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POLICY BRIEF

'Plugging' Indigenous knowledge into scientific knowledge in agricultural research and development

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Abstract
This policy brief calls for a transformative shift in how Indigenous knowledge is valued and integrated across research, policy, and practice. It emphasizes the urgent need to recognize Indigenous knowledge as a foundational knowledge system essential in agricultural research and development. Despite its proven effectiveness in areas such as sustainable land management, climate adaptation, and biodiversity conservation, Indigenous knowledge remains marginalized due to systemic exclusion, cultural assimilation, and intellectual property exploitation. Drawing on concrete case studies on soil fertility management in Africa, the brief contrasts modern agricultural practices with inclusive approaches that integrate Indigenous knowledge with scientific knowledge. This brief advocates for the need to integrate indigenous knowledge and practices with scientific knowledge toward an effective knowledge system and development interventions. It also provides practical recommendations for researchers, policymakers, academia, civil society, and Indigenous communities to co-create equitable knowledge systems and institutional frameworks that value, protect, include and promote Indigenous knowledge. The policy brief was written as part of the Knowledge Management for Agricultural Development (KM4AgD) Challenge 2024, an initiative of the Forum for Agricultural Research in Africa (FARA) and collaborating institutions.

Keywords: Indigenous knowledge; agroecology; biodiversity; inclusive policy; participatory research; Indigenous rights; environmental governance; Africa

1. Introduction

> *We envisage an ecosystem where Indigenous voices are amplified. An ecosystem where indigenous knowledge and practices are recognized, included, practised, and promoted (Authors' opinion).*

Evidence shows that indigenous agricultural systems and practices, such as polyculture and agroforestry practices, demonstrated sustainable land management techniques that enhance soil fertility, water retention, and high crop productivity (Awazi, 2025; Sileshi et al., 2020; Wana et al., 2023). Similarly, it has been reported that lands managed by Indigenous people often have higher levels of biodiversity than protected areas managed by the state and conservation agencies (IPBES, 2019).

Rapid socio-economic changes, including urbanization and cultural assimilation, threaten the transmission of Indigenous knowledge to future generations. Other issues such as communication and language barriers, absence of clear intellectual property rights and benefit-sharing agreements, and socio-economic and political marginalization limit the inclusion of indigenous knowledge in development agendas and environmental management strategies. Fortunately, in recent years, more evidence of the benefits of Indigenous knowledge is unfolding, and as a result, more voices are calling for the integration of Indigenous knowledge in policy discussions and global development agendas. For example, the 'Agenda Knowledge for Development' (Brandner &

Cummings, 2025) has advocated for the integration of Indigenous knowledge on the international Agenda with Goal 3: Strengthening local knowledge ecosystems: Collaboration and context-based communication, based on local realities and local knowledge; decolonization of knowledge and also to the sixth generation of knowledge Management for Sustainable Development which has tried to centre Indigenous and local knowledge in knowledge management for development (Boyes et al., 2023).These calls are complex in nature but they are essential for sustainable development and respect for the rights of Indigenous communities. They can lead to a change in the system only if they are accompanied with concerted efforts to address the prevailing systemic issues, eventually needing a paradigm shift towards recognizing the value of indigenous perspectives, fostering equitable collaborations, and developing inclusive policies that honour and protect Indigenous knowledge systems. There is also the need to clearly map out the actions, who is to act and where to act in the creation of these knowledge systems. By doing so, we can harness the full potential of Indigenous knowledge to promote sustainable development and address global challenges (Sekhar et al., 2024). With this policy brief, we advocate for the integration of scientific knowledge and indigenous knowledge with a call for action to different stakeholders.

2 Recognizing and promoting Indigenous knowledge: from pitfalls to good practices

Integrating indigenous knowledge into scientific and decision-making processes is essential to ensure sustainable and inclusive development. This approach must be carried out with care and respect while recognizing indigenous communities, their knowledge and their rights. By examining best and bad practices, one can identify effective strategies and mistakes to avoid in order to successfully integrate Indigenous knowledge in science, policy and practice. Insights of this policy brief were gathered through a participatory and mixed approach combining literature with a knowledge café that took place on 24th May 2024.

The session convened 181 knowledge stakeholders including knowledge managers, researchers, academicians, students, policymakers, extension service providers, farmers and farmer organisations, civil society organisations and non-governmental organisations to address the following questions:

a. What are good/desirable practices in research that appreciate indigenous knowledge and include it in the research structures and processes?
b. What are bad examples/practices in research that disregard or exclude indigenous knowledge?
c. What would be your vision for a research practice/policy that appreciates and reflects indigenous knowledge?
d. Which concrete elements would you include in a research policy on indigenous knowledge?

2.1 Pitfalls

Widdowson and Howard (2008) refer to Indigenous knowledge as “junk science." Scholars who adhere to this thinking consider Indigenous knowledge to be less valid than Western knowledge and need scientific testing before validating it as knowledge (Matsui, 2015). Due to this, indigenous knowledge is often undervalued or overlooked leading to the development and promotion of purely conventional interventions. Unfortunately, this can lead to cultural erosion, loss of identity and knowledge of local communities, and lack of crucial global partnerships (Al-Shorbaji et al., 2024). Further, top-down approaches often prevail in policies and project planning and implementation like in the industrial (“green revolution”) agricultural system, the 2030 global agenda and the Sustainable Development Goals (SDGs) (Al-Shorbaji et al., 2024; Ditto et al., 2025). Failure to integrate indigenous knowledge into the green revolution discourse has been linked to its failure (Ditto et al., 2025). With the SDGs focusing mainly on science and technology with very little attention to the integration of indigenous knowledge, we are also prone to succumbing to negative consequences (Cummings et al., 2018).

The exclusion of indigenous knowledge usually leads to ineffective solutions that do not take into account local contexts and needs. Development interventions imposed in a hierarchical manner lack relevance and acceptability by the communities concerned and often fail to achieve their objectives (Wana et al., 2023). This usually stems from the fact that representatives of indigenous communities are excluded from being members of councils or strategic boards that decide on research objectives and practices. Additionally, indigenous knowledge holders are sometimes considered as recipients and not experts in project design and implementation. Many people consider experts as people in academia or research, while in reality, Indigenous communities are also experts as they hold a wealth of knowledge of their systems, developed and sustained over

generations. This exclusion hinders sustainable development and leads to the loss of valuable knowledge. The marginalization of Indigenous knowledge deprives societies of the potential benefits of this knowledge and reinforces systemic inequalities. Further, as there are ongoing conversations on the integration of indigenous knowledge in science, policy and practice, there still seems to be a failure to protect the intellectual property rights of indigenous communities. This practice results in undue appropriation and commercialization of indigenous communities' knowledge without fair compensation or recognition. It is not only unfair but also undermines trust between indigenous communities and outside entities, jeopardizing any future cooperation. Lastly, as indigenous knowledge is mostly transferred orally, there is a lack of proper and effective communication mechanisms. For example, interpretation and translation can lead to misunderstandings and misinterpretations partly because some words don't have a correct equivalent in other languages. Differences in modes of knowledge transfer can create barriers to effective integration, requiring concerted efforts to develop appropriate communication channels.

2.2 Good practices

The first entry point into bridging the gap between research, policy, and practice through the integration of indigenous knowledge is to ensure active participation of indigenous communities in research projects and decision-making processes. This participation promotes trust and mutual respect and allows the co-creation of knowledge, policy, and practices adapted to the local context. A principle referred to as the "plug-in" principle involves integrating Indigenous knowledge with scientific knowledge. The plug-in principle is rooted in the lessons learned from the low success rate of interventions that did not integrate existing knowledge in interventions formulation and attempted to replace them (Dittoh, 2025; Wana et al., 2023). The plug-in principle recognizes the value of existing knowledge while leveraging technology advancement and ensures the co-creation of solutions that are more robust and adaptable to the world's most pressing challenges.

Effective integration of Indigenous knowledge into wider knowledge systems requires approaches that uphold both scientific rigor and cultural integrity. One such approach is careful documentation and validation using scientific methods. This ensures that the knowledge held by Indigenous communities is recognized and given the same credibility as scientific knowledge. Rigorous documentation not only safeguards this knowledge for future generations, but also strengthens its acceptance and use in broader development and research contexts. Equally important is the communication of research results to indigenous communities in accessible and culturally appropriate formats. The use of plays, videos, radio, and local languages ensures the visibility and recognition of indigenous communities and fosters the acknowledgement of their contributions. This form of knowledge sharing ensures that indigenous people are not merely subjects of research but acknowledged participants in the co-creation of knowledge. Inclusive policy making emerges as another critical good practice. Integrating indigenous knowledge into policy processes shows a commitment to recognizing and valuing the knowledge of indigenous communities. Countries and organizations that include this knowledge in their policies often achieve higher rates of sustainable development and environmental conservation. This demonstrates that the recognition and inclusion of indigenous knowledge can bring significant ecological and social benefits. Furthermore, capacity strengthening and education play a central role in bridging the knowledge gap between indigenous and non-indigenous populations.

Training programs and educational initiatives should emphasize the value of Indigenous knowledge and promote its integration into various fields. Educating both Indigenous and non-Indigenous populations on the importance of this knowledge promotes mutual understanding and appreciation of Indigenous knowledge. Finally, establishing ethical guidelines and legal frameworks to protect indigenous communities is essential. Such measures ensure that indigenous communities benefit from their knowledge, while being fairly compensated, recognized and protected against exploitation. Ethical frameworks ensure that indigenous knowledge sharing and practices respect the rights of communities and contribute to their well-being.

2.3 Case studies on the integration of Indigenous knowledge into conventional agricultural practice

In most farming communities, indigenous farmers have accumulated over centuries a wealth of knowledge regarding local soil types, climate patterns, and agricultural practices with the potential to curb some of the world's most pressing challenges such as land degradation, biodiversity loss, and climate change (Adefila et al., 2024). It is also evident that conventional agricultural practices are increasingly being

introduced to solve the same challenges. However, each approach has its own limitations and when they are adopted alone, they fall short to deliver their promises. Hence, integrating the two approaches can be synergistic as indigenous practices are often deeply rooted in cultural values and local ecological contexts while conventional approaches focus on technological advancement. This integration can inform the development of context-specific agricultural interventions that are more likely to be adopted and sustained by farmers (Bisht et al., 2020; Kumar et al., 2025). The integration of indigenous knowledge into modern practices such as Integrated Soil Fertility Management (ISFM) has shown immense potential for enhancing the sustainability, resilience, and adoption of soil fertility management strategies in various African contexts. Below are practical examples where the integration of Indigenous knowledge and conventional practices has demonstrated success:

Based on the principle of "plug-in," everything has to start from exciting practices which are built upon with the new ideas, techniques and practices to improve the status quo (Dittoh et al., 2025). Following this principle, a soil improvement project in Malawi integrated indigenous practices of organic fertilizer management into a new cereal-legume cropping system (Ellis-Jones et al., 2015). Farmers in this community traditionally used composted household waste and crop residues for soil fertility, applied based on local indicators such as soil colour and texture. Leveraging the knowledge of already existing practices, researchers introduced soybean–maize rotations and inoculation of legumes with Rhizobium, combined with micro-dosing of mineral fertilizers as an Integrated Soil Fertility Management approach. This integration resulted in higher yield and improved soil health, leading to sustained agricultural productivity compared to when each practice was done alone (Sekhar et al., 2024). Additionally, this knowledge integration reduced the dependency on expensive synthetic nitrogen fertilizers as legumes improve soil fertility through symbiotic nitrogen fixation. Furthermore, farmers widely adopted the introduced practice due to its alignment with their traditional organic matter use. This knowledge integration enhanced trust in research due to co-development and validation with farmers.

Similarly, in the early 1960s, farmers in Burkina Faso developed the “zai” pit system, an indigenous technology to manage the fertility of poor soils, particularly in drought conditions (Danso-Abbeam et al., 2019). The zai pit system, popularly known as zai technology, has emerged as a promising practice for sustainable land management in arid and sub-arid West African countries. Zai technology is a land rehabilitation technique that improves the viability of crops by providing a hole, which serves as a small reservoir for water and organic matter (Sawadogo, 2011). This allows crops to establish vigorously and avoid the consequences of early mini-droughts. A traditional technique, zai can be combined with conventional technology such as ISFM consisting of a combined application of mineral and organic fertilizers, improved resilient crop varieties (Vanlauwe et al., 2015). The combination of zai pit and ISFM has been reported to have higher positive impacts on agricultural production and soil fertility compared to when each is applied alone (Kebenei et al., 2021).

3 Bridging the gap

Indigenous knowledge has proven to be an asset for sustainable development. Integrating indigenous knowledge into mainstream frameworks and policies enhances policy effectiveness, preserves invaluable cultural heritage and empowers local communities, ensuring their active participation and recognition in addressing global challenges. Modern practices and services must complement and not substitute indigenous practices. For this to happen, it is imperative to create inclusive platforms and communication formats for knowledge sharing, exchange, and co-creation that prioritise the incorporation of Indigenous knowledge.

Below are some recommendations that various stakeholder categories must consider to ensure Indigenous knowledge is documented, recognized, included and preserved. Translating these recommendations into action will first require a rigorous global awareness on the importance and value of Indigenous knowledge. Stakeholders must be deliberate in providing and welcoming opportunities that promote recognition and use of Indigenous knowledge.

3.1 Academic institutions and researchers

Academic and research institutions should make deliberate efforts to move from the “one knowledge” system approach towards the “plug-in” system of scientific and indigenous knowledge. To achieve this, they need to be cognizant of the appropriate and respectful ways of interacting with Indigenous communities and methods for capturing their knowledge. Further, Indigenous communities must be

involved as equal partners in research, with representatives included in decision-making processes and institutional bodies that influence research objectives, methodologies, and funding allocation. Research projects should have explicitly formulated approaches to include Indigenous knowledge, ensuring it is treated as complementary to, and not subordinate to, scientific knowledge. This integration must be carried out respectfully and in a participatory manner, with the consent and involvement of Indigenous communities, leading to co-creation of knowledge. The process should also include fair benefit-sharing and proper recognition of all stakeholders involved. In scaling interventions, collaboration between research and media is essential to ensure that Indigenous knowledge is effectively disseminated to target audiences, particularly rural farmers.

Although not common, a strong tendency to dismiss Indigenous knowledge as non-scientific, primitive and under-developed still prevails in academic research, teaching and learning (Ditto et al, 2025). To avoid this negative bias toward Indigenous knowledge, academic institutions should form partnerships with groups and organizations working on Indigenous knowledge and leverage these collaborations to develop curricula for higher education courses to foster a better understanding of local cultural, social and environmental contexts. This would not only enhance the value of this knowledge from a perspective of respect and sustainability, but also encourage a more holistic approach to development, integrating traditional practices with modern scientific knowledge. Such an approach would also help to strengthen the links between indigenous communities and educational institutions, while preparing students to become development players who are sensitive to cultural diversity and social justice issues.

3.2 Policymakers

Policymakers should develop policies at local, national, and international levels that recognize and protect Indigenous knowledge and include Indigenous communities in decision-making processes. Local communities should be included in policy and decision-making, with mechanisms established to anchor them within relevant institutions. The establishment and operationalisation of national knowledge partnerships and communities of practice should be facilitated. Legal frameworks must be formulated to protect the intellectual property and data sovereignty of Indigenous communities. Knowledge institutions should be established that place Indigenous knowledge at the centre, prioritising local cultural values, contexts, languages, and methods over a default scientific approach. Funding for these institutions should be allocated at levels comparable to established scientific universities.

3.3 Extension service providers

Extension service providers should use a pluralistic approach when working with Indigenous knowledge and civil society. They should also de-emphasize referring to Indigenous knowledge as 'local knowledge,' as this term can downplay its importance or suggest it is inferior to 'improved knowledge.' Through the adoption of a pluralistic approach, extension service providers create a space for diverse knowledge systems to exist and promote co-creation with the aim of informing more practicable agricultural and development practices. This fosters mutual learning and improves the relevance and uptake of research.

3.4 Indigenous knowledge holders, including elders and youth

Indigenous knowledge holders should receive sensitization, training, protection, support, and recognition. They should be engaged in research as leading actors rather than only participants and be acquainted with research approaches that are most suitable, such as applied research. Indigenous people should also seek appointments for leading positions and operational roles in existing research organisations to represent their communities and contribute with an Indigenous perspective. When Indigenous knowledge holders actively lead research and policy engagements, their knowledge is positioned as equal and essential to scientific inquiry. This enhances the legitimacy of indigenous knowledge, ensures its protection, and enables the creation of inclusive systems where community realities inform both policy and practice.

3.5 Civil society organizations (CSOs) and non-governmental organizations (NGOs)

CSOs and NGOs should create national, regional, and global partnerships through the formation of alliances and consortia that promote Indigenous knowledge through knowledge and experience sharing. They should also form communities of practice that focus on Indigenous knowledge. Additionally, they should develop toolkits and user guides on best practices and success stories of Indigenous knowledge that can be used as reference documents. Civil society

organisations have become very influential in policy influencing and advocacy initiatives. Through networking and resource sharing, these organisations can amplify indigenous knowledge by embedding it into some of their program initiatives.

3.6 Funding bodies and private sector

Funding organizations should create funding mechanisms that accommodate Indigenous knowledge and establish mechanisms that outline ethical approaches to working with Indigenous knowledge holders. They should include intentional reporting on how Indigenous knowledge contributed to project deliverables and leverage local resources in their funding strategies. Similarly, the private sector should stimulate funds for partnerships and raise awareness on Indigenous knowledge within its networks and operations.

4 Conclusions

Indigenous farmers learn and form different knowledge based on their long farming experiences. They hold knowledge of what has happened and what worked in the past, which can provide experiences to draw upon and an immense source of inspiration in designing modern approaches. This brief strongly argues and recommends that indigenous farming communities should not be treated as recipients and passive followers in the development of agricultural knowledge but rather as equal partners and decision-makers in the formulation of agricultural development agendas and innovations. This brief advocates for knowledge partnerships through the integration of both indigenous and conventional knowledge to curb the limitations of each of the approaches in order to develop impact-driven solutions to world challenges.

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