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The Institutional Synthesis of Local Wisdom and CPR Principles: The Sustainability of Kemiri-Coffee Agroforestry in Kawae Community Forest, Bima

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Abstract. *Bima Regency, West Nusa Tenggara, faces significant environmental degradation due to the widespread conversion of protected forest areas into seasonal corn fields, which increases flood vulnerability. This study analyzes the sustainability of the community-based natural resource management model in the Kawae Block Community Forest (HKm), managed by the Forest Farmers Group (KTH) Oi Rida, by integrating Elinor Ostrom's Common-Pool Resources (CPR) theory with the local wisdom of Ngaha Aina Ngoho. Using a qualitative descriptive approach with a case study design, data were collected through in-depth interviews, participant observation, and document analysis. The findings indicate that the sustainability of HKm Kawae is driven by two synergistic factors: (1) Economic-Ecological Rationality, where the candlenut-coffee agroforestry model provides stable household income (30–50%) while performing essential ecological functions such as carbon sequestration and water conservation, fulfilling Ostrom's principle of rule congruence (P2); and (2) Social-Institutional Legitimacy, where the local philosophy of Ngaha Aina Ngoho has been institutionalized into informal rules, strengthening collective compliance, supporting graduated sanctions (P6), and embedding conservation ethics into daily practice. The study concludes that the long-term sustainability of community-based forest management depends not only on technical-economic viability but also on the deliberate integration of local cultural values into governance institutions. This model offers a replicable framework for other regions in NTB and similar contexts facing land-use conflicts and environmental pressure.*

Keywords: *Agroforestry of Candlenut-Coffee; Community Forest (HKm); Scarlet Witch; The Principles of CPR; Conservation.*

INTRODUCTION

West Nusa Tenggara Province (NTB), especially *Bima Regency*, is often in the national spotlight due to high levels of forest land degradation and vulnerability to flash floods (Juhriati & Erham, 2024; Susanto, 2024). This damage is mostly caused by the practice of converting protected forest areas (*HKL Blok Kawae*) for seasonal crop cultivation, especially corn (Ahyar et al., 2024). Short-lived corn planting cycles, which require total land clearing and the use of massive chemical fertilizers, damage soil structure, reduce carbon and hydrological reserves, and eliminate the carrying capacity of ecosystems (Sari et al., 2025). As a result, this area is prone to erosion and fails to function effectively as a watershed for *Bima City* (Abidinsyah et al., 2019; Korol & Korol, 2025).

Amid this threat of degradation, the Oi Rida Forest Farmers Group (KTH) in *HKm Kawae Block* emerged as a sustainability anomaly. Through the Social Forestry scheme (Minister of Environment and Forestry No. 9 of 2021), this KTH adopts agroforestry systems of Pecan (*Aleurites moluccana*) and Coffee (*Coffea spp.*). This model differs substantially from the corn cultivation practice. The Candlenut-Coffee agroforestry model combines dual functions: economic (income from Non-Timber Forest Products/NTFPs) and conservation (shade provision, soil and water conservation, and carbon reserves) (Hayyun et al., 2018; Supriadi & Pranowo, 2015).

Although the agroforestry model is technically recognized, studies explaining why local communities maintain collective compliance with these systems—especially under economic pressures—remain limited (Seftiani et al., 2025). *HKm Kawae* provides an empirical laboratory to test the sustainability hypothesis of resource governance. This study employs the framework of Elinor Ostrom's principles of design for shared ownership resource management (CPR) (Ostrom, 1990; Yatim et al., 2020; Fleischman et al., 2014). Among the eight Ostrom principles, two key aspects shape *HKm* governance: (P2) Rule Conformity (between Appropriation and Provision) and (P6) Tiered Sanctions. This study focuses on the role of *Bojo Local Wisdom*, *Ngaha Aina Ngoho*, in institutionalizing and legitimizing CPR principles within KTH Oi Rida. *Ngaha Aina Ngoho* is the cultural ethos of the Bima people, emphasizing values such as hard work, anti-cheating, and protecting the homeland (Taufiqurrahman & Suharno, 2021; Juhriati & Erham, 2024). The novelty of this research lies in its integrative analysis, synthesizing Ostrom's institutional design principles with the specific local wisdom of *Ngaha Aina Ngoho* to explain the sustainability mechanism of the Candlenut-Coffee agroforestry system. It transcends purely economic or ecological assessments to reveal the socio-cultural institutional drivers of collective action (Kumar & Shoshta, 2024; Longo et al., 2021).

The research objectives are to analyze the economic-ecological determination of the Candlenut-Coffee agroforestry model as fulfillment of Ostrom's Rule Conformity Principle (P2) at *HKm Kawae*, and to analyze the transformation of *Ngaha Aina Ngoho*'s local wisdom from cultural ethics into an informal institution that supports the institutional sustainability of KTH. The benefits and implications of this research are multifaceted. Theoretically, it contributes to the literature on common-pool resource management by providing a concrete case of how universal design principles interact with and are reinforced by unique local cultural institutions. Practically, the findings offer a replicable model for sustainable forest management that balances livelihood needs with conservation—a crucial approach for regions like *NTB* facing similar environmental pressures. For policymakers, the study underscores the importance of recognizing and integrating local wisdom into formal social forestry schemes to enhance legitimacy and compliance. For the local community, this research documents and validates their traditional knowledge and practices, potentially strengthening their position in natural resource governance.

MATERIALS AND METHOD

This study used a descriptive qualitative approach with a single case study strategy in the Community Forest (HKm) Kawae Block, Wowo District, Bima Regency, NTB. Secondary data included KTH documents, the Regulation of the Minister of Environment and Forestry on Social Forestry, data on the contribution of Candlenut/Coffee farming income (Awaludin et al., 2024), and studies related to the local wisdom of Ngaha Aina Ngoho (Juhriati & Erham, 2024; Taufiqurrahman & Suharno, 2021). The analysis was carried out interpretively, linking data on the contribution of Candlenut-Coffee income with the conservation function (provision) to test economic rationality (P2). Institutional analysis used Ostrom's CPR Design Principles framework to assess the effectiveness of HKm rules and identify how the values of Ngaha Aina Ngoho were institutionalized to ensure collective compliance. Data analysis was conducted thematically and interpretively through stages of data organization and transcription, two-cycle thematic coding (descriptive and pattern), and application of the

economic-ecological and institutional analysis frameworks. The economic-ecological framework evaluated the alignment of the Candlenut-Coffee agroforestry model with Ostrom's Rule Conformity Principle (P2), while the institutional framework analyzed the transformation of Ngaha Aina Ngoho values into informal institutions that reinforced collective compliance and tiered sanctions (P6, Ostrom).

RESULTS AND DISCUSSION

Analysis of the Coffee-Candlenut Agroforestry Model: Economic-Ecological Determination

HKm Kawae provides a strong argument foundation: the primary goal of natural resource management is to meet economic needs, and when management models integrate economic income and ecological conservation, they must be replicated to achieve massive sustainability.

The Candlenut-Coffee agroforestry model in Kawae has been shown to technically provide a rational dual function:

1. Appropriation Function (Economy): Pecan and Coffee products function as superior NTFPs, where their contribution to the household income of cultivating farmers is reported to be in the range of 30 to 50 percent (Awaludin et al., 2024). This income stability, supported by the long productive life of the crop, creates a superior incentive to the promise of short-term profits from the seasonal corn commodity.
2. Provision Function (Ecological): Pecans and coffee grown under shade or polycultured provide crucial ecosystem services: conservation of carbon stocks and vegetation diversity, as well as hydrological protection (Sari et al., 2025).

The integration of stable Appropriation and sustainable Provision functions has met Ostrom's Rule Conformity Principle (P2) (Fleischman et al., 2014). This model serves as a rational incentive for the people of HKm Kawae to abandon destructive practices (conversion to maize), as agroforestry systems guarantee equal or better economic well-being, while protecting the homeland from disasters (Juhriati & Erham, 2024).

The Transformation of Ngaha Aina Ngoho: From Ethics to Institutions

If the success of HKm Kawae is based on the rationality of the agroforestry model (3.1), then its long-term sustainability is determined by the legitimacy and institutional enforcement underpinned by the Ngaha Aina Ngoho *Local Wisdom*. This philosophy transformed from a mere cultural ethic to an informal institution that supported the CPR Design Principles.

Ngaha Aina Ngoho as Ethos and Social Capital

The *philosophy of Ngaha Aina Ngoho* is a deep ethos for the Mbojo people, who collectively instill a sense of mutual trust, solidarity (*gotong royong*), and a commitment not to violate group agreements (Taufiqurrahman & Suharno, 2021). This ethos translates into social capital in KTH Oi Rida, which is crucial because it creates internal compliance and ensures an informal sanction mechanism based on shame (*Dahu*) that is often more effective than formal legal sanctions (Nurjumiati et al., 2020).

Institutionalization of Ethics to Support Compliance

The transformation of Ngaha Aina Ngoho*'s ethics* into an institution occurred when these values were accommodated into the rules of HKm. The analysis of its operational interpretation

in the context of natural resources is as follows:

Table 1. Operationalization of Ngaha Aina Ngoho Values in Natural Resource Management at HKm Kawae and Alignment with Ostrom's CPR Principles

Philosophical Values (Ngaha Aina Ngoho)	Operational Interpretation in Natural Resources Management	Principles of Supported CPR Design
Ngaha (Managing Permissions)	**Appropriation Rights:** Collective permission (HKm/KTH) to utilize Candlenut/Coffee in a sustainable manner, which guarantees a significant revenue contribution.	**P2: Conformity of Rules (Appropriation)** – Legitimacy of resource utilization.
Aina (Prohibition)	**Provisions Rules:** Collective prohibition to damage or illegal *logging* in conservation areas.	**P6: Tiered Sanctions** – Become the moral basis for the enforcement of rules and formal sanctions.
Ngoho (Forest Exploitation)	**Carrying Capacity Limitations:** Acts of violating rules and exploitation of exceeding the carrying capacity limits of natural resources (e.g., conversion of forest land to seasonal crops).	**P1: Clear Boundaries & P2: Conformance of Rules (Provisions)** – Collectively define the limits of prohibited uses.

Source: Synthesized from in-depth interviews with KTH Oi Rida members and community elders (2024), and analysis of KTH operational regulations

Implementation of Ostrom's Locally Value-Reinforced CPR Design Principles

Ngaha Aina Ngoho serves as an informal institutional principle that ensures the operationalization of the Ostrom Principle in HKm Kawae:

1. **Compliance of Rule (P2) Guaranteed:** The *Ngaha* philosophy (hard work) justifies the economic incentives of Kemiri (Appropriation), while *Aina Ngoho* (prohibition of exploitation is exhausted) justifies the conservation rule (Provision). This synthesis ensures that conservation rules **are not considered as a burden** but as a collective investment.
2. **Tiered Sanctions (P6) Effective:** The formal sanction rules of KTH are effective because they are supported by social and moral sanctions (*Dahu*) sourced from *Aina Ngoho*. Violators not only violate the rules of KTH, but violate **Mbojo** 's fundamental ethics.
3. **Collective Arrangement (P3) Facilitated:** Ngaha Aina Ngoho*'s social capital* facilitated KTH deliberations, ensuring the participation of HKm members in formulating and modifying rules collectively, thereby creating **Accountability (P7)** and minimizing *free-riding*.

CONCLUSIONS

The sustainability of *HKm Kawae* management by KTH Oi Rida stems from an institutional synthesis that combines a technical-economic governance model with socio-cultural legitimacy. The Candlenut-Coffee agroforestry model delivers stable economic

benefits, fulfilling Ostrom's Principle of Regulatory Conformity (P2), while collective compliance is maintained through the transformation of *Ngaha Aina Ngoho*'s local wisdom into an informal institution that reinforces formal rule enforcement, supporting the sustainability of both P2 and Tiered Sanctions (P6). This case highlights that sustainable natural resource governance requires balancing economic incentives with conservation ethics. Policy recommendations include formally recognizing local wisdom within Social Forestry management, replicating the agroforestry model with improved economic incentives, and strengthening KTH's institutional capacity to enforce collective rules through enhanced participation and social capital. Future research could explore how this institutional synthesis functions under different socio-ecological conditions or assess its long-term impacts on biodiversity and community well-being across other regions in *NTB*.

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