiversity and guarantee sustainable land use. For example, the varied environments of the Cévennes National Park, from Mediterranean valleys to polar-like vegetation, remain strong through local ecological knowledge, which preserves rather than exploits[25]. These actions are also consistent with global sustainability objectives, e.g., the United Nations' Sustainable Development Goals (SDGs), specifically SDG 15 (Life on Land), through ecologically sustainable maintenance and conservation of biodiversity.

The value of IKS in Europe lies in the fact that it provides ecologically sound solutions to contemporary environmental issues, closing the divide between science and locally acquired knowledge. European TK is focused on stewardship in practice, for instance, the preservation of holy forests or communal orchards that are biodiversity hotspots[26]. The EU identifies this value in policy such as the EU Biodiversity Strategy 2030, which is maintaining traditional ecological practices such as agroforestry and organic farming to restore biodiversity by 2030. For instance, the strategy's ambition to recover 20% of terrestrial and marine ecosystems is to promote practice such as that in the Cévennes, where local knowledge has conserved diverse

[23] Tobias Kien, Traditional Knowledge in the European Context, Iddri Working Paper No. 02/2006 (2006)
[24] Jasmine, B., Singh, Y., Onial, M., & Mathur, V. B. (2016). Traditional knowledge systems in India for biodiversity conservation. *Indian Journal of Traditional Knowledge, 15*(2), 304–312.
[25] European Commission. (2020). *EU Biodiversity Strategy for 2030: Bringing nature back into our lives*.
[26] European Commission. (2023). The Common Agricultural Policy 2023–2027.

ecosystems[27]. Similarly, the Common Agricultural Policy (CAP) supports such traditional crop management strategies as crop rotation that enhance soil quality and reduce the use of chemicals, as seen in India's Kondh multi-cropping systems[28]. These policies attest to the EU's appreciation of TK's role in ensuring sustainable development.

The Nagoya Protocol, which has been adopted in the EU through Regulation (EU) No. 511/2014, is an important regime for protection of TK linked to genetic resources. Adopted in 2014 under the Convention on Biological Diversity (CBD), it allows for sharing of advantages of a fair and equitable character arising from the utilization of genetic resources and linked TK. The regime requires due diligence on stakeholders, like industries and researchers, to attain ABS compliance so that the providing communities are benefited. In contrast to India's Biological Diversity Act, placing community control through BMCs at the top, the EU approach places greater emphasis on compliance through institutions rather than with communities, restricting its access to local TK holders[29]. Portugal's sui generis regime for plant genetic resources takes a more people-oriented route, awarding exclusive rights to farming communities to preserve agrobiodiversity and register TK related to plant material, such as methods of cultivation and traditional crops[30]. Portugal's legislation, in conformity with the CBD, reflects India's attempt at documenting TK on People's Biodiversity Registers (PBRs), reiterating a common commitment towards conservation of cultural and ecological heritage.

Despite these efforts, integrating IKS into European environmental frameworks faces significant challenges. The EU's technocratic policies, such as the Biodiversity Strategy 2030, often lack cultural sensitivity, homogenizing diverse TK systems under a one-size-fits-all approach. For example, although the strategy calls for the promotion of customary practices, it does not name specific cultural settings of non-European indigenous knowledge systems or subaltern European groups[31]. Likewise, Regulation (EU) No. 511/2014 prioritizes institutional homogeneity against community outreach, jumping over local knowledge holders for institutional conformity. This is pitted against India's focus on decentralized local government via BMCs, which with the challenges of implementation, aim to empower citizens. Second, the

[27] European Parliament and Council of the European Union. (2014). Regulation (EU) No. 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union. Official Journal of the European Union, L 150, 59–71.

[28] United Nations Economic Commission for Europe. (1998). Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

[29] Ministry of Law and Justice, Government of India. (2003). Biological Diversity Act, No. 18 of 2003

[30] Ministry of Law and Justice, Government of India. (2007). The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, No. 2. Acts of Parliament.

[31] Ministry of Law and Justice, Government of India. (2007). The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, No. 2. Acts of Parliament.

CAP, although pro-traditional agriculture, has been faulted for not taking the loss of biodiversity into consideration sufficiently as industrial agriculture overshadows TK-based methods[32]. Aarhus Convention ensuring public access to environmental decision-making indirectly supports TK by ensuring openness but does not support community-based knowledge[33]. Second, poor documentation and possible erosion of knowledge through modernization threaten the existence of TK, as with the disappearance of traditional seed varieties, which also affects India where hybrid seeds overwhelm indigenous ones.

The EU has made progress in the integration of IKS into contemporary systems, particularly through projects such as the Bavarian Specialities Handbook, a database that was launched in the 2000s documenting more than 200 local produce and production techniques, which ensures their cultural and ecological value to be maintained[34]. This initiative, by calling for local production of products and on the basis of local identity is defending against TK misappropriation by patent examiners. Likewise, Portugal's sui generis law brings TK into biodiversity conservation through local knowledge registration, providing a model for sensitive policy-making. Yet all these attempts are sporadic, and the EU's top-down method overlooks the integrated approach of TK, which, perceives nature as holistic rather than segmented.

These challenges can be addressed by the following proposals. The EU can, first, increase people's involvement in policy provision in order to build local systems for harvesting and conserving TK. Community-held registers, can provide culturally appropriate recording and prevent overdependence on external actors without familiarity of local situations. Second, the EU needs to make policy cultural sensitivity, i.e., re-birth the Biodiversity Strategy 2030 so as to particularly acknowledge multiple TK systems, e.g., those of non-European indigenous communities in Europe. Third, capacity-building programs may educate local communities on legal and financial literacy for effective interface with ABS mechanisms of the Nagoya Protocol. Lastly, if the EU were to make programs such as the Bavarian Specialities Handbook available throughout member states within one TK database, it would equalize protection and public access. Such steps would bring the EU into promoting just and sustainable integration of TK.

Finally, IKS was discovered to possess a rich cultural and ecological understanding to tackle today's environmental issues. The EU has started welcoming the utilization of TK

[32] European Commission. (2023). The Common Agricultural Policy 2023–2027.
[33] United Nations Economic Commission for Europe. (1998). Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.
[34] Kien, T. (2006). Traditional knowledge in the European context. Iddri, N° 02/2006, Ressources Naturelles

complemented by initiatives like Portugal's sui generis law and Bavaria's specialty database through the EU Biodiversity Strategy 2030, CAP, and Regulation (EU) No. 511/2014, among others. But issues like technocratic homogenization, lack of community participation, and inadequate documentation stand in the way of its full incorporation. With the implementation of people-oriented practices, cultural sensitivity, and improved documentation, the EU is able to harness more of TK's potential in incorporating traditional knowledge towards ensuring the sustainability of the modern age. This will make European TK, a basis for an ecologically benign and equitable future.

Comparative of analysis of the Indian and European Union scenarios

The legal systems of both India and the European Union (EU), with the passage of time, have confronted the imperative of integrating the Indigenous Knowledge Systems (IKS) into their environmental governance framework in order to tackle pressing environmental concerns. Both these systems approach this issue in different ways, reflecting the fundamentally different traditions, priorities, and policy goals. In India, IKS is situated and operates within the constitutional framework, thereby promoting decentralisation and participatory rights to the marginalised communities. On the contrary, in the EU, the IKS is embedded within and constrained by the procedure-heavy and treaty-driven framework, thereby ensuring regulatory consistency and uniformity across a culturally diverse population.

In India, the Biological Diversity Act, 2002 (BD Act), is the foundational legislation that regulates the country's environmental governance framework. It mirrors and embodies the objectives of the Convention on Biological Diversity, while at the same time integrating its own flair through its three-tiered framework consisting of National Biodiversity Authority, State Biodiversity Boards and the Community level Biodiversity Management Committees. The legislature, through this legislation, intends to create People’s Biodiversity Registers to document community-held ecological knowledge, thereby in essence granting communities rights and agency over access and benefit sharing (ABS). Additionally, complementing the aforementioned is the Forest Rights Act, 2006, which recognises and restores the customary rights of the forest-dwelling indigenous communities over the resources of the forest. But this aspirational and ideal approach of the legislature suffers from severe implementation deficits and bureaucratic hurdles; due to these hurdles, there remains a significant gap between the goal that the legislature wants to achieve and the realities that exist on the ground.

On the contrary, in contrast, the EU's handling of IKS is oriented through Regulation (EU) No.511/2014, which embodies the provisions of the Nagoya Protocol. This regulation imposes due diligence requirements, standardised procedures for Access and Benefit Sharing (ABS), and emphasises centralised record keeping, thereby promoting greater uniformity over a diverse population spread throughout a varied landscape. Unlike India, the EU's framework does not grant autonomy or authority to Indigenous communities over their functioning; rather, it enforces compliance with the statutory framework through state institutions.

Therefore, India's legal system bases its approach on a bottom-up ownership and community-centric participatory model, while the EU prioritises uniformity, transparency, and administrative enforcement. But it is pertinent to note that each of these two varying models suffers from critical shortcomings that affect the overall functioning of the environmental governance frameworks of these two nations.

India's participatory model is structurally rich but constrained in reality and suffers from enforcement problems. A majority of BMCs across various states like Kerala, Madhya Pradesh, and Bihar remain nonfunctional and dormant at large owing to the resource deficit. In another instance in 2023, the ABS regulations that were designed to empower local communities allowed the State Biodiversity Boards to consider an absence of response as implied approval, thereby bypassing the established mechanism of consent. The Forest Rights Act, although groundbreaking and visionary on paper and in principle, often suffers resistance from the forest department's bureaucracy and thereby limits community control over natural resources.

The EU's framework, on the other hand, is robust in its implementation and the clarity that it possesses. Its adaptation and incorporation of the global mandate of the Nagoya Protocol through its local legislations uniformly throughout its member states ensures consistency in the environmental governance framework across the jurisdiction. The EU's engagements include its participation in the Convention on Biological Diversity Working Group 8(j) and the adoption of ethical codes such as the Tkarihwaiéri Act and the Akwe-Kon guidelines showcase multilateral commitments. Despite the extensive and well-structured framework of environmental governance, the EU's approach, without involving the stakeholders in the system, reduces IKS merely to codified and commodified data, completely divorced and detached from its roots.

Suggestions

India's strategy in mainstreaming Indigenous Knowledge Systems (IKS) into environmental governance policy, as reflected in the Biological Diversity Act, 2002, and the Forest Rights Act, 2006, is to be applauded for its people-oriented and inclusive design. But time-worn implementation mishaps like non-functional Biodiversity Management Committees (BMCs), bureaucratic opposition, and lack of sufficient benefit-sharing under Access and Benefit-Sharing (ABS) agreements hold it back. The EU, with its strong, rule-based framework as illustrated through Regulation (EU) No. 511/2014 (Nagoya Protocol), the EU Biodiversity Strategy 2030, and the CAP, can learn from India. Adopting the best practices of the EU, like procedural transparency, enforceability, and systematic documentation, India can develop its IKS system stronger. Secondly, cross-jurisdictional learning can work towards developing a model that is half India's cultural diversity and half the EU's administrative efficiency. This segment offers recommendations to India, prioritizing direct interface with tribal populations, facilitating IKS in contemporary contexts, and harmonizing environmentally unsustainable tribal practices while learning from EU practice to do it better

One of the lessons of the EU is process and enforcement clarity, as can be seen in Regulation (EU) No. 511/2014, where the Nagoya Protocol is adopted with uniform due diligence standards and centralized reporting. India can learn to adopt such process clarity to allow remedying of BMCs' dysfunctionality due to their insufficient resources, training, or legal literacy. For example, in Kerala and Madhya Pradesh states, BMCs are essentially paper-based and operate in contrast to documentation of People's Biodiversity Registers (PBRs)[35]. India can have a centralized monitoring system, similar to the EU, to track BMC performance to ensure that they are adequately funded and manned with trained officers. Systematic audits and transparent guidelines for ABS agreements would avert instances of circumventing the approval by community of State Biodiversity Boards, as in 2023 situations where non-response was equated with implied consent[36]. Policymakers can detect grassroots issues, like administrative delay or corruption, and frame solution strategies addressing local needs by directly interacting with tribal societies like the Kondh or Apatani through workshops and consultations. For instance, the EU's Bavarian Specialities Handbook, with over 200 local

[35] Upadhyay, V. (2021). Indian knowledge tradition and environment. International Journal of Law Management & Humanities, 4(5), 106–118

[36] Biodiversity News. (2021). National Biodiversity Authority.

specialties with elaborated production histories, is an example of enriching PBRs by culturally attuned documentation by educated local facilitators as opposed to foreign consultants with little understanding of tribal environments[37].

Direct interaction with the tribes is vital to know and solve grassroots problems. India can learn from the EU's Aarhus Convention for public involvement in environmental decision-making to offer systematized avenues t hear the voices of the tribes[38]. Regular exposure to such communities as the Bishnoi, traditionally protective of wildlife, or the Apatani, with their wet rice and fish farming conservation methods, might enable policymakers to identify some barriers, e.g., inadequate exposure to government programs like the Forest Rights Act or ABS benefits[39]. The creation of community liaison officers, locally trained in language and culture, can make this gap, familiarizing tribes with schemes and allowing them to assert their rights. For example, the National Innovation Foundation (NIF) of India already facilitates grassroot innovations based on IKS like herbal medicines or traditional farming implements[40]. Scaling up such programs with EU-style documentation rigor, as in the instance of the sui generis law of Portugal registering traditional knowledge concerning plant genetic resources, would ensure tribal knowledge is rigorously documented and safeguarded against misappropriation while its commercial appeal is enhanced[41].

Creating IKS in current times is all about highlighting its superiority to some of the contemporary practices, specifically sustainability and resiliency. Some lessons can be learned by India from the EU's CAP supporting indigenous agriculture practises such as crop rotation and organic farming, for instance, based on India's Kondh multi-cropping culture that produces 75–80 crop varieties for increasing biodiversity and food security. For example, Sikkim Organic Mission, which declared Sikkim to be the first organic state of India in 2016, reflects how IKS-based organic agriculture reduces the use of chemicals, enhances soil health, and contributes to climate change mitigation in comparison with contemporary monoculture systems that deplete the soil of nutrients[42]. Similarly, traditional water management technologies like Rajasthan's johads, which act to recharge groundwater, offer sustainable substitutes to contemporary irrigation technologies that have a tendency to produce water

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shortages[43]. These practices can be popularized by India through countrywide campaigns, incorporating IKS into school curricula and agricultural extension services, as the EU attempts to integrate traditional knowledge into biodiversity programs. For example, ethnobotanical research of the Forest Research Institute supports tribal healing traditions, which can be upscaled to generate low-cost health materials, minimizing reliance on expensive modern drugs[44]. By projecting these achievements, India is able to place IKS as a developing solution, similar to the EU's adoption of indigenous traditions in the Cévennes National Park for biodiversity conservation.

Yet, certain of these tribal pursuits like forest clearing for temporary cultivation (jhum) are ecologically destructive by deforestation and soil loss, as in Northeast India. Although jhum is value-driven on a cultural plane, its environmental consequence is contrary to sustainable objectives like SDG 15 (Life on Land). India may learn from the EU's Biodiversity Strategy 2030, which offsets traditional occupation with conservancy by alternatives such as agroforestry[45]. Policies can incentivise tribes to shift into ecologically sustainable patterns of jhum like long fallow periods or intercropping with nitrogen-fixers like some Apatani communities. EU-type community workshops modelled on its involvement mechanism under the Aarhus Convention can sensitize tribes to the ecological effects of the deleterious practice and provide incentives, such as subsidies under CAP-type schemes, to shift into sustainable alternatives. For instance, the agroecological practice of Andhra Pradesh, such as traditional water and soil science, can be scaled up across the country in place of destructive methods with IKS-based alternatives protecting forests and increasing soil fertility.

To apply these suggestions, India can prioritize capacity development for BMCs from the coordinated training programs of the EU for environmental conformity. Continuous consultation with the community through legal help in scheme interpretation such as the Forest Rights Act can equip tribes in asserting their rights such as the EU's models of public engagement. Encouraging IKS through new media, e.g., on-line databases or agricultural shows illustrating customary practices, will raise awareness, as the EU has promoted regional specialties. Lastly, abolishing deleterious practices will entail culturally aware policies that provide conducive substitutes without abandoning communities, in a manner such that IKS continues to be a pillar of sustainable development. By incorporating these EU-inspired

[43] Jasmine, B., Singh, Y., Onial, M., & Mathur, V. B. (2016). Traditional knowledge systems in India for biodiversity conservation. Indian Journal of Traditional Knowledge, 15(2), 304–312.
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[45] European Commission. (2020). EU Biodiversity Strategy for 2030: Bringing nature back into our lives.

practices, India is able to close the gap between policy and reality and make IKS a living tradition that operates efficiently to solve contemporary environmental issues.

Connection to sustainable development goals

Indian Knowledge Systems (IKS) are built around India's historic and traditional customs, which are based on scripture wisdom and ancestral teachings. Ayurveda, Yoga, traditional farming, and water management are all profoundly rooted in environmental sustainability, providing timeless solutions to modern concerns. This section looks at how IKS can be integrated with environmental regulations to help the United Nations achieve its Sustainable Development Goals (SDGs), which address global concerns such as poverty, clean water access, and climate change. Far from becoming obsolete, IKS offers real solutions to promote sustainability. This section discusses SDG 13 (Climate Action), SDG 15 (Life on Land), and SDG 16 (Peace, Justice, and Strong Institutions) (Quality Education), using examples from the Sikkim Organic Mission and the Kondh community's practices.

IKS supports SDG 13, which calls for immediate action against climate change through sustainable practices that maintain ecological balance. Traditional water management practices, such as Rajasthan's johads, collect rainwater and replenish groundwater, thereby increasing climate resilience in dry places. The Sikkim Organic Mission, begun in 2003, aims to make Sikkim India's first totally organic state by 2016, eliminating chemical fertilizer use, encouraging climate-friendly agriculture, cutting greenhouse gas emissions, and improving soil health[46]. These experiences demonstrate how IKS can inform policies aimed at achieving SDG 13 by emphasizing low-carbon solutions. IKS also advances SDG 15, which focuses on safeguarding terrestrial ecosystems and biodiversity, by emphasizing ecological harmony. The Kondh community in Odisha, motivated by veneration for Dharani Penu (Earth Goddess) and Niyam Raja, practices sustainable foraging and crop rotation to conserve biodiversity and prevent destruction[47]. Their battle against Vedanta Aluminium's mining in the Niyamgiri hills saved holy forests, showing IKS-driven activism as a conservation tool[48]. Sacred woods in

[46] Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and Change, 26*(3), 413–439.
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India, safeguarded by traditional beliefs, function as biodiversity hotspots, in line with SDG 15's goals.

IKS promotes inclusive governance in line with SDG 16, which calls for peaceful communities and strong institutions. Kondh's Kutumba councils use communal decision-making to resolve disputes and manage resources, fostering social cohesion and equitable governance. Integrating IKS into policy frameworks can result in culturally responsive models that promote justice and fit with SDG 16. IKS contributes to SDG 2 by promoting food security through techniques such as Kondh's multi-cropping and organic farming, planting 75-80 crop varieties like millets and pulses with natural fertilizers like cow dung and neem. Burlang Natra seed fairs encourage seed exchange and genetic diversity, leading to more robust food systems than soil-depleting monoculture.

For SDG 3, IKS offers affordable healthcare through traditional healing. The Kondh's Bejuni healers use herbal intelligence to heal diseases at affordable prices for communities with minimal access to medicine, and Ayurveda's preventive care drew global traction during COVID-19 to enhance immunity strategies. SDG 4 provides IKS's locally applicable education, whereby Kutumba councils impart sustainable livelihood and the renewed Gurukul system, advocated by institutions such as IIT Delhi, combines traditional knowledge with contemporary curricula to form eco-sensitive youth[49]. Nevertheless, use of IKS in SDG frameworks is limited by lack of documentation, possibility of knowledge loss, and market-oriented policies such as carbon markets, which have a possibility of marginalizing indigenous people.

Initiatives such as UNREDD have limited forest access, compromising SDG 10 (Reduced Inequalities). Individuals have to acknowledge indigenous land rights and engage people in conservation, as has been done in the Pacific Northwest[50]. Integration of IKS into policy frameworks will allow India to accelerate SDG outcomes, leveraging the Kondh's tradition and IKS's holistic spirit for scalable, inclusive, and culturally adept solutions honoring nature as well as heritage.

[49] Rout, S., & Patnaik, S. (2014). Indigenous knowledge and sustainable practices.
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Conclusion

The comparative analysis of India and the EU's integration of Indigenous Knowledge Systems (IKS) into environmental governance reveals distinct approaches shaped by cultural and institutional contexts. India's participatory model, anchored by the Biological Diversity Act, 2002, and Forest Rights Act, 2006, prioritizes community rights but struggles with implementation gaps. Conversely, the EU's centralized, compliance-driven framework, through the Biodiversity Strategy 2030 and Regulation (EU) No. 511/2014, ensures uniformity but lacks cultural sensitivity. Both systems recognize IKS's value for sustainability, yet face challenges like bureaucratic resistance and homogenization. Cross-jurisdictional learning—India adopting EU's procedural clarity and the EU embracing India's community-centric approach—can foster inclusive, culturally sensitive frameworks. By empowering communities, enhancing documentation, and addressing unsustainable practices, both jurisdictions can leverage IKS to achieve Sustainable Development Goals, ensuring traditional wisdom drives resilient, equitable environmental governance for a sustainable future.

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