Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2026-24.2.009

RESEARCH ARTICLE

Influence of Institutional Dynamics on Knowledge Production in Agroecological Transition in Benin

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ARTICLE INFO

Received: AUG 5, 2026

Accepted: AUG 28, 2026

Keywords

Agroecological Transition
Institutional Dynamics
Knowledge Production
Benin

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ABSTRACT

Knowledge is a structuring element of the agroecological transition, but its production is closely tied to the institutional dynamics that shape interactions between actors, guide research priorities, and organize the mobilization of knowledge. This study examines how Benin's institutional framework influences knowledge production. It follows a qualitative approach based on a documentary review of 23 strategic and regulatory texts published between 2017 and 2025, complemented by a case study of the TAERA agroecological project, chosen for its focus on agroecological transition and its involvement of the main categories of actors engaged in knowledge production. Data from the documentary review and from 12 semi-structured interviews with project actors were analyzed through thematic content analysis using NVivo 14 software. The findings show that Benin's institutional framework encourages the emergence of participatory governance arrangements conducive to co-constructing knowledge, even though it remains marked by fragmented public policies, dependence on project funding, and only partial integration of local knowledge into research processes. The TAERA case study illustrates how these institutional features play out in practice, supporting participatory diagnosis, the collective definition of research priorities, joint validation of protocols, and experimentation with producers, while also revealing the limits of how local knowledge is taken into account across the different stages of the research process. These results suggest that knowledge production depends as much on the coherence of the institutional framework, the stability of funding mechanisms, and the effective integration of producers' knowledge as it does on actors' technical capacities. This points to the decisive role institutions play in supporting agroecological transitions.

INTRODUCTION

Concerns related to climate change, food security, biodiversity loss, and the sustainability of food systems have prompted a rethinking of conventional agricultural systems, paving the way for alternative models of production (Ong and Liao, 2020; Bezner Kerr et al., 2021; Van der Ploeg, 2021). Among these, agroecology stands out as a promising option, distinguished from the conventional model by its processual and transdisciplinary character, and drawing on theoretical and methodological principles aimed at designing and managing sustainable agroecosystems (Norder et al., 2016). It is thus not merely a technical alternative but part of a broader paradigm shift, proposing a transformation of production systems grounded in the integration of ecological, social, and economic principles (Bezner Kerr and Wynberg, 2024).

In practice, agroecology faces numerous constraints among others land tenure insecurity, difficulties accessing appropriate inputs and credit, challenges in marketing produce at remunerative prices, weak technical capacity in soil fertility and pest management, and limited producer organization (Assogba et al., 2022; Adéchian and Baco, 2025; Sithole and Olorunfemi,

2024). Access to knowledge is a particularly major challenge, as confirmed by recent work on agricultural advisory services in Africa, which highlights the persistent weakness of linkages between research, extension, and producers (Mapiye and Dzama, 2024).

Indeed, unlike conventional models based on the linear, standardized diffusion of innovations, agroecological transition relies on the production of contextualized knowledge, built through interactions among actors and adapted to the diversity of local agroecosystems (Magrini et al., 2019; Wezel et al., 2020). It thus draws on a plurality of knowledge forms (scientific, technical, experiential, and local) whose combination enables agricultural systems that are more sustainable, resilient, and adapted to socio-economic and ecological realities (Rossi, 2020; Gliessman, 2018).

In its practical dimension, agroecology cannot therefore be regarded as a set of transferable technologies, but rather as a process of social and collective learning, innovation, and social transformation involving a diversity of actors : farmers, researchers, research institutions, and non-governmental organizations. It is thus centred on the co-construction of knowledge, the integration of local knowledge, in situ experimentation, collective learning, and territorial embeddedness (Nelson et al., 2023; Coolsaet, 2016; Käyhkö et al., 2025; Asare-Nuamah et al., 2025). From this perspective, knowledge appears as a structuring element of agroecological transformations, shaping not only agricultural practices but also forms of organization, relationships among actors, and capacities to adapt to environmental and socio-economic challenges (Adenan et al., 2025).

In this respect, Benin constitutes a particularly relevant case study: its production systems are undergoing agroecological transition (Assogba et al., 2022), evidenced by a proliferation of action-research projects, experimental initiatives, and actor networks that promote the experimentation and dissemination of sustainable practices adapted to local realities (Tapsoba et al., 2020). Often driven by partnerships among research institutions, support organizations, and donors, these initiatives structure local dynamics of knowledge production and sharing. Yet they struggle to generate real impact, as public policy remains largely shaped by the productivist model subsidies for chemical inputs, export-oriented value chains despite official discourse in favour of sustainability (Tapsoba et al., 2020; Gaillard et al., 2025). This institutional lock-in does not merely steer investment and value chains: it also shapes, upstream, which forms of knowledge are deemed legitimate and fundable, to the detriment of agroecological and local knowledge (Gaillard et al., 2025).

Yet the production of knowledge whether scientific or local remains closely shaped by institutions, power relations, dominant scientific norms, and historical-political contexts, as posited by institutionalist and sociological approaches of knowledge (Coolsaet, 2016; Rossi, 2020), the perspective adopted in this article.

Agroecological transition, understood as a process of social transformation, therefore requires an institutional framework capable of supporting sustainable practices through producers' access to production factors and remunerative markets (Wezel et al., 2020; Iocola et al., 2023) together with learning oriented towards knowledge suited to producers' realities. This requires institutional mechanisms capable of strengthening actors' capacities, supporting innovation at different levels, and fostering the diffusion and appropriation of agroecological knowledge.

Given the current shift of agricultural production systems towards greater sustainability and the role played by the institutional framework, a central question emerges: to what extent does Benin's institutional framework foster the production of agroecological knowledge within local transition initiatives? This is the question addressed in this article, from an institutionalist perspective.

This theoretical strand treats the institutional framework as the set of formal and informal rules, norms, organizational arrangements, and governance mechanisms that structure interactions among actors and shape their behaviour (North, 1990).

According to Scott (2014), the institutional framework rests on three dimensions: regulative, normative, and cultural-cognitive. The first refers to formal elements (laws, public policies, enforcement mechanisms), the second to values, social rules, and standards of behaviour, and the third to collective representations, frames of reference, and the forms through which knowledge becomes legitimate. Together, these three dimensions structure the modalities of coordination among actors as well as the processes through which knowledge is produced, circulated, and used.

In the context of agroecological transition, the institutional framework plays a major part in shaping how knowledge is produced: according to Rantamäki et al. (2023), it influences research priorities, the forms actor participation takes, the recognition of local knowledge, funding arrangements, and the mechanisms of collaboration among researchers, producers, and support organizations, an analysis echoed by work on Agricultural Knowledge and Innovation Systems (AKIS), for which the degree of institutional structuring of advisory and research arrangements determines their capacity to support sustainable transitions (Kountios et al., 2024).

In this article, Scott (2014) three dimensions of the institutional framework are operationalized through four analytical components, policy and regulatory arrangements, participatory and governance arrangements, funding and support mechanisms, and institutional recognition of local knowledge, a choice grounded both in this typology and in agricultural innovation system frameworks that distinguish research funding, coordination among actors, and systemic policies (Ragasa et al., 2025). Policy and regulatory arrangements thus correspond to the regulative dimension, participatory arrangements to coordination mechanisms, funding mechanisms to the framework historically centred on investment in research (Scott, 2014; Ragasa et al., 2025), whose stability determines the durability of collaborations (Iocola et al., 2023; Richelle et al., 2025), and recognition of local knowledge to the cultural-cognitive dimension (Coolsaet, 2016; Vysochanska, 2021).

Knowledge production can be understood as an interactive, institutionally embedded social process through which actors mobilize, produce, share, and transform knowledge in order to understand a given reality, solve problems, or guide action (Gibbons et al., 1994; Nowotny et al., 2001). In the context of agroecological transition, its implementation raises several major challenges, which constitute the operational components of the framework.

Operationalizing this process means moving beyond conventional approaches to technology transfer towards participatory mechanisms capable of integrating farmers' knowledge (Coolsaet, 2016) ; facilitating the co-creation of knowledge through sustained interaction and collaborative governance (Rossi, 2020; Magrini et al., 2019); stabilizing funding mechanisms to support in situ experimentation and the capitalization of experience (Iocola et al., 2023) ; strengthening participatory-research skills in the face of persistently weak linkages between research, extension, and producers (Mapiye and Dzama, 2024; Asare-Nuamah et al., 2025); and, finally, genuinely involving producers in defining research priorities; a precondition for the relevance and appropriation of the knowledge produced (Ajates et al., 2025).

Knowledge production, in the end, depends as much on actors' technical capacities as on the institutional, organizational, and political conditions that structure interactions, the recognition of knowledge, and collective learning. What influence, then, does Benin's institutional framework exert on knowledge production through co-creation, collective learning, in situ experimentation, knowledge integration, the setting of the research agenda, and funding?

Taken together, the analytical framework of the article rests on an institutionalist perspective according to which the institutional framework structures the conditions under which actors interact, coordinate their actions, and mutually recognize each other's knowledge, thereby shaping the co-creation of knowledge, collective learning, in situ experimentation, knowledge integration, the setting of the research agenda, and funding. The article thus hypothesizes that the more participatory, stably funded, and attentive to local knowledge these institutional arrangements are, the more they foster knowledge production that is contextualized, shared, and sustainable.

RESEARCH METHODOLOGY

The study adopted a qualitative, interpretive approach, particularly well suited to understanding the interactions among institutional arrangements, actors, and knowledge processes.

Data collection drew on a documentary review, intended to characterize the formal institutional framework, and on semi-structured interviews conducted with two categories of actors: on the one hand, project managers, agricultural technicians, and producers who took part in the co-design, experimentation, and dissemination of agroecological practices; and on the other, institutional actors responsible for agricultural research and advisory services, in order to gain a broader understanding of the institutional framework and how it is implemented on the ground. This triangulation of sources strengthened the credibility of the findings by cross-checking institutional arrangements against observed practices (Patton, 2015).

The documentary review focused on the main regulatory and strategic texts governing agricultural research, innovation, and agroecological transition in Benin over 2017–2025, a period marked by growing attention to agroecological issues. Documents were collected from official databases (FAOLEX, the Ministry of Agriculture, Livestock and Fisheries ((MAEP- Ministère de l'Agriculture, de l'Élevage et de la Pêche), and National Institute of Agricultural Research of Benin (INRAB - Institut National des Recherches Agricoles du Bénin) portals, government platforms) according to three criteria drawn from the Political, Economic, Social, Technological, Environmental and Legal (PESTEL - Politique, Économique, Sociale, Technologique, Environnementale et Légale) framework: being an official document issued by a recognized institution, addressing agricultural research, innovation, or agroecology, and being in force or having shaped public policy during the period. A total of 23 documents were retained (6 laws, 9 decrees, 5 strategies, 2 policies, 1 ministerial order).

The Agroecological Transition through Agricultural Research (TAERA - Transition Agroécologique par la Recherche Agricole) project served as the empirical setting for two reasons: first, it specifically targets the conditions for agroecological transition among rice and vegetable producers in southern Benin, making it representative of the object of study; second, its implementation mobilizes the categories of actors central to the analytical framework offering direct empirical access that reinforces the documentary analysis. Purposive sampling favoured actors directly involved in the project as well as institutional actors with in-depth knowledge of the field, with data collection continuing until theoretical saturation was reached. A total of 12 actors were interviewed (2 project managers, 2 agricultural technicians, 1 Territorial Agencies for Agricultural Development (ATDA -Agences Territoriales de Dévelopmement Agricole) officer, 7 producers), covering the institutional framework, the mechanisms of knowledge production and dissemination, interactions among actors, and the factors fostering or constraining agroecological transition.

Data were analysed using an approach combining thematic documentary analysis and content analysis of the interviews; documents and interview excerpts were imported into NVivo 14 and subjected to three complementary approaches: treating official documents as qualitative sources (Bowen, 2009), structuring coding and categorization (Bardin, 2013), and distinguishing manifest from latent content (Graneheim and Lundman, 2017). The analysis proceeded in four stages (Paillé and Mucchielli, 2021): decontextualization (identifying units of meaning using a grid built from the PESTEL framework and the four components of the institutional framework, supplemented by emergent codes), recontextualization (checking the consistency of coded excerpts), categorization (grouping codes into thematic categories), and synthesis (identifying convergences, complementarities, and gaps).

On ethical grounds, participants were informed of the research objectives and gave their free, informed consent; data were processed confidentially and anonymized.

RESULTS

Descriptive Analysis of the Institutional Framework

Policy And Regulatory Arrangements

Benin's institutional framework rests on a body of laws, strategies, and decrees structuring agricultural development, natural resource management, and agricultural research (Table 3). The Framework Law on Agriculture and Food and Nutrition Security (LOASAN-Loi d'Orientation Agricole et de la Sécurité Alimentaire et Nutritionnelle) (Law No. 2022-14) sets out the fundamental principles of sustainable agricultural development and establishes an organic-quality system; the National Strategy for the Development of Digital Agriculture in Benin (SNDAEB-Stratégie Nationale de Développement de l'Agriculture Digitale au Bénin), for its part, dedicates an institutional framework to ecological agriculture. The Strategic Plan for Agricultural Sector Development (PSDSA-Plan Stratégique de Développement du Secteur Agricole) and National Agricultural Investment and Food and Nutrition Security Plan (PNIASAN-Plan National d'Investissements Agricoles et de Sécurité Alimentaire et Nutritionnelle) steer the sector towards sustainable resource management and climate-proofed investment, with the National Agricultural Research Programme (PNRA-Programme National de Recherche Agricole) defining research priorities and funding. Environmental laws (Framework Law No. 98-030, Law No. 91-004, Law No. 93-009) govern natural resource protection, phytosanitary control, and forest conservation; Decrees No. 2020-212 and No. 2021-532, in turn, establish National Agricultural Research System (SNRA- Système National de Recherche Agricole) and INRAB as the pillars of agricultural research.

Table 1: Policy and regulatory arrangements and their relevance to agroecology

Documents	Relevance to agroecology
LOASAN (Law No. 2022-14)	Fundamental principles of agricultural development and actor participation (Art. 2–3); integrated agricultural development accounting for agroecological specificities (Art. 8); organic quality system: certification, traceability, labelling (Art. 26–27); adaptation of agricultural training (Art. 88); orientation of research towards sustainability (Art. 91);
SNDAEB (2023–2030)	Institutional and legal framework dedicated to organic and ecological agriculture; 16 ministries involved (dispersed governance)
PNRA (2017–2022)	Institutional and financial framework for agricultural research; national R&D orientations
Framework Law No. 98-030, Law No. 91-004, Law No. 93-009	Environmental protection; phytosanitary control; forest conservation
Decrees No. 2020-212 and No. 2021-532	Establishment of SNRA-Bénin and INRAB as research coordination structures

It appears that Benin's institutional framework grants agroecology a degree of formal recognition, with several actors regarding the LOASAN as one of the few framework laws in West Africa to establish an organic-quality system that explicitly steers research towards sustainability. Yet the proliferation of instruments (LOASAN, SNDAEB, PSDSA, PNIASAN, PNRA) and the involvement of some fifteen ministries in the SNDAEB alone point to a regulatory fragmentation liable to dilute, rather than reinforce, the operational reach of these orientations.

This regulatory fragmentation weakens, first and foremost, the setting of the research agenda, as the multiplicity of instruments makes it difficult to establish a clear, effective hierarchy of agroecological research priorities. As one INRAB researcher observes: "When several research priorities compete for limited resources, research centres cannot arbitrate on their own. They then defer to ministerial guidance, so that scientific priorities end up reflecting political and budgetary trade-offs more than the needs expressed by actors on the ground." This observation is echoed by the Director of PAPA, for whom "the various strategies broadly pursue the same objectives, but they are often drawn up to meet the requirements or seize the opportunities offered by technical

and financial partners. This logic leads more to an accumulation of documents than to the construction of a coherent national strategy capable of durably steering research priorities."

Participatory Governance Arrangements

Participatory governance arrangements organize consultation at complementary scales within this framework. The National Steering and Monitoring Committee (CNOS), established by the LOASAN (Art. 79–80) and formalized by Decree No. 2021-376, is the national space for dialogue among institutions, producers, and civil society. At the regional and sectoral levels, the Regional Research and Development Committee (CRRD-Comité Régional de Recherche et Développement) and the CSRD structure consultation through the Integrated Agricultural Research for Development (IAR4D-Recherche Agricole Intégrée pour le Développement) approach, fostering co-construction via multi-stakeholder platforms. Territorial coordination falls to the ATDA, while the SNRA pools resources among research institutions, universities, and farmer organizations.

Table 2: Participatory governance arrangements

Documents	Relevance to agroecology
LOASAN (Art. 79–80, 100)	Establishment of the CNOS (research institutions, producers, private sector, civil society); consultation mechanisms for agricultural value chains
Decree No. 2021-376	Institutionalization of the CNOS (23 members) as a framework for dialogue and participatory governance
PNRA (2017–2022)	Agricultural Research Management Cycle (CGRA); IAR4D approach based on innovation platforms; SNRA–ATDA partnership
Decree establishing the ATDA (2017)	Territorial coordination through Agricultural Development Hubs
Decree No. 2020-212 (SNRA-Bénin)	Inter-institutional mechanism for consultation and resource pooling

However, the stacking of these bodies (CNOS, CRRD/CSRD, ATDA) raises the question of how they actually interlock, as nothing in the texts specifies how priorities relayed locally through the ATDA are arbitrated at the CNOS level, leaving open the question of how genuine producer participation really is.

In concrete terms, the IAR4D approach and the innovation platforms it promotes are especially well suited to agroecology, whose logic of knowledge co-construction precisely calls for this type of multi-stakeholder space. By design, this approach is meant to work from the bottom up: as a Directorate of Agricultural Advisory Services, Innovation and Entrepreneurial Training (DCAIFE-Direction du Conseil Agricole, des Innovations et de la Formation Entrepreneuriale) officer describes it, "the IAR4D approach rests on the active participation of value-chain actors within innovation platforms. In theory, research questions originate with producers, who identify concerns on the ground. These needs are then relayed through the communal units and the ATDA up to INRAB, where researchers design appropriate protocols. This approach fosters the diffusion of knowledge, improves the adoption of innovations, and strengthens their fit with local realities." This gap between design and practice is confirmed by the Director of PAPA, for whom "in theory, innovation platforms are designed to foster the co-construction of knowledge. In practice, however, they are often used simply as mechanisms for transferring or disseminating already-developed technologies, which diverts them from their original purpose. Moreover, these platforms are generally set up on project initiative and rely heavily on external funding. Once projects end and partners withdraw, very few platforms actually keep functioning, for lack of durable ownership by local actors."

This arrangement makes co-creation directly possible, but the absence of explicit arbitration between levels, together with dependence on project funding rather than durable local ownership, once again weakens the setting of the research agenda.

Funding and Support Mechanisms

These mechanisms combine domestic funding and external support. The National Fund for Environment and Climate (FNEC-Fonds National pour l'Environnement et le Climat) supports environmental and climate initiatives and the National Fund for Agricultural Development (FNDA-Fonds National de Développement Agricole) finances agricultural investment and producer advisory services, while the PC2D steers broader public investment in the sector. The National Climate Change Management Programme (PNGCC-Programme National de Gestion des Changements Climatiques) and the Nationally Determined Contribution (NDC–Contribution Déterminée au niveau National mobilize climate finance for adaptation, complemented by technical and financial partners (IFAD, the World Bank, the European Union, AFD, GIZ, Enabel, SNV); Decree No. 2022-286 funds continuing vocational training, and MAEP's technical services provide on-the-ground support.

Table 3: Funding and support mechanisms and their relevance to agroecology

Documents	Relevance to agroecology
Law No. 2022-14 of 19 July 2022 (LOASAN)	State budgetary commitment to agricultural research (Art. 101); research funding without a defined amount or access mechanism for producers (Art. 95); support for the viability of agricultural research and advisory services (Art. 98)
National Agricultural Research Programme (PNRA 2017–2022)	Competitive funds through calls for proposals and commissioned projects; partnerships with TFPs (World Bank, IFAD, FAO, GIZ, AFD);
Decree No. 2017-304 of 21 June 2017 (FNDA)	Three windows: grants, non-financial services, financial services; applied agricultural research eligible for calls for proposals; partnerships with ADPME, CDC-Bénin, and SoNaMA
Decree No. 2012-140 (FNRSIT) / Decree No. 2024-1067 (ABRI)	Funding for scientific research and innovation, dissolved in 2024 and replaced by ABRI in 2024
PNIASAN (2017–2021)	Tripartite funding: national budget, external funding, gaps covered by TFPs; priority given to family farms and the private sector
SNDAEB (2023–2030)	TFP funding (PADMAR/ProCaR, ProSOL/GIZ, ProSilience/GIZ, PACOFIDE); one-off actions (training, inputs, advisory support)
FNEC (Decree No. 2017-128, updated by No. 2021-191)	Funding for agricultural practices with climate/environmental benefits
ECOWAS inventory report	Local financial system: banks, microfinance institutions, village savings and credit associations, public and private mechanisms; calls for proposals: equipment grants, credit funds, IFAD support via the GCF

This coexistence of domestic public funding (FNEC, FNDA) and external funding reproduces, at the level of funding, the same institutional dispersion already noted for the regulatory arrangements. As each donor operates according to its own priorities and timelines, the stability and duration of funding directly affect in situ experimentation and the capitalization of learning, two dimensions central to the knowledge-production process. This mismatch between funding calendars and agricultural realities is illustrated by the Director of PAPA, for whom *"it happens that experiments cannot start because the project has not yet been entered into the Annual Budgeted Work Plan, even though agricultural seasons do not wait."* This dependence also weighs on the orientation of scientific priorities, as noted by the Director of an Agricultural Research Centre (CRA): *"researchers are often led to orient their work towards funded topics in order to obtain resources,"* which limits the capacity to build a coherent, sustainable national research strategy.

This instability and dispersion of funding sources weaken actors' capacity to sustain, over time, the intensity of interactions and the depth of experimentation needed for knowledge production grounded in field practice.

Institutional Recognition of Local Knowledge

Several further instruments valorize indigenous knowledge, each within its own domain: Framework Law No. 98-030 recognizes local actors' involvement in environmental management, the National Pastoral Charter preserves herders' traditional knowledge, and the National Languages Promotion Policy and Agricultural Advisory Strategy facilitate producers' access to knowledge in their own languages. Decree No. 2020-212 and Ministerial Order OPA-137 integrate

farmer organizations into the research architecture, while Farmer Field Schools and innovation platforms promote local knowledge through horizontal exchange.

Table 4: Contribution to the recognition of local knowledge

Documents	Contribution to the recognition of local knowledge
Framework Law No. 98-030 of 12 February 1999 on the environment	Recognizes the participation of local actors in natural resource management, fostering the consideration of indigenous knowledge.
National Pastoral Charter of Benin	Valorizes herders' traditional knowledge and practices in pastoral resource management.
National policy for the promotion and development of national languages	Fosters the dissemination of agricultural knowledge in national languages, improving producers' ownership of it.
National agricultural advisory strategy	Encourages the use of local languages and exchange between producers and agricultural advisors, contributing to the valorization of local knowledge.
Decree No. 2020-212 (SNRA)	Provides for the participation of professional farmer organizations within the agricultural research architecture, opening a space for local knowledge to be expressed.
Order No. 137/MAEP/DC/SGM/DRH/DPQC/SA of 17 June 2021 (recognition of farmer organizations)	Strengthens the institutional representation of farmer organizations, facilitating the relay and valorization of producers' knowledge.

With respect to agroecology, these arrangements provide real but largely declarative recognition of local knowledge: none of the texts cited establishes a binding mechanism for integrating this knowledge into research priorities, unlike what the IAR4D approach provides for participation. This asymmetry is visible even within the experimental design itself, as described by a researcher at the pest-research laboratory: "During experiments, we compare producers' indigenous practices with the treatments proposed by research. The control follows local practices alone, and we then analyse the results to identify the constraints limiting their effectiveness or their diffusion." Farmers' knowledge thus serves as a baseline to be improved upon, rather than as a resource integrated from the outset into protocol design, raising the question of whether the institutional framework does not implicitly help establish a hierarchy between scientific and local knowledge, even where the latter is formally "recognized."

This declarative recognition, lacking any binding mechanism, structurally limits the integration of knowledge into the production process and results in a time lag in the validation of farmers' practices. A DCAIFE officer states: *"The capitalization of an innovation does not happen immediately. We wait for producers to use it for three to five years. If the results are consistent and farmers confirm the benefits, we compile these experiences into technical sheets and reference guides. That is the point at which the practice becomes a 'proven' technology ready to be scaled up."* Local knowledge is thus recognized only after the fact, once it has been filtered and reformulated into technical sheets and institutional reference materials, rather than being mobilized upstream.

Taken as a whole, the documentary analysis shows that Benin's institutional framework mobilizes regulatory, participatory, financial, and cognitive arrangement capable of influencing each of the six dimensions of the knowledge-production process defined in the analytical framework, but it also reveals a recurring tension between the richness of these formal arrangements and how effectively they interlock, a tension that the TAERA case study allows us to examine concretely.

An Institutionalized Process of Agroecological Co-Innovation

Process of Knowledge Production in the TAERA Project

The knowledge-production process within the TAERA project unfolds through seven iterative stages, combining diagnosis, experimentation, and collective validation, with each stage offering an opportunity to co-construct knowledge and innovation.

Participatory Diagnosis

The process begins with a field diagnosis aimed at identifying the actual constraints and the solutions already used by producers in vegetable and rice production, conducted directly with producers by PhD candidates and researchers using a participatory approach. As the project coordinator reports, *"it's a meeting between researchers, ourselves, and producers,"* which brought to light constraints, some of which had not been anticipated in the initial project document. For vegetable growing, bacterial wilt and pest management emerged as priorities; for rice, irrigation management and fertilizer use were the main concerns.

Feedback And Validation Of The Diagnosis

The results of the participatory diagnosis are then presented back to producers for validation, through workshops bringing together a wide range of actors (researchers, producers, representatives of the FéNoMA and CCRB federations, ATDA staff, INRAB researchers), where each participant can voice their views, challenge, or add to what is proposed.

Collective Definition of Research Themes

Building on the validated results, research themes are defined collectively during workshops, with priorities established through ranking and a show of hands ; work in mixed groups (academics, extension staff, producers) allows each category to express its views before a plenary synthesis settles on themes by consensus. The exercise is not without friction : as one PhD candidate reports, *"we had to find ways, by any means necessary, to convince as many people as possible,"* with some actors getting involved without even waiting to be paid, so urgent did the issues raised seem to them.

Development and Validation of Research Protocols

Once themes are settled, research actors develop protocols combining data from the participatory diagnosis with insights from the scientific literature; these are then submitted for validation by the full set of actors during a roughly four-day workshop, which can result in the protocol being sent back for redesign if the approach is judged unsuitable. An episode involving a cabbage–tomato intercrop, reported by a PhD candidate, illustrates this mechanism: "initially chosen on the basis of the literature, it was rejected by producers on the grounds that both crops were already highly exposed to pests. Researchers ultimately opted for a tomato–onion combination, judged more suitable to the local context."

On-Farm Experimentation

Validated protocols are then implemented in the field under real production conditions, in two configurations : controlled sites under the direct supervision of researchers, and plots run by volunteer producers identified by the federations according to criteria of availability, accessibility, and openness to innovation. Producers actively monitor the progress of the trials and assess results according to their own criteria (for rice, taste, aroma of the varieties, response to pests). Action-research groups meet periodically on-site to discuss intermediate results and propose adjustments, with exchanges continuing between meetings via WhatsApp groups. Mid-term and end-of-project feedback workshops bring together a broader panel (municipal authorities, other agroecological projects in the area such as Prosilience and Défia, ATDA staff). TAERA has also introduced a notable change in coordination practices : PhD candidates now take part in the value-chain reviews organized by the ATDA, which was not previously the case.

Transfer to Farmer Field Schools And Dissemination

Once validated at the experimental sites, innovations are transferred to Farmer Field Schools (FFS), opening access to producers who did not take part in the initial trials. Run by trained lead farmers, the FFS reproduce validated practices and teach them to groups of at least twenty-five producers per session. The CCRB has thus run around ninety Farmer Field Schools based on the project's innovations, reaching areas well beyond the initial experimental sites.

Capitalization and Institutionalization of Innovations

An assessment of the practices adopted by FFS participants was carried out at the end of the cycle to measure actual changes in production systems. Technical sheets and capitalization notes were produced, and multi-stakeholder innovation platforms (producers, researchers, processors, traders, organic-input producers), each with its own charter, were established for each value chain. The fact that some of these platforms have continued to operate independently after funding ended points to genuine ownership by the actors involved.

This descriptive account of the knowledge-production process within TAERA nonetheless leaves one question open : how do the institutional dynamics identified above concretely play out through this process? This question is examined in light of the institutional arrangement framing the project, the methodology guiding it, and the financial constraints shaping its scope.

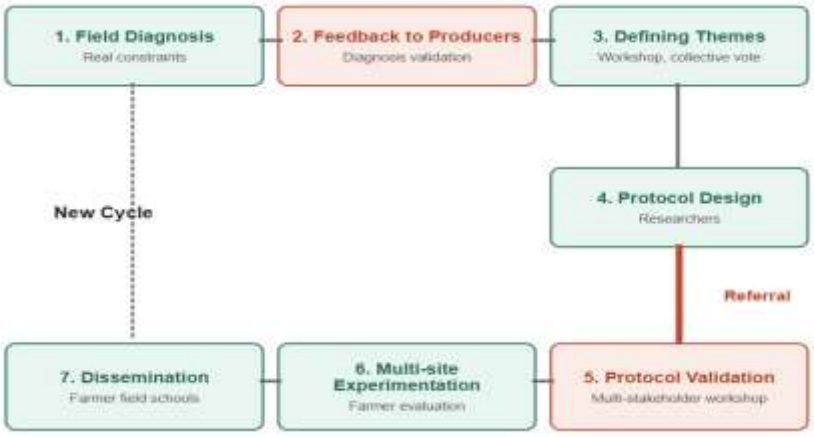

Figure 1: Knowledge-production cycle within TAERA network

A Multi-Stakeholder Institutional Arrangement

The TAERA project, implemented in Benin, is led by Enabel under the European DeSIRA initiative and funded by the European Union. It aims to promote agroecological innovation through participatory, multi-stakeholder approaches, supporting the co-construction of technical solutions adapted to local realities. The project thus constitutes a privileged vantage point from which to observe knowledge-production processes in real conditions, allowing the formal institutional arrangements analysed in section 4.1 to be empirically confronted with their actual implementation.

Analysis of the TAERA project shows that agricultural knowledge production is not an autonomous or strictly scientific process, but one embedded in a multi-actor institutional framework governed by norms and arrangements. This framework brings together coordinating institutions (the European Union, which funds the project through the DeSIRA Plus programme, and Enabel, responsible for implementation), research and training institutions (the University of Abomey-Calavi, the University of Parakou, INRAB), producer organizations (FeNOMA for vegetable growing, CCRB for rice), and public and territorial actors (ATDA, municipalities) involved in implementing, monitoring, and validating activities. This framework functions as a system of constraints and opportunities that shapes methods, interactions, and the forms of knowledge produced.

An Imposed Methodology, an Appropriated Co-Construction

The methodological approach adopted by the project was not the result of a choice made by the project teams but was imposed upstream by the DeSIRA programme. As the coordinator explains: “the guiding thread was participatory action research, already built into the TAERA project, so we

didn't really have much choice to make. We just had to implement it, to operationalize that participatory action research." Co-construction thus appears as a norm set in advance, the coordinator adds: "since the spirit of the project was clear, we had to work in co-construction with several actors," which required defining everyone's role in order to facilitate exchange.

To this end, collaboration among institutions is governed by grant agreements that precisely define each party's roles and responsibilities. As the project manager states : "The agreements define everything. […] People already knew what to do ; in that agreement, everything was already mapped out so that people could work together." These arrangements stabilize interactions but also introduce inclusion criteria that go beyond technical competence: "Criteria that aren't all technical, you know. It can be fiscal… being registered, having such-and-such a document." Participation in knowledge production is thus conditional on prior institutional recognition, illustrating the tension between formal recognition and the genuine integration of local knowledge.

The configuration of actors nevertheless remains partially flexible in practice : although some partners are identified in advance, adjustments are made according to realities on the ground, with the choice to work with value-chain federations rather than an umbrella organization initially planned reflecting a search for technical relevance. The coordinator notes in this regard that "actors are identified who will take part in the project, but the process is long, and once the project starts, if things need updating, they get updated," illustrating the arrangement's capacity to adapt. Working with these organizations facilitates the mobilization of actors, as the coordinator explains: "having the federations themselves carry things forward was simpler." This structuring, however, also reinforces the role of institutionally legitimate actors in validating knowledge.

Financial constraints weighing on the intensity of activities

Financial constraints also weighed on the scope of activities, illustrating the tension between funding stability and the capitalization of learning, with limited resources affecting the intensity of interactions and the depth of experimentation, as a facilitator explains: "If we'd had more funding, we would have held more meetings, but funding was really limited." To adapt, the team relied on pooling resources: "We tried to do things jointly to limit costs."

Institutional arrangements and spaces for co-construction

The TAERA project structured its approach around participatory action research, imposed upstream by the DeSIRA programme, which placed all actors within a collaborative logic. To operationalize this, the project built a heterogeneous multi-institutional network (funding institutions, research institutions, producer organizations, territorial actors), coordinated through grant agreements that precisely define each party's role, while retaining enough flexibility to adjust to realities on the ground.

This organizational framework made possible an iterative process grounded in farmers' practices (diagnosis fed back to producers, collective definition of themes, protocol validation by farmers with the possibility of redesign, assessment of results against their own criteria). Farmers' knowledge thus does not come into play downstream as mere validation, but upstream as a structuring resource for research.

The co-constructed innovations were then disseminated through Farmer Field Schools, multiplying learning beyond direct participants and embedding diffusion within horizontal networks. The TAERA case thus illustrates how a strongly formalized arrangement (agreements, an imposed methodology) can nonetheless make room for genuine spaces of co-construction, qualifying the strictly constraining reading suggested by the documentary analysis, while also confirming the tension between institutional structuring and actor autonomy identified in the theoretical framework.

DISCUSSION

An Institutional Framework that Shapes the Agenda and the Legitimacy of Knowledge

Benin's institutional framework, the findings show, functions at once as a constraint and an opportunity for knowledge production. Policy, economic, and regulatory frameworks steer scientific priorities towards agroecology and climate resilience while also opening up participatory spaces.

These mechanisms directly shape epistemic processes, determining what counts as relevant knowledge and how it is produced (Rantamäki et al., 2023). Within TAERA, this influence translates into an upstream imposition of methods, actors, and modes of interaction (participatory action research, formalized agreements), which structures the conditions of co-production ex ante echoing Scott's (2014) framework and Käyhkö et al. (2025) research on the gradual and uneven institutionalization of co-production. The selection and validation of knowledge also constitute a central institutional mechanism: participation is conditional on institutional recognition criteria that shape the diversity of knowledge mobilized and its legitimacy (Francesco and Guaschino, 2020). Within TAERA, these explicitly formalized criteria reinforce the legitimacy of the knowledge produced, at the risk of excluding certain actors or forms of knowledge.

Funding as a Determinant of Experimentation snd Learning

The results indicate, interactions are organized and stabilized by formal arrangements that define roles and frame exchanges, which fosters coordination but can limit flexibility and adaptation to local dynamics, a finding that echoes Neef and Neubert's (2011) work on the tension between the rigidity of donor-mandated work plans and the need for continuous adjustment to local priorities. This tension materializes concretely in TAERA through budgetary constraints that limited the intensity of interactions and the depth of experimentation, forcing the team to pool resources with other initiatives, a configuration that resonates with Guleid et al. (2025) analysis of the "playing field" that institutional arrangements define for actors. These findings support Iocola et al. (2023) recommendation to extend the duration of funding, a necessary condition for stabilizing co-production collaborations.

Recognition of Local Knowledge: Real But Non-Binding

Knowledge production is also embedded in dynamics of circulation and translation of knowledge, which depend on institutional arrangements among actors (Evans and Scarbrough, 2014). This translation relies on arrangements such as actor networks, support organizations, and coordination mechanisms, which either facilitate or constrain the circulation of knowledge across levels of the system. For Coolsaet (2016), the recognition of farmers' knowledge often remains little more than a facade of cognitive justice, without genuine empowerment of producers in defining priorities, a reading confirmed by the documentary analysis of Benin's framework, in which no text imposes a binding mechanism for integrating local knowledge. Formalization fosters the structuring of knowledge flows, while the informal character of certain arrangements allows for finer-grained adaptation to local contexts, findings corroborated by recent work in Burkina Faso: Tega et al. (2025) on regional variation in the density of ties among actors, and Ebile et al. (2026) on the dependence of the adoption potential of agroecological innovations on local institutional arrangements.

Structuring Versus Flexibility: A Cross-Cutting Tension

Institutions, according to these findings, are not fixed structures but evolving frameworks shaped by interactions among actors, an observation. Within TAERA, actors adapt these arrangements to constraints and opportunities, as illustrated by the replacement of an umbrella organization with more operational value-chain federations. These dynamics nonetheless reveal a tension between institutional structuring and actor autonomy: the strong institutionalization of the TAERA process can standardize the practices and knowledge produced, at the risk of limiting their contextualization, echoing McKay et al. (2024) political economy of agroecological transitions, for

whom institutions and public policy constitute one of five structuring dimensions of such transitions, alongside labour, markets, and social organization.

CONCLUSION

This article examined the extent to which Benin's institutional framework influences knowledge production in the context of agroecological transition, combining documentary analysis with semi-structured interviews around the TAERA project as a case study. The findings show that this framework acts simultaneously as a constraint and a resource. Regulatory fragmentation weakens the research agenda, even though agroecology enjoys genuine formal recognition. Participatory arrangements (CNOS, CRRD/CSRD, IAR4D) make co-creation possible, but do not always arbitrate between competing priorities, and the recognition of local knowledge, while real, stops short of being binding. The TAERA case confirms and nuances these findings: the project's strong formalization structures the legitimacy of the knowledge produced and coordination among actors, yet still leaves genuine space for co-construction.

The article's theoretical contribution lies in showing that institutions do not shape knowledge production uniformly across its different dimensions. They structure the research agenda and the legitimacy of knowledge directly, they condition experimentation and learning indirectly through funding stability, and they leave the recognition of local knowledge at a declarative rather than binding level. On the ground, these findings point to a rebalancing between institutional structuring and flexibility, longer funding cycles, and clearer coordination among the many public and technical partners involved.

This study has limitations : relying on a single in-depth case restricts the generality of its conclusions. Future research could extend the comparison to other agroecological initiatives and other West African countries facing similar institutional configurations.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTIONS

FFFS and ASCG conceived the idea, designed the study and developed the methodology. FFFS collected the data and analysed these data with ASCG contribution. They contributed together to the critical revision of the manuscript. ASCG and FFFS edited the final version of the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS

The authors thank all actors who generously gave their time for the interviews and shared their experience for this study. The authors also thank the reviewers for their comments on this manuscript.

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