

Indigenous Peoples and Climate Technologies



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Acknowledging indigenous peoples' technologies
and identifying linkages with Technology Needs Assessments



Technology Needs Assessments

Indigenous Peoples and Climate Technologies

ISBN: 978-87-94094-07-8

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Thank you to the reviewers as well as the following persons for providing their time and expertise: Anne Barre (Women Engage for a Common Future), Antonella Cordone (International Fund for Agricultural Development)

Design & Layout: Kowsky / kowsky.dk

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A young fisherman walks under a living root bridge at Mawlynnong village, India. In the relentless damp of Meghalaya's jungles the Khasi people have used the trainable roots of rubber trees to grow Jingkieng Dieng Jri living root bridges over rivers for centuries. Photo from the book Lo-TEK: Design by Radical Indigenism by Julia Watson. Copyrights Amos Chapple (cover), Esme Allen (p.6), Sandyman (p.16), Ami Vitale (p.25), Framalicious (p.32)

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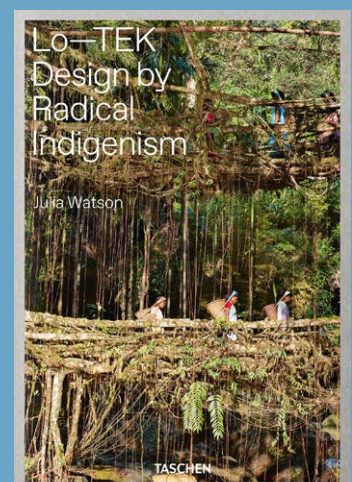
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2021

UNEP DTU Partnership

Copenhagen, Denmark

www.unepdtu.org



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Introduction

It is estimated that around six percent of the world's population, over 476 million people, self-identify as indigenous peoples. According to an estimate cited by the World Bank, they are protecting about 80 percent of the world's remaining biodiversity, covering a quarter of the world's surface area (World Bank 2021). Indigenous peoples' knowledge about climate resilience and their global contribution to the sustainable management of our shared natural resources are critical to combating climate change and its impacts. Yet, their contribution often remains unacknowledged, and too often indigenous peoples have little access to the financial resources or forums for decision-making concerning the environment, severely undermining their opportunities to exert a significant influence over climate policy, planning and action.

Acknowledging and learning from indigenous peoples' technologies can support countries in implementing their Nationally Determined Contributions and achieving the Sustainable Development Goals. Indigenous women in particular, who are often the custodians of knowledge, can be powerful agents of change when engaged in national planning processes such as the Technology Needs Assessments (TNAs), a set of country-driven activities designed by the UNEP DTU Partnership (UDP) to help identify and facilitate the implementation of countries' climate technology priorities (UNFCCC 2021a).

Relevant stakeholders, including institutional, governmental, technical and other experts, are involved throughout the TNA process to strengthen the likelihood that climate technologies will be understood, accepted, supported and implemented. The country-driven nature and legitimacy of the TNA process could be further strengthened by engaging with those populations, including indigenous peoples, who may be directly affected by the technologies identified and prioritized in the process. Further added value to the process comes from also considering solutions and groups with long-standing experience in developing technologies to adapt to climate change across generations.

This guidance report seeks to present the various ways in which indigenous peoples draw on their knowledge to find solutions and technologies to combat climate change that can help societies at large cope with the impending changes. Rather than being a prescriptive step-by-step guide on how to integrate these considerations into the TNA process, this report aims to familiarize the reader with key concepts and to offer a better understanding of the importance of acknowledging the diversity of knowledge systems, as well as the role indigenous peoples' technologies can play in this context. TNA stakeholders are recommended to read this guidance when drawing up their TNAs, and to identify and integrate relevant considerations on indigenous peoples and technologies into the process, while ensuring that their free, prior and informed consent is obtained and thereafter documented for future reference. In reading this report, some concepts may appear for which clarification and details are best provided in previous TNA guidance books.

This report focuses on¹:

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- introducing some of the main concepts, definitions and frameworks related to indigenous peoples and their rights, knowledge and technologies;
-
- highlighting concrete examples of indigenous peoples' technologies and knowledge to address climate change with a focus on food security, natural resource management, disaster risk reduction and innovation;
-
- presenting opportunities and challenges to take better account of the knowledge and voices of indigenous peoples and their technologies in the TNA process.
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¹
Note: as this guidance report has been developed specifically for the TNA process and countries' identification and prioritization of technologies, it does not focus in-depth on the impact of climate action on indigenous peoples at the stage of technology implementation.

PART 1

Indigenous peoples, rights and technologies



The section below presents key concepts and definitions of indigenous peoples, knowledge and technologies. It also introduces the main rights framework regarding indigenous peoples and the institutions and frameworks that guide the topic in the context of climate change.

Relevant rights frameworks

ILO and UNDRIP

The Indigenous and Tribal Peoples Convention (No.169) was adopted in 1989 by the International Labour Organization (ILO) and has been ratified by 23 countries. It is a legally binding international treaty in which, once ratified, states have an obligation to enforce all its requirements in both law and in practice. The Convention is a comprehensive instrument that covers a wide range of issues concerning indigenous peoples, including land rights, access to natural resources, health, education, vocational training, conditions of employment and contacts across borders. It is the only international legal instrument open to ratification that deals exclusively with the protection of indigenous and tribal peoples' rights. In terms of consultations, the Convention provides an important framework ensuring meaningful consultation with and participation of indigenous peoples in decision-making.

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) has been adopted by 148 countries since it was passed in 2007. The UNDRIP consolidates and affirms the mandating of governments to address all issues concerning the rights of indigenous peoples. It complements, reinforces and reaffirms the principles of ILO Convention No. 169, is the most comprehensive international instrument on the rights of indigenous peoples, and establishes a universal framework of minimum standards for their survival, dignity and well-being. Among several articles, the Declaration highlights the right of indigenous peoples to their traditionally owned lands and resources, as well as the *conservation and protection of the environment and the productive capacity of their lands or territories and resources*. As such, states are mandated to *establish and implement assistance programmes for indigenous peoples for such conservation and protection, without discrimination*. It notes the importance of consulting with indigenous peoples in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories, particularly in connection with activities which might have an impact on mineral, water and/or other resources. The Declaration also states that indigenous peoples have the right to access financial and technical assistance from states and through international cooperation for the enjoyment of the rights contained in the Declaration.

Free, Prior and Informed Consent

The principle of free, prior and informed consent (FPIC) is important in upholding the rights of indigenous peoples and their right to determine their own priorities themselves. It reflects indigenous peoples' right to be consulted, their right to participate, and the right to their lands, territories and resources (OHCHR 2018). The United Nations

Declaration on the Rights of Indigenous Peoples (UNDRIP) requires states to consult and cooperate in good faith with indigenous peoples in order to obtain their free and informed consent *prior to* taking actions which may affect them, such as any development project including building of dams requiring relocation or resettlement of communities as well as the exploitation of mineral and other natural resources or the storage of non-declared hazardous materials on indigenous peoples' lands.

All the elements of free, prior and informed consent are interlinked, and their definitions have been endorsed by the United Nations Permanent Forum on Indigenous Issues (UNPFII).² The first three components of FPIC (Free, Prior and Informed) qualify and set the conditions for the fourth (Consent). Consent is thus required before any action takes place, while being independently decided and based on accurate and sufficient information, and on full understanding, for it to be the valid outcome of a collective decision by indigenous peoples. In short:

- **Free** refers to consent given voluntarily without coercion, threat, intimidation, bribery or manipulation, and without externally imposed expectations or timelines, as an independent process of decision-making
- **Prior** means that consent is sought sufficiently in advance of any authorization or commencement of activities with respect for the time and information needed to understand, consult, analyse and evaluate the activities under consideration in accordance with indigenous peoples' own customs
- **Informed** refers to the nature of the engagement and the type of information that is provided prior to consent being sought. Importantly, the information should be accessible, clear, consistent, accurate and transparent. This includes taking measures such as delivering the information provided in the local language and in forms that are easily understood by the affected communities of indigenous peoples through culturally appropriate means covering the nature, scope, actors, procedures, purpose, duration and locality of the project and its potential impacts
- **Consent** refers to the collective decisions made by the rights-holders that have been reached through the customary decision-making processes of the indigenous peoples or communities affected. Here, the participation of young people, women, the elderly and persons with disabilities, customary institutions and leaders must be ensured and consent provided or withheld according to the unique customs of each community. This provision affirms the right of indigenous peoples to give or withhold their consent to any decision that will impact on their lands, territories, resources, and/or livelihoods.³

Some examples of climate technology initiatives that have been opposed by local and indigenous communities in the past, and that highlight the importance of free, prior and informed consent, are presented below.

² Definition of FPIC endorsed by UNPFII at its Fourth Session in 2005, also taken from the UNREDD Programme Guidelines on Free, Prior and Informed Consent.

³ United Nations Permanent Forum on Indigenous Issues (UNPFII), *Report of the International Workshop on Methodologies Regarding Free Prior and Informed Consent*, Document E/C.19/2005/3, endorsed by the UNPFII at its Fourth Session.

- **Monocrops for biofuels.** Indigenous communities, especially in South-East Asia and Latin America, often oppose the growing of monocrops for biofuels due to the risk of displacement. The United Nations Permanent Forum on Indigenous Issues noted back in 2007 that demand for biofuels and expansion of the production of bio-fuel crops is destroying tribal people's land and lives, potentially displacing 60 million indigenous peoples worldwide, resulting in a loss of land and livelihood (Survival International 2008). Global biofuel production has since increased, exacerbating competition over land between biofuel crops and food, and over the land required to sustain the livelihoods of indigenous and local communities.
- **Carbon markets.** While there are several examples of emissions trading or offsetting projects that have successfully involved indigenous peoples (UNU-IAS 2008), the use of international carbon credit markets, such as the Clean Development Mechanism (CDM) and REDD+, have often been challenged, as in some instances they have forced displacement on indigenous peoples and their communities and shifted the control of lands and forests towards private companies. Indigenous peoples should be considered key stakeholders in such processes, given their intrinsic and multiple (social, cultural, economic and environmental) relationships with and dependence on forests. Yet, during the Paris climate change conference, the No REDD in Africa Network reported that violations of indigenous peoples' rights to free, prior and informed consent had occurred in ten out of sixteen countries with UN REDD programs. Indigenous peoples require governments to respect the principle of free, prior and informed consent before developing carbon market policies and regulations or conservation legislation. Anthropologists have stated that over a million indigenous peoples have been forcibly removed from their lands in the last hundred years by conservation legislation alone (Dowie, M. 2009).
- **Wind farms.** In countries such as Mexico, Colombia and Kenya, indigenous peoples and their communities have been fighting the expansion of some wind farms on their lands and protesting at the lack of consultation in their planning and implementation, as well as at forced relocation in order to build roads. This opposition has often divided indigenous communities internally, as some members receive benefits and payments in exchange for the use of their land to set up wind farms, while others resist what they consider exploitation and land-grabbing. Several groups have filed civil suits for violation of their human rights during what was supposed to be a free, prior and informed consultation over the installation of the wind farms (Debates Indigenas 2021a,b,c).
- **Hydropower.** Hydropower has widely been popularized as a clean energy source with the potential to reduce greenhouse gas emissions. However, large-scale hydropower projects have on several occasions inflicted negative social, cultural and environmental impacts on their immediate environments, partly through the displacement and violation of the rights of indigenous peoples. In some instances, adverse impacts on indigenous peoples may come from not only the dam itself but the associated transmission lines, as in the case of the Khimti-Dhalkebar transmission line in

Nepal. It was found that indigenous peoples in Sindhuli District were not consulted in the design, location or alignment of the transmission line. They were also not invited to participate in the preparation of the various safeguarding documents, such as the environmental impact assessment, in order to keep transmission lines away from their communities, homes and schools (World Bank Inspection Panel 2013).

Free, prior and informed consent in the TNAs

Relevant to the TNA process, the United Nations Declaration on the Rights of Indigenous Peoples also requires states to seek free, prior and informed consent through their own representative institutions, prior to the adoption and implementation of legislative or administrative measures that may affect indigenous peoples (Article 19). This may indeed be the case in identifying technology needs and projects related to, for example, forest and natural resource management, agriculture and renewable energy infrastructure. As the Technology Action Plans (TAPs) include a set of concrete actions needed for the successful implementation of technology in a country, it is important to consider the risk of such activities inadvertently doing more harm than good to groups such as indigenous peoples and communities by failing to consider associated aspects.

Rights of indigenous peoples in international climate processes

Climate change exacerbates the difficulties already faced by vulnerable indigenous peoples and their communities. At the same time, indigenous peoples draw on their knowledge to actively protect ecosystems and enhance resilience to climate change in creative and sophisticated ways. Their inclusion in international climate processes is crucial to ensure sustainable and sustained climate action. The section below describes the mechanisms and platforms that are of particular relevance in a climate context.

The Paris Agreement and the Sendai Framework for Disaster Risk Reduction were both adopted in 2015, providing a clear mandate for countries and increased coherence in their approaches to climate change and disaster risk reduction. The Sendai Framework recognises the rights and knowledge of indigenous peoples in the development of national policies, plans and disaster risk assessments. It states that *indigenous peoples, through their experience and traditional knowledge, provide an important contribution to the development and implementation of plans and mechanisms, including for early warning*. It also calls on governments to empower local authorities to work and coordinate locally with different groups, including indigenous peoples, in disaster risk management.

The capacities and knowledge of indigenous peoples have further been recognised in the Convention on Biological Diversity Article 8 (j), which references among other provisions, the need to respect, preserve and promote the knowledge, innovations and

practices of indigenous and local communities for the conservation and sustainable use of biological diversity.

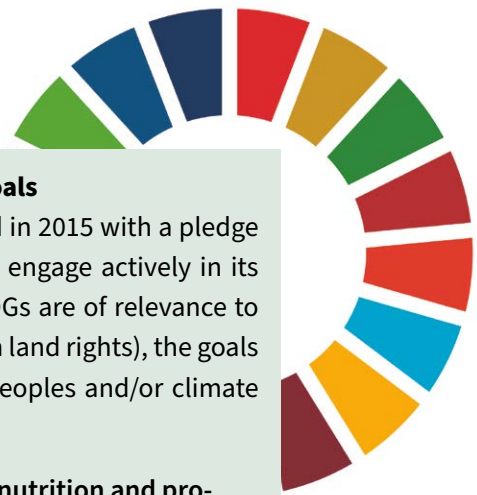
In its preamble, the Paris Agreement states that Parties should respect, promote and consider their respective obligations regarding human rights and the rights of indigenous peoples and local communities. The Agreement, in Article 7.5, also specifies Parties acknowledging that adaptation actions should *follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate*. Yet, in a review of countries' Nationally Determined Contributions (NDCs), only nineteen countries mentioned the importance of indigenous peoples (RRI 2016), and in Africa only nine of the 44 NDCs indicated a need to pay greater attention to the importance of traditional knowledge both regionally and nationally (Marrie 2019).

With regard to the development and transfer of climate technologies to developing countries, the UNFCCC Technology Mechanism, which consists of two bodies: the Technology Executive Committee (TEC) and the Climate Technology Centre & Network (CTCN), have been mandated to take into account the enhancement of indigenous peoples' capacities and endogenous technologies in their implementation of the Paris Agreement. More specifically, the mandate is to catalyse development and enhancement of endogenous capacities for climate-related technologies and harnessing indigenous peoples' knowledge, and to take into account indigenous aspects in the support provided (UNFCCC, 2018b).

In order to uphold these principles and mandates during international climate negotiations, indigenous peoples voice their positions through the Indigenous People's Major Group⁴ organised in the International Indigenous People's Forum on Climate Change (IIPFCC). In this space, indigenous peoples develop common positions and statements to lobby and advocate at UNFCCC meetings and sessions. At COP24 in 2018, the Local Communities and Indigenous Peoples Platform (LCIPP)⁵ was established with a mandate to focus on knowledge, capacity-building and climate change policies and actions. Its two-year work plan was later adopted at COP25 listing twelve concrete activities to be delivered by 2021. 2018 was also the year the Green Climate Fund (GCF) adopted the Indigenous Peoples' Policy to guide the GCF's work and monitor compliance with indigenous people's rights (GCF 2018).

4
One of the nine 'major groups' for participation in UN activities.

5
See UNFCCC, Decision /CP.24 "Local Communities and Indigenous Peoples Platform" at <http://bit.ly/2Tkn68e>



Indigenous peoples and the Sustainable Development Goals

The 2030 Agenda for Sustainable Development was adopted in 2015 with a pledge to leave no one behind. It called on indigenous peoples to engage actively in its implementation, follow-up and review. Although several SDGs are of relevance to indigenous peoples (particularly indicators 1.4.2 and 5.a.1 on land rights), the goals and targets set out below explicitly reference indigenous peoples and/or climate change:



- **SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.**

- Target 2.3: by 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, and other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.



- **SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.**

- Target 4.5: By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.



- **SDG 13: Take urgent action to combat climate change and its impacts.**

- Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Target 13.2: Integrate climate change measures into national policies, strategies and planning
- Target 13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
- Target 13.A: Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly USD 100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
- Target 13.B: Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.

*Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Key concepts and definitions

Indigenous peoples and communities

Given the diversity of indigenous peoples, an official definition of *indigenous* has not been adopted by any UN body. Similarly, for the term *indigenous peoples*, the prevailing view today is that a strict definition is unnecessary and undesirable, and indigenous peoples themselves have argued against the adoption of a formal international definition, stressing instead the need for flexibility and to respect the desire and the right of each indigenous people to define themselves. The lack of a formal definition has not been considered crucial in the promotion, protection or monitoring of such rights (OHCHR 2013).

A commonly cited “working definition” of indigenous peoples was adopted by the United Nations Commission on Human Rights in 1971:⁶

Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system.

The study also notes that an indigenous person is:

... one who belongs to these indigenous populations through self-identification as indigenous (group consciousness) and is recognized and accepted by these populations as one of its members (acceptance by the group). This preserves for these communities the sovereign right and power to decide who belongs to them, without external interference.

It is worth noting that some UN bodies, including the International Labour Organization (ILO), use two terms, *indigenous peoples* and *tribal peoples*, as there are tribal peoples who are not indigenous in the literal sense. Nevertheless, in order to be included on the indigenous peoples’ rights agenda and in the discussions that take place at the United Nations, many of these peoples refer to themselves as indigenous. Thus, the terms *indigenous* and *tribal* are often used as synonyms in the UN system when the peoples concerned identify themselves with reference to the indigenous peoples’ agenda. Other terms have also been used. For example, in some parts of Asia and Africa governments use the terms *ethnic groups* or *ethnic minorities*, although some of these groups have identified themselves as *indigenous*.⁷

⁶ Study of the problem of discrimination against indigenous populations” (E/1982/34). The study is commonly known as the Martinez Cobo Study, as it is named after the Special Rapporteur of the Sub-Commission on the Prevention of Discrimination and the Protection of Minorities. It is said to have helped lay the foundations for the modern indigenous international human rights system.

⁷ The right of peoples to self-determination is recognized in Article 1 common to the International Covenant on Economic, Social and Cultural Rights and the International Covenant on Civil and Political Rights, both adopted by the United Nations General Assembly in 1966 and ratified by the overwhelming majority of states.

The technologies and knowledge of indigenous peoples

The knowledge of indigenous peoples can be defined as the skills, know-how, innovations and practices that are passed on from generation to generation in a traditional context and that form part of the traditional lifestyles of indigenous peoples and communities (WIPO 2004). The knowledge of indigenous peoples can also be viewed as:

... local knowledge that is unique to a culture or society. This knowledge is passed from generation to generation, usually by word of mouth and cultural rituals, and has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world. (UNFCCC 2017)

Similarly, in a more climate-related context, the UNFCCC describes the knowledge of indigenous peoples as generally referring to:

... knowledge systems embedded in the cultural traditions of regional, indigenous, or local communities. Traditional knowledge includes types of knowledge about traditional technologies of subsistence, such as tools and techniques for agriculture, ecological knowledge, the climate knowledge, traditional health care and others. (UNFCCC 2018a)

Other definitions developed by indigenous peoples themselves have placed greater emphasis on the biological, cultural, physical, spiritual and sometimes religious aspects of their knowledge and its transmission. They describe such knowledge as a systematic way of thinking, with insights based on evidence acquired through direct experiences and multigenerational observations, lessons and skills. Such knowledge is described as still developing in a living process (ICC 2021) and is considered crucial for subsistence and survival. The non-formal scientific status of the knowledge of indigenous peoples, and the manner in which it is communicated and transmitted, has attracted very little documentation or scientific research (Enda Energie 2017).

The term *technologies* in this guide is defined as a piece of equipment, technique, practical knowledge or skills to perform a particular activity. It can refer to either hardware (tangible components), software (know-how, experience and practices), or orgware (institutional frameworks or organization). When it comes to the specific case of *indigenous technologies*, it can refer to the technological knowledge, skills and resources that are transmitted or handed down from past indigenous peoples to present ones to meet their needs. As such, indigenous peoples' technologies are used by the indigenous inhabitants of a country or region and constitute an important part of their cultural heritage (Gumbo, M. 2014).

Difference between *indigenous* and *endogenous*

A distinction is often made between the terms *indigenous* and *endogenous*. Although the two concepts are related and endogenous technologies are often considered to include technologies of an indigenous nature, the two terms are distinct from each other. The main difference is that endogenous technologies can be described as including not only indigenous technologies, but also non-indigenous technologies and even technologies developed elsewhere and adapted to the country context. This report will only focus on the concept *indigenous*. In the context of sustainable development there is no broad definition of the term *endogenous*, as the concept has evolved over time. From a climate technology perspective, the UNFCCC Technology Executive Committee has presented suggested understandings of *endogenous capacities* and *endogenous technologies* based on research with and surveys of key climate stakeholders:

- **Endogenous capacities** include the capacities to:
 - Assess climate-related technology needs from the individual to the national level;
 - Identify appropriate technologies to assist in meeting identified needs
 - Adapt technologies to local needs and conditions.
- **Endogenous technologies** are those that have been:
 - Developed within the country or by a team of in-country and external people, or;
 - Developed elsewhere but modified and adapted within the country or by a team of in-country and external people to meet the country's needs and conditions.

To sum up, although there is no formal definition of indigenous peoples, the rights of indigenous peoples to self-identification must be acknowledged and respected. This report will focus on indigenous peoples' technologies, which have been transmitted for generations and have bonds with historical contexts, ethnic groups and identities. As such, endogenous technologies, which also include technologies developed elsewhere and adapted to the country context, or the local and traditional technologies of non-indigenous peoples, fall outside of the scope of this guidance. Nevertheless, it is acknowledged that all forms of local and traditional knowledge, as well as endogenously adapted technologies, provide valuable solutions to the sustainable management of natural resources and the adaptation and mitigation of climate change. They should therefore be taken into consideration in national climate-planning.

PART 2

Examples of the knowledge and technologies of indigenous peoples



Indigenous peoples are disproportionately affected by coastal erosion, extreme weather events, forest fires, melting glaciers and rises in sea level. In addition to physical and financial damage, climate change exacerbates the threats to indigenous peoples' social, cultural and spiritual ways of living. For generations, communities have been coping with climate variability by applying their accumulated knowledge, practices and world views. Rather than conquering nature in their pursuit of development and progress, indigenous peoples' technologies, climate solutions and knowledge often work with nature and biodiversity as a main building block in ways that are local, affordable and easily constructed, yet sophisticated in their durability and resilience. By observing nature, predictions can be made of weather patterns. In some communities, weather can be predicted by observing simple events like insects carrying their eggs under cover in anticipation of rain. The rich knowledge of indigenous people with regard to the environment and ecology is inherited from generation to generation and should be included when considering the 'best available technologies' for climate action. By acknowledging and highlighting indigenous peoples' climate technologies, we are better equipped to identify appropriate and sometimes overlooked solutions to support climate mitigation and adaptation through national processes such as the TNAs. The section below highlights a few of these examples in the areas of natural resource management, food security, disaster risk management and innovation.

Natural resource management

The process of adopting and scaling up innovative technologies and practices in natural resource management would greatly benefit from understanding, learning about and integrating indigenous peoples' knowledge and technologies and building on existing and successful efforts to manage resources sustainably. Indigenous resource management relies on community organisation and customary governance institutions to control sustainable use and access to natural resources, applying their technologies and techniques of conservation and preservation, and using customary norms and procedures to manage and share the benefits of natural resources within indigenous peoples' territories.

Carbon sequestration through indigenous peoples' forest management

Indigenous communities are good forest protectors and have successfully opposed mining and logging while relying on non-timber forest products (NTFPs) to ensure lower deforestation rates compared to land owned by non-indigenous groups (FAO & FILAC 2021). Many indigenous territories mitigate deforestation as effectively as protected nature reserves and national parks. Forests managed by indigenous peoples typically have higher carbon densities due to vegetation being in a better condition, thereby sequestering more carbon (Walker et al. 2020). Enhancing efficient carbon sequestration and sustainable forest management requires legal recognition of customary land and traditional tenure systems, as well as the provision of formal land documents to provide indigenous peoples, including women, with land security. Securing indigenous land and facilitating their ability to protect and manage their land is a cost-effective approach to carbon sequestration and climate mitigation. While there is more to be

understood, the IPCC has acknowledged that land-titling and programs that recognise indigenous and communal tenure can improve forest management and carbon storage (IPCC 2019). In the Amazon, it has been estimated that securing indigenous lands is 5 to 29 times cheaper than the cost of carbon capture and storage (CCS) for coal-fired power plants (WRI 2016).

Indigenous peoples' fire management in Australia

The devastating bushfires in Australia in 2019-2020 released approximately 830 million tonnes of carbon dioxide into the atmosphere according to a government estimate (Commonwealth of Australia 2020). That is far more than the country's annual greenhouse gas emissions in a normal year. Despite being locally banned in most areas, there are now increased calls for the integration of indigenous fire-management techniques known as cultural burns, traditionally practised by peoples such as the D'harawal communities in Australia. These methods have been used for thousands of years to mitigate bushfires.

Through cool-burning, the smaller controlled fires mitigate large natural bushfires by burning kindling and dead organic material. The cultural burnings are seen as working with the environment and enhancing biodiversity by maintaining and protecting the habitat for mammals, reptiles, insects and birds while permitting a more sustainable re-growth of the forest to facilitate its capacity to reabsorb carbon dioxide in future years. The technique involves lighting small fires in selected areas between March and July during the early dry season in Australia. The fires burn gradually and remove the fuel for larger fires late in the dry and hot season, while fertilizing the ground with their ashes (Skiba 2020).

Shifting cultivation and slash-and-burn techniques

Shifting cultivation or slash-and-burn techniques are types of rotational farming where cultivation alternates between different plots. They have been practised by indigenous peoples for many generations, such as the Igorot of the Philippines, the Karen of China, Myanmar and Thailand, Chepang and others in Nepal, and the Achiks in India. Although there are difficulties in capturing the landscape dynamics through remote sensing, it has been estimated that shifting cultivation landscapes cover anything between 280-1,000 million hectares worldwide (Heinimann et al. 2017). By practising shifting cultivation, a piece of forest or land is burned to clear it for cultivation. The ashes provide nutrition for the soil and facilitate a fertile ground for growing. The fields are used for only one season, and once the crop is harvested, the field is left to recuperate and revert its their natural vegetation for ten to twenty years, while the cultivators move on to another plot.

However, due to increased population pressure, external economic interests, the pressure on natural resources and the need to shorten the regeneration phase in some cases, the technique has become controversial and is seen by some as a destructive farming technique and an emitter of carbon. This often leads to shifting cultivation being banned when the territories of indigenous peoples become protected areas under government

policies, thereby criminalising the livelihoods of the indigenous peoples who are the protectors of that land. While the debate proceeds, shifting cultivation continues to be an important livelihood system for indigenous communities in Sub-Saharan Africa, South and Southeast Asia and South America. Indigenous communities continue to defend their right to pursue their traditional methods, maintaining that continuous cultivation on the same plot of land would eventually lead to loss of soil fertility. Here, the knowledge of indigenous peoples could benefit from being combined with modern approaches to natural resource management (WWF, IWGIA, KULU, Nepenthes & DIIS 2005). Priority areas for support identified by the FAO include better fallow management and combining slash and burn with agroforestry, crop diversification and improvements to soil fertility (FAO, IWGIA & AIPP 2015). Rightly implemented, slash and burn can increase the health of forest ecosystems, allowing them to both mitigate and adapt to the effects of global warming, while playing an important and culturally relevant role in indigenous farming communities.

Food security

Food security exists when people's dietary needs and food preferences can be met, allowing them to lead active and healthy lives. This depends on having physical, social and economic access to sufficient, safe and nutritious foods (Briones et al. 2018). In a climate context, climate-resilient crops are needed. Here indigenous crop and seed varieties and environmentally friendly agriculture can offer effective solutions while maintaining the health of both populations and ecosystems. Indigenous peoples' climate adaptation technologies can improve livelihoods and reduce poverty and hunger (Anik & Khan 2012). Many indigenous peoples are reviving their agro-ecological food systems, as they are considered to provide more nutritious diets and to be more resilient to climate change.

Waru Waru: agricultural terraces in Peru and Bolivia

For centuries, indigenous groups around Lake Titicaca in Peru and Bolivia have developed an agricultural landscape based on raised fields and irrigation canals (also known by the Aymara term *Waru Waru*), which facilitate water movement and increase soil fertility while working in symbiosis with climate change and weather fluctuations. By gathering soil to create raised planting beds, the beds can be irrigated by the adjacent canals, making cultivation possible in nitrogen-poor soils while preventing soil erosion during floods. The efficiency of the system contributes to larger yields and food security. The water surrounding the beds also trap solar radiation during the day and protect crops from freezing overnight while facilitating further biodiversity by attracting fish, birds and other animals (Janusek & Kolata 2004). Systems of raised agricultural fields have also been used in countries like Mexico, China and Belize. While more advanced irrigation systems have been developed, the system was reintroduced in collaboration with indigenous communities in Bolivia and Peru at the end of the 20th century, which has enabled cultivation on otherwise harsh and unfavourable lands. This serves as a replicable, scalable and sustainable model of how agricultural systems could be and are being developed today through various forms of raised field agriculture.

Floating gardens in Bangladesh

Unlike raised field agriculture on land, floating gardens are soil-less cultivations where native plants such as water hyacinths are layered about three feet deep and float like rafts in the rivers. Farmers then plant vegetables inside those rafts, and as the native plants decompose, nutrients are released which help feed the crops and vegetables planted in them. As the floating gardens adapt to the movements of the water, they are particularly interesting where climate change causes increased weather extremes, floods and droughts, with fluctuations in the highs and lows of the rivers. In Bangladesh, floating gardens (locally known as *dhap* or *baira*) have been around for hundreds of years and permit the continued growing of foods such as okra, gourds, spinach and eggplant during periods of increased and erratic rainfall, when the rivers fill with water. This secures a variety of nutrient- and protein-rich foods in areas that cannot otherwise be cultivated. Around a quarter of Bangladesh is flooded for several months a year, with rising salinity in the soil and water disrupting agricultural practices.

Despite volatilities in yield due to climate impacts, floating gardens provide stability in terms of food production and income, sometimes earning families several times more than traditional rice cultivation (Pyka et al. 2020). Farmers can earn an average profit of USD140 per 100 square meters during the monsoon season (FAO 2017). The Food and Agriculture Organization declared Bangladesh's floating gardens a globally important agricultural heritage system in 2015, and the practice has been applied locally in countries like Myanmar, Cambodia and India (Pyka et al. 2020). Indigenous floating gardens are now seeing a revival by farmers and have been identified as an effective climate adaptation technology, which can reduce food insecurity and provide incomes for rural households in flood-prone areas. In 2013, the government of Bangladesh allocated USD 1.6 million to promote floating farms for climate change adaptation in close to fifty locations across the country. Floating beds could provide a means for coastal populations, including women, to deal with sea-level rises by minimizing financial risks and avoiding salt-water intrusion (Islam & Atkins 2007). Challenges include the need to purchase hybrid seeds on a yearly basis, pests, and the lack of low-interest loans for the initial investment costs of building the beds, which could be mitigated with governmental or non-governmental support for such loans and training. Such challenges can also be addressed through Technology Action Plans (TAPs) and turned into project ideas to leverage funding for implementation.

Drought-resistant farming and zai pits

Climate change is exacerbating desertification in countries like Burkina Faso, Mali and Niger, where a large proportion of energy needs are fueled by firewood. Degraded soils are becoming increasingly difficult to restore, which is why farmers are beginning to revive indigenous farming techniques to combat severe drought by planting in so-called *zai* pits, that is, small planting pits. The pits are dug into the soil and filled with organic matter like crop waste or manure, encouraging termite activity in the soil. The pits typically measure 20-30 cm in width, are 10-20 cm deep and are spaced 60-80 cm apart. Moisture and rain can be captured and stored in this organic matter, thus preventing evaporation. By placing stones around the plantings, water runoff can be slowed down.

Indigenous peoples' practices, such as *zai* pits, are now widely accepted as a means of reducing soil erosion and increasing crop yields, and they have been promoted regionally by international organisations as an important climate adaptation tool. Although the technique could easily be replicated by farmers in other regions and countries, there is a lack of stakeholder initiative to promote it to the rest of West Africa, requiring financial support and training to restore the systems successfully on a larger scale. If well executed, the technique can increase production by about 500% (Nuraddeen & Muhammed 2015).

Disaster risk management

Indigenous peoples' experience and knowledge in weather forecasting provide timely warnings and are an effective strategy for early warning and disaster risk management to help mitigate negative climate impacts. By observing nature, conclusions can be drawn about climatic cycles and seasonal events. The Sendai Framework for Disaster Risk Reduction (2015-2030) promotes the complementary nature and contribution of indigenous peoples' knowledge and practices to modern scientific knowledge in disaster risk assessment.

Climate adaptation and coastal protection in the Solomon Islands

Small island states, particularly in the South Pacific, are threatened by rising sea levels as a result of climate change. The coastal zones of countries like the Solomon Islands are also at risk of cyclones, storms, erosion, flooding and tsunamis, which risk disrupting local ecosystems, coral reefs and biodiversity. Indigenous peoples like the Babankira have been applying their knowledge and adapting to such hazards for many years, playing an important role in ensuring the resilience of coastal communities. Here, such communities prepare for disasters through various means, including planting native species along the shore to withstand sea-level rises and preparing households for cyclones and floods by cutting trees around the houses and using reeds and branches to reinforce their homes. Crop diversification and the use of wild plants as substitutes for vegetables in times of scarcity also enable indigenous communities in the Solomon Islands to manage resources and remain resilient to disasters and food shortages. The same concept of preservation to prepare for disasters also applies to marine resources, as fishing locations are occasionally closed to allow species to recover. Crops are chosen that survive seasons with low rainfall and ensure food security (IFAD 2016). Organisations such as IFAD have recently supported the revival, application and sharing of such traditional knowledge and practices to mitigate the effects of natural disasters and document them from oral to written form.

Weather forecasting systems in sub-Saharan Africa

By observing tree phenology, animal behaviour, weather and other natural phenomena, indigenous communities around the world have been known to forecast and predict weather to prepare themselves for disasters and plan their agriculture seasonally. In Zimbabwe, for example, the indigenous peoples in Muzarabani study the life-cycle of

trees and animals to predict early onset of the rainy season, wind, floods, and seasonal changes such as drought. More specifically, they believe that the rainy season can be expected earlier if the *munanga* tree (*Acacia nigrescens*) blossoms in early September, and that by observing the abundance of termite colonies collecting biomass in their mounds, migratory birds and large numbers of Christmas beetles, rainfall and the potential for the flooding of low-lying areas could be predicted (Makate 2019). In certain communities in Zimbabwe, elders inform wider communities of their rainfall predictions, and each household prepares a dugout canoe in case of heavy flooding. In Eswatini, floods can be predicted by observing the cries of certain bird species or the height of their nests, while famine can be predicted from the yields of certain wild fruit plants. Natural hazards have also been predicted by assessing wind direction, the shape of the crescent moon and the behaviour of animals such as bees and snakes (Mafongoya & Ajayi 2017).

In areas where official weather and seasonal forecasts are scarce, such knowledge offers higher resolution local information and is highly valuable in strengthening communities' climate adaptation capacity. The knowledge of indigenous peoples, their understanding of nature and their observations of ecosystems could very well be used to complement conventional scientific forecasting and early warning systems. However, it should be noted that the increased occurrence of extreme climatic events is making indigenous peoples' knowledge less reliable, leading to increased reliance on external systems instead.

Innovation and intellectual property rights

We will need many types of knowledge to tackle the challenges of climate change. Indigenous peoples' technologies are at the root of technological innovation. By putting together our different knowledge systems – science, technologies, traditional knowledge – we can deliver more effective solutions to mitigate and adapt to climate change. However, this also requires preserving indigenous peoples' knowledge and their right to their knowledge and innovation. The threat of loss of such knowledge is increasingly being recognized, due to factors such as urbanization, the loss of land and traditional livelihoods, youth migration and the passing of elders. Several strategies for ensuring the continued generation, transmission and protection of indigenous peoples' knowledge and technologies have been employed by countries and organisations, including culturally significant education programs, the promotion of indigenous languages and using digital technologies such as drones, geographic information systems and smartphones, to allow indigenous peoples to monitor their territories and keep track of their resources.

Indigenous peoples' knowledge and technologies can also be preserved by harnessing them and adapting them alongside modern technologies. For example, indigenous reindeer herders in the Arctic are facing major challenges related to a changing climate, and the pastures essential for the survival of their reindeer are under threat

from changing weather patterns, the effects of mining, oil spills and the expansion of infrastructure. Indigenous communities are now addressing these issues by adapting their resilient strategies, built on knowledge and the practice of seasonal migrations, with information systems and modern science provided by NASA (Marrie 2019).

The rights of indigenous peoples to protect and enjoy their traditional knowledge is acknowledged in various international, regional and national declarations, conventions and laws, including the Universal Declaration of Human Rights. However, protection for indigenous peoples' traditional knowledge is not comprehensive. Organisations such as the World Intellectual Property Organization (WIPO) have been engaged in addressing this issue and avoiding the misuse and misappropriation of such knowledge by developing an agreement on an international legal instrument relating to intellectual property in order to protect traditional knowledge and traditional cultural expressions (Marrie 2019). Despite indigenous peoples' rights over their traditional knowledge being recognized in the UNDRIP, for the most part they are unprotected under existing intellectual property laws due to their unique communal and transgenerational characteristics, and there are no legal instruments available to protect collective knowledge and technology. Thus, when engaging with indigenous peoples and considering their knowledge and technologies in Technology Needs Assessments, there should be mechanisms in place to avoid treating their cultural heritage as "public domain" and misappropriating their intellectual property (IWGIA 2019). Done appropriately, the combination of indigenous and conventional knowledge systems can provide innovative techniques to address climate mitigation and adaptation. An illustrative example is provided below.

Participatory 3D mapping in the Mbororo community, Chad

In Chad, climate change has exacerbated conflicts over land and natural resources. Meteorological scientists and the indigenous Mbororo communities have worked together to map natural resources and ecosystems through 3D participatory mapping in order to facilitate climate adaptation planning by creating pathways and calendars for seasonal grazing patterns to fertilize farmlands. The 3D participatory mappings first require joint agreement between scientists and communities regarding the objectives of the mappings, such as natural resource management or understanding the issue of land limitation. The mapping process involves a long process of consultation and consensus-building by and with the communities.

Through joint workshops, inventories are drawn up in which key elements of the chosen space and ecosystems are identified. These can include rivers, lakes, mountains, trees, grass and even birds and other fauna. The workshops are conducted in the mother tongue, as some phenomena might not have names in other languages. Importantly, representatives of the entire community are included: men, women, elders and the young, as well as those who have livelihoods in the area such as farmers, pastoralists and fishermen. After the inventory has been drawn up, geographical information is connected to each element, and maps are created by agreement within the community on matters such as location and colour. This process can take two to three weeks, depending on the size of the space being mapped.

Such mappings can improve communities' understanding of their land and help prevent resource-based conflicts as climate change affects their access to useful resources. Secondly, it can help communities to monitor the preservation and conservation of the most vulnerable ecosystems so they can identify how spaces change over time. This can then lead to appropriate adaptation plans and activities for restoring the space.

The importance of the mappings being intergenerational and participatory cannot be stressed enough. For example, the elders may have memories of the transformation of natural environments over time which can support understanding and predict which future actions are needed. Building such resource maps can also support governments in decision-making and help them understand local community needs during planning processes, such as the Nationally Determined Contributions and National Adaptation Plans. By understanding the land, communities are empowered to participate in joint decision-making to protect the natural balance of the ecosystems and plan which areas are to be used for water, protection, community forests etc. This also helps partners who may wish to invest in the land so they have direction in terms of understanding which areas are dedicated to agriculture, which areas are protected land, and which can be used by pastoralists (AFPAT 2021).



Ripple Effect

PART 3

Implications for Technology Needs Assessments



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Strengthening the role of indigenous peoples' knowledge in climate policy and planning can improve climate adaptation, and to some extent also mitigation (IPCC 2019). The international community has agreed on ambitious frameworks for tackling climate change that recognize the rights of indigenous peoples and demonstrate the importance of taking indigenous voices and capacities into account, including in countries' TNAs. However, limited information is available in existing TNAs with regard to such considerations in identifying and prioritizing the technologies, barriers, enabling frameworks and actions needed to integrate, strengthen and scale technologies. Rather than introducing specific requirements in the TNA process to indicate the elements of indigenous peoples' capacities and technologies, such considerations could be applied on a needs basis and encouraged through awareness-raising and capacity-building. The discussion over the added value of endogenous elements of technologies and capacities in the TNAs has also been highlighted by the UNFCCC Technology Executive Committee (UNFCCC 2017). Although the term *endogenous* is distinct from *indigenous*, the two terms are related. In this context, *endogenous* should be considered inclusive of *indigenous* elements (see key concepts and definitions on p.14). While this section is not meant as a step-by-step guide, an overview is provided of a number of considerations that should be taken into account on the topic of indigenous peoples' technologies and voices in the TNA process.

Entering into dialogue

When engaging with indigenous peoples and their communities throughout the TNA process, it is important to view the engagement as a dialogue rather than a conventional stakeholder consultation, and to understand and respect the cultural protocols that should be used, in accordance with the principles of free, prior and informed consent. For example, factors such as the provision of timely, clear and comprehensive information, use of local languages, allowing time for consideration and exercising patience must be considered. The communities themselves have the role of determining who the appropriate groups are to enter into dialogue with outside consultants, and who has the authority to speak as *their* representatives. Dialogues are often a central part of indigenous and traditional cultures and identity. For example, *talanoa* is a traditional word used in Fiji and across the Pacific for a process of inclusive, participatory and transparent dialogue. The purpose is to make collective decisions based on empathy and trust, so accordingly it involves a process of sharing ideas, skills and experiences through storytelling. At COP23, the Fijian presidency introduced the Talanoa Dialogue in order to support countries in developing and implementing their Nationally Determined Contributions.

In engaging with indigenous peoples throughout the TNA process and facilitate communication using a participatory and inclusive approach, it is helpful to identify the collective representative organizations of indigenous peoples, such as customary governance systems, structures and institutions, federations of indigenous peoples' organizations and local organisations focused on indigenous peoples and their community identity and participation. While collaboration with official government entities can be

entered into to ensure the dialogues are officially recognized, the dialogues themselves are best facilitated by territorial or national indigenous representative structures or the indigenous communities themselves, instead of relying on external groups. Prior to the dialogue, the relevant literature, reports and policy documents should be reviewed in order to understand the history and nature of self-identification of the indigenous communities in the country, as well as their rights in a national and international context.

Some climate initiatives, particularly for mitigation, may have negative direct and indirect effects on indigenous communities. While reducing greenhouse gas emissions, they could, for example, lead to an increase in monocrops with an associated decline in biodiversity and food security for peoples who depend on such resources and environments. The Fifth Assessment Report (AR5) of the IPCC also pointed out how poorly designed mitigation and adaptation strategies can increase the risk of violent conflict (IPCC 2014). Seeking insights and engaging with a broad range of stakeholders during the TNA process, particularly during the TAPs, would improve the chances of successfully implementing climate technology solutions. It would also support risk management planning in order to take into consideration the distinct vulnerabilities of indigenous peoples.

In summary, the full and effective participation of indigenous peoples in informed decision-making is the key to harnessing synergies between the traditional knowledge of indigenous peoples and modern science in the interests of more effective climate action.

Identifying and prioritizing technologies

The prioritization of technologies within the selected priority sectors is the first step in the TNA process. When preparing the technology factsheets and other information for input into the Multi-Criteria Analysis (MCA – see *TNA Step by Step* for details),⁸ the TNA team should include two important considerations:

1. Broaden the sources of information to include knowledge provided through consultations with indigenous peoples and their communities or other types of documented information about indigenous peoples' knowledge and technologies in various sectors.
2. Assess the risk and impacts of the identified technologies on the culture, livelihoods or natural assets of indigenous peoples and, where relevant, ensure their engagement in the process of identifying, scoring and weighting essential criteria in the TNA process in accordance with the principles of free, prior and informed consent.

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<https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2019/04/2019-02-tna-step-by-step-guide.pdf>

During the TNA process in Liberia, the country team focused on identifying coastal adaptation technologies, among other issues. While not necessarily an example of engagement with indigenous peoples, the team followed the same principle of broadening the scope of knowledge input and their understanding of what constitutes a technology by engaging extensively with local communities. Communities along the coast were approached to identify perceptions of and traditional approaches to the protection of coastal erosion. The team discovered that the planting of coconut and almond trees along some beaches in the southeast, rural part of the country had been practised for many decades primarily to provide food and income. Over time the trees had proved effective against coastal erosion, strong ocean winds (which destroys roofs), storm surges and other climate change impacts in coastal areas. The dense root systems, which spread for meters and penetrate deeply into the ground are effective in holding the sand and reducing the rate of dune degradation and beach erosion caused by waves and wind. However, this green solution does not offer immediate results, as it may take years for the trees to grow. In the process of prioritization, it was the integrated approaches as well as the hard technologies against coastal erosion, such as revetments, groynes and seawalls, that were identified and prioritized more highly for future support. Yet, certain hard anti-erosion infrastructure may inadvertently inhibit local communities' easy and quick access to the shore and their fishing boats. Therefore, the team recommends the widespread planting of coconut trees as a green adaptation measure both nationally and regionally. The inclusion of such traditional and nature-based climate technology options should not be disregarded, and their prioritization should be considered in the light of their economic competitiveness, environmental co-benefits, and social and nutritional benefits.

Challenges to adapting and scaling up technologies

One of the main activities in drawing up Technology Needs Assessments is identifying the challenges and barriers to having the chosen technologies transferred, diffused and taken up in a successful, replicable manner. Many countries share similar challenges, the most frequently noted barriers being economic and financial, often linked to implementation, operating and maintenance costs, and affecting 90% of all technologies (UNFCCC 2021b). However, these barriers are not the only challenges for a prioritized technology in the TNAs. Other barriers for climate mitigation and adaptation technologies include legal and regulatory issues, technical problems, lack of information and awareness, inadequate human skills and institutional and organisational problems (UDP 2018).

In developing its definition of the term *technology transfer*, the IPCC took the view that the term also covered the process of learning to understand, utilize and replicate the technology, including the capacity to choose and adapt to local conditions and integrate this with indigenous peoples' technologies (IPCC 2000). As indigenous peoples have been adapting to various changes in climate for thousands of years, integrating and scaling such technologies could offer pathways to shrinking ecological and

carbon footprints. However, indigenous peoples today are facing barriers to integrating, strengthening and scaling their traditional climate adaptation strategies in the face of intensifying climatic change. Various legal and institutional barriers are preventing them from coping with climate change, the main such barrier being the lack of recognition and promotion of their human rights as enshrined in UNDRIP and ILO C169. Indigenous peoples' rights and voices have not been sufficiently considered in climate discussions at various levels, and while their potential contribution to combating the adverse effects of climate change is substantial, there is a lack of formal participation of indigenous peoples in decision-making processes, and consequently in the design and implementation of climate actions, as a result of their knowledge not being properly recognized. The opportunity to influence and contribute to economies and governance is necessary if indigenous peoples are to strengthen their livelihoods and culture in the face of climate change. As the UNFCCC's processes recognize the importance of country ownership and climate action, extending such ownership beyond government priorities means including the ownership and participation of citizens, including indigenous peoples. This resonates well with aligning climate action, including technology transfer, with the Paris Agreement preamble with regard to respecting human rights and the rights of indigenous peoples.

Other barriers include indigenous peoples' lack of knowledge about climate-change policies and interventions and their lack of access to financial resources (IWGIA 2008). Often climate finance for indigenous peoples is channelled through intermediaries, depriving indigenous peoples' organisations of direct access to such funds (LCIPP 2020). Procedures to access existing funding opportunities are rigorous and often involve multiple stages and stakeholders. It can be challenging for indigenous peoples to navigate such a complex funding landscape. As of yet, none of the Accredited Entities of the Green Climate Fund (GCF) have been indigenous peoples' organisations, despite the centrality of the Fund. The Fund's Indigenous Peoples Policy of 2018 has now recognized that the nationally designated authorities and accredited entities may seek support for the development priorities of indigenous peoples and the facilitation of partnerships through government programs. However, the challenge in bridging the gap and providing indigenous peoples with direct access to such country-driven governance mechanisms and funding structures remains. It may be more easily overcome by increasing the visibility of indigenous peoples in such forums and facilitating their participation in decision-making.

Considering gender and intersectionality

The successful identification and adoption of technologies to meet countries' climate mitigation and adaptation needs depend on an understanding of many cross-cutting factors, including the role of gender. Women and men may differ in their skills sets, needs, productive and social roles, and access to resources, finance and technologies. For the same reasons, technologies themselves may have different impacts on women

and men. Women, particularly indigenous women, often have important knowledge about the sustainable management of natural resources, land and food systems, and play a key role in educating households and communities in such practices, thereby contributing to the greater responsiveness of communities to climate change adaptation and mitigation solutions (IWGIA 2020). Often, discriminatory practices may prevail, thus marginalising women in inheriting productive assets or equally participating in decision-making and planning processes and preventing them from fully responding to climate change. Notably, women are not a universal group, and indigenous women may face multiple barriers, leading to vulnerabilities that are unique to their situations or regions. In addition to gender, factors like race, sexual orientation and socioeconomic class also play a role in understanding such barriers and marginalisation.

If women's critical skills and leadership are not considered fully, this could have a significant impact on the efficiency of a country's response to climate change, while increasing existing inequalities. The same principle applies to other often marginalised groups, including persons with disabilities and persons who identify as LGBTQ+. Adopting an inclusive approach in the TNA process also means engaging with elders and young people, respecting indigenous peoples' intergenerational solidarity, and benefitting from each generation's unique knowledge, values and culture. When drawing up TNAs, it is important to pay attention to intersectionality and gender considerations, as described in the *Guidance for a Gender-Responsive Technology Needs Assessment*.⁹ The guide supports TNA teams in taking gender issues into account when deciding technological priorities and conducting barrier analyses, as well as integrating gender considerations into Technology Action Plans (TAPs) and project ideas.

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<https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2019/07/web-tna-gender-guidebook-01.pdf>

Conclusion



Indigenous peoples' knowledge, including that of indigenous women, offers technologies for increasing adaptation capability, the protection of natural resources, disaster prevention and other challenges related to climate change. While most technologies are centred around climate change adaptation, indigenous peoples also have distinctive knowledge about important mitigation technologies and practices, such as carbon sequestration through forest management.

Although they contribute very little to greenhouse gas emissions, indigenous peoples are among those who are most affected by the impacts of climate change. Environmental degradation, the erosion of natural resources and biodiversity loss are challenging their otherwise strong ability to cope with and adapt to climatic change. Such changes also threaten their ability to pursue productive and stable livelihoods and remain in their traditional environments. Indigenous peoples' cultural heritage, knowledge systems and livelihoods are adversely impacted by climate change, and often by climate actions and policies themselves. At the same time, indigenous peoples play a crucial role in sustainably managing a major share of the world's lands and ecosystems. Strengthening indigenous peoples' rights, especially to their land tenure, acknowledging their knowledge systems and combining them with appropriate modern technologies can enhance livelihood options, revitalize agriculture, increase food security and improve health.

This report has presented the key concepts and frameworks that recognize the rights of indigenous peoples and demonstrate the importance of taking their rights, voices and capacities into account in climate action and climate processes. Several examples of the ways in which indigenous peoples draw on their traditional knowledge to develop technologies and find solutions to climate change have been presented.

In identifying linkages with the TNA process, incorporating consideration of indigenous peoples and technologies in the TNA process could be explored by asking the following questions:

	Examples of questions to ask
Setting up and preparing for the TNA process	What relevant literature, reports and policy documents should be reviewed in order to understand the history of indigenous peoples in the country, as well as their rights in the national and international contexts?
	Are there self-identified indigenous peoples within the country or region of relevance that need to be consulted as part of the TNA context?
	Is there any expertise on indigenous peoples' rights in the TNA country team? If not, is it possible to engage closely with external experts and international or local organisations with experience of working with indigenous communities and knowledge systems?
	Are the planned TNA processes and proposed activities in full conformity with the rights of indigenous peoples according to established frameworks, including through implementation of the principle of free, prior and informed consent, and do they support these rights?
	How can factors such as gender, age, ethnicity and social status be taken into account while integrating indigenous perspectives into the TNA process?

	Examples of questions to ask
Stakeholder consultation and dialogue	How can the full and effective participation of indigenous peoples in the TNA process be ensured, with the timely and accessible sharing of information, particularly in cases where the identified technologies and projects may potentially affect indigenous peoples?
	How can you engage in constructive dialogue with local organizations, especially with indigenous peoples' organizations or organizations respected by indigenous peoples?
	What measures and actions need to be put in place to ensure the full and equal participation of both indigenous women and men in dialogue? Is it necessary to make any specific arrangements, such as adapting the timing of dialogues and consultations to men's and women's respective work schedules, while respecting the communities right to facilitate the dialogue and process?

	Examples of questions to ask
Identification and prioritization of technologies	When preparing the technology factsheets, what sources of information could be consulted to help identify indigenous peoples' knowledge and technologies in various sectors?
	What mechanisms have been put in place to assess the risks and impacts in order to avoid technological activities that may inadvertently harm indigenous peoples or disadvantage women, for example, forced displacement?
	Who, in terms of ethnicity, community, gender, age or social status, would benefit from the technologies identified, and how are those benefits to be distributed in society?

	Examples of questions to ask
Barrier analysis and enabling frameworks	What are the economic, institutional, legal, technical, social and cultural barriers faced by indigenous communities in using and scaling the identified technologies?
	What rules, regulations and incentives are required to overcome these barriers?
	How adaptable are indigenous peoples' technologies to market conditions?

	Examples of questions to ask
Technology Action Plans	What mechanisms are in place to avoid treating indigenous peoples' technologies and their cultural heritage as a "public domain" and thus misappropriating their intellectual property?
	To what degree does the current methodology for risk management planning in the Technology Action Plans take into consideration the distinct vulnerabilities of indigenous peoples?
	How can the enhancement of indigenous peoples' capacities and technologies be promoted through the Technology Action Plans?

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This guidebook is produced as part of the GEF-Funded Global Technology Needs Assessment (TNA) Project, which is implemented by UNEP and UNEP DTU Partnership. Since 2009, close to one hundred countries have joined the Global TNA Project.

Indigenous peoples' knowledge of climate resilience and their global contribution to a sustainable management of our shared natural resources are critical to combating climate change and its impacts. Yet, their contribution often remains unacknowledged, and too often indigenous peoples have little access to the financial resources or forums for decision-making concerning the environment, which severely undermines opportunities for significant influence in climate policy, planning and action. This guidebook provides information about how to identify and integrate relevant considerations on indigenous peoples and technologies into the TNA process, while ensuring that their free, prior and informed consent is obtained.

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