

Research article

Indigenous Knowledge Systems and Sustainable Development Goals: Bridging Traditional Wisdom and Global Sustainability Agendas

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Abstract

Indigenous Knowledge Systems (IKS) are millennia-old collections of wisdom, practices, and beliefs, created by local and indigenous communities as a response to the surrounding environments. With the world community working towards meeting the United Nations Sustainable Development Goals (SDGs) by the year 2030, the importance of indigenous knowledge as a source of invaluable information about environmental management, food security, health, and community resilience is increasing. This essay explores the overlap between Indigenous Knowledge Systems and the 17 SDGs and posits that the key to real success in sustainable development may lie in the effective incorporation of indigenous epistemologies into development discourse. The study, which is based on a structured integrative review of peer-reviewed literature, international policy documents, and case studies in Africa, Asia, Latin America, and the Pacific, examines the role of IKS in conserving biodiversity (SDG 15), as well as climate action (SDG 13), zero hunger (SDG 2), good health and well-being (SDG 3), clean water and sanitation (SDG 6), and the overall goal of reduced inequalities (SDG 10). The article also interrogates the institutional constraints that privilege indigenous knowledge, such as colonial pasts, intellectual property systems, and epistemic hierarchies embedded in scientific institutions. It suggests a comprehensive framework, the Indigenous-SDG Nexus Model, grounded on four pillars of Recognition, Reciprocity, Representation and Regeneration, that makes indigenous communities' co-architects of sustainable development, instead of passive receivers of externally imposed interventions. These results highlight the importance of decolonising development discourse, the implementation of free, prior and informed consent (FPIC) procedures, and the development of transdisciplinary research relationships that view indigenous and scientific knowledge as complementary and not rival systems.

Keywords:

Indigenous Knowledge Systems, Sustainable Development Goals, traditional ecological knowledge, decolonizing development, FPIC

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Introduction

The United Nations 2030 Agenda on Sustainable Development, adopted in September 2015, is one of the most ambitious global frameworks for human progress that have ever been envisaged. It has 17 Sustainable Development Goals (SDGs) and 169 targets spread along the lines of poverty eradication, climate resilience, gender equity, clean energy, biodiversity protection, and the establishment of just and peaceful institutions (United Nations, 2015). Nevertheless, regardless of the breadth and scope of this agenda, critiques have continued to remark on its disposition toward privileging technocentric, market-driven, and Western-centric solutions and marginalizing the knowledge systems of the roughly 476 million indigenous people who live in over 90 countries (International Labour Organization [ILO], 2019) and who control or have tenure rights to at least a quarter of the global land surface (Garnett et al., 2018).

Holistic and dynamic bodies of knowledge, practices, and beliefs known as Traditional Ecological Knowledge (TEK), local knowledge, or traditional knowledge, are the adaptive processes that led to these bodies of knowledge, and the process of cultural transmission that has passed these down through generations (Berkes, 2018).

These systems are not inanimate monuments of the past, but dynamic systems in which indigenous communities perceive, interpret, and act upon their socio-ecological worlds. Ranging from the water-harvesting systems of the Rajasthani communities of India to forest management systems of Amazonian peoples, agropastoral systems of Sahelian herders, and maritime navigation systems of Pacific Islander communities, IKS store highly developed insights into ecological processes, climatic variability, medicinal botany, and sustainable resource management.

The need to incorporate IKS in sustainable development planning is not a mere academic one. The global assessment conducted by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) established that nature is usually diminishing at a slower pace on lands that are managed by indigenous peoples and local communities compared to other lands. The Intergovernmental Panel on Climate Change (IPCC, 2022) also recognized the importance of traditional knowledge systems as sources of important data on climate variability, phenological changes and ecosystem transformation that in many cases are old-fashioned and supplementary to instrumental records. Irrespective of these appreciations, indigenous populations remain marginalized in the process of designing, implementing, and assessing development programmes seemingly meant to enhance their welfare.

The paper presents the thesis that to achieve the transformative potential of the SDGs, a fundamental paradigm shift is needed: between a model of development that views indigenous people as beneficiaries or stakeholders of the sustainable futures envisioned in the 2030 Agenda and a model of development that positions indigenous people as knowledge holders, rights-bearers, and co-designers of the sustainable futures of the 2030 Agenda.

The following is the sequence of the paper. The following section details the review methodology, such as the selection of sources, SDGs, and case studies. This is then succeeded by a conceptual model of appreciating IKS and its epistemological basis. Then the convergences between IKS and the individual SDGs are discussed, the impediments to integration, an integrative model, and three case studies. The paper ends by providing policy recommendations and future research directions.

Methodology

Review Design

This research is an organized integrative literature review. A formal systematic review similar to the one employed to assess interventions (such as that adhering to the PRISMA reporting guidelines) was not preferred due to the overwhelming heterogeneity of the evidence about IKS and the SDGs. It integrates empirical field research, theoretical and philosophical research on knowledge and justice, international legal and policy tools, assessment of knowledge, and documented case studies worldwide through scientific research and evaluation. It is impossible to pool or appraise such material statistically or using a single quality tool, yet it can be searched, chosen, and synthesized in a clear and reproducible manner (Whittemore & Knafl, 2005; Snyder, 2019). The procedures followed are described below.

Search Strategy and Sources

A literature search was conducted using academic databases, such as Google Scholar, with a combination of the terms as follows: indigenous knowledge, traditional ecological knowledge, traditional knowledge, and local knowledge, plus Sustainable Development Goals and domain-specific terms, e.g., food security, traditional medicine, water management, climate adaptation, biodiversity conservation, and indigenous rights. The publication date did not limit the searches; the sources mentioned at the end are dated between 1963 and 2024. Searches were complemented by the use of backward citation of major works and selective searching of the websites of intergovernmental agencies, such as the United Nations, IPBES, IPCC, FAO, WHO, ILO, WIPO, and the Secretariat of the Convention on Biological Diversity, to search for assessment reports, conventions, declarations, and policy documents.

Selection Criteria

They had to meet the following criteria to be considered a source: (a) must be related to the indigenous or traditional knowledge regarding at least one of the SDG areas that are the focus of this paper, or to the governance circumstances of the integration of such knowledge in development; (b) must be peer-reviewed articles, scholarly books or chapters, or official documents issued by intergovernmental bodies or national governments; and (c) must be in English. Sources were filtered out where indigenous knowledge was cited incidentally or where they were opinion pieces or media reports that failed to reference primary evidence. In cases where a statistic was reported in a number of secondary sources, it was traced and quoted back to its source. The last corpus included 59 sources, which are all indicated in the references.

Selection of SDGs and Case Studies

There were six SDGs that were chosen to be analyzed in detail. Five of them, SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 6 (clean water and sanitation), SDG 13 (climate action), and SDG 15 (life on land), are the goals for which the literature on the contribution of IKS is most extensive. SDG 10 (reduced inequalities) was added as the sixth one since the rights aspect (to which the other contributions are attached) belongs to it. Other objectives, including SDG 4 (quality education) and SDG 16 (peace, justice and strong institutions), are discussed in the context of barriers and the suggested model instead of being discussed in distinct sections.

The three case studies were chosen purposely based on three criteria: regional diversity (Central Africa, Oceania and Mesoamerica); addressing various SDGs (forests and climate, freshwater, and food systems); and having documentation in peer-reviewed or official sources. They both help to demonstrate varying levels of incorporation of IKS into policy, ranging from disputed (the Congo Basin) to legally entrenched (New Zealand).

Analysis and Synthesis

Thematic synthesis was used to analyse the selected sources in two phases. In the initial step, SDG arranged evidence to figure out where IKS intersects with every goal. Second stage: Coding inductively, recurrent themes within the SDG domains and especially the circumstances that facilitate or impede the use of indigenous knowledge were coded and clustered. Four cross-cutting themes were identified: recognition or delegitimization of indigenous knowledge; sharing or appropriation of its benefits; indigenous people involvement in decision-making; and knowledge transmission erosion or renewal. These themes become the four pillars of the Indigenous-SDG Nexus Model that will be discussed further in the paper.

Limitations

The review is limited in three aspects. To begin with, it is limited to English-language sources, and this means the exclusion of a large body of literature in Spanish, Portuguese, French, and indigenous languages. Second, since it is based on published and documented materials, indigenous knowledge is perceived mostly through the interpretation of the researchers and institutions, but not as expressed by the holders of the knowledge. Third, since evidence is heterogeneous, both a formal quality appraisal and quantitative synthesis were not conducted; results must thus be interpreted as an interpretive synthesis and not estimates of effect.

Conceptual Framework: Understanding Indigenous Knowledge Systems

Defining Indigenous Knowledge Systems

The idea of Indigenous Knowledge Systems is difficult to define, in part due to the vast heterogeneity of indigenous peoples, in part due to the fact that the very process of definition threatens to transform the rich, multifaceted epistemologies into fixed categories that can be subjected to external classification. According to the definition by the World Bank (2004), indigenous knowledge is the local knowledge, know-how, skills, and practices that are created and transmitted by the local people who have lived in these regions since time immemorial. Sillitoe (2010) goes on to add to this definition to highlight the systemic nature of indigenous knowledge in that it is not a set of isolated facts but a system of knowing, relating, and acting that is specific to particular cultural, spiritual, and ecological settings.

Importantly, IKS should be perceived as relational and holistic. Native knowledge does not divide ecology and culture, health and spirituality, agriculture and cosmology, unlike the compartmentalized fields of Western science. Such a vision of well-being, such as the Andean Kichwa concept of Sumak Kawsay (Buen Vivir or Good Living), as well as other principles, is inherently communal, ecological, and spiritual and therefore speaks to, but also questions, the anthropocentric individualism underlying most SDG indicators (Gudynas, 2011). The Ubuntu philosophy of sub-Saharan Africa, similarly, codifies values of collective responsibility, mutual support, and interconnectedness that have significant ramifications in development ethics (Metz, 2011).

Epistemological Foundations and the Challenge of Epistemic Justice

One of the main issues of the incorporation of IKS into mainstream development discourse is the history of what Boaventura de Sousa Santos (2016) calls the so-called epistemicide, the systematic annihilation of non-Western systems of knowledge by colonialism, missionary activity, and the hegemony of Eurocentric science. The lack of traditional knowledge bases and institutions of traditional medicine and governance, as well as the enactment of colonial land tenure systems, the outlawing of indigenous languages, and the delegitimization of traditional cultures, has not only resulted in incalculable cultural destruction but has also robbed humanity of priceless resources of knowledge.

Epistemic justice, as defined by Miranda Fricker (2007), entails that communities are perceived as legitimate producers of knowledge, not as the subject of research but as epistemic agents whose testimony and epistemic practices should be equally acknowledged. When applied to development, this implies going beyond instrumental incorporation of IKS (the instrumental use of traditional knowledge to meet externally determined developmental objectives) to a true pluriversity of knowledge, a world where multiple knowledge regimes coexist and communicate and enrich each other (Escobar, 2018).

An example of this epistemic pluralism spirit is the Two-Eyed Seeing (Etuaptmumk) philosophy, which was developed by Mi'kmaw Elder Albert Marshall of Canada. It demands learning to view through one eye with the capabilities of indigenous knowledge and through the other eye with the capabilities of Western science, and to combine both eyes so that the good of all can be achieved (Bartlett et al., 2012). This system has been fruitfully used in environmental research, people's health, and the management of natural resources, showing that integrative methods can provide insights that either of the traditions would not have been able to provide independently.

Indigenous Knowledge Systems and the Sustainable Development Goals: Key Convergences

SDG 2: Zero Hunger and Indigenous Food Systems

One of the greatest contributions made by IKS towards sustainable development is in the field of food security and agrobiodiversity. SDG 2 aims to end hunger, improve food security, improve nutrition, and promote sustainable agriculture. The indigenous food systems, which include the diversity of crops, varieties, livestock breeds, wild food species, and their management practices developed over thousands of years, can be a critical resource in achieving this objective.

According to the Food and Agriculture Organization of the United Nations (FAO, 2019), the most significant focus of conservation and sustainable use of biodiversity in the context of food and agriculture is the knowledge and practices of the indigenous people and local communities. The most vital staple crops globally: maize, potato, cassava, quinoa, amaranth, and many others have been bred and selected throughout thousands of years by indigenous people. In Peru, hundreds of native potato varieties, some of which were repatriated to the International Potato Center genebank, are conserved in the Potato Park near Písaq, managed by six Quechua communities with the assistance of the non-governmental organization, Asociación ANDES, and used as a living laboratory of climate adaptation strategies based on traditional knowledge (Argumedo & Pimbert, 2010).

Agroforestry and polyculturally-based indigenous food production systems that may be primarily used today as models, e.g., the Mesoamerican milpa (maize-beans-squash intercropping system) or the Javanese pekarangan (homegardens), are now viewed by agronomists as exceptionally resilient, nutritionally diverse, and ecologically sustainable food production systems (Altieri and Nicholls, 2017; Lopez-Ridaura et al., 2021). These systems ensure that the soil remains fertile by fixing nitrogen, minimize pest pressure by promoting biological diversity, and offer more nutritious foods compared to monocultural food systems with limited nutritional profiles.

The value of indigenous knowledge of wild food species is also becoming a significant issue in the framework of food system resilience. Sub-Saharan African research has reported a significant body of indigenous knowledge of non-cultivated food plants which can be used as buffers to food shortages or drought, or conflict; in the Turumbu of the Democratic Republic of Congo, Termote et al. (2010) documented a comprehensive body of knowledge of wild edible plants and their uses. Land dispossession, agricultural intensification, and undermining traditional practices, often in the custody of women and elders, pose a threat to such knowledge, making IKS protection an essential part of food security strategy.

SDG 3: Good Health and Well-Being Through Traditional Medicine

The World Health Organization states that 170 out of its 194 Member States (88% of them) recognize the practice of traditional and complementary medicine by the people (WHO, 2019). Ayurveda and Traditional Chinese Medicine, as well as African traditional medicine and the healing rituals of the Amazonian shamans, are examples of indigenous medical systems that are a rich source of pharmacological knowledge that has contributed to modern medicine. Farnsworth et al. (1985), in a well-known analysis, discovered that approximately 74 percent of the 119 plant-derived compounds then in use globally as drugs have been identified by chemical research of traditional medicine plants.

The example of artemisinin, the active ingredient of the most efficient antimalarial drug group, demonstrates the usefulness and the susceptibility of IKS in the sphere of health. Artemisinin, which was discovered after a research team led by Tu Youyou, who would become a Nobel laureate, conducted a systematic study of classical texts, including a fourth-century handbook of emergency prescriptions by Ge Hong (Tu, 2016), was based on *Artemisia annua* (qinghao), a plant known in Chinese medical literature over a thousand years prior. Although this finding has rescued millions of lives, it also raises broader concerns about how the custodians of traditional knowledge are identified and how the benefits of commercial application are distributed, and there is an urgent need for equitable frameworks to regulate the use of biocultural knowledge.

In addition to pharmacology, indigenous health systems provide holistic approaches to illness and well-being that could be beneficial to biomedical practice. Health as a concept in most indigenous traditions is relational in nature and covers the health of individuals, communities, ecosystems, and the spiritual realm in one. Medical anthropology and public health studies have shown more and more that culturally congruent health care integrating native healing traditions, languages, and community organization can enhance access to health care and health outcomes among indigenous people as compared to biomedical services (Czyzewski, 2011; Reading and Wien, 2009).

SDG 6: Clean Water and Sanitation Through Traditional Water Management

Clean water and sanitation are a sensitive issue of concern across the world, and around 2 billion individuals did not have access to safe drinking water services in 2020 (WHO and UNICEF, 2021). Over millennia, indigenous communities have developed sophisticated water management systems that entail knowledge of hydrology, watershed processes, and water conservation that is becoming central to the sustainable governance of water. An example of the most glorified indigenous water management is the johads (traditional water harvesting structures) of Rajasthan, India. The johad system, which had been developed by the indigenous knowledge community-based institutions of groundwater governance, showed that traditional water harvesting technology, along with community governance institutions, could restore degraded watersheds, increase groundwater levels, and revitalize agriculture in semi-arid regions (Agarwal & Narain, 1997). This case is examined as a model of community-based management of water in South Asia.

Pre-Inca qochas (sunken garden systems) and amunas (infiltration canals) of the Andean highlands are complex solutions to the hydrological problem of high-altitude agriculture. Recent studies on the rehabilitation of these systems in Peru have shown that they can be effective in groundwater recharge and irrigation and hold promising avenues for climate adaptation in highland communities with greater variability in precipitation (Ochoa-Tocachi et al., 2019).

Water governance systems of indigenous peoples are usually integrated within cultural and spiritual systems that explain a mutual relationship between communities of people and water. An example of the legal acknowledgment of indigenous water rights and responsibilities as a platform for sustainable water management is the Māori notion of kaitiakitanga (guardianship) in New Zealand that has found its way into the national environmental laws (Harmsworth and Awatere, 2013).

SDG 13: Climate Action and Traditional Ecological Knowledge

Climate change is, perhaps, the most pressing issue of sustainable development, and indigenous people are among the worst victims of climate change, despite having the least contribution to global greenhouse gas emissions. Ironically, these localities are the ones with some of the most advanced systems of climate monitoring, adaptation, and mitigation. The IPCC (2022) acknowledges that indigenous and local knowledge is critical to creating locally suitable adaptation strategies, as mentioned in the introduction.

Traditional Ecological Knowledge (TEK) includes multi-generational or even multi-century long-term observations of seasonal patterns, species behavior, weather predictors, and ecological processes that give qualitative records of environmental change. Recent research in the Arctic has shown that Inuit record keeping on sea ice, snow environments, and animal activities furnishes information on climate change that is supplemental and sometimes precedes the instrumental data (Huntington, 2011). Equivalent records of native climate pointers have been carried out in East Africa, Hindu Kush Himalayan territory, and the Pacific Islands and show the worldwide suitability of TEK-based climate observation.

The native land management practices can also play direct roles in mitigating climate change through carbon sequestration. Indigenous lands and conserved natural ecosystems in the Amazon basin alone held 58 percent of the aboveground forest carbon in the region in 2016 but contributed only about 10 percent of the net carbon loss in the region between 2003 and 2016 (Walker et al., 2020). Landscape mosaics created by the

forest management practices of these communities, such as rotational cultivation, selective harvesting, fire management, and maintenance of sacred groves, contribute to high levels of biodiversity and sequester high levels of carbon.

It is therefore not only a question of justice that the indigenous land rights be recognized but also a cost-effective climate mitigation strategy. Comparative studies of deforestation rates in indigenous versus non-indigenous land tenure regimes have consistently reported lower rates in indigenous stewardship systems than in non-indigenous protections or open access areas, indicating that indigenous stewardship systems could be one of the most effective forest protection mechanisms available (Schleicher et al., 2017; Nolte et al., 2013).

SDG 15: Life on Land and Indigenous Biodiversity Conservation

Perhaps the most widely reported intersection of IKS and SDGs is the relationship between indigenous people and biodiversity. SDG 15 entails the protection, restoration, and sustainable use of land-based ecosystems, sustainable management of forests, combating desertification, and ending the loss of biodiversity. In 87 countries, indigenous peoples have at least tenure rights over a total of 38 million km² of land, which is more than a quarter of the total land area of the world, and the area of which touches approximately 40 percent of all terrestrial land under protection and all landscapes without human influence (Garnett et al., 2018). They further overlap at least 36% of the remaining forest landscapes of the world (Fa et al., 2020).

The processes through which the native land management systems preserve biodiversity are numerous and intricate. Sacred natural places, spaces that are devoted to spiritual and ritual use in indigenous cultures around the world, serve as de facto nature reserves, keeping important habitats untouched and undisturbed (Verschuuren et al., 2010). Traditional conservation tools are taboo systems that control entry to resources in breeding seasons or ecological stress periods. The ecological knowledge of a particular species, encoded by oral tradition, song, and ceremony, is the means of passing on ecological knowledge through the generations.

Article 8(j) has formally acknowledged the role of indigenous communities in the conservation of biological diversity, through its provisions of the Convention on Biological Diversity (CBD) that require indigenous knowledge to be respected, preserved, and maintained, and that are relevant to biological diversity. The Nagoya Protocol on Access and Benefit-Sharing (2010) further provides a guideline on how indigenous communities obtain fair and equal benefits in the use of genetic resources and related traditional knowledge (Secretariat of the Convention on Biological Diversity, 2011).

Models of community-based natural resource management (CBNRM) based upon indigenous institutions of governance have shown spectacular results in the protection of biodiversity in Africa, Asia, and Latin America. The Community Conservancies of Kenya and Namibia, Communal Areas Management Programme of Indigenous Resources (CAMPFIRE) in Zimbabwe, and the community forestry programs of Nepal all build on and strengthen indigenous knowledge systems and governance structures to meet conservation and livelihood goals in concert (Fabricius and Koch, 2004).

SDG 10: Reduced Inequalities and Indigenous Rights

The world is overrepresented by the indigenous people as a group of the poorest and most marginalized groups. They constitute approximately 6.2% of the global population but account for almost 19% of the world's extreme poor (ILO, 2019). They are subjected to

systematic discrimination, land dispossession, cultural repression, and disenfranchisement. SDG 10, which requires a decline in inequalities within and between nations, is therefore closely related to the identification and safeguarding of indigenous rights.

In 2007, the United Nations made the most extensive international document addressing the rights of indigenous people with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which declares rights to self-determination, land, culture, language, education, and health. The principle of Free, Prior, and Informed Consent (FPIC), as embedded in UNDRIP, stipulates that indigenous people must be consulted in good faith and their consent must be given before any project, law, or administrative decision that may interfere with their rights and territories is approved (United Nations, 2007).

FPIC is not just a procedural protection but a substantive acknowledgment of the right of the indigenous people to development in their own way. FPIC-free development initiatives have been shown over and over again to have negative impacts on the indigenous peoples, such as displacement, cultural disruption, health decline, and the loss of livelihoods, even though they were implemented to bring development benefits (United Nations Human Rights Council, 2013). However, a systematic review of 169 conservation projects concluded that those projects that involve the indigenous people and local communities in the center of the decision-making process are more likely to achieve better conservation and human well-being results compared to externally managed interventions (Dawson et al., 2021).

Structural Barriers to the Integration of Indigenous Knowledge Systems in SDG Implementation

Colonial Legacies and Epistemic Hierarchies

Although more and more people are appreciating the importance of IKS, structural obstacles still hinder its successful implementation into sustainable development models. The legacy of colonialism is chief among them, but it not only deprived indigenous communities of their lands and resources, but also systematically dehumanized their knowledge systems. The colonial project not only entailed political domination (which was analyzed by Frantz Fanon, 1963) but also what has been referred to as the colonization of the mind (Ngũgĩ wa Thiong'o, 1986), in which the internalization of the cultural and epistemic structures of the colonizer as universally valid and the subsequent devaluation of the native systems of knowledge occurred.

This epistemic order is replicated in modern scientific and development organisations, which still prefer peer-reviewed, quantitative, and formally credentialed knowledge to experiential, qualitative, and system-based bodies of knowledge. As Harding (2015) points out, traditional scientific institutions are characterized by certain social and political assumptions regarding objectivity, authority, and the division of knower and known that are culturally particular and not universal. Without extensive changes, indigenous knowledge, as a context-driven, relational, and embodied knowledge, cannot be easily incorporated into these frames.

Intellectual Property and Biopiracy

A key dilemma at the intersection of IKS and the SDGs is the problem of intellectual property and so-called biopiracy, the exploitation of indigenous biological and genetic material and related traditional knowledge by commercial entities or scientists, often

without permission or payment to the community where the knowledge is found. The weakness of traditional knowledge to commercial exploitation by existing intellectual property regimes has been pointed out in high-profile cases, including patents on the wound-healing use of turmeric and on the pesticidal properties of the neem tree (Shiva, 1997), and subsequent controversies over patent claims to the Andean maca root.

The prevailing intellectual property paradigm, as embodied in the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement, was meant to safeguard individual inventors and corporate bodies instead of collective, inter-generational and place-based knowledge. Attempts to establish sui generis regimes of protection of traditional knowledge, such as the WIPO Intergovernmental Committee on Genetic Resources, Traditional Knowledge and Folklore, have been slow to take form. In May 2024, the WIPO member states approved the Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge, obliging patent applicants to specify the country of origin of genetic resources and the indigenous peoples or local communities that supplied the associated traditional knowledge (World Intellectual Property Organization [WIPO], 2024). The treaty is a good move, although a disclosure requirement does not ensure consent or fair benefit-sharing.

Land Dispossession and the Fragmentation of Biocultural Landscapes

Access to the lands and territories where the indigenous knowledge is embedded cannot be meaningfully exercised without access to the knowledge itself. It is not an abstract entity; IKS is geographically and ecologically particular, co-evolving over the course of generations in the direct interaction with specific landscapes, assemblages of species, and ecological processes. The expropriation of land, then, does not simply deny the communities access to economic means; it breaks the connection between knowledge systems and ecological referents, speeding up the loss of knowledge and eroding the conditions under which intergenerational discursive transfer of IKS is possible.

The worldwide growth of extractive industries, commercial agriculture, infrastructural projects and even conservation projects (with the so-called fortress conservation models in which indigenous societies are not included in the zones of protection) has further undermined native lands (Brockington et al., 2008). The Land Rights Now global campaign and the World Resources Institute document, the Securing Land Rights report, present current trends in land dispossession of indigenous peoples in Asia, Africa and Latin America, oftentimes in the guise of development and conservation, a fundamental contradiction that reveals the conflicts within the SDG framework itself.

Inadequate Representation and Participation in SDG Governance

Although nominal, the governance architecture of the SDGs has been criticized for lacking any substantial space in which indigenous people can participate. Indigenous peoples are represented at the High-Level Political Forum (HLPF) on Sustainable Development, the principal venue for the SDGs follow-up and review, via the mechanism of major groups and other stakeholders, which offers consultative access but not decision-making (United Nations General Assembly, 2013). Voluntary National Reviews (VNRs), with the help of which countries report on SDG progress, hardly disaggregate data by indigenous status; therefore, it is not possible to determine whether SDG progress bypasses indigenous communities.

One of nine stakeholder groups identified in the multi-stakeholder model of the HLPF is the Major Group of Indigenous Peoples, which offers an option of indigenous participation but is limited by tangible resources, logistical challenges, and inherent asymmetry of stakeholder involvement in the process and actual co-governance. This, as Coulthard (2014) puts it, is because recognition of the indigenous peoples in state and international regimes without a change of the power relations that organize them runs the risk of being a kind of colonial recognition, recognizing indigenous difference and absorbing its potential to change.

Toward an Integrative Framework: The Indigenous-SDG Nexus Model

As a reaction to the shortcomings of current methods, the paper presents an Indigenous-SDG Nexus Model (ISNM) that attempts to operationalize the place of IKS within SDG implementation in a way that will be epistemically just, institutionally feasible, and practically effective. It is based on four pillars that are interrelated: Recognition, Reciprocity, Representation, and Regeneration.

Pillar 1: Recognition

Formal recognition of IKS as legitimate, valuable, and irreplaceable contributions to sustainable development is the first pillar of the ISNM. This recognition should work on several levels: scientific (recognizing IKS as generating valid knowledge of the world), legal (preserving IKS via intellectual property and land rights systems), and political (integrating IKS as an evidence base into policymaking). In order to be recognized, one must go beyond the surface-level appreciation of indigenous cultural heritage to more substantive interaction with the epistemological and ontological aspects of various bodies of knowledge.

On the scientific level, recognition involves reforming research methods that will allow the co-production of knowledge with indigenous peoples. Participatory action research (PAR), community-based participatory research (CBPR), and ethnoecological research methods provide models of research collaborations where indigenous knowledge bearers are considered as co-investigators (not research subjects) (Minkler and Wallerstein, 2008). Journals and funding agencies need to devise evaluation standards that are responsive to indigenous methodologies of research such as oral testimony, ceremonial knowledge, and place-based observation.

Pillar 2: Reciprocity

The second pillar is known as reciprocity, which states that when benefits are made out of indigenous knowledge, fairness should be extended to those communities in which indigenous knowledge is obtained. Reciprocity entails strong enforcement of access and benefit-sharing provisions under the Nagoya Protocol, establishment of community protocols, which allow indigenous communities to control the use of their knowledge, and establishment of the institutional mechanisms to make sure that the proceeds of bio-prospecting, eco-tourism, and cultural industries are repatriated back to indigenous communities.

Reciprocity also means intellectual reciprocity, a readiness to learn indigenous knowledge, and to share scientific knowledge with indigenous communities on their conditions. The spirit of mutual learning implicit in Two-Eyed Seeing is an example of this kind of spirit, as is the increasing trend of indigenous-led science education that implicates scientific

learning within cultural systems in place of opposing imperatives of science and culture (Bang et al., 2012).

Pillar 3: Representation

Representation- Representation also means that the indigenous people should have a meaningful representation in the governance systems of sustainable development at all levels: local, national, and international. This cannot be achieved by mere token inclusion in consultative processes, but rather institutional changes that establish real power-sharing relationships between indigenous governance institutions and state and international institutions. One of the ways of operationalizing indigenous representation in development governance is the setting up of indigenous co-management institutions that have practical powers over decisions on the management of territorial resources.

Formal negotiating status for indigenous peoples' organizations in SDG review processes, climate negotiations, and CBD meetings would be a big boost to the representation of indigenous people at the international level. A regional precedent, the Escazú Agreement in Latin America and the Caribbean, that includes robust clauses on indigenous rights to environmental information, participation, and justice, can be used to inform global models (Economic Commission for Latin America and the Caribbean [ECLAC], 2018).

Pillar 4: Regeneration

The fourth pillar, regeneration, responds to the pressing necessity to contribute to the revival and intergenerational passing of IKS that may face the threat of extinction through cultural assimilation, land dispossession, age-related death of elders, and decline of traditional livelihoods. The IKS regeneration revolves around language revitalization, because the indigenous languages contain ecological, agricultural, and medical knowledge in words, grammar, and oral forms that cannot be translated properly into other languages (Maffi, 2001). The conservation of IKS is therefore inseparable from supporting indigenous language education, documentation, and use in public life.

One of the best ways to ensure that IKS is passed on intergenerationally is through community-controlled land-based education programs, where young people are taught traditional knowledge through direct interaction with ancestral territories under the tutelage of elders (Wildcat et al., 2014). Such programs should be supported by way of a publicly funded program, as well as institutional acknowledgment of land-based learning credentials, which would help curb the transfer of indigenous knowledge as the aged population dies without an inheritor to whom they can pass their knowledge on.

Case Studies: Indigenous Knowledge Systems in SDG Practice

Case Study 1: The Forest Peoples of the Congo Basin and Climate Mitigation

With numerous forest-dependent communities, such as the Baka, Aka, and Mbuti, the Congo Basin forest system, which is the second largest tropical rainforest in the world, has helped to maintain this globally important carbon sink and biodiversity hotspot. The territories of indigenous people globally intersect with at least 36 percent of the intact forest landscapes of the world (Fa et al., 2020).

Efforts like the Congo Basin Forest Partnership and the Central African Forest Initiative have been growing to address indigenous land rights and knowledge systems in forest conservation and climate mitigation efforts. Beymer-Farris and Bassett (2012), however,

warn, based on evidence in the Tanzanian mangrove forests, that unless REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programs are implemented in a genuinely participatory manner and ensure that the rights of the indigenous forest peoples are respected, the program would result in merely a repetition of the so-called fortress conservation model that has traditionally dispossessed the indigenous forest peoples and brought conservation benefits to outsiders.

Case Study 2: Māori Knowledge and Freshwater Governance in New Zealand

The case of New Zealand and the introduction of Māori knowledge and principles of governance into the management of freshwater presents one of the most developed examples of IKS integration into the national regulations. One of the landmark moments in the legal acknowledgment of indigenous ecological relationships was the Te Awa Tupua Act (2017), which gave the Whanganui River legal personhood and two co-guardians, a Māori guardian and a Crown representative (Salmond, 2017). This act was directly inspired by the Māori idea of the river as an ancestor (tupuna awa) and the concept of kaitiakitanga (stewardship) as being central to freshwater management.

The National Policy Statement of Freshwater Management, which has been revised in 2020 with enhanced provisions about Māori participation and te Mana o te Wai (the fundamental significance of water), makes it a requirement of the regional councils to engage the tangata whenua (Māori as people of the land) in freshwater management and to facilitate matauranga Māori (Māori knowledge) in the process of environmental monitoring and decision-making (Ministry for the Environment, 2020). This example indicates that effective legal and institutional reforms have the potential to build enabling conditions for IKS integration that will bring about benefits to both indigenous communities and the environment.

Case Study 3: Agroecology and Indigenous Food Systems in Mesoamerica

The polyculture of maize, beans, and squash, known as the milpa system, which has nourished Mesoamerican people for thousands of years, has increasingly attracted scientific interest as an example of sustainable agriculture to SDG 2 and SDG 15 goals. By expanding on the agroecological evidence outlined under SDG 2 (Altieri and Nicholls, 2017), a study in the Western Highlands of Guatemala discovered that milpa plots were more productive than maize monocrops and contributed more to household nutritional security (Lopez-Ridaura et al., 2021), implying that millennia of indigenous agricultural knowledge have led to a food system that remains unclear to modern agronomy and is only now being worked to be comprehended and recreated.

In Mexico, Guatemala, and Honduras, community seed banks under the care of indigenous communities hold the genetic diversity of traditional maize varieties (landraces) that form the basis of food security in the region and globally. Indigenous communities, national gene banks, and international agricultural research centers have developed models of community-managed seed conservation which build on indigenous knowledge but use complementary scientific methods, a model of the integrative approach recommended in the ISNM proposed in this paper.

Policy Recommendations

Based on the above discussion, the following policy recommendations to governments, international organizations, research institutions, and civil society organizations interested in integrating IKS into SDG implementation are proposed in this paper:

First, as a prerequisite to the maintenance and application of IKS, governments need to expedite the legalization of indigenous land rights in the legal system. This is made possible by land tenure security, which allows indigenous communities to practice and pass on their knowledge systems and be in a position to perform the stewardship functions that drive benefits of biodiversity, climate, and food security to the larger community. This will necessitate the adoption of UNDRIP provisions, such as FPIC, in national laws and development planning.

Second, the national and international statistical systems should be transformed to gather, examine, and publish disaggregated statistics on the SDG position of indigenous people. In the absence of disaggregated data based on ethnicity and indigenous status, one cannot determine whether SDG programs serve or ignore indigenous populations or hold governments responsible for their specific developmental performance in relation to indigenous people.

Third, funding agencies and universities should be dedicated to authentic collaboration with indigenous communities during research design, implementation, and dissemination of knowledge. This necessitates the creation of ethical research frameworks for indigenous research that extend beyond harm minimization to active support of the community in self-determination in knowledge generation. The funds to fund research must be made available directly to the local community organizations, and not just to schools.

Fourth, the Nagoya Protocol should be effectively enforced, and a multilateral benefits-sharing mechanism for using the digital sequence information on genetic resources should be operationalized and properly resourced. This encompasses the Cali Fund to be created at the sixteenth Conference of the Parties to the CBD in 2024, stipulating that no less than half of its funds should aid the self-determined requirements of indigenous peoples and local communities (Convention on Biological Diversity, 2024). Less developed nations and the indigenous populations need to be given adequate technical and financial assistance to formulate the community protocols and national laws to enable successful implementation of ABS.

Fifth, climate finance mechanisms, such as the Green Climate Fund and the Adaptation Fund, need to commit significant resources to indigenous-led climate adaptation efforts that draw on traditional knowledge. The reporting requirements and eligibility criteria need to be changed to suit the indigenous governance systems and knowledge documentation practices that are not the same as those of the formal civil society organizations.

Conclusion

The connection between Indigenous Knowledge Systems and the Sustainable Development Goals is one of the most important and under-represented aspects of the global sustainability agenda. IKS, as this paper has argued, not only provides an additional source of information that can be pasted onto externally designed development programs but also offers core epistemologies, forms of governance, and practical technologies that

would radically reshape the way humanity handles the ecological, social, and economic crises to which the SDGs are addressed.

The literature examined in this paper suggests that indigenous territories overlap with much of the global land area under protection and preserved ecosystems, that indigenous agricultural practices hold the key to resilient food production systems, that indigenous water management presents a model of sustainable hydrological governance, that traditional medicine is a rich and underutilized drug bank, and that indigenous land management may be an economical approach to climate control and adaptation. They are not nostalgic or romantic assertions; they are corroborated by an accumulating body of interdisciplinary research, albeit with some unique domains and contexts showing stronger evidence.

Nevertheless, to achieve this potential, the structural barriers, the legacies of colonialism, epistemic hierarchies, poor land rights, and tokenistic processes of participation that still marginalize indigenous knowledge and communities must be faced. Based on Recognition, Reciprocity, Representation, and Regeneration, the Indigenous-SDG Nexus Model presented in this paper provides a framework of the institutional and policy changes that need to be made to change the relationship between indigenous knowledge systems and global sustainable development governance.

This review has a number of recommendations for future research. The co-production of empirical studies with indigenous communities is required to evaluate the contribution of IKS to specific SDG targets and indicators, and to test the four pillars of the Indigenous-SDG Nexus Model in a specific context. Other areas that need further work include the goals that this review has only discussed briefly, including SDG 4, SDG 5, and SDG 16, and must exploit non-English-language literature (including indigenous languages).

The 2030 Agenda aims at not leaving anyone behind. To make this commitment more than rhetorical, it should be operationalized as a commitment to epistemic justice, to a very real pluriversality of knowledge where indigenous modes of knowing are not only respected and safeguarded but also drawn upon in the development of sustainable futures. There is a limited time to act: climate change, the decline of biodiversity, and the erosion of cultural diversity are increasing the rate at which invaluable knowledge is being lost. SDGs offer a roadmap as well as an expiry date. It is time to take action.

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