

## Harnessing Indigenous Knowledge for Global Innovation

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### Abstract

Indigenous knowledge, a multidimensional framework of knowledge system passed down from generation to generation, provides a valuable but often neglected tool in addressing global challenges. Such understanding, rooted in millennia of cultural, environmental, and spiritual traditions, fosters sustainable livelihoods, resilient communities, and social harmony. In an era of ecological crises, climate change, and growing divisions between rich and poor amidst the promise of rapid technological advancement, incorporating indigenous wisdom into innovation processes offer an opportunity for deep system change that can create effective, impactful, sustainable solutions. However, the place of indigenous knowledge within global systems of entrepreneurship and innovation presents both opportunities and challenges worthy of engagement. This paper explores how indigenous knowledge can be integrated in a manner beyond a Western paradigm; something that would be valuable to global innovation in sustainable development, biodiversity strategies, and social entrepreneurship. Through archival documents and specific case studies of indigenous knowledge applications in environmental management and community-driven business models, the paper illustrates a mutualistic relationship between traditional practices at local levels and modern science and technology. Agroforestry and crop diversification, for instance, are indigenous agricultural practices that provide sustainable methods of producing food as alternative models to industrial agriculture. Traditional medicinal knowledge has also played a complementary role in the progress of pharmaceutical products by introducing novel natural agents that can potentially be used as therapeutic agents. Indigenous governance systems, with their emphasis on communal well-being and sustainability for future generations, offer ethical frameworks for social entrepreneurship that can engender more equitable models of doing business around the world. Despite the potential benefits, there are challenges. For instance, incorporating indigenous knowledge raises the concern in intellectual property of whether indigenous communities would be acknowledged as legitimate source of innovation. The paper advocates a holistic approach in collaboration and promotion of indigenous knowledge towards a more inclusive innovation and sustainable development for the overall benefit of the global population.

**Keywords:** Indigenous knowledge, global innovation, social entrepreneurship, Sustainable development, Inclusive innovation.

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## INTRODUCTION

When people think of global innovation, they tend to think of technological advancements, advanced science and entrepreneurial endeavors that spur economic development. But this limited definition is by far too narrow for what innovation is all about. For millennia, Indigenous People (World Bank, 2023) have cultivated diverse ecosystems through cultural practices, environmental stewardship, and communal life, and their knowledge is a little known and untapped wealth of innovation. This is despite their occupying about 6 percent of the global population. From managing natural

resources, agriculture to health, and social governance, Indigenous peoples across the globe have developed the knowledge systems that could help address some of our biggest issues today including climate change, food security, and social inequalities, all of which if left unaddressed will undermine our survival and our ability to live healthy fulfilling lives.

Indigenous knowledge is deeply embedded in the experiences and traditions of indigenous groups and communities, transmitted through oral histories, ceremonies, and practices that tend to be closely linked

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to specific geographic regions. These traditions are often specific to certain locales; however, their principles can be applied anywhere, especially when faced with global challenges. The passages of sustainable farms, information systems, and cultivation methods practiced today can draw on thousands of years of land use in diverse environments where biodiversity and the health of ecosystems were critical for survival, and where society's fragmentation into distinct classes in more recent history is a recent phenomenon.

Indigenous knowledge systems provide alternative frameworks for innovation that promote resilience, sustainability, and social justice. They encourage the technology side of innovation and fill with ethical and cultural vectors, where the aspects of community well-being, environmental stewardship, and sustainable living take precedence. Indigenous knowledge can help establish the ground for a more inclusive and socially just system of innovation.

But the path to joining indigenous knowledge with global innovation is unclear, and very challenging. In conventional innovation processes, Indigenous knowledge systems are frequently neglected, as they place more importance on scientific and technological ways of knowing than cultural and social perspectives. This raises issues of the use of traditional medical knowledge, as the use of skills for profit may infringe on intellectual property and encourage cultural appropriation. Because indigenous knowledge is traditional in nature, the commonalities of ownership and usage are not easily defined within modern intellectual property frameworks, which are often individualist and commercial. Consequently, it is a danger that it can lead to the extraction and commodification of indigenous knowledge without proper compensation or acknowledgment.

Simply acknowledging the value of indigenous knowledge is not sufficient; we need to address why it has taken so long to integrate indigenous knowledge into global innovation frameworks. It requires a fundamental change in the definition and practice of innovation. This calls for a move towards an innovation landscape that acknowledges indigenous peoples as equal partners in the process, ensures their rights are protected, and opens up space for the provision and usage of indigenous knowledge in a culturally-binding and ethically sound manner. This leads to a space where indigenous communities, researchers, entrepreneurs and policymakers are able to reduce the divide between traditional knowledge and modern tech development.

This paper seeks to explore how indigenous knowledge can serve as a driving force behind global innovation, by highlighting its potential in sustainable development, environmental conservation, and social entrepreneurship. It will through certain case studies demonstrate the successful integration of indigenous

knowledge within modern framework of innovations and endeavor to highlight the lessons learned from such case studies. In addition, it will explore the challenges and ethical dilemmas that arise when dealing with indigenous knowledge, including the need to respect intellectual property rights and cultural heritage. In conclusion, this paper lays a foundation for rethinking innovation as a holistic process that can benefit from the wise elders of indigenous traditions, more than the knowledge of modern science and technical competencies needed to address global challenges can offer alone, or that scientific creativity which can solve all innovation problems.

### **The place of Indigenous Knowledge in Global Innovation:**

Indigenous knowledge is a comprehensive system of wisdom developed by communities through their interaction with local environments over centuries. It encompasses a deep knowledge of ecosystems, agriculture, medicine, architecture, governance, and social systems, often reflecting a holistic thought which includes humans, nature, and the cosmos. Amid crises of climate change, biodiversity loss, resource extraction and depletion, and social inequity, the conjoining of indigenous knowledge with modern systems of innovation may offer pathways to equitable development and progress forward.

Sustainable practices using indigenous knowledge have been one of the fundamental values that can be integrated with global innovation. Traditional ecological knowledge (TEK) is based on the long-term sustainable stewardship of natural resources. However, Indigenous peoples also unknowingly created agricultural systems and land management practices that guarantee food security for their communities, while protecting and promoting the environment. For example, agroforestry techniques by native farmers in the Amazon and Southeast Asia encourage biodiversity, restore soil and help save water. The role of these practices in sustaining ecosystem health while providing livelihoods is therefore highly relevant in light of contemporary initiatives addressing land degradation and climate change (which collectively underpin the UN Decade for Ecosystem Restoration). The rise of industrial agriculture has led to environmental degradation and threatened the future of food production through soil erosion, loss of biodiversity, and excessive use of chemical inputs; traditional practices give us critical insights into how we can build more resilient and sustainable food systems moving forward.

Indigenous knowledge is an integral part not only of agriculture but also of medicine and health care. Traditional healing, which employs indigenous plants, herbs, and natural products, is based on generations of accumulated knowledge about local ecological systems. Indigenous knowledge about plants is the basis for many modern pharmaceutical drugs — like quinine, derived

from the bark of the cinchona tree, or aspirin, developed from willow bark (Duke, 2009). More recently, there has been increasing focus on ethnobotany and bioprospecting, whereby scientists work with indigenous communities to discover new plant compounds with the potential to be used as medicine (Sawadogo *et al.*, 2025). Such collaborations are crucial, not just for the advancement of modern medicine, but for the protection of indigenous knowledge and ensuring communities are compensated for any commercial exploitation of their resources.

Indigenous governance systems provide a powerful model for social innovation. Unlike the top-down approaches that dominate modern state governance, many indigenous communities are governed by both collective decision-making, consensus-building, and shared responsibility. These systems prioritize community sustainability over capitalism, driving communities to be a sense of belonging, social cohesion, and mutual aid. Such governance models can inspire socially responsible entrepreneurship, especially as we rethink how to solve inequality and exclusion challenges in modern societies. By operating from indigenous governance principles—like inclusivity, equity, and sustainability, social enterprises can become more resilient and compassionate businesses, putting people and planet over profit.

The role of indigenous knowledge in innovation lies beyond agriculture, medicine, business and humanitarian or governance. It also marks a paradigm shift in our understanding of progress and development. Indigenous knowledge holders have a different perspective; they are often grounded in holistic, systems-based thinking, which seeks interconnected solutions as opposed to single, implementation-based technologies. It fosters an environment for innovation where what is technologically feasible is also ethically appropriate and ecologically considerate. Indigenous communities, for example, do not, but rather consider nature to be a partner, not a resource to exploit. By enabling innovation to be co-created in authenticity, relationship and interconnectedness brings the potential for a reverence and respect for the planet which naturally leads to co-created solutions that are blessings for the world as we navigate times of uncertainty and change.

Indeed, Indigenous peoples have long survived environmental, political, and economic shocks and adapted to their aftermath, drawing on their knowledge of local ecosystems and social systems. As they have adapted over the years to changing circumstances, like changing weather patterns or natural disasters, these communities have become resilience experts. This knowledge is becoming more crucial as the world grapples with the various effects of climate change and natural disaster. The integration of Indigenous knowledge systems with contemporary practices may offer valuable insights into disaster preparedness,

resource management, and community-driven resilience strategies that can work alongside modern scientific and technological approaches.

The harmonization of traditional wisdom with technology and scientific inquiry will expand fellowships and benefit cooperation at a global level. Centering the wisdom of traditional knowledge with modern science can coexist, support, and create ways to solve our world's ailments through comprehensive, multi-faceted approaches. This not only leads to a richer and more diverse approach to problem-solving but also helps ensure that the resulting innovations are sustainable and address the needs of local communities as well as the wider global population.

The importance of indigenous knowledge to global innovation cannot be overstated. With immense contributions to sustainability, healthcare, governance and resilience, it is providing concrete solutions and alternative perspectives that can help address the most urgent global challenges. They will be able to unlock the full benefits only if they address public goods and change the way they recognize, protect and integrate indigenous knowledge in international structures for innovation. Creating a more inclusive and sustainable future is possible simply by encouraging respectful, ethical partnerships so that indigenous communities are paid and renowned for their input.

Indigenous peoples' knowledge systems - though they are under recognised in the broader discourse around innovation - have also played a major role in shaping the modern world, particularly around environmental management, agricultural techniques, health care and social entrepreneurship. These case studies showcase the successful integration of indigenous knowledge into modern industrial innovation and demonstrate how it can lead to more sustainable and resilient solutions while also empowering indigenous communities.

### **Collaborative biodiversity protection in Amazon forest**

An example is the alliance between environmental groups and indigenous people in the Amazon rain forest. Indigenous peoples like the Yanomami, Kayapo and Mundurucu tribes have lived in the Amazon for centuries and have a deep understanding of the region's ecosystems. This insight has been crucial to their ability to sustainably manage the forest, promoting biodiversity and protecting key ecosystems. Yet with rising threats from deforestation, illegal logging and mining, the Amazon is experiencing unprecedented levels of environmental devastation.

In response, collaborations between indigenous peoples and global conservation organizations have formed, blending ethnic ecological knowledge with contemporary scientific approaches. Such as the

Indigenous Peoples and Biodiversity program, that asks Indigenous leaders to partner with scientists and environmental organizations to monitor and protect the rainforest, and empowers them to do so. Often, the ways Indigenous communities understand the lived-in, dynamic reality of the land are used to inform conservation strategies, highlight important species to protect, and turn to traditions of sustainable land use that meet the needs of local people while supporting ecosystem health.

They work together to develop and implement innovative solutions for conservation that benefits the land, the environment, and the livelihoods of local indigenous peoples. One such type of initiative, where communities are provided with legal rights over their lands and appointed as guardians to protect those lands, is an indigenous-managed protected area, and the results have been found as better conservation outcomes than conventional protected areas run only by governmental entities or non-governmental organizations. And these indigenous-led projects are more effective than others at reducing deforestation and protecting biodiversity as well as being able to generate income through ecotourism and sustainable forest products.

### **Resurgence of Sustainable Traditional Agriculture Methods**

Another powerful example of indigenous knowledge propelling global systems innovation can be found in the renaissance of the Milpa agriculture system, developed by indigenous farmers in Mesoamerica. In the Milpa system, a centuries-old, polycultural method of growing and rotating crops—typically maize, beans and squash—alongside multiple other crops, designing one complex ecosystem in place of a monospace field. This method enhances soil fertility, biodiversity, and pest control while minimizing chemical fertilizers and pesticides. For thousands of years, it has been a pillar of indigenous agricultural practices.

Milpa has recently been reinterpreted by modern agricultural scientists as a model of a sustainable agricultural system. Given that industrial agriculture is a driver of soil depletion, biodiversity loss, and susceptibility to climate change, the Milpa system represents a sustainable alternative with access to agronomic benefits and long-term food security.

Researchers and non-governmental organizations have worked together with native farmers in countries such as Mexico, Guatemala and Honduras, to analyze the requirements of the milpa system and modify their principles to modern agriculture.

The results of these partnerships have been innovative farming practices that combine ancestral wisdom with modern technology like GIS mapping and soil analysis to enhance crop productivity and lessen its environmental footprint.

Besides the environmental advantages, the Milpa system in part represents a cultural heritage, and addresses the cultural necessity of preserving native agricultural practices, supporting the community work (solidarity) against the agrobusiness that destroys such agricultural practices. These partnerships contribute to global sustainability by promoting indigenous knowledge in agriculture, and in doing so, they also help keep indigenous cultures alive.

### **Traditional Medicine in Modern Drug Development**

The fields of medicine have also benefited from indigenous knowledge, such as the study of ethnobotany, the practice that involves understanding how indigenous peoples use local flora for medical purposes. A large proportion of modern pharmaceuticals is derived from indigenous plant information, yet the majority of these natural resources give many nature's wonders waiting to be discovered (Blanck *et al.*, 2022).

One example is the collaboration between the indigenous peoples of the Amazon and pharmaceutical companies. In the Amazon, indigenous tribes such as Shipibo-Conibo have long been acquainted with plants like *Uncaria tomentosa* (cat's claw) for its anti-inflammatory properties, and some species have even been used to treat diseases such as malaria and cancer. Over the last few decades, pharmaceutical companies have teamed up with indigenous peoples to study these plants and extract compounds with possible use as new drugs.

Examples include the particular partnership between the Biopharma global pharmaceutical and the indigenous Asháninka community in Peru. In this initiative, the healers share their knowledge of the medicinal plants with scientists, who then use modern scientific methods to validate the effectiveness of these plants. Their collaboration has resulted in life-saving treatments, but also ensures that the Asháninka people receive fair payment for their work. Such a model would not only facilitate the progress of medical research, but also safeguard the intellectual property rights of indigenous communities, and discourage misuse of such resources.

### **Community Empowerment through Indigenous-Led Entrepreneurship**

Alongside environment and health innovations, social entrepreneurship is driven by indigenous knowledge. An inspiring case to look at is the work of the Warlpiri Youth Development Aboriginal Corporation (WYDAC) in Australia. WYDAC is an indigenous-led institute that emphasizes the advancement of Aboriginal youth through education, employment and community development programs. Inspired by indigenous principles of collectivism, land stewardship and responsibility to the community, WYDAC integrates these time-tested concepts with

contemporary business models to forge sustainable, community-owned social enterprises.

WYDAC has a number of programs in progress, including an immensely favourable enterprise, which shows young people how to run businesses based on conventional Aboriginal expertise, such as generating native artwork, storytelling, and cultural tourism. WYDAC has bridged the gap between tradition and modern entrepreneurship by providing opportunities for young Aboriginal people to participate in meaningful work in their community and earn money while doing so, enabling them to develop their economic independence. Not only does this model support the development of indigenous communities, but it also enables cultural pride and resilience.

Indigenous-led entrepreneurship is also evident in the co-operative movement among the Inuit peoples of Canada. Indigenous-led co-operative societies like the Pangnirtung Co-op seek to provide economic opportunities to local communities based on traditional understanding of the land, wildlife, and hunting practices. These cooperatives foster sustainability in natural resources, such as the responsible harvesting of fish, and create value-added products such as Inuit art and clothing. These are businesses that help preserve traditional ways of life, while ensuring economic growth and social equity.

### **The Baobab Tree and *Zai pit* Technology in Food Security**

The Baobab tree (*Adansonia digitata*) which is endemic to the African continent is central to food security and sustainable agriculture. It is called the “tree of life” because of its resilience in extreme drought conditions, and it provides resources such as food, edible leaves, seeds, and oil. For centuries, indigenous cultures in Africa have domesticated dry-season fruits, particularly the Baobab tree fruit which is high in Vitamin C, antioxidants, and other nutrients, both for nutritional and medicinal and cosmetic purposes.

The Baobab has recently attracted international markets and through partnerships with indigenous peoples and international organisations, its tremendous benefits are arising in the heart of innovation. In countries such as Senegal, Malawi, and Tanzania, local populations have started collecting Baobab fruit and converting it into powders, oils, and drinks for both local use and export. This initiative has turned the Baobab into an economically valuable product while protecting ancient wisdom on sustainable harvesting practices and product development.

A significant global Baobab product market has developed that has become a valuable source of income for local people. This approach supports sustainable agriculture and provides an environment-friendly alternative to traditional high-risk agriculture, that is

heavily impacted by climate change and environmental degradation. This innovative initiative promotes food security, economic opportunity as well as environmental sustainability by integrating indigenous knowledge of the Baobab tree with modern business practices. Local communities' engagement and participation across the entire value chain—harvesting, processing and marketing—ensures the benefits are equitably distributed.

Another Nigerian indigenous practice with implication for soil erosion prevention and water conservation is the *Zai pit* farming technique which indicates a deep understanding of the need for soil erosion prevention and water conservation. Its efficiency in moisture and nutrient retention even in arid and semi-arid regions of Nigeria is amazing. The *zai pit* is a small, shallow hole dug into the ground to trap water and nutrients. Researchers have demonstrated how these indigenous techniques can be unified with modern agricultural systems in order to address the challenges of climate change and food insecurity.

### **Traditional Rice Farming as Indigenous Knowledge in Asia**

In Asia, traditional knowledge systems have contributed to biodiversity conservation and agriculture that supports local communities. One such example is the rice terraces of the Ifugao located in the island of Luzon, Philippines, where the indigenous culture of the Ifugao people have practised complex agro-ecological systems for generations.

The Ifugao people's traditional rice terraces, particularly the Banaue Rice Terraces, are a UNESCO World Heritage site and a stunning demonstration of indigenous agricultural knowledge. The Ifugao rice terraces are not just an engineering marvel, but a very sustainable agricultural system that harmonizes with the natural landscape. These terraces conserve moisture, maximize soil fertility and protect from erosion. Indigenous communities in the mountainous Cordillera region have adapted this traditional practice over centuries to ensure a reliable food supply.

The Ifugao rice terraces have been increasingly recognized for their role in sustainable agriculture in recent years. Indigenous farmers, in collaboration with environmental organizations and research institutions, have promoted the conservation of these terraces as a model of climate-resilient agriculture. One of the other things is called "Terraces in Trust" project which aims to promote sustainable rice farming by reviving traditional practices and modern ecological farming techniques. This not only preserves biodiversity and ecological balance but also serves as food sovereignty and cultural identity for the Ifugao people.

Additionally, there are international efforts to promote native strains of rice, like the “unpolished

heirloom rice” grown by the Ifugao, which is now heralded for its nutritional benefits and environmental sustainability. These rice types are naturally resistant to pests and diseases and are significantly able to avoid chemicals and those reducing inputs and are certainly helpful for biodiversity preservation. These indigenous practices are perceived as workable solutions to the present-day issues of food security and sustainable agriculture through the adoption of a combined knowledge of traditional rice farming practices and modern agricultural policies.

These case studies illustrate the need for integration of indigenous knowledge in promoting innovation on a global level. They show how traditional knowledge underpins global innovation and what lessons can be learned in order to create a more sustainable, equitable and resilient future.

### Challenges in Integration

While indigenous knowledge has the potential for generating innovation, there are barriers. One major challenge is the issue of intellectual property rights. Indigenous knowledge has traditionally been shared among a community, handed down through generations, and does not fit the more recent scientific idea of authorship that is associated with intellectual property. This creates a difficult situation for innovators who want to safeguard their inventions while also acknowledging the rights of indigenous peoples.

Additionally, an extractive and commercial abuse of indigenous knowledge with lack of proper acknowledgement or cultural appropriation poses a risk. This calls for the creation of ethics frameworks that provide for equitable use of indigenous knowledge in research and innovation.

In addition, there is an absence of acknowledgment of indigenous individuals as knowledge holders inside mainstream innovation ecosystems. The traditional indigenous leader, the knowledge bearer is often not connected to the platforms and resources to share this knowledge to the world. But this gulf can be bridged through cross-cultural collaboration and the promotion of inclusion of indigenous inputs in innovation processes.

### Policy Role and Global Collaboration

Regulations that promote maintaining indigenous intellectual property whilst furthering worldwide ideas from such knowledge should be a joint effort by governments in collaboration with business to ensure interests are also mutually beneficial and effectively communicated via academic institutions. This requires a change in the very fabric of how we perceive and engage with innovation, transitioning to a more inclusive and culturally attuned model.

Internationally, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) underpins the acknowledgment and respect for the rights of indigenous peoples. Such frameworks can inform the establishment of policy interventions facilitating ethical use of indigenous knowledge within research and innovation.

Moreover, they should aim to promote collaboration between indigenous peoples, scientists, entrepreneurs, and regulators where they can learn from one another and develop solutions together. Moreover, connecting indigenous and contemporary innovation ecosystems through programs that facilitate the exchange of knowledge and access to tools and resources is vital, particularly as indigenous technology approaches are increasingly addressed in a knowledgeable manner.

## CONCLUSION

Harnessing indigenous knowledge for innovation on a global scale presents exciting opportunities to address some of the most pressing challenges of our time, from climate change to social inequality to food security. This essentially involves combining traditional knowledge with modern technology to create a more sustainable, and inclusive innovative ecosystem. But such integration must be carried out respectfully, sensitively, and with a dedication to maintaining an authentic integrity for indigenous cultures. Indigenous knowledge is a driving force for technological advancement, with far-reaching implications on global innovation.

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