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The International Journal of Justice and Sustainability

ISSN: 1354-9839 (Print) 1469-6711 (Online) Journal homepage: www.tandfonline.com/journals/cloe20

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To cite this article: Glynnis Vergotine, Almas Mazigo, Palesa Molebatsi, Presha Ramsarup, Jovitha Mayega & Tristan McCowan (10 Nov 2025): Co-creating climate knowledge: informal networks, local innovation, and ecosystem restoration in coastal Tanzania, Local Environment, DOI: 10.1080/13549839.2025.2579585

To link to this article: https://doi.org/10.1080/13549839.2025.2579585

Published online: 10 Nov 2025.

LOCAL ENVIRONMENT
https://doi.org/10.1080/13549839.2025.2579585

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Co-creating climate knowledge: informal networks, local innovation, and ecosystem restoration in coastal Tanzania

Glynnis Vergotine[a], Almas Mazigo[b], Palesa Molebatsi[a], Presha Ramsarup[a], Jovitha Mayega[b] and Tristan McCowan[c]

[a]Centre for Researching Education and Labour, University of the Witwatersrand, Johannesburg, South Africa; [b]Department of History, Political Science and Development Studies, University of Dar es Salaam University College of Education (DUCE), Dar es Salaam, Tanzania; [c]International Education, Institute of Education, University College London, London, United Kingdom

ABSTRACT

This study investigates the role of informal knowledge networks in climate adaptation and ecosystem restoration in coastal Tanzania. Focusing on coral reef and mangrove restoration efforts in Somanga village, the research applies the Shaxson et al. knowledge co-creation framework to analyse how local actors serve as intermediaries, translators, brokers, and innovators. Data collected through photovoice and interviews reveal that knowledge is not merely transferred but is re-contextualised through embodied practice, metaphor and social learning. These processes facilitate the synthesis of scientific and indigenous knowledge, generating hybrid practices tailored to local ecological and cultural contexts. Informal networks, sustained through trust, shared memory and collective action, emerge as key infrastructures for technical innovation and social transformation. Findings highlight increased inclusion of women and youth, shifts in local leadership dynamics, and the development of community-driven pedagogies. Rather than acting as recipients of externally defined solutions, communities mobilise knowledge through participatory processes that embed adaptation within local realities. This research contributes to broader debates on epistemic justice, place-based resilience, and polycentric governance, emphasising the centrality of informal knowledge systems for navigating socio-ecological change.

ARTICLE HISTORY
Received 9 July 2025
Accepted 8 October 2025

KEYWORDS
Knowledge co-production; informal knowledge systems; community-led adaptation; participatory action research; ecosystem restoration

1. Introduction

Recent scholarship has called for more inclusive and participatory approaches to knowledge production in sustainability science (Mauser et al. 2013; Norström et al. 2020). In particular, there has been a growing emphasis on *knowledge co-creation* – a process that brings together diverse epistemologies (scientific, local, indigenous, experiential)

CONTACT Glynnis Vergotine glynnis.vergotine@wits.ac.za 27 St Andrews Road, Parktown, Johannesburg, 2193, South Africa

to produce contextually relevant and actionable knowledge (Armitage et al. 2011; Pohl et al. 2010). These collaborative processes are increasingly seen as central to addressing "wicked" sustainability problems that cannot be solved by scientific expertise alone (Kreiling and Paunov 2021; McCowan 2025). However, most existing co-creation frameworks remain biased toward formal institutional arrangements, such as government-led platforms, academic–policy dialogues, and structured participatory research, thus overlooking the vital but often invisible role of informal community-based knowledge networks (Nie, Schultz, and Feldman 2010; Schwartz and Hornych 2011). This article contributes to global debates on decolonising knowledge production and epistemic justice by foregrounding the role of informal and indigenous knowledge systems in environmental governance. While the empirical focus is on Somanga village in coastal Tanzania, the findings have broader relevance for climate adaptation efforts worldwide. Informal networks that are characterised by trust, shared memory, and collective action are shown to be critical infrastructures for knowledge mobilisation and social transformation. By analysing how knowledge is co-created, re-contextualised, and sustained through community-led restoration efforts, this study offers insights applicable to diverse socio-ecological contexts, particularly in regions where formal institutions are limited or contested.

This article aims to contribute to a growing body of research that seeks to decolonise knowledge production by foregrounding the role of informal and indigenous knowledge systems in environmental governance (Adger et al. 2013; Lotz-Sisitka and Pesanayi 2019; Murove 2018). Specifically, we explore how informal networks in Somanga village, southern Tanzania, mobilise knowledge for climate action through coral reef and mangrove restoration projects. These networks are characterised not by formal hierarchies or bureaucratic procedures, but by dynamic and evolving relationships among community members, local leaders, researchers, and government actors. Within these spaces, knowledge is not simply disseminated or transferred; rather, it is co-produced, re-contextualised, and transformed through dialogue and practice.

Tanzania's coastal communities are increasingly bearing the brunt of anthropogenic climate change. With over 800 kilometres of coastline along the Indian Ocean, these communities face complex socio-ecological challenges, including rising sea levels, ocean acidification, declining coral reef health, and mangrove deforestation (Chauka and Nyangoko 2023; Ussi et al. 2024). The degradation of these ecosystems not only threatens biodiversity but also jeopardises the livelihoods of local populations reliant on fisheries, aquaculture and marine-based economic activities (Hammill et al. 2005). In this context, strategies for resilience and adaptation, rooted in the lived realities of affected communities, have become crucial.

To guide our analysis, we draw on the knowledge co-creation framework of Shaxson et al. (2012), which conceptualises knowledge generation as a systemic, actor-oriented process involving four main types of actors: information intermediaries, knowledge translators, knowledge brokers, and innovation brokers. This model challenges linear models of knowledge transfer and emphasises iterative, reciprocal relationships that span multiple knowledge systems. Shaxson et al. (2012) argue that these actors perform overlapping and evolving roles – mediating between knowledge producers and users, adapting content for different audiences, fostering networks, and enabling systemic innovation. This framework is particularly well-suited to understanding informal settings where

boundaries between roles are fluid and shaped by local power dynamics, cultural practices, and resource constraints.

The significance of this study lies in its empirical focus on informal knowledge networks as underexplored yet critical arenas of climate adaptation and social learning (Ensor and Harvey 2015; Fabricius et al. 2007). While co-creation has been extensively studied in relation to formal knowledge systems and transdisciplinary research (Armitage et al. 2011; Norström et al. 2020), few studies have examined how such processes unfold in settings where formal educational or institutional infrastructures are limited or absent. Moreover, there remains a limited understanding of how informal knowledge – often tacit, embodied, and experiential – can evolve to incorporate more structured, codified forms of knowledge (Bernstein 2006; Winch 2017), without undermining its contextual authenticity or local ownership.

We therefore ask: how is knowledge co-created, mobilised, and re-contextualised in informal, community-led initiatives aimed at promoting sustainability and climate resilience in coastal Tanzania? Sub-questions include: what roles do various actors play in this co-creation process? How is knowledge transferred, adapted or transformed within informal networks? What types of knowledge – both formal and informal – are being mobilised, and to what effect?

To answer these questions, we utilised photovoice and semi-structured interviews. This approach allows community members to document and reflect on their practices while actively shaping the knowledge generated. By centring community voices, we respond to calls for more epistemically just forms of research that do not merely extract knowledge but empower local actors to become co-authors of change.

2. Conceptual framing

2.1. Informal knowledge, indigenous practice, and environmental adaptation

The complexity of climate change adaptation, particularly in ecologically sensitive and socioeconomically marginalised contexts, demands an appreciation of multiple ways of knowing. In Tanzania's coastal communities – where coral reefs, mangroves, and marine biodiversity support not only the environment but also the cultural and economic fabric of everyday life – local responses to climate change are deeply embedded in informal knowledge systems. These systems are developed through lived experience, cultural transmission, communal practice and relational knowledge-making rather than through formal education or scientific methods (Adger et al. 2013; Nie, Schultz, and Feldman 2010).

Informal knowledge, also known as indigenous, traditional, or local knowledge, has often been portrayed in academic literature as peripheral or supplementary to formal knowledge (Dare Kolawole 2022). However, more recent scholarship reclaims its value, recognising that informal knowledge can provide highly detailed, context-sensitive insights into environmental patterns, biodiversity management, and socio-ecological resilience (Norström et al. 2020). Unlike formal knowledge, which is typically generalisable, codified, and universalised, informal knowledge tends to be tacit, orally transmitted, emotionally resonant, and deeply embedded within local norms, gendered roles, and historical memory (Bernstein 2006; Freidson 2001; Winch 2017). Bernstein (2006) provides a structural perspective which indicates that educational and institutional systems

distribute and revalue knowledge, favouring formal and hierarchical over contextual and practical knowledge. While Winch (2017) offers a modal perspective, where he defines and defends the legitimacy of non-propositional knowledge – especially practical and contextual aspects – as essential components of expertise but often undervalued in formal settings. Together, these theories emphasise how informal knowledge – practical, experiential, tacit – is structurally and epistemically different compared to formal, propositional knowledge.

This differentiation, however, is not simply epistemological – it is political. The epistemic marginalisation of informal knowledge is symptomatic of broader power asymmetries that have historically excluded indigenous and local voices from development planning and environmental governance (Mauser et al. 2013). These exclusions perpetuate epistemic injustice, where certain knowledge systems are deemed less credible, legitimate, or valuable within decision-making processes (Fricker 2007). In the context of Tanzanian coastal communities, where formal infrastructure for environmental education and scientific research is limited, informal knowledge represents not a deficit, but an essential and underutilised capacity for climate adaptation.

This study seriously considers the role of informal knowledge in driving sustainable action. In Somanga and surrounding villages, we observe how community members utilise long-standing knowledge of tidal rhythms, fish breeding cycles, and mangrove propagation techniques – knowledge that is increasingly threatened by climate variability, resource extraction, and changing ecological baselines. At the same time, we document how this knowledge evolves when exposed to external inputs such as training programmes, research collaboration and exposure to new technologies. In this process, informal knowledge is not displaced but re-contextualised – adapted, translated, and integrated into new environmental practices that blend tradition with innovation (Ensor and Harvey 2015; Shaxson et al. 2012).

The re-contextualisation process challenges rigid binaries between "informal" and "formal" knowledge. Following Bernstein (2006), we recognise that knowledge is characterised not only by its source but also by its structure and function. Informal knowledge may begin as context-specific and tacit, but through processes of abstraction, generalisation, and communal learning, it can become structured and transferable. This occurs, for instance, when communities develop new taxonomies of coral species, document best practices for mangrove planting, or codify techniques into visual or oral pedagogies for intergenerational learning. These transitions represent *gradations* of knowledge – rather than a static dichotomy – which must be captured to appreciate the full epistemic potential of local communities (Armitage et al. 2011; Winch 2017).

By focusing on these gradations, the present study aims to disrupt technocratic models that narrowly define adaptation knowledge as something that must be "transferred" from experts to local communities. Instead, it conceptualises knowledge as co-produced through relational, iterative, and reflexive processes – especially in contexts of ecological uncertainty and social vulnerability.

2.2. Co-creation of knowledge in informal networks

The rise of knowledge co-creation frameworks in sustainability science represents an important paradigmatic shift. It reflects growing dissatisfaction with traditional models

of knowledge dissemination – often critiqued as linear, top-down and disconnected from the social realities of end-users (Mauser et al. 2013; Pohl et al. 2010). These models tend to operate under assumptions of knowledge deficits among communities, positioning external experts as solution-bearers and local actors as passive recipients. By contrast, co-creation frameworks propose that knowledge is most effective and equitable when produced collaboratively, with equal recognition of the diverse knowledge actors involved. The rationale for not using the following models in our study is outlined here: The Knowledge-to-Action (KTA) Framework introduced by Graham et al. (2006) prioritises formal, top-down implementation, which contrasts with our focus on informal, community-led knowledge sharing. Pluriversal Epistemologies (Hosseini and Gills 2025), while aligned with decolonial aims, its abstract, philosophical orientation was less suited to our applied, practice-based approach. Transformative Adaptation Frameworks (Fedele et al. 2019) emphasise broad systemic change, whereas our study centres on localised, everyday adaptation practices. Instead, we adopted the Shaxson et al. (2012) framework, which better supports analysis of informal knowledge networks and community-driven climate adaptation.

The concept of knowledge co-creation refers to a participatory and iterative process through which multiple stakeholders – scientists, local communities, policymakers, and practitioners – jointly contribute to the generation, validation, and application of knowledge (Armitage et al. 2011; Norström et al. 2020). Rather than treating knowledge as a static object, co-creation sees it as emergent from dialogue, negotiation, and mutual learning. This is particularly critical in contexts like Somanga, where the capacity to generate formal scientific knowledge may be limited, but the capacity for adaptive learning and innovation is strong.

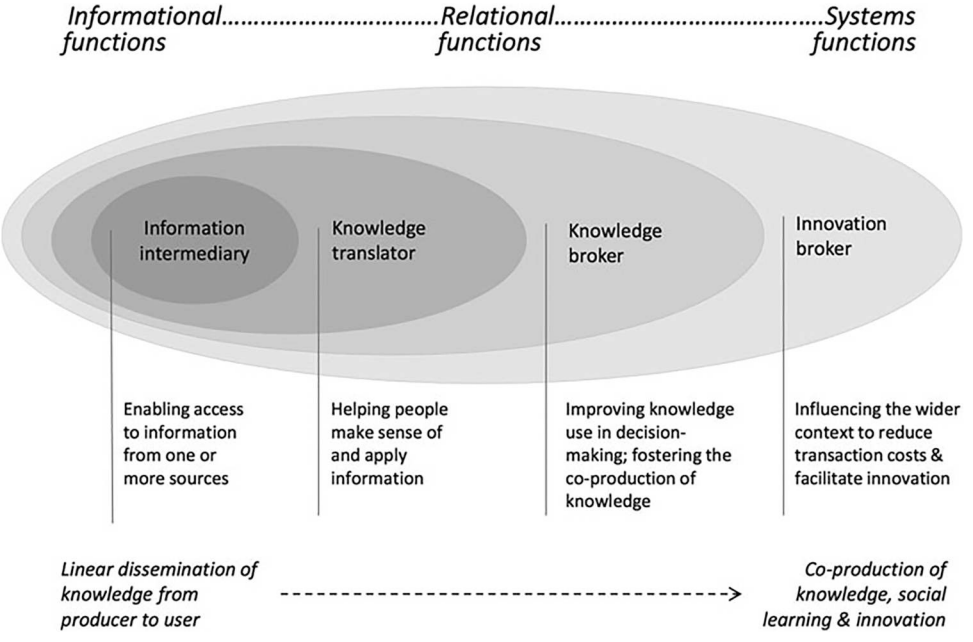

Figure 1. Shaxson et al. (2012) knowledge co-creation framework.

Among the frameworks that articulate this process, the Shaxson et al. (2012) model is particularly relevant to our study. Unlike the widely used Knowledge-to-Action (KTA) framework (Graham et al. 2006), which presumes a planned, often top-down process of knowledge translation, Shaxson's framework (Figure 1) highlights actor diversity, role fluidity, and systemic interconnections.

Shaxson's framework categorises knowledge actors into four overlapping roles: (i) Information Intermediaries: actors who source, compile, and distribute knowledge; (ii) Knowledge Translators: those who interpret, simplify, and communicate knowledge for specific audiences; (iii) Knowledge Brokers: actors who enable dialogue, manage relationships, and facilitate collaboration across sectors; and (iv) Innovation Brokers: visionaries and facilitators of systemic change, who often push the boundaries of knowledge systems. Table 1 presents possible achievement indicators for each function (Shaxson et al. 2012).

Importantly, these roles are not static; individuals often move fluidly between them. This dynamism underscores the non-linearity of informal knowledge networks, which do not conform to the sequential knowledge production processes typical of formal institutional settings (van Kerkhoff and Lebel 2015). Moreover, these networks are often bound not by contractual obligations but by social ties, shared histories, and collective visions of ecological stewardship. They are sustained through trust, respect, and cultural cohesion, which is foundational to effective co-creation (Fabricius et al. 2007).

In applying the Shaxson et al. model to a grassroots context, we expand the framework's utility beyond policy and research institutions to the informal, often overlooked, spaces of community-driven adaptation. These informal networks may lack formal metrics or bureaucratic visibility, but they constitute vibrant arenas of knowledge negotiation, transformation, and empowerment. By foregrounding these processes, we not only illuminate how climate resilience is enacted on the ground but also contribute to reimagining co-creation as a relational praxis – a practice rooted in equity, participation, and cultural responsiveness.

3. Methodology

In 2023, five university researchers from institutions in Tanzania, South Africa, and the United Kingdom convened in Somanga village to follow up on a 2022 intervention that employed two participatory action research (PAR) groups: "Coral Reef Restoration" and "Mangrove Planting" (Mazigo et al. 2023).[1] These interventions introduced community

Table 1. Knowledge functions and corresponding achievement indicators based on Shaxson et al. (2012).

K* Function	Possible Indicators of Achievement
Information Intermediary	Accessible information in diverse formats; documented communication; reach and cost-effectiveness
Knowledge Translator	Credibility and inclusiveness; responsiveness to audience needs; uptake of knowledge into decisions
Knowledge Broker	Stakeholder engagement in agenda-setting, long-term relationships, responsiveness to local needs, and attention to power dynamics
Innovation Broker	Institutional sustainability; enabling environments; capacity-building; infrastructure and self-sustaining systems

members to ecological conservation practices through structured training sessions, field visits to coral reefs and mangrove sites, consultations with government officials, and academic engagement at the Dar es Salaam University College of Education (DUCE).

Members of Kikundi cha Utunzaji wa Mazingira na Matumbawe (KIUMAMA)[2] led coral reef restoration activities, while members of Somanga Environment Group (SEG) spearheaded mangrove restoration efforts. By April 2023, the coral team had planted 6,918 corals and trained and empowered other villages to participate in coral reef restoration. Meanwhile, the mangrove team had planted and maintained 17,735 mangroves across 10 hectares, inspiring others to form groups for mangrove reforestation initiatives.

The 2023 study examined how climate change perceptions were articulated and shared, how the interventions addressed the anthropogenic drivers of marine habitat degradation, and assessed the mechanisms through which knowledge was communicated to promote local environmental stewardship (Mazigo et al. 2023). Central to the study was an investigation of knowledge co-creation processes, highlighting the collaborative roles of researchers, community leaders, government representatives, conservation organisations, and local participants. This research emphasises the participatory dimension of the project, in which stakeholders not only engaged with scientific knowledge but also actively contributed as co-researchers and co-producers of contextually relevant environmental solutions.

The fieldwork was conducted in Somanga village, where communities face intensified climate pressures, including coral bleaching, mangrove deforestation, saline intrusion and declining fish stocks (Chauka and Nyangoko 2023; Ussi et al. 2024). This ecological vulnerability is compounded by socio-economic precarity and limited access to formal environmental education. Yet, these same communities demonstrate remarkable ecological intelligence, grounded in intimate, everyday interactions with marine and coastal environments.

The two community-led restoration interventions – coral reef restoration and mangrove planting – were entry points for studying knowledge co-creation. Both initiatives began in 2022, with local actors facilitating them and university researchers providing support. They provided a fertile ground for examining how informal knowledge networks evolve through contact with formal interventions.

A total of 52 participants were purposively selected because they were directly involved in the two participatory action research (PAR) groups – *Coral Reef Restoration* (KIUMAMA) and *Mangrove Planting* (Somanga Environment Group) – or were local officials linked to these interventions. The inclusion criteria were therefore open to all active members of these groups and to relevant officials supporting or overseeing the initiatives, ensuring that all participants had first-hand experience of the restoration work and knowledge co-creation processes under study.

The two groups represented a diverse mix of elders, youth, women, local officials, fishers, seaweed farmers, farmers, small traders, and conservation officers. Participants ranged from young adults in their late teens and twenties to elders over sixty years of age, with women comprising a significant proportion of both groups and assuming leadership and teaching roles. This demographic and epistemic diversity enabled the research team to explore intersectional dimensions of knowledge co-creation, including gendered knowledge practices and generational differences in environmental understanding (Kolawole 2022).

The research employed photovoice and semi-structured interviews, which are particularly suitable for knowledge co-creation.

3.1. Photovoice

Photovoice was selected as the primary method for engaging participants in critical reflection and collaborative knowledge generation. First developed by Wang and Burris (1997), photovoice empowers participants to document their lived realities and express their perspectives through photography and narrative. In contexts where literacy levels vary or where knowledge is primarily oral and embodied – as in many coastal Tanzanian communities – photovoice acts as a powerful tool to surface tacit, affective, and sensory knowledge that might otherwise remain invisible to formal research methods (Catalani and Minkler 2010). The two pictures below show how participants engaged with the photographs by viewing and discussing them, and placing comments in their home language next to each photograph (Figure 2).

In this study, the photovoice process was adapted to reflect on previous coral reef and mangrove restoration activities. Ten photographs capturing moments from the 2022 interventions were printed and displayed in a communal hall. Participants engaged with these images through structured prompts designed to elicit both factual recollection and critical interpretation: What are the people doing in this image? Why is this activity important to the community? What did you learn through this process?

With these questions, participants explored the emotions, experiences and new knowledge insights that arose when they participated in the activities represented in the photographs. As participants viewed the photographs, they discussed their reflections in groups of three or more before writing their responses down. All responses were captured and pasted under the corresponding photographs. This was later collected by the research team, translated and transcribed for analysis.

Figure 2. Participants engaging in a photovoice activity.

To ensure the reliability of these reflections, participants' interpretations were validated through a process of peer discussion and collective agreement. Each photograph was first discussed in small groups, where participants negotiated meaning and wrote down their agreed-upon reflections before sharing them with the larger group. These written responses were displayed alongside the images during subsequent community feedback sessions, allowing participants to confirm, refine, or contest earlier interpretations. This iterative, dialogic approach ensured that the resulting narratives were grounded in shared community perspectives rather than individual viewpoints alone.

The reflective conversations captured in these sessions provided insights into how knowledge was co-created, shared, contested, and re-contextualised. The photovoice sessions also fostered horizontal learning, where participants taught and learned from one another in ways that mirrored the informal knowledge-sharing networks at the heart of the study (Ensor and Harvey 2015; Nie, Schultz, and Feldman 2010).

3.2. Semi-structured interviews

To complement the visual and dialogic richness of photovoice, semi-structured interviews were conducted with six key informants who played diverse roles in the interventions. These included a local coral restoration innovator, a female member of SEG, a male member of KIUMAMA, a village leader, a representative from a conservation NGO, and an academic partner involved in earlier training.

Interviews were designed to probe the relational and functional dimensions of knowledge co-creation. Participants were asked to describe their roles, the kinds of knowledge they engaged with, the relationships they built, and the outcomes they observed. Interview questions also explored perceptions of actor roles within the Shaxson et al. (2012) typology – e.g. who facilitates knowledge transfer? Who adapts it? Who builds relationships across domains?

This actor-centred approach allowed us to trace non-linear knowledge trajectories, revealing how individuals often moved between roles (e.g. from knowledge translator to innovation broker) depending on social context, access to resources, and emergent needs. These findings helped uncover informal credibility, trust and legitimacy dynamics, which often determined the success or failure of knowledge mobilisation efforts (Armitage et al. 2011; Fabricius et al. 2007).

3.3. Data analysis

Data from both photovoice and interviews were analysed using a combination of thematic coding and framework analysis. We employed thematic analysis following Braun and Clarke's (2006) six-step process: (1) familiarisation with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. This approach enabled us to systematically identify patterns of meaning across the photovoice and interview data. We also adopted a hybrid coding strategy, combining deductive codes from the Shaxson et al. (2012) framework with inductive themes emerging from participant narratives, in line with Fereday and Muir-Cochrane (2006).

The Shaxson et al. (2012) model served as an analytic scaffold, providing deductive codes for knowledge actor types and functions (information intermediary, translator,

broker, innovation broker). At the same time, inductive coding was employed to capture emergent themes such as: trust and credibility in knowledge sharing; gendered roles in environmental knowledge; tensions between traditional and scientific paradigms; and scaling and sustainability of co-created knowledge.

Themes were iteratively refined through team discussions and community feedback sessions. This hybrid approach enabled the research team to maintain analytical rigour while remaining responsive to the complex nature of the data (Fereday and Muir-Cochrane 2006). Coding paid attention to modalities of knowledge and how these were mobilised or transformed during the interventions.

Steps were also taken to minimise researcher bias. Group discussions during photo-voice were facilitated primarily by community members in the local language, ensuring that participant voices and framings guided the data rather than researcher prompts. In addition, the research team engaged in reflexive journaling and debriefing after each session to identify and address potential positionality biases.

3.4. Ethics, reflexivity, and positionality

Given the political and ethical dimensions of researching informal knowledge systems in a postcolonial setting, the study was underpinned by a strong commitment to research ethics and reflexivity. Community consent was not a one-time event but a continuous process, involving multiple rounds of engagement and feedback. Research activities were co-designed with local stakeholders, ensuring that the research agenda remained grounded in community priorities.

Researchers engaged in reflexive journaling and debriefings to examine their own positionalities and potential biases. As a transnational team working across institutional and cultural lines, the researchers were acutely aware of the risk of re-inscribing colonial hierarchies in knowledge production (Lotz-Sisitka and Pesanayi 2019; Smith 1999). To mitigate this, local knowledge holders were engaged not only as participants but as epistemic collaborators whose insights informed the interpretation and dissemination of findings. Informed consent was thus received verbally to participate in the research and for the publication of the data collected.

To protect confidentiality, all participant names cited in the manuscript are pseudonyms, except for Mr. Chande and Mr. Basha. These individuals were consistently identified by community members as central figures in the knowledge co-creation process – Mr Chande as a respected intermediary who initiated external collaborations, and Mr Basha as a local innovator whose techniques significantly shaped coral reef restoration practices. Both gave explicit consent to be named, and their approval was documented. Acknowledging their contributions by name was deemed ethically appropriate, as concealing their identities could diminish recognition of their agency and innovation. This approach strikes a balance between participant anonymity and the ethical imperative to credit those whose work was foundational to the interventions.

4. Findings

The findings from this study are presented in two interrelated parts: the roles and interactions of key knowledge actors identified through the framework of Shaxson et al. (2012), and the types of knowledge mobilised and re-contextualised during the coral

reef and mangrove restoration interventions. Drawing on photovoice reflections and semi-structured interviews, this section highlights the lived experiences of participants and the mechanisms through which knowledge was co-created in informal community networks. Quotations from participants illustrate how knowledge actors operated in practice and how learning was rooted in culturally situated, experiential, and dialogic processes.

4.1. Knowledge actors and their roles in informal networks

Using Shaxson et al.'s (2012) framework of knowledge co-creation, four primary types of knowledge actors emerged from the Somanga case study: information intermediaries, knowledge translators, knowledge brokers, and innovation brokers. Importantly, these roles were not fixed but fluid and relational – shaped by context, social position, and the evolving needs of the community. The analysis reveals how actors moved across these categories over time, performing multiple functions as the interventions unfolded. This fluidity reflects the non-linear nature of knowledge co-creation in informal networks, where boundaries between knowledge production, translation, and application are often blurred.

4.1.1. Information intermediaries: anchoring access and initiating exchange

Information intermediaries played a foundational role in bridging external knowledge with local needs. They did not necessarily generate new knowledge themselves, but they were pivotal in facilitating its circulation and initial acceptance within the community. One such actor was Mr Chande,[3] a respected community member who initiated contact with Mr Basha, a coral restoration expert, based in the Mtwara region:

> During my visit to a village in Mtwara, I met Mr Basha and engaged in an informal conversation with him. When I mentioned the increasing degradation of coral reefs in our district, he shared his knowledge and experience in reef restoration. I invited him to lead a training session in Somanga, which he accepted. He later came to Somanga and facilitated a coral reef restoration workshop for community members. (Interview, Mr Chande).

Importantly, this was not a planned policy meeting or NGO initiative. It was a casual interaction between individuals that triggered an institutional shift. The ability to act as an intermediary was grounded not in formal authority but in social capital, mobility, and trust. This encounter exemplifies the informal, often serendipitous mechanisms through which knowledge flows are activated in community settings – mechanisms not easily captured by formal knowledge dissemination models.

Another key intermediary function was carried out by the Coral team, whose members, trained in coral reef restoration, subsequently shared their knowledge with neighbouring communities:

> After mastering coral restoration skills, we travelled to Pombwe[4] village to teach others. We recognised the importance of sharing what we had learned (Photovoice Reflection, Coral Member).

Members of Somanga Environment Group (SEG) also acted as intermediaries by coordinating logistics and mobilising local participation in capacity-building workshops:

> We helped organise the workshops, ensured the hall was ready, and informed people. When everyone arrived, the training went smoothly (Interview, SEG Member).

These examples underscore the embeddedness of information intermediaries in social and institutional structures. Their legitimacy and effectiveness often arise from their local reputation, trustworthiness, and ability to mobilise others – factors crucial for ensuring that new knowledge is not only received but also respected.

4.1.2. Knowledge translators: making meaning through local practice

Knowledge translators were individuals who not only received new information but also interpreted, adapted, and enacted it in ways that aligned with local realities. In the Somanga case, community members prominently assumed this role by directly engaging in coral and mangrove restoration.

A female member of the coral team expressed her learning process in profoundly personal and reflective terms:

> I used to think corals were just rocks under the sea. Now I know they are homes for fish. When we plant coral, we create a future for the ocean and for ourselves (Photovoice Reflection, Fatuma, Photo C3).

This shift in perception illustrates that translation is not merely about simplifying technical language; it involves reframing knowledge through emotional and ethical lenses, enabling it to resonate with lived experience.

Another knowledge translator described how she began teaching others using analogies and visual demonstrations:

> I told my younger cousins, "Imagine the coral reef like your house. If someone breaks it, where will you sleep? That is why we protect the reef." (Photovoice Reflection, Mariamu, Photo C5)

Another participant spoke about acquiring specific procedural knowledge and applying it practically:

> I have learned to plant mangrove propagules in a straight line. Initially, we did not know the correct distance, but we practised and figured it out (Photovoice Reflection, Anna, Photo M6).

Community translators often combine new technical knowledge with indigenous insights:

> We understand the sea and recognise the ebb and flow of the tides. Now, we are applying that knowledge alongside what scientists have taught us about coral (Photovoice Group Dialogue)

These translators were crucial in bridging ontological gaps between scientific and local ways of knowing. Their work was relational and iterative, rooted in doing, testing, and discussing rather than in formal instruction alone.

4.1.3. Knowledge brokers: linking people, institutions, and power

Knowledge brokers facilitated dialogue among various groups, secured support from institutions, and helped maintain the momentum of restoration interventions. Their influence extended beyond technical knowledge; they navigated political, social, and

institutional landscapes, enabling the co-creation process to be both legitimised and sustained. A village leader described his role in endorsing the project:

> When KIUMAMA members proposed restoring coral reefs, we met with them, listened, and offered our full support. We ensured they had permission to proceed (Interview, Village Leader)

The SEG leaders arranged registration for Kikundi cha Mwani na Mikoko (KIMWAMI),[5] a new community group focused on mangrove restoration:

> We understood they were serious, so we helped them to get registered with the local government. This way, they could seek assistance and potentially secure funding in the future (Interview, SEG Leader)

In many cases, brokers also helped balance competing demands, ensuring equitable participation:

> We made sure women were included. Sometimes they get left out of these things, but here, everyone has a role (Photovoice Reflection, Khadija, Photo M8).

These brokers exercised soft power, using relational strategies to influence processes of inclusion, resource access, and institutional engagement. They were vital in creating a supportive environment for the knowledge network to grow organically and inclusively.

4.1.4. Innovation brokers: catalysts of contextualised change

Innovation brokers were individuals who adapted or developed new tools, practices, or strategies to address specific local challenges. In Somanga, they often emerged from within the community, demonstrating how innovation in informal networks is rooted in experiential intelligence and adaptive capacity.

Mr Basha, who had previously participated in a coral reef training programme, innovated a locally appropriate technique for coral propagation:

> At Kunduchi, I learned that coral dies if it is out of water for too long. Therefore, we must ensure a coral seedling is planted within seven minutes. I also learned that coral must be securely placed on the seabed to survive tides and winds. Knowing that cement hardens in ocean water after 10 min, I thought we could create small cement bricks with holes to keep coral pieces securely tied. That is why we use the three-hole small cement bricks (Interview, Mr Basha).

This innovation not only addressed a technical problem but also reshaped the entire restoration practice by reducing coral mortality and standardising the process for others to replicate. This technique, developed outside formal institutions, was also later adopted and improved collaboratively by others. It exemplifies grassroots innovation that is culturally embedded, ecologically sensitive, and scalable. The KIMWAMI group also adapted their planting techniques to the specific characteristics of the local environment.

> In our area, the waves are strong. We used sticks to secure the seedlings so they would not be washed away. We tried it, and it worked (Photovoice Reflection, Nurdin, Photo M6)

These innovations were not imported but emerged through cycles of trial, error, and shared learning, echoing Wenger's (1998) concept of "communities of practice" where knowledge and practice evolve together through participation.

The diverse roles that actors in the Somanga case played underscore the relational, adaptive, and role-fluid nature of informal knowledge networks. Knowledge was not simply disseminated or implemented – it was continuously interpreted, negotiated, and reinvented through community dialogue, situated experimentation, and collective decision-making.

Each actor category – intermediary, translator, broker, and innovator – represents a different mode of agency in the co-creation process. However, the boundaries between them were fluid. Individuals often occupied multiple roles, depending on context and opportunity, as one participant highlighted:

> I was trained by Mr Basha. Then, I taught my neighbours. Now, I'm exploring my own method of planting corals faster. We learn, share, and adapt (Photovoice Reflection, Coral Team Member).

This finding supports the idea that informal knowledge networks are dynamic learning ecologies, where authority is earned through participation, and legitimacy is relational, not positional. One community member succinctly stated:

> Knowledge is not a title here. It is what you do with your hands, your heart, and your words (Photovoice Reflection, Community Member, Photo M5).

Participants' movement across roles – from receivers to translators, from learners to brokers – demonstrates the non-linear and participatory nature of knowledge co-creation in contexts of environmental adaptation. This challenges hierarchical models of knowledge flow and underscores the importance of investing in local actors not merely as implementers but as intellectual contributors and innovation leaders in their own right.

4.2. Knowledge mobilisation and re-contextualization

The process of knowledge mobilisation in Somanga did not conform to linear models of knowledge transfer. Instead, it unfolded as a socially embedded, dialogic, and iterative process where knowledge was interpreted, modified, and owned by the community through sustained engagement. This process is better understood through the lens of knowledge re-contextualisation – a concept that captures how knowledge shifts in form, meaning, and application as it moves across social, spatial, and epistemological boundaries (Bernstein 2006; Shaxson et al. 2012).

Drawing on empirical evidence from photovoice sessions and interviews, four interrelated dimensions of knowledge mobilisation emerged: Materialisation and Procedural Structuring of Knowledge; Epistemic Hybridisation and Situated Adaptation; Social Learning and Knowledge Diffusion; and Knowledge Ownership and the Reimagining of Identity and Power.

4.2.1. Materialising knowledge: from abstract ideas to embodied practices

One of the most immediate ways knowledge areas were mobilised was through their materialisation in physical practice. Community members translated verbal or visual instructions into concrete tasks – such as making bricks, mixing cement, and planting coral or mangroves – transforming abstract knowledge into procedural and embodied routines. One participant confirmed:

> We didn't just learn with our ears; we learned with our hands. You feel it when you mix the cement and press the coral piece onto the brick. That's when you understand (Photovoice Reflection, Fatuma, Photo C1).

The procedural clarity that emerged from this practice helped stabilise learning and made it transferable. Over time, participants developed informal protocols that were validated through peer repetition rather than institutional training:

> If the brick is not dry, the coral breaks. Therefore, we always wait at least two days. Everyone knows this now – it's the rule, even if it isn't written (Photovoice Reflection, Hamza, Photo C2).

This procedural structuring represents a form of informal codification, where community innovations and techniques became internalised and standardised through iterative use and collective validation.

4.2.2. Epistemic hybridisation: fusing scientific and indigenous knowledge

A powerful feature of knowledge mobilisation in Somanga was its hybrid nature. Instead of replacing local knowledge with scientific techniques, the restoration interventions enabled participants to synthesise both knowledge systems – selecting, adapting, and blending insights into strategies that were contextually appropriate.

> They showed us how to choose coral pieces that are still alive. However, we noticed that the ones from deeper water remain healthier here. Consequently, we combine both types of knowledge – what they taught us and what we have learned from fishing (Photovoice Reflection, Coral Team Member, Photo C4).

This hybridisation was neither automatic nor frictionless; it involved negotiation and sometimes contestation. One elder explained:

> Initially, I wondered why they were changing our way. But then I observed how the fish returned. I realised that this new way does not oppose our knowledge; rather, it builds on it (Interview, Elder and Fisher).

Hybridisation also occurred at the level of language and metaphor. Participants employed local analogies to understand scientific explanations:

> Coral acts like a mat for the sea. Without it, everything slips away – the fish, the sand, the coast (Photovoice Reflection, Nurdin, Photo C3).

These metaphors grounded scientific concepts in cultural cognition and emotional familiarity, making them accessible across generations and literacy levels.

4.2.3. Social learning: the relational fabric of knowledge diffusion

The transmission of knowledge was fundamentally social and relational. It did not depend on formal dissemination channels but on everyday practices such as sharing, imitation, mentorship, and observation. In this sense, knowledge mobilisation occurred through informal learning ecologies, structured by kinship, respect, trust, and communal effort.

> I learned coral planting from my uncle, who learned from Mr Basha. Now, I teach my younger brother. This way, the knowledge moves through the family (Photovoice Reflection, Youth Participant, Photo C7).

Participants also emphasised horizontal learning, where peers taught one another without hierarchy:

> Sometimes I teach the new women who join our group, while other times I learn from them. We all have something to give (Photovoice Reflection, Khadija, Photo M8).

Photovoice itself became a tool for social learning, enabling reflection and dialogue:

> When we saw the pictures, we remembered what we had done and how we had done it. This experience helped us teach more effectively when new people joined (Photovoice Reflection, Coral Group, Photo Discussion).

This process was not merely informational – it helped build social cohesion**,** collective confidence, and a sense of shared purpose in environmental stewardship.

4.2.4. Re-contextualising knowledge as empowerment and identity transformation

Perhaps the most profound form of knowledge mobilisation was its impact on identity, agency, and empowerment. As knowledge became re-contextualised – adapted and owned by community members – it also reshaped their sense of self and place in the world.

> Before this, I never thought I could speak before the village assembly. Now, when I discuss the corals, people listen. They ask me questions and refer to me as a leader (Photovoice Reflection, Fatuma, Photo C6).

This transformation extended beyond individual empowerment to encompass the development of a collective identity. Community members began to view themselves not only as beneficiaries of knowledge but also as its producers, stewards, and ambassadors.

> We are not just villagers now; we are conservationists. People from other villages come to see what we are doing, and we are proud. (Photovoice Reflection, Coral Group Leader, Photo C8)

Knowledge thus became not only a resource but also a site of dignity and recognition – a means of asserting visibility, capability, and environmental citizenship.

These shifts also challenged existing power dynamics. Several women reflected on how their involvement in the projects disrupted gendered expectations:

> Men used to say, "This is sea work, not for women." But now they respect us. They see that we plant corals better than some of them (Photovoice Reflection, Mariamu, Photo C3)

By participating in technical, decision-making, and teaching roles, women have redefined their societal contributions, demonstrating how the co-creation of knowledge can promote gender justice and social inclusion.

4.2.5. Sustaining knowledge through informal systems

Importantly, knowledge mobilisation did not conclude with the interventions. Participants described ongoing learning, adaptation, and replication of the techniques in new locations and among new groups.

> We didn't stop after the training; we continued. We showed the Pombwe people how to do it, and now they are doing it too. Maybe one day, every village will plant corals (Photovoice Reflection, Coral Group).

This highlights the development of distributed knowledge systems – informal networks of practice that span across space, replicating not only methods but also values of collaboration, care, and resilience. One elder asserted:

> This knowledge has taken root. It is growing like the mangroves – branching out and protecting us (Photovoice Reflection, Elder, Photo M9).

The mobilisation and re-contextualisation of knowledge in Somanga demonstrate that knowledge is not merely a tool for solving problems; it is a social force that reconfigures relationships, identities and possibilities for action. Through material practice, epistemic hybridisation, social learning, and empowerment, knowledge becomes a living, evolving asset that communities adapt, share and sustain.

These findings reinforce the central proposition of this study: that informal knowledge networks are not passive vessels of received wisdom but active sites of creativity, negotiation and transformation. By embedding new knowledge in local narratives, routines, and relationships, the community transformed externally introduced information into an ecosystem of locally relevant, culturally grounded, and collectively owned knowledge.

5. Discussion

This study sought to understand how knowledge is co-created, mobilised and re-contextualised through informal community networks engaged in coral reef and mangrove restoration in coastal Tanzania. Using participatory methods grounded in a co-creation framework (Shaxson et al. 2012) and informed by knowledge theories (Bernstein 2006; Winch 2017), the findings illuminate how communities function as active epistemic agents, shaping not only local ecological practices but also broader knowledge systems and power dynamics.

Contrary to narratives that portray rural communities as passive recipients of externally sourced knowledge, this study demonstrates that informal knowledge networks act as fertile grounds for innovation, adaptation, and epistemic transformation. Below, we explore this argument through five interlinked dimensions, each engaging the findings with broader theoretical discourses.

5.1. Informal knowledge as situated expertise

The study confirms that informal knowledge – rooted in lived experience, cultural practice, and local observation – constitutes a form of situated expertise essential to climate resilience. This aligns with work in political ecology and indigenous studies that recognises traditional ecological knowledge (TEK) not as static folklore but as a dynamic, evolving epistemology grounded in interaction with place (Agrawal 1995; Tengö et al. 2017).

Participants in Somanga demonstrated a nuanced understanding of seasonal cycles, coral behaviour, sediment dynamics, and mangrove propagation – knowledge often overlooked in conventional development and conservation planning. This challenges dominant models of climate adaptation that remain heavily influenced by top-down, technocratic, and universalising paradigms (Mauser et al. 2013; Pelling 2011).

Moreover, this "informal" knowledge was neither undocumented nor inarticulate. It was deeply embodied, symbolically encoded, and socially transmitted, as evidenced by photovoice reflections, analogies, and teaching practices. As one participant described:

> The coral is like our bones – when it breaks, everything falls apart. So we protect it like we protect our body (Photovoice Reflection, Juma, Photo C4)

This metaphor reflects ecological understanding while framing knowledge through ethical and affective registers, which are often dismissed in technocentric discourse.

5.2. Role fluidity and the collective intelligence of informal networks

Drawing on Shaxson et al.'s (2012) framework, the study identified community actors serving as intermediaries, translators, brokers and innovators. However, unlike formal knowledge infrastructures – where such roles are rigidly assigned – informal networks in Somanga were characterised by role fluidity, adaptability and collective intelligence.

People transitioned between roles based on the situation, needs and relational trust. A coral planter became a trainer. A village elder became a policy advocate. A woman who once prepared food at events became a technical expert and group leader.

This aligns with Wenger's (1998) theory of communities of practice, which suggests that learning is social, participatory and identity-forming. Knowledge was not merely transferred; it was cultivated through practice, recognition, and evolving forms of participation.

Moreover, this fluidity reflects an alternative epistemic architecture – one based on reciprocity, trust and ecological intimacy, rather than on formal credentials or institutional mandates (van Kerkhoff and Lebel 2015). One participant asserted this very strongly:

> Here, when you know something and help others, you become a leader. Not because of a paper, but because people trust you (Photovoice Reflection, Shabani, Photo C6).

This finding has implications for our understanding of legitimacy and authority in knowledge systems, particularly in contexts of climate adaptation where formal expertise may not resonate socially.

5.3. Re-contextualization as epistemic innovation

One of the most powerful insights from this study is the role of re-contextualisation – the adaptation and reinterpretation of knowledge as it moves between domains (Bernstein 2006). In Somanga, community members did not merely adopt externally introduced knowledge; they transformed it into forms that were locally meaningful and functionally effective.

This occurred through *material adaptation* (e.g. modifying coral brick size based on ocean conditions), *temporal adjustment* (e.g. aligning planting with moon and tide cycles), and *semantic reinterpretation* (e.g. explaining coral ecology through metaphors about home, kinship, and safety). These acts of re-contextualisation were not trivial; they reflect a process of epistemic innovation, where knowledge is indigenised – made culturally, ecologically, and socially comprehensible.

This aligns with what De Sousa Santos (2007) calls "cognitive justice" – the right of different knowledge systems to coexist, be valued, and shape the future. Instead of

forcing local knowledge into global models, the community maintained their autonomy and agency, contributing back to broader knowledge systems.

> We didn't just take their knowledge; we mixed it with our perspective. Now, it is better (Photovoice Reflection, Coral Group Member)

This iterative process reflects a dialectic between learning and knowing, producing not only adaptive practices but also new hybrid epistemologies.

5.4. Knowledge, identity, and social transformation

Beyond technical knowledge, the study reveals that knowledge mobilisation in informal networks also involves reconfiguring identity, status, and belonging. As knowledge was co-created and internalised, participants began to see themselves differently – not merely as rural villagers, but as environmental stewards, innovators, and educators.

This transformation was especially significant for women and youth, who gained a voice, recognition, and decision-making power through their active roles in restoration. This confirms literature in feminist political ecology that emphasises how knowledge practices are entangled with power, gender, and inclusion (Elmhirst 2011; Harcourt and Nelson 2015).

> I used to follow. Now, people follow me. Not because I'm better, but because they see that I know something useful (Photovoice Reflection, Fatuma, Photo M8).

Knowledge, in this sense, becomes a social technology of empowerment – one that reshapes both ecological landscapes and social hierarchies. It contributes to a form of "slow transformation" (Leach, Stirling, and Scoones 2010), where learning leads to subtle yet profound shifts in roles, relationships, and resource access over time.

5.5. Rethinking knowledge governance for climate adaptation

Ultimately, the findings challenge dominant paradigms in climate knowledge governance that continue to prioritise formal data systems, expert modelling, and prescriptive frameworks. Somanga demonstrates the viability and necessity of polycentric and pluriversal knowledge systems, where multiple actors and epistemologies collaborate without hierarchy (Escobar 2018; Ostrom 2010).

Rather than viewing informal knowledge as a gap to fill, development and climate actors should see it as a system to support, nurture, and learn from. Policies that overlook these networks risk ineffectiveness and injustice.

Moreover, replicating practices across villages (e.g. the Coral team influencing Pombwe) illustrates the potential for informal, lateral diffusion of innovation, which often outpaces formal scaling mechanisms. This suggests that investing in relationship-based capacity building may yield more sustainable impacts than traditional "scaling up" strategies. As one participant put it: *Projects come and go. But, if you give us knowledge that fits us, we carry it forward ourselves* (Photovoice Reflection, Village Leader). This underscores the potential of informal networks not just as implementation sites but as drivers of sustainability transitions from below.

The findings from Somanga demonstrate that informal knowledge systems are not ancillary to formal science – they are engines of epistemic innovation, social

transformation, and ecological resilience. Co-creation in this context is not a buzzword – it is a lived, relational process, forged through trust, experimentation, and mutual learning.

We compared this study to other regional climate adaptation studies and found the following: In Kenya, studies in Nakuru and Wajir counties highlight the importance of group membership, access to climate information, and livelihood diversification as key adaptation strategies (Karani et al. 2025). Similar to Somanga, Kenyan communities rely on informal networks and experiential knowledge, though Kenya's policy environment provides more structured support through national climate legislation.

In Mozambique, adaptation efforts focus on ecosystem-based approaches, particularly in coastal and forested areas (Mabutana, Molander, and Klintenberg 2025). Community-led mangrove restoration and sustainable charcoal production practices are central to resilience strategies. These findings echo our emphasis on embodied practice and ecological stewardship, though Mozambique's exposure to cyclones has led to stronger integration of disaster risk reduction.

In Ghana, cocoa-farming communities employ agroforestry, early warning systems, and livelihood diversification to reduce climate vulnerability (Olwig, Skovmand Bosselmann, and Owusu 2024). The integration of trees into farming and the use of local metaphors and cultural knowledge closely mirror the re-contextualisation processes observed in Somanga. Ghanaian studies also emphasise the need to recognise and support existing informal strategies through policy alignment.

In Nigeria, climate-smart agriculture is gaining traction, with emphasis on chemical interventions, soil fertility, and crop resilience (Abogunrin-Olafisoye 2025). While the Nigerian context is more focused on technical innovations, recent reviews call for greater inclusion of local knowledge and community participation in adaptation planning. This aligns with our findings on the importance of trust, social learning, and community ownership.

Across these contexts, informal knowledge systems emerge as critical infrastructures for climate resilience, yet they remain under-recognised in formal adaptation frameworks. Our study contributes to this discourse by demonstrating how knowledge is co-created, re-contextualised, and sustained through community-led processes in Tanzania, offering a model for justice-centred and culturally grounded adaptation across Africa.

By positioning informal networks at the centre of climate action, this study contributes to a growing body of scholarship that advocates for epistemic pluralism, decoloniality, and justice-centred adaptation. It urges researchers, practitioners, and policymakers to consider not only how to transfer knowledge but also whose knowledge is valued, how it is shared, and what it becomes when integrated into community life.

5.6. Cognitive justice and the decolonial imperative

The findings from Somanga reveal the importance of cognitive justice, which recognises multiple, coexisting knowledge systems as a foundation for equitable climate adaptation. As De Sousa Santos (2007) argues, cognitive justice demands that diverse epistemologies should be valued equally, and not subordinated to dominant Western scientific paradigms. This principle is central to decolonial scholarship, which critiques the historical marginalisation of indigenous and local knowledge in environmental governance.

In Somanga, knowledge was not merely transferred from external experts to local actors; it was re-contextualised, adapted, and transformed through community-led processes. Participants blended scientific techniques with indigenous insights, using metaphors, embodied practice, and social learning to make knowledge meaningful and actionable. These acts of epistemic translation reflect what De Sousa Santos calls an "ecology of knowledges", which is a dialogic space where different ways of knowing interact without hierarchy (73).

By foregrounding informal networks and community innovation, this study challenges the abyssal thinking that separates valid (scientific) knowledge from excluded (local) knowledge. Instead, it affirms that knowledge legitimacy is relational, rooted in trust, relevance, and lived experience. The coral and mangrove restoration efforts in Somanga exemplify how cognitive justice can be enacted through participatory, place-based adaptation, where communities are not passive recipients but active producers of knowledge.

This approach not only enhances the effectiveness of climate interventions but also contributes to epistemic justice, empowering marginalised groups – especially women and youth – to redefine their roles as environmental stewards and knowledge leaders. In doing so, the study aligns with broader calls to decolonise sustainability science by embedding adaptation within culturally grounded, locally owned frameworks.

6. Conclusion

This study has illuminated how informal knowledge networks in coastal Tanzania serve not only as vessels of community memory but also as engines of innovation, agency, and environmental transformation. Through the lens of coral reef and mangrove restoration efforts in Somanga, we demonstrate that knowledge co-creation is not a peripheral feature of sustainability work; it is its very foundation.

Drawing on participatory methodologies and Shaxson et al.'s (2012) co-creation framework, we observed community members stepping into fluid and overlapping roles: acting as information intermediaries, connecting actors across distances; as knowledge translators, making complex ideas usable and locally resonant; as brokers, linking informal networks to institutional legitimacy; and as innovation brokers, driving context-specific solutions. These roles were not formally appointed; they were earned through practice, trust and contribution.

What emerged was a portrait of knowledge that is alive, adaptive and relational. Community actors did not merely absorb knowledge – they transformed it. Through a process of re-contextualization, they grounded external ideas in local realities, aligned them with cultural metaphors, and embedded them in practice. This knowledge was not consumed – it was remade: "We didn't just take their knowledge. We made it fit us. That's why it works" (Photovoice Reflection, Coral Team Member).

Importantly, these processes also reshaped power. Women, youth, and marginalised voices became visible as knowledge leaders. Learning evolved into a pathway to leadership. Teaching developed into a practice of collective care. In these ways, knowledge co-creation served not only ecological goals but also social transformation and climate justice.

The implications extend beyond Tanzania, in informal networks around the world, whether in coastal Kenya, rural India, or urban Brazil they hold similar potential to drive

sustainability transitions from below. Recognising and investing in these networks is essential for building just, resilient, and culturally grounded responses to climate change.

The implications are clear: if sustainability and climate adaptation are to succeed in complex, rapidly changing environments, we must recognise informal networks as critical infrastructure. These networks may lack institutional credentials, but they possess the social capital, experiential wisdom and adaptive flexibility that top-down interventions often overlook.

Thus, this study makes three key contributions: It repositions informal knowledge as a central epistemic system, not a supplement to formal science; it demonstrates the transformative potential of re-contextualization, where knowledge becomes embedded, owned, and innovated by communities; and it affirms that co-creation must be grounded in relational ethics, trust, and the right to self-define what knowledge matters.

In summary, knowledge that is co-created, re-contextualised, and collectively held is not only more sustainable; it is also more just, resilient, and authentic.

Notes

1. The initial research was conducted as part of the Climate-U (Transforming Universities for a Changing Climate) project, funded by the UK's Global Challenges Research Fund (https://www.climate-uni.com/).
2. "Kikundi cha Utunzaji wa Mazingira na Matumbawe" translates from Swahili as "Group for the Conservation of the Environment and Corals."
3. All names used in this manuscript are pseudonyms, except Mr Chande and Mr Basha, who consented to be identified by name in recognition of their significant contributions to the coral reef restoration initiative.
4. Pombwe is a rural coastal village located in Tanzania, situated within the Pwani Region. It is known for its proximity to coral reef ecosystems and community-based environmental conservation initiatives.
5. "Kikundi cha Mwani na Mikoko (KIMWAMI)" is Swahili for "The Seaweed and Mangrove Group," a local community organisation focused on marine resource conservation and livelihood activities.

Acknowledgements

The research was supported by a grant from the "UCL-Wits-ARUA Strategic Partnership Fund".

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by UCL-Wits-ARUA Strategic Partnership Fund.

Ethical approval statement

Ethical approval was granted by the University College London IOE Research Ethics Committee, and the ethical clearance reference/permit number is: Z6364106

Generative AI tools were used for refinement and corrections of the final draft of our manuscript.

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