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Research paper

Capital Transformation and Community-Based Forestry in Taiwan: A Community Capitals Framework and Key-Actor Perspective

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ABSTRACT

In response to global environmental changes and biodiversity conservation challenges, Community-Based Forestry (CBF), emphasizing local participation, has become an important approach to forest management worldwide. In 2002, Taiwan's Forestry and Nature Conservation Agency (FANCA; formerly Forestry Bureau) launched the CBF Program to empower communities and strengthen partnerships between government agencies and Indigenous peoples and local communities. Employing the Community Capitals Framework (CCF) and a key-actor. This study analyzed CBF program data from 2002 to 2024 using MAXQDA, alongside in-depth interviews with 13 key informants. The analysis focused on the impact of seven forms of capital–human, financial, technical, cultural, natural, infrastructural, and social–on CBF program outcomes. The findings indicate that the CBF Program's implementation is centered on human and social capital, which interact dynamically with technical, cultural, and natural capital. Financial and infrastructural capital primarily play a supporting role which reflects the policy's underlying logic of "asset-light" design and "small-grant" strategy. Stakeholder perspectives differed: public sector actors placed greater emphasis on rebuilding trust and strengthening social capital, whereas, community representatives and intermediary teams focused more on human capital empowerment. The practical outcomes of CBF in Taiwan are built upon sustained accumulation of social capital and collaborative relationships among the public sector, communities, and intermediary teams. Moreover, intermediary teams play an important bridging role on trust rebuilding, knowledge translation, and flexible co-management practices. This study contributes to the literature by employing the CCF and a key-actor perspective to highlight the pivotal role of intermediary teams

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in bridging the public sector and communities. These findings advance understanding of long-term CBF Program governance mechanisms and provide an empirical basis for future policy design.

Keywords: Community-based forestry, Community capitals framework, Co-management, Social capital, Taiwan

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INTRODUCTION

Since the 1970s, the failures of centralized, state-led forestry in many developing countries have prompted a global shift toward Community-Based Forestry (CBF), emphasizing local participation (Arts et al. 2012, 2017, 2023, Carter and Gronow 2005, Gilmour 2016). Driven by concerns over tropical deforestation and the 1992 Convention on Biological Diversity (CBD), the core CBF concept evolved to focus on decentralizing management authority to achieve sustainable forest management (SFM) (Aggarwal et al. 2021, Brown et al. 2002, Carter and Gronow 2005, Sotirov et al. 2020). Today, CBF is implemented in over 60 countries, early adopters like Nepal–with its extensive Forest User Groups–and Cameroon, exemplify this global transition toward empowering local communities in forest governance (Agarwal 2001, Brown et al. 2002, FECOFUN 2026, Gilmour 2016, Kimengsi and Bhusal 2022, Minang et al. 2019, Ojha 2014).

Although CBF is globally recognized for effective promoting of sustainable forest management, its motivations, governance models, and implementation challenges vary significantly between developing and developed nations (Gilmour 2016). Globally, only 14% of the world's forests are managed by communities; although, the proportion in low- and middle-income countries is as high as 28%. In response to poverty and livelihood concerns, developing countries began promoting CBF in the 1980s to address local needs for fuelwood, fodder, construction materials, and medicinal resources. These initiatives are typically implemented on small- to medium-sized forest areas of less than 500 hectares, relying on labor-intensive, manual techniques, with community members directly participating in both planning and labor input. Such systems tend to exhibit low market orientation, with funding primarily sourced from international institutions, non-governmental organizations (NGOs), or national and local governments. However, effectiveness is often constrained by state-retained land ownership, restricted communal rights, elite capture, and weak governance. These challenges can be further exacerbated by centralized control in Pakistan, or by prolonged armed conflicts such as in Colombia (Hajjar et al. 2021, Imran 2025, Mallik and Rahman 1994, Millner et al. 2020, Pulhin et al. 2024, Vélez Zapata et al. 2026).

In contrast, developed countries did not begin developing CBF until the 1990s, in response to unemployment resulting from the transition away from industrial logging, as well as growing concerns over ecological conservation. Depending on the type of

land use–such as orchards, croplands, or pastures–these models have given rise to various designations, including community forestry, social forestry, agroforestry, forest farming, communal forestry, rural forestry, village forestry, and homestead forestry. Compared with CBF programs in developing countries, the operational scale of these initiatives tends to be larger, sometimes exceeding 5,000 ha, and typically rely on mechanized, capital-intensive operations. Funding is primarily provided by joint investment between communities and national or local governments, emphasizing a "people-centered" approach and participatory decision-making. Although local communities are involved in planning, implementation is largely carried out by hired labor and professional personnel. These models aim to stabilize community development through economic benefits while continuously supplying timber, promoting tourism, and implementing biodiversity conservation and ecosystem sustainability (Charnley and Poe 2007, Hajjar et al. 2021, Mallik and Rahman 1994). While these developed-country models successfully support rural livelihoods and deliver socio-ecological benefits, they face ongoing challenges, including land-use conflicts, monoculture risks, and climate change impacts (Giffen et al. 2025, Mizuuchi et al. 2025). Hajjar et al. (2021) further noted that although CBF holds theoretical potential for both forest conservation and community development, a persistent gap remains between theory and practice and suggested that future research should continue to clarify community participation, power distribution, and institutional integration, alongside sustained accumulation of empirical evidence.

In 2002, Taiwan's CBF Program was launched as a three-stage CBF mechanism, rooted in community empowerment and aimed at transitioning from top-down management to bottom-up public–private partnerships (Chen et al. 2021, Guan et al. 2009). By 2024, the program had accumulated 3,589 approved CBF projects. Although the CBF policy initially envisioned a Phase III for establishing formal co-management mechanisms, and the government promulgated the *Regulations on Resource Co-management in Indigenous Areas* in 2007, no community has yet applied to enter Phase III to date. Nevertheless, Indigenous community participation has more than tripled since 2006, reflecting strengthened collaborative dialogues with the Forestry and Nature Conservation Agency (FANCA) regarding resource protection (FANCA 2025b, 2025c). Contrastingly, the focus of projects has shifted substantially. While early initiatives (2002–2005) were predominately oriented toward forest recreation (Wang 2006, 2007), recent trends have seen a marked decline in recreation-oriented projects and a surge in Forest Protection initiatives, from just six initial cases to 90 projects in 2024. This transition from recreation-oriented activities to active ecological stewardship reflects the strengthening capacity of local communities and their sustained commitment to environmental conservation.

To systematically evaluate the diverse implementations and outcomes of CBF, it is crucial to recognize that success depends not only on natural resource conditions but also on a broad range of social, economic, cultural, technical, institutional, and policy factors. From a capital-based perspective, human capital comprises the labor force, skills, experience, professional expertise, and leadership required to implement CBF, with an emphasis on individual capacity building (Gilmour 2016). Financial capital comprises the financial resources needed to support

forestry activities, drawing on revenues from forest product sales, ecotourism, and payments for environmental services (PES), including REDD+ (Reducing Emissions from Deforestation and Forest Degradation) as well as government subsidies and external investments (Clare et al. 2019, Millner et al. 2020, Piabuo et al. 2025, Vélez Zapata et al. 2026). Technical capital includes the tools, equipment, and specialized knowledge to implement CBF practices (Clare et al. 2019, Gilmour 2016). Cultural capital encompasses traditional ecological knowledge (TEK), cultural values, beliefs, rituals, customs, and resource-use norms that profoundly shape how communities perceive, use, and manage forests (Baral et al. 2024, Vélez Zapata et al. 2026). Natural capital denotes the stock of resources providing ecosystem services–including forests, biodiversity, water, soil fertility, and various non-timber forest products (NTFPs)–that underpin CBF activities (Imran 2025, Millner et al. 2020). Infrastructural capital comprises the physical facilities (e.g., trails, and signage) and digital platforms (e.g., Facebook, and LINE groups) that support community functions (Clare et al. 2019, Yang et al. 2025). Finally, social capital spans the structural, cognitive, and relational dimensions of social life, including network ties, shared narratives, trust, norms, and identification (Nahapiet and Ghoshal 1998).

The inputs of these various forms of capital affect CBF at multiple levels. Lee et al. (2013) noted that CBF generates not only direct economic and social benefits, but also indirect outcomes related to ecological maintenance, environmental conservation, and cultural heritage preservation. In a similar vein, Lou and Lu (2024) developed an evaluative framework for CBF effectiveness based on natural, social, human, and financial capital. Taken together, these studies underscore the importance of multiple forms of capital in shaping CBF outcomes.

The Community Capitals Framework (CCF), also known as the Capital Cluster Framework, provides a multidimensional perspective for understanding how communities mobilize different forms of capital to achieve sustainable development and resource governance. The CCF encompasses seven types of capital–natural, social, human, financial, built, cultural, and political–and emphasizes a comprehensive, multi-faceted assessment to avoid the blind spots associated with single-dimensional analyses (Burch 2002, Flora et al. 2016). It highlights the interconnections and transformative cycles among these capitals; for instance, sustainably managed natural capital can generate financial capital, which is then reinvested in human or built capital (Butler et al. 2023, Mngulwi et al. 2025). Furthermore, the CCF positions communities as active agents rather than passive recipients. By assessing their own capital assets, communities can enhance local empowerment, participation in decision-making, and a sense of ownership over resource governance (Kailola et al. 2023, Mngulwi et al. 2025).

Against this theoretical backdrop, this study, considering the software and hardware support systems required to advance CBF, reframes built capital as Infrastructural Capital. In addition, this study incorporates the substance of political capital into discussions of policy, human capital, and social capital. Drawing on Gilmour's (2016) identification of viable technology–defined as the technical skills, knowledge, and tools needed to establish and manage forests sustainably–as one of the six conditions for effective CBF, this study conceptualizes these resources as technical capital. Therefore, we adapt the CCF into seven dimensions: natural,

social, human, financial, infrastructural, cultural, and technical capital.

Building on this theoretical framework, this study applies the CCF to analyze the successful experiences and challenges of Taiwan's CBF Program at the community level. Accordingly, this study addresses the following research questions: (1) How do various capital inputs interact with the CBF Program and the local social, economic, and ecological contexts, and how do these interactions shape communities' capacity to participate in forest co-management? (2) What roles do different forms of capital inputs play in enabling or constraining the implementation of CBF?

MATERIALS AND METHODS

We adopted the CCF as an analytical framework to evaluate the factors influencing the outcomes of Taiwan's CBF Program. In this context, capital refers to investments in the community, its members, and their surrounding forests, encompassing human, financial, technical, cultural, natural, infrastructural, and social dimensions. This framework systematically maps the impacts of various capital inputs against CBF practices.

Using a qualitative design, we conducted semi-structured in-depth interviews and applied MAXQDA (version 26.1.0) to code the interview transcripts and generate quantitative summaries of code frequencies and co-occurrences. Between September 2025 and January 2026, purposive sampling was utilized to select 13 key informants with a comprehensive understanding of Taiwan's CBF policies and operations (Table 1). The sample comprises six public sector officials (ranging from central government to local grassroots), three intermediary team representatives (including academic institutions and NGOs, including one academic who also served as a key policy planner), and four representatives from communities that received the 2024 CBF Excellence Award. Among the community representatives were one Indigenous female elder and three Han Chinese women who married into Indigenous communities and currently lead local CBF projects.

All participants possessed an in-depth understanding and extensive practical experience of CBF policies and practices. The four Indigenous community team representatives were not selected to represent all Indigenous or non-Indigenous communities; rather, they were selected as critical cases–representing award-winning communities with long-term, in-depth engagement and rich practical experience in CBF. Their selection through a rigorous multi-tiered evaluation process provided deep understanding of how the CCF is transformed and applied in CBF practice. This multi-actor composition ensures robust representativeness across policy formulation and practical implementation.

Semi-structured interview outlines were tailored for three stakeholder groups: public sector officials, community organizations, and academic and intermediary teams. For public sector officials, including both central and local FANCA administrators, questions focused on policy objectives and frontline implementation challenges, drawing on Gilmour's (2016) governance models and Pulhin et al.'s (2024) observations on the gaps between policy intent and actual outcomes. For community organizations, specifically recipients of the 2024 CBF Excellence Award, interviews explored motivations for participation, capital needs, and perspectives on co-management. This

segment was informed by Clare et al. (2019), regarding discrepancies between institutional design and practice, and was structured around Gilmour's (2016) seven dimensions of capital–human, financial, technical, cultural, natural, infrastructural, and social–to assess program effectiveness. Finally, interviews with academic and intermediary teams evaluated their bridging roles within multi-level governance and the challenges of community engagement. This design was grounded in Gilmour's (2016) emphasis on long-term institutional support and insights from Vélez Zapata et al. (2026) regarding external organizational support and local leadership.

With participants informed consent, all interviews were conducted in Mandarin Chinese, audio-recorded, transcribed verbatim in Traditional Chinese, and coded based on the CCF framework. Quoted excerpts were translated into English by the authors. When cited, quotes are identified by their file location codes (e.g., [A_320-322]) to ensure data traceability.

Data analysis employed data triangulation–cross-referencing different stakeholders, documents, and literature–to mitigate single-perspective bias (Huang 2021, Pan 2022, Tsai and Chang 2018). We used MAXQDA for coding to transform qualitative data into quantitative representations. As a mixed-methods tool, MAXQDA enables the systematic organization, coding, visualization, and collaborative analysis of complex datasets, efficiently revealing underlying patterns, co-occurrences, and recurrent themes (Adi et al. 2025, Chuang and Ting 2024, Guetterman and James 2023, Löhr et al. 2024, Schwenck et al. 2025, Star et al. 2025). However, MAXQDA's limitations include a steep learning curve (Chuang and Ting 2024, Star et al. 2025), basic rather than advanced statistical modeling capabilities (Guetterman and James 2023), and the risk that software-driven coding or generative AI might prioritize quantitative metrics over qualitative depth, oversimplifying nuanced emotions (Star et al. 2025, Wheeler 2026). Since research validity ultimately relies on rigorous analytical discipline (Adi et al. 2025), we mitigated these risks by manually reviewing the contextual nuances of all coded segments, ensuring the software served merely as an organizational scaffold rather than a substitute for deep qualitative interpretation.

Table 1. Characteristics of in-depth interview participants

No.	Code	Background of interviewee
1	A	Participated in the drafting and promotion the Taiwan's CBF policy as a key academic intermediary and member of accompaniment team, played a central role in initiating, advancing, and implementing Taiwan's CBF policy; has nearly 25 years of community accompaniment experience.
2	B	Has been engaged in Phase II CBF projects since 2006. As a civil intermediary organization, serves as a communication broker between the public sector and local communities, bringing 20 years of extensive experience in providing on-the-ground support and integrating resources across different sectors.
3	C	Has managed CBF projects for 10 years, from the Ranger Station level to FANCA, and has promoted regulatory relaxation and the cooperative economy while witnessing the transition of the public sector from a defensive stance to partnership building with communities.

Table 1. (continued)

No.	Code	Background of interviewee
4	D	Served as the Regional Branch-level coordinator for CBF from 2011 to 2015. Experienced heavy administrative challenges involving cumbersome reimbursement procedures and repeated document returns, witnessed the substantive support of intermediary teams, and participated in promoting alliances between the public sector and neighboring communities, as well as the development of eco-tours and strategic partnerships.
5	E	A Regional Branch officer who was assigned to CBF work upon entering public service and had accumulated 3 years of experience by 2025. In response to frequent turnover in the public sector and reimbursement difficulties caused by community aging, introduced intermediary teams as a local support platform and established an official LINE account to help communities resolve problems.
6	F	Director of a Ranger Station. Has been involved in CBF project implementation, management, and review since 2006 (with about 3–4 years of direct front-line administration of CBF), and understands the difficulties remote communities face in proposal writing and reimbursement; introduced intermediary teams as a bridging support mechanism to strengthen cooperation between the government and Indigenous communities.
7	G	Managed CBF work at the Regional Branch and Ranger Station levels during 2005–2009 and 2023–2026. Experienced community hostility toward forestry authorities during the early promotion stage and observed how long-term field accompaniment fostered mutual trust and a strong sense of solidarity; has front-line experience in CBF promotion, the introduction of intermediary teams, and cross-agency coordination (e.g., the Soil and Water Conservation Bureau).
8	H	Recipient of the 2024 CBF Excellence Award (Southern Taiwan). Has been engaged in community development and CBF since 2009, has long accompanied young people in taking root locally, and insists on transmitting traditional culture and Indigenous language through CBF-based livelihood development.
9	I	Recipient of the 2024 CBF Excellence Award (Eastern Taiwan). A Minnan woman who married into an Indigenous community, took over the CBF project in 2020, and has since led elders and younger generations in promoting CBF, helping bridge cultural discontinuities among the middle generation.
10	J	Recipient of the 2024 CBF Excellence Award (Northern Taiwan). A Han woman who married into an Indigenous community and has been responsible for the CBF project since 2019; has actively engaged in ecological monitoring and restoration, revitalized hunting norms and forest knowledge, and promoted eco-cultural tourism.
11	K	A Han woman who married into an Indigenous community, with more than 26 years of experience in community development; has promoted CBF since 2021 and is a recipient of the CBF Excellence Award for three consecutive years (Central Taiwan). Dedicated to preserving traditional crafts and cultural heritage while adhering to cultural norms and ecological ethics.
12	L	A key scholar in promoting the Satoyama Initiative in Taiwan, he has integrated its principles with CBF and embedded them into the National Green Network policy. He advocates the establishment of multi-stakeholder co-management platforms and has accumulated around two decades of experience in long-term accompaniment of Indigenous communities, with proven expertise in cross-sector communication, intermediary organization governance, and policy advocacy.
13	M	Officer in charge of CBF projects at FANCA Regional Branch and Ranger Station. Has more than 15 years of front-line experience in facilitating and administering CBF, is familiar with different types of communities and advisory needs, and has helped communities connect with diverse resources.

RESULTS AND DISCUSSION

The following sections present the detailed qualitative findings for each of the seven forms of capitals in the CFF, examining how each form of capital contributed to or constrained the implementation of CBF in Taiwan.

Human capital

Burch (2002) posited that the continuity of leadership within community organizations is critical for aligning social cycles with the biological cycles of forest development. Our findings indicate that many CBF projects are led by a few active individuals or a single key figure, whose enthusiasm, dedication, availability and financial resources allows them to support community efforts. Consequently, educational initiatives that foster commitment and consensus are essential for sustaining these endeavors. To ensure leadership continuity, early-stage groups must empower these key individuals and formalize their organizational structure.

However, relying solely on the enthusiasm of implementers is unlikely to ensure the long-term sustainability of CBF initiatives. Our findings highlight the need for comprehensive backing including employment opportunities, financial support, peer support networks, and childcare. As one FANCA officer pointed out, "People remain the most crucial factor, as resources from the government sector are actually quite abundant" [D_115]. A policy drafter bluntly echoed this reality: "No matter how much passion they have, they still need to make a living!" [A_93]. Therefore, long-term retention cannot be solved merely by subsidies; as another stakeholder noted, "You have to provide them with this complete support system; it's not something that can be resolved simply by handing out a sum of money" [D_123]. These findings indicate that sustaining human capital in CBF requires comprehensive support systems that extend beyond financial subsidies.

Furthermore, demographic shifts and intergenerational discontinuity exacerbate these leadership challenges. Despite some communities possessing highly educated leaders–with one official noting, "It is completely different from our time. We now have a group of experts with master's and doctoral degrees serving as chairpersons, and possibly as general secretaries" [G_106]–most rural areas face rapid population aging and youth outmigration. These trends have led to significant gaps in knowledge and labor succession–a struggle articulated by one of the community representatives: "This generational gap is simply too severe, and bridging it is exactly what our association has been doing" [I_107]. Other representatives echoed this critical shortage of manpower. "We are indeed severely understaffed. Because our community is very close to the urban area, people usually work outside" [J_35], "They all leave after junior high school. They have to leave the community to pursue further education" [K_580]. This continuous outmigration leaves the physical burden of forest management to the aging population: "Our elders are almost all passing away. For someone like me, nearing 70, growing these mushrooms is actually very exhausting, you know?" [H_118]. These accounts indicate that youth outmigration and population aging undermine the labor and knowledge succession needed to sustain CBF.

In addition to demographic changes, local political disputes and administrative burdens exert substantial influence on community leadership. Small non-profit organizations (NPOs) have limited capacity to institutionalize their leadership. Intense

local political rivalry renders leadership susceptible to turnover coinciding with the four-year election cycle, making organizational priorities more responsive to external forces rather than to local needs. This frequent personnel change leads to a severe loss of institutional memory, as one interviewee lamented: "Data is not handed down... you truly have to start from scratch" [B_101]. This instability is also mirrored in the public sector, creating high learning costs: "Personnel changes are frequent... from application and execution to project closure... just learning how to operate the [administrative system] takes a lot of time" [E_56]. These findings suggest that the program should provide capacity-building support at the individual, organizational, and community levels to address leadership instability arising from these factors.

To mitigate these challenges and sustain long-term performance, continuous institutional accompaniment is essential, a finding that aligns with Millner et al. (2020). This study identifies that intermediary teams play a pivotal mediating role in the accumulation of human capital. Through long-term accompaniment, these "civilian partners" buffer the impact of leadership instability by assisting new personnel in grasping the policy context. Their extensive involvement is indispensable: "There are so many issues in the community... you have to be able to accompany them and provide answers" [F_210]. They push the initiative forward together, "providing us with references and feedback" [D_215]. Despite their undeniable value, establishing such capacity remains a hurdle for the future: "Intermediary organizations have always been highly needed and extremely crucial, but producing such intermediary groups is not easy at all" [A_78]. These accounts show that intermediary teams sustain human capital by providing continuity and practical support amid leadership turnover, although developing such teams remains challenging.

Financial capital

The distinction between forest property ownership and the authority to implement forest practices is fundamental. The CBF Program provides the opportunity for communities to engage in co-management with government agencies, as most of the woodland in Taiwan is state-owned. Because communities adjacent to national forests generally lack the financial capacity to manage these resources, they apply for small grants to assist the Regional Branch in forest maintenance. These grants are allocated based on approved projects that reflect the community's aspirations. While substantial financial support is primarily directed toward Phase II projects, Phase I provides limited funding restricted to conducting resource inventories and human capital training, which communities often perceive as insufficient.

However, this small grant strategy is intentionally designed as a catalyst and a risk control mechanism. It inherently prevents resource misuse and excessive hardware construction, while encouraging investment in software and capacity building. As one policy drafter explained, "If it's too much [money], the community's capacity often cannot handle it well... Using small amounts of money... for capacity building, resource surveys, or patrol monitoring! These activities are more related to resource conservation, and people are less likely to use the money for random development or construction" [A_29]. From the public sector's perspective, this approach minimizes risks associated with audits, accountability, and resource waste that might arise from failed large-

scale investments; consequently, they rely on administrators and intermediary teams to assist with reimbursement, with a primary focus on mitigating administrative risks. In contrast, intermediary teams view these grants as an incubation mechanism, using small amounts of funding as a stepping stone to lower the socio-cultural risks and internal factional conflicts that might otherwise be triggered by excessive capital infusion. This allows communities to build their capacities in a low-pressure environment.

Although these grant amounts are often regarded as nominal, relevant literature indicates that external financial support remains vital for the viability of CBF. Piabuo et al. (2025) noted that despite attempts to improve efficiency through business models, many CBF organizations still struggle to compete with industrial-scale producers. Similarly, Pulhin et al. (2024) demonstrated in the Philippines that forestry income is often insufficient to sustain livelihoods, necessitating continued reliance on external funding. In Taiwan's context, these "small grants" have demonstrated remarkable policy resilience. Interviewees highlighted that the program's strategic design prevents environmental disturbance while precisely channeling resources into remote areas to maximize their effect [A_29-30; D_244]. Furthermore, the efficacy of financial capital relies heavily on internal governance and financial transparency [I_13-14], with some owners of Indigenous reserved land even demonstrating a spirit of "supporting public goals with private resources" by investing personal funds into management efforts [J_129-133].

Despite these benefits, financial operations face significant administrative challenges and dependency risks. Exhausting reimbursement procedures create hurdles for both sides. One local officer admitted, "There are always difficulties during the reimbursement process" [F_34], a frustration echoed by a regional branch officer: "When it comes to reimbursement, it is truly a painful process for the community, and an equally painful task for us as project officers" [D_57]. Moreover, over-reliance on subsidies may lead to prolonged dependency and unfairness. One interviewee bluntly criticized this phenomenon: " It is unfair to communities that are just getting started, while some communities may remain dependent indefinitely. No matter how much support they receive, they may never become self-reliant." [C_80].

To mitigate these risks and foster partnership building, the continuity of funding may be more critical than the amount. This perspective adds nuance to the argument by Clare et al. (2019), who contended that insufficient public sector support is a major factor hindering CBF. Although grant amounts within Taiwan's CBF Program are modest, the opportunity to continuously apply for funding has emerged as a pivotal driver, enabling communities to sustain their conservation initiatives. As one community representative reflected, "It has already become a partnership, a cooperative relationship... using this program to cultivate talent, or to do some ecological conservation work that the community wants to do" [B_145-150]. Communities emphasize that the government need not be overly anxious about the scale of community industries, explicitly advising against "indiscriminate subsidies". The program's high degree of flexibility enables Indigenous communities to organically integrate cultural heritage with daily life practices. As a 99-year-old tribal leader remarked, this was the first project that made him feel he could "truly teach

his people," and through this demanding process, community teams derive their greatest reward–a profound sense of intrinsic fulfillment [K_433-436, 671-688].

Ultimately, interviewees advocate developing a self-sustaining "Deep Economy" (Chen and Pan 2023) to achieve self-sufficiency. This involves developing local economies based on biodiversity, forming cooperatives, or partnering with corporate ESG initiatives. One policy planner suggested, communities should "generate a local 'deep economy' from biodiversity, and then feed it back into environmental stewardship and cultural transmission" [A_70]. Practical pathways include establishing cooperatives, which "are highly anticipated; they are potential collaborative partners in community building" [C_38], and seeking corporate partnerships, where "they [corporations] fulfill some social responsibilities for society, and ESG might become a flagship investment for them" [J_99]. However, interviewees also emphasize that the spiritual value of cultural transmission cannot be measured solely by economic indicators, reminding policymakers that "production volume does not necessarily equal economic value" [K_913].

Technical capital

Existing literature corroborates the importance of a diverse forms of technical capital for the effective implementation of sustainable forest management. A deficiency in ecological understanding or silvicultural knowledge may result in resource overexploitation and environmental degradation (Clare et al. 2019). Furthermore, Ghalandarzadeh et al. (2025) emphasized that beyond "hard skills" such as forest management, business acumen–including marketing strategies and community communication skills–is equally indispensable for the success of CBF. To meet these multidimensional needs, the introduction of external expertise is essential. Because technical capital encompasses diverse knowledge and skills such as ecological monitoring, industrial production, traditional crafts, and administrative operations, drawing solely on internal resources is insufficient. As one policy drafter noted, "The input of technology... is not just from the Forestry Bureau and the community! Many experts from universities, research institutes, and agricultural extension stations are also gradually coming in" [A_68]. This highlights the importance of collaboration between communities and external experts in meeting diverse technical needs for CBF.

Reflecting this need for diverse capabilities, community residents–who often possess a wealth of local knowledge and interest in community development–require systematic empowerment. Within the framework of the CBF Program, communities are empowered to design education and training curricula tailored to their specific needs. According to an analysis by Chen et al. (2021), these training courses span both hard and soft domains and can be categorized into 11 types, ranging from resource survey techniques to product design and marketing. Through expert guidance, communities can master specific technological applications in ecology, crafts, and industry. For instance, ecological conservation efforts rely heavily on modern tools and training: "Using iNaturalist... to record the flora and fauna of the community; to transition from forest protection to ecological conservation, we have to use... infrared camera monitoring" [M_37, 72]. Traditional crafts, on the other hand, require the long-term accumulation of specific techniques. One artisan shared the nuances of this process: "Because we

scrape rattan very slowly, the color becomes relatively [dark]. But you see, once I mastered the timing, it could achieve the whiteness of my grandfather's [craftsmanship]" [K_285]. Meanwhile, the developing under-forest economy faces hardware challenges, with residents stressing that "mechanized equipment... is highly needed" [H_119].

Beyond these operational and field technologies, administrative and soft technical skills are equally indispensable. To address tedious reimbursement difficulties, the public sector provides administrative technical support, with one officer explaining, "We have a CBF SOP manual, and there are templates in it" [F_34]. However, intermediary teams play a core role in bridging the gap between public sector expectations and local capacities. They provide the professional judgment, localized support, and the skills required to link multi-stakeholder platforms. In the early stages of collaboration, "when neither side knows each other, or doesn't know how to do it or what to do, the intermediary group has the professional judgment" [A_77]. Their long-term, localized presence is highly valued by government officials: "This accompanying team has always been local, accompanying and taking root like this... providing a lot of support, yes, and assistance... Actually, they know the situation better than us, better than we do" [D_42-52]. Furthermore, these teams facilitate crucial platform-linking role by connecting residents, competent authorities, and other stakeholders through multi-stakeholder meetings. As one intermediary team member described, "In such a multi-stakeholder participatory meeting, we can systematically... focus, and then think of countermeasures... The competent authorities can also join in... and residents will feel that this platform can be used to discuss and solve specific problems" [L_98-103]. The public sector's administrative tools, combined with intermediary teams' professional judgment, long-term localized accompaniment, and platform-linking role, provide the complementary soft technical support needed to implement CBF in locally workable ways.

Interviewees generally noted that although the CBF projects have achieved notable success in cultural transmission and ecological conservation, translating these achievements into sustainable economic benefits remains challenging, particularly because of visibility and marketing strategy. As one interviewee remarked, "Very few people in Taiwan knew we were doing a great job... until we set up a Facebook page" [K_168]. Another echoed this instability: "It's very unstable, but we participate with the mindset and principle that any exposure brings opportunities" [J_68]. These observations reveal a persistent gap in industrialization and promotional capacity within the accumulation of technical capital. To strengthen this dimension of technical capital, communities require greater professional assistance in promotion and marketing skills to broaden participation and effectively promote diverse community products and services. Consequently, supplementary plans provided by the Regional Branch must address these specific technical needs by engaging experts from various fields.

Cultural capital

Agrawal and Gibson (1999) argued that environmental awareness and regulations of community members are closely intertwined with local natural resources. This results in customs and norms that are often more efficient for resource conservation and long-term management than formal legislation. In Taiwan, certain Indigenous communities have developed their own governance

rules, generating institutional frameworks and management patterns that diverge significantly from administrative expectations (Guan 2002, Yang 2004). Against this backdrop, interviewees widely regard cultural capital as the soul and foundation of CBF. It is not only the foundation for economic development but also the basis of community consciousness awakening and sustainable development. As one policy drafter emphasized, "The protection and transmission of local culture associated with biodiversity conservation can itself become valuable economic capital" [A_17].

However, these communities face the severe challenge of cultural loss, highlighting the need for revitalization of traditional ecological wisdom. Recent literature highlights the multifaceted role TEK plays in this context. Negi et al. (2025) observed that TEK practices not only bolster climate resilience but are also intrinsically linked to community identity and lifestyles. Yet, the current reality can be stark, with one interviewee lamenting, "Their cognition of their own culture is already extremely weak" [I_91]. To combat this, Indigenous communities embody cultural capital through traditional norms that regulate ecological extraction and promote a spirit of sharing. Hunting culture, for example, inherently contains the wisdom of ecological balance: "If we can't finish eating it, we don't hunt it; if you can't use it, don't hunt it; if you can't retrieve it, don't hunt it" [J_25]. Adherence to these traditional hunting norms [J_16-24] and the profound connection between elders' wisdom and the natural environment are regarded as foundational pillars for CBF development [H_155, 258].

To effectively return culture to everyday life, communities are pragmatically integrating cultural capital with local industry. In the practical context of Taiwan, the "technology" valued by community practitioners is essentially cultural capital. By combining culture with industry, native languages and practices are transmitted through shared working processes. One community leader expressed a profound commitment to this approach: " Indigenous community industries are all like this... they are inseparable from the culture... I would rather lose money... and keep it going... through this working process... the elders will speak [teach]" [H_150-155]. Consequently, many communities are revitalizing traditional crafts–such as ramie weaving, rattan weaving, and salt drying–through CBF projects to reinforce social cohesion [I_63-64, 224-225; D_259]. For instance, the M'bwanan community (Atayal people) utilize rattan weaving as a medium to impart concepts of traditional territories, adherence to intangible norms (Gaga), and environmental stewardship. They maintain the conviction that culture is deeply embedded in everyday tools and actions: "Culture is life... it includes the cultivation of character... care for the environment... stewardship of environmental resources, and even the use of tools; all these things are encompassed within this culture" [K_930]. Ultimately, the core objective of this integration is retention: "We hope these resources, these materials remain here [in the community]" [K_776].

Through the accumulation of cultural capital, a profound value transformation occurs, prompting communities to build confidence and re-evaluate their own environment. While the mobilization of cultural capital is not without challenges–such as deeply ingrained patriarchal norms that may exclude women from core decision-making processes, as observed by Baral et al. (2024)–the inclusion of CBF is now considered essential (Gilmour 2016). The CBF Program's training courses and practices

in Taiwan fill a critical niche, enhancing productive potential within the socio-ecological mosaic of the forest ecosystem. Most importantly, this shift revitalizes the communities themselves. As one Regional Branch officer enthusiastically observed, the program "has created something unique for Taiwan, namely community micro-tours... this aspect of Taiwan is fantastic! ... those small, highly localized elements that are also rich in culture and local flavor ... have also revitalized the communities" [D_250-253].

Natural capital

Collective action is essential for communities to regulate resource use, provide ecological services, and devise their own governance rules (Baland and Platteau 2000, Ostrom 1999, Poteete and Ostrom 2002). Building upon this foundation, interviewees emphasized that natural capital is the cornerstone of CBF, necessitating a paradigm shift from strict protection to sustainable use. Practitioners advocate for breaking the boundaries of traditional protected areas, noting that "there is biodiversity right in rural areas" [A_18]. Consequently, communities seek a balance between conservation and livelihoods by abandoning absolute protection. One interviewee stressed that "[we should not adhere to] that dogmatic approach where absolutely nothing can be touched" [C_44], but rather "use it while preserving the functional mechanisms of its ecosystem" [L_115].

Sustaining these conservation efforts presents an intergenerational challenge, particularly when communities face financial constraints. Addressing this, Giffen et al. (2025) emphasized that in the context of climate change, sustainable forest management must prioritize mitigation and adaptation while maintaining ecosystem health. Aligning with the global trends of the CBD, Taiwan's CBF policy has transformed conservation efforts from top-down mandates into grassroots implementation. This shift facilitates "the mainstreaming of biodiversity" [G_126], ensuring that conservation concepts gradually take root within local communities [C_41-44]. Through public-private partnerships, daily conservation actions are concretely implemented. For instance, communities are "continuously organizing the removal [of the invasive *Mikania micrantha*]" [D_248], and assisting in data collection: "While patrolling, we incidentally conduct some conservation monitoring... the accumulation of baseline data is helpful" [E_234]. Collaboration also extends to habitat maintenance: "Over there by the high floodplain, where endangered plants are to be planted, they will collaborate with the community. And they are also willing to come and learn from each other" [F_80]. Through these daily practices, residents deeply recognize that "owning the mountains and forests is actually our greatest asset" [J_122].

Alongside these daily practices, Indigenous TEK plays a crucial role in maintaining natural capital, particularly through intergenerational stewardship and customary norms governing access to and use of particular places. Members of Indigenous communities adhere to strict, albeit unwritten, rules regarding resource use: "This is an Indigenous community with a long history; there are actually many rules to follow...there are invisible ancestral spaces... everyone knows that they must not be violated" [K_227-228]. This stewardship is rooted in a profound ethic of coexisting with nature, beautifully captured in ancestral teachings: "The elders used to say: treat it [the snake] as an ancestor, talk to it, tell the snake, 'I am going to see our ancestors'

land, going to patrol and protect it. VuVu, please let me pass...'" [H_258]. Such wisdom actively prevents resource degradation. As one leader explained, "We don't want people to overexploit... we want to promote some of the Truku people's [wisdom] regarding forests and the natural environment… heading towards sustainable environmental protection" [I_174]. This sense of ownership and responsibility is fiercely defended: "Each Indigenous community has its own water source... If you don't take care of your own resources, what right do you have to come and ask for ours?" [K_617].

Ultimately, these integrated efforts yield tangible outcomes, demonstrated by a significant enhancement of community ecological conservation awareness. Interviewees indicated that community residents now not only actively intervene in or report environmental violations but also voluntarily initiate conservation actions. For instance, the Kalotong community in Hualien proactively installed signage to mitigate roadkill incidents threatening the yellow-margined box turtle (*Cuora flavomarginata*) [B_408, 420]. These local observations corroborate the findings of Pulhin et al. (2024) and Piabuo et al. (2025), confirming that the promotion of CBF indeed reduces natural resource degradation, thereby making a substantial contribution to the accumulation of natural capital.

We also observed an increasing investment in natural capital in rural areas, driven by the CBF Program's encouragement of environmental rehabilitation practices. A number of communities have initiated neighborhood environmental rehabilitation efforts for their collective benefit. These new practices are often integrated into communal spaces, featuring the planting of native species and greenery.

Furthermore, communities selected for Excellence Awards actively assist in forest patrols or planting culturally relevant species to revitalize their traditions. These cases indicate that substantive co-management is already being practiced in many Indigenous communities. This perspective is further corroborated by Chen and Lin (2017). Following Typhoon Morakot in 2009, which caused severe flooding and landslides across southern and eastern Taiwan, they act as an intermediary team and assisted the Labuwan and Adiri communities in Pingtung in developing a Satoyama-based economy–an approach to development grounded in harmonious coexistence between people and nature. This process successfully bridged historical divides and rebuilt mutual trust with the government, serving as powerful evidence of effective collaboration outside the rigid policy framework.

However, despite these successful cases demonstrating substantive co-management potential, communities' efforts to develop local economies through the utilization of natural resources remain constrained by existing regulations. For example, one interviewee noted, "Some of it comes down to regulatory conflicts. Like, the Forestry Act says you can't build campfires in the forest... therefore, if communities want to conduct activities that require campfires, we cannot support them" [F_82]. In addition, the utilization and development of traditional Indigenous crops also face difficulties in cross-ministerial regulatory coordination. As one interviewee explained, "We grow traditional plants... but for the Ministry of Health and Welfare, this is a big question mark [because the use of these plants does not comply with the relevant regulations]. But if we want to develop our products, we have to use these plants" [H_101]. This situation also arises in the national forests, as one tribal

representative remarked with frustration, "On Indigenous reserved land that's also protection forest, you can't just cut things down as you please... [to grow mushrooms] we have to buy [logs] from outside... we just watch [the protection forest], we can't touch it, you know?" [H_120]. Or as another put it, "For a piece of the national forest land–bamboo forest–the biggest economic value comes from bamboo shoots, but the regulations seem to say you can't sell bamboo shoots... so there's some conflict with the regulations there too" [B_335-339]. These cases collectively demonstrate that deepening co-management of natural capital still depends on regulatory flexibility and breakthroughs in cross-ministerial institutional coordination.

Infrastructural capital

In the policy design of the CBF Program, infrastructural capital is strictly regulated. Given past budgetary contexts, the strategy for investing in infrastructure has significantly evolved. Early community empowerment efforts often prioritized hardware construction; however, due to insufficient maintenance manpower and funding, this frequently led to "white elephant" facilities or unsustainable greening [B_303]. In contrast, current subsidies from the CBF Program deliberately suppress large-scale hardware construction in favor of software capacity building and talent cultivation to achieve ecological conservation [A_29-30]. Consequently, infrastructure development has become highly problem-oriented and adopts a low-impact development model. As one policy drafter questioned, "Does local development necessarily have to sacrifice and destroy the environment? ... Retaining a piece of pristine land... gives us hope!" [A_60-72]. Practical cases demonstrate this balance between regulations and practice; for example, communities address construction needs by adopting eco-craft trails, "using hand-made methods, which means no machinery [to reduce ecological disturbance]" [E_242].

This shift toward minimal physical intervention is echoed in international contexts, where the definition of infrastructural capital is shifting towards "asset-light" and "digitalization" models. Mizuuchi et al. (2025) proposed "forest rental services" in Japan, which balance recreation and forestry needs through the leasing of small forest plots; the primary advantage lies in obviating the need for forest owners to invest heavily in physical infrastructure. Similarly, Yang et al. (2025) analyzed the REKO (fair consumption) model in Sweden. This approach uses Facebook groups as free digital platforms combined with public parking lots as physical pickup points, achieving a low-cost, high-efficiency community trading infrastructure. These cases provide inspiring alternative pathways for future infrastructural capital investment in Taiwan's CBF projects.

Despite this asset-light trend, communities still face real shortages of physical space and support systems. To survive and thrive, they actively seek cross-ministerial support–such as from the Ministries of Environment, Interior, Health and Welfare, and Economic Affairs–to secure necessary resources. In response to these limitations, communities adopt highly pragmatic strategies or transform physical structures into spaces for cultural practice. Supported by the relatively stable funding of the CBF Program, communities willing to sustain future development often adopt an iterative approach to overcome facility shortages–Building while doing, which means we build our business and construct simultaneously" [J_64]. Others build traditional structures with cultural significance, having "built a

stilt house... its granary, and also built a rice pounding room" [K_424]. As a community matures, it naturally proposes needs for overall development and hardware facilities, the realization of which heavily relies on strong partnerships [G_98].

Notably, expanding the definition of infrastructure beyond physical buildings, some interviewees extend the concept to include the "regulatory system," calling for appropriate deregulation. They argue that invisible institutional structures can be as limiting as physical ones. As one officer observed, "Actually, many restrictions come from certain regulations... Is there any room for adjustment?" [C_49]. Overall, while the policy correctly avoids excessive physical hardware, basic infrastructure remains a necessary condition for supporting software operations, highlighting an ongoing supply-demand gap in rural areas. As an interviewee emphasized, "To settle down and thrive in the future, we locals must always have some basic infrastructure" [L_152].

Social capital

Social capital is widely seen as the foundation for facilitating the effective operation of organizations (Wang et al. 2025). Correspondingly, interviewees regard it as the most crucial and unquantifiable asset within the CBF Program, rooted in the accumulation of trust and partnership. In terms of the relational dimension, Furness et al. (2022) posited that the establishment of "care-trust" relies heavily on frequent face-to-face contact, an argument that aligns closely with the field observations of this study. In the early stages of CBF promotion, the public sector was often perceived by communities as an antagonistic "villain" due to its long-standing role as a strict law enforcer cracking down on hunting, which created significant hostility [G_34, 38]. As one interviewee put it, "You have to understand, they [the local Indigenous communities] were basically in direct conflict with the national park before" [L_60]. However, sustained interaction, transformed this dynamic represents from hostility to cooperation. One officer vividly described this transformation: "Developing a certain degree of... revolutionary camaraderie... willing to tell us the community's difficulties... rather than constantly being in a cat-and-mouse situation" [G_46].

This relational transformation is particularly significant when compared to international contexts. Machoň (2024) observed that in the Czech Republic, the legacy of socialist directives created a persistent reluctance among forest owners to engage in collaborative regimes, viewing them as a "historical throwback." In contrast, Taiwan's experience suggests that a strategy of "long-term accompaniment" and "staying in the field" can effectively dismantle historical hostility and foster new forms of social capital [A_62-64; C_29; D_93-95, 117-118]. This paradigm shift requires a fundamental change in bureaucratic attitude. A FANCA interviewee noted her approach shifted from "telling the community what you can do" to "listening to what the community says first and then deciding together what can be done" [F_178-182]. Consequently, public sector support now actively drives community growth: "When we mention our needs... they give us great information, letting us understand... some government policies... so that we can align with them" [H_91-92]. Over two decades of cultivation, public servants act less like superiors and more like kin: "It really feels like being family with those communities... helping and supporting each other" [A_33]. Ultimately, as one policy drafter concluded, "This mutual trust and

reliance are exactly the things that money cannot buy" [A_64].

Complementing these relational shifts, structural and cognitive dimensions are critical for achieving win-win outcomes, a process where intermediary teams play a pivotal bridging role. Liu et al. (2022) argued that trust and reciprocity foster coordination and cooperation motives, while complex social networks facilitate knowledge exchange. This study identifies that intermediary teams–such as the Niu-Li Community Exchange Association, the CBF Lab of National Pingtung University of Science and Technology, National Dong Hwa University and the National Taitung University team–serve as vital communication bridges to reduce bureaucratic barriers. These teams not only coordinate between public and private sectors but also provide stability in knowledge transmission amidst the frequent turnover of public sector personnel. As one intermediary explained, "Back then, some Indigenous communities felt a bit resentful toward the Forestry Bureau (now FANCA). Yeah. So at that time, we also served as a bridge between, a communication bridge. For things that some communities dare not say directly to the officials, they will convey them through us" [B_37]. Such translation of local knowledge is catalytic, as "having such a bridging intermediary can open up many opportunities" [L_84]. Furthermore, horizontal linkages and cross-departmental cooperation within the public sector have expanded the resource network, jointly establishing a partnership framework of "mutual prosperity".

Social capital plays a vital role in promoting the CBF Program. The long-term accompaniment provided by both the public sector and intermediary teams has successfully rebuilt the trust relationship between Indigenous communities and the government. This result is consistent with the findings of Vélez Zapata et al. (2026), which suggest that accompaniment and support from external organizations are key to enhancing the effectiveness of CBF Programs.

However, the accumulation of social capital is not without internal challenges; it can occasionally manifest as negative social capital. Communities frequently encounter integration difficulties stemming from deep-rooted factional characteristics. One interviewee vividly described this local fragmentation: "They all claim their own territories, act as their own kings, do things their own way, and yield to no one" [J_128]. Additionally, negative social capital arises from the monopolization of discourse power by certain individuals, which can severely skew resource distribution and stifle collective participation. As one participant critically observed, "Because he monopolized the right to speak, all the funding went to him" [K_830].

MAXQDA comprehensive analysis

To provide an overview of qualitative coding and stakeholder priorities, Table 2 presents a Code Matrix Browser analysis generated in MAXQDA, which displays the distribution of coded interview segments across stakeholder groups and the seven forms of capital. The analysis reveals that the public sector yielded the highest number of coded segments (431 from 6 interviewees), while the intermediary teams contributed the fewest (258 from 3 interviewees). To mitigate potential bias resulting from varying response volumes and coding frequencies, we applied within-group percentages to objectively present the relative priorities of different stakeholders regarding various forms of capital. Furthermore, to prevent analytical

bias, Interviewee K was analyzed separately due to the extreme length of their transcript (yielding 425 coded segments, contributing 28.7% of the total dataset). Their responses predominantly focused on cultural capital (37.2%, 158 segments) and natural capital (21.6%, 92 segments), aligning with their profound dedication to preserving Indigenous culture and coexisting with nature. In contrast, interviewee K devoted the least attention to financial capital (4.7%) and infrastructural capital (7.5%).

The primary quantitative analysis of the qualitative data focused on the remaining 12 key informants, yielding a total of 1,056 coded segments. The Code Matrix analysis (Table 2) reveals that human capital (25.57%, 270 segments) and social capital (21.78%, 230 segments) were the most frequently coded capital categories, underscoring that policy implementation relies heavily on local capacity building and mutual trust. Conversely, infrastructural capital received the lowest attention (5.87%, 62 segments), echoing the "asset-light" design of the CBF policy.

Regarding stakeholder differences, the public sector placed the highest emphasis on social capital (11.46%, 121 segments), reflecting their priority to rebuild trust and relational networks with communities. Community representatives focused primarily on human capital (7.29%, 77 segments) and social capital (6.82%, 72 segments), highlighting grassroots concerns over labor shortages and local network building. Intermediary teams prioritized human capital (8.62%, 91 segments), objectively corroborating their crucial role as "bridgers" dedicated to accompanying and empowering local actors.

Visual analysis of the Code Relations Browser was conducted to understand the interactions among the seven forms of capital within the CCF (Figure 1). A larger node size indicates a higher co-occurrence frequency of that capital in the interviews, or a broader degree of association with other capital types; a shorter distance between nodes indicates a higher co-occurrence frequency and closer association, whereas a greater distance indicates a lower co-occurrence frequency and weaker association; and the thickness of the connecting lines reflects the strength of the relationship between capitals, with thicker lines indicating stronger relationships and thinner lines indicating weaker ones. Corresponding numerical values represent

Table 2. Code matrix browser: capital focus by stakeholder group

	Community % (Frequency)	Intermediary teams % (Frequency)	Public sector % (Frequency)	Total % (Frequency)
Human capital	7.29 (77)	8.62 (91)	9.66 (102)	25.57 (270)
Financial capital	5.49 (58)	2.46 (26)	3.31 (35)	11.27 (119)
Technical capital	3.60 (38)	3.31 (35)	6.44 (68)	13.35 (141)
Cultural capital	5.02 (53)	1.80 (19)	3.03 (32)	9.85 (104)
Natural capital	4.36 (46)	3.88 (41)	4.07 (43)	12.31 (130)
Infrastructural capital	2.18 (23)	0.85 (9)	2.84 (30)	5.87 (62)
Social capital	6.82 (72)	3.50 (37)	11.46 (121)	21.78 (230)
Total	34.75 (367)	24.43 (258)	40.81 (431)	100 (1056)

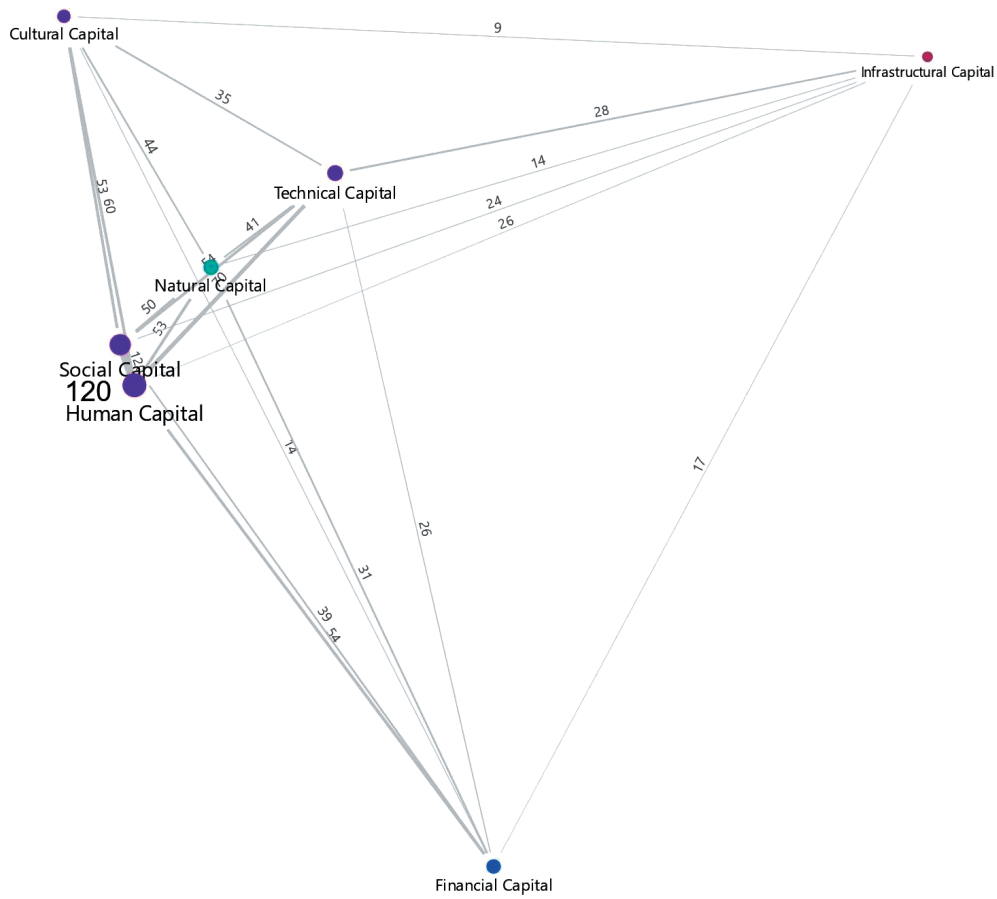

Figure 1. Code Map representing the co-occurrence network of different types of capital

the actual co-occurrence counts between the two codes (Table 3). The analysis revealed strong linkages between specific capitals, notably between human and social capital (120 co-occurrences), and between technical and human capital (70 co-occurrences). Furthermore, the MAXQDA Code Map delineates the distances among 4 implicit structural modules within the interviewees' narratives. The core purple cluster comprises social, human, technical, and cultural capital, while the green natural capital is situated within the core purple cluster, illustrating that natural resources serve as a vital interface for social networks and cultural practices within the CBF Program. The red infrastructural capital functions as a foundational framework supporting the program's "software" and capacity-building elements rather than serving as the central focus of development. The blue financial capital is positioned furthest from the core cluster, reflecting the small-grant strategy inherent in the CBF policy design, which deliberately avoids fostering community over-dependence on a single funding source.

This finding demonstrates that practicing CBF requires a holistic perspective and no single form of capital should be viewed in isolation. Instead, these capitals must be

Table 3. Table of co-occurrence frequencies for different capital types

	Human capital	Financial capital	Technical capital	Cultural capital	Natural capital	Infrastructural capital	Social capital
Human capital	0	54	70	60	53	26	120
Financial capital	54	0	26	14	31	17	39
Technical capital	70	26	0	35	41	28	54
Cultural capital	60	14	35	0	44	9	53
Natural capital	53	31	41	44	0	14	50
Infrastructural capital	26	17	28	9	14	0	24
Social capital	120	39	54	53	50	24	0

treated as an interacting system. For instance, enhancing a community's human capital involves not only technical skill training but also strengthening social networks (social capital) and integrating local cultural contexts (cultural capital). Human capacity, social networks, and technical applications serve as the core drivers of project development, and these drivers are profoundly influenced and shaped by the community's cultural background and natural resources.

CONCLUSIONS

Having been implemented for over 20 years, Taiwan's CBF Program was analyzed in this study through the lens of the CCF to examine practical experiences and constraints at the community level. Findings indicate that the implementation of CBF is centered on human and social capital, which interact dynamically with technical, cultural, and natural capital, whereas financial and infrastructural capital play a supporting role, reflecting the policy's underlying logic of "asset-light" design and "small-grant" strategy. Regarding differences among key actors, the public sector places the greatest emphasis on trust rebuilding and the accumulation of social capital, whereas communities and intermediary teams focus more on the empowerment of human capital. Overall, the practical outcomes of CBF in Taiwan do not stem from a single policy instrument, but are instead built upon the sustained accumulation of human and social capital, as well as the collaborative relationships shaped by long-term interaction among the public sector, communities, and intermediary teams–particularly through the bridging role played by intermediary teams in trust rebuilding, knowledge translation, and flexible co-management practices.

This study contributes to the literature by employing the CCF and a key-actor perspective to highlight the pivotal role of intermediary teams in bridging the public sector and communities. These findings deepen the understanding of long-term CBF Program governance mechanisms and provide an empirical basis for future policy design. This study adopted a qualitative research approach, focusing primarily on communities that received the Excellence Award as the main units of analysis. While this approach facilitates the identification of successful experiences, it is less suited to quantifying the benefits of different

forms of capital. Furthermore, the sample selection did not include comparative cases of underperforming, non-participating, or withdrawn communities. Future research should expand the sample to conduct cross-case comparisons across different types of communities, in order to develop more context-sensitive indicators for capital assessment, and further explore capacity models for intermediary organizations, as well as differences in cultural capital between Indigenous and non-Indigenous communities.

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ETHICAL STATEMENT

This study adhered to social science research ethics and the procedures for obtaining informed consent. All interview content focused on public policy practices and did not involve personal medical information or sensitive Indigenous traditional biological knowledge. Before each interview, participants were fully informed of the study's purpose, and audio recording commenced only after their informed consent was obtained. Data were processed using de-identified codes and statements unrelated to the research topic (private matters) were removed to strictly protect participants' privacy and rights.

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研究報告

臺灣社區林業計畫之實踐與資本轉化：以社區資本架構與關鍵行動者為研究取向

王翠菱[1]、王鴻濬[2]、陳美惠[3]

摘 要

背景

面對全球環境變遷與生物多樣性流失的挑戰，強調在地參與的「社區林業」(Community-Based Forestry, CBF)已成國際森林經營趨勢。臺灣林務局(Forestry Bureau；現為林業及自然保育署/林業保育署，FANCA)於2002年啟動社區林業計畫，期望透過社區營造精神賦權社區，重建政府與在地居民的互信，並促進在地經濟。本研究目的在於運用CCF架構解析臺灣社區林業計畫在社區層級實踐的成功經驗與所面臨的挑戰。

材料與方法

採社區資本架構(Community Capitals Framework, CCF)及關鍵行動者作為分析視角，探討人力、財政、技術、文化、自然、基礎設施及社會等資本投入效益。針對6位林業保育署中央與地方之承辦人員、3位中介團隊代表(1位NGO、2位學術界，其中一位學術界代表亦是政策規劃者)、4位特優社區代表等13位關鍵知情者進行深度訪談並製成逐字稿，再以MAXQDA 26.1.0軟體進行編碼、分析各項資本投入對計畫與社區發展之交互影響。

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結果與討論

截至2024年底，社區林業計畫累計執行3,589案，且原住民社區參與顯著提升，執行重心已由初期「森林育樂」轉向「生態保育」行動。資本集群在政策執行的關鍵作用包括：(1)人力資本方面，社區雖面臨人口老化與領導斷層挑戰，中介團隊與綠領人才扮演「橋接者」(bridgers)角色，有助補足缺口並穩定推動；(2)財政資本雖以小額補助為主，但其「持續性」與「高彈性」，支持社區的長期實踐；(3)技術資本透過中介者的轉譯與行政協助，將專業技術轉化為社區的實質運作能力；(4)文化資本藉由傳統生態知識(如狩獵規範)與傳統工藝復振，強化社區認同與凝聚；(5)社區由被動受限轉為主動進行生態監測與棲地巡護累積自然資本；(6)基礎設施資本已由硬體建設思維轉向手作步道等低環境干擾的「輕資產」模式；(7)社會資本在中介團隊與公部門長期陪伴下逐漸累積，重建政府與社區間的信任，有助於促進政策推動。

資本代碼共現及編碼地圖分析顯示特定資本間的密切聯繫，尤其是人力資本與社會資本(共現120次)以及技術資本與人力資本(共現70次)；編碼地圖顯示社會、人力、技術與文化資本構成核心群集，且自然資本緊鄰核心群集，顯示自然資源不僅是保育標的，亦是連結社會網絡與文化實踐的關鍵介面。顯示任何單一資本都不應被孤立地看待，應視為相互作用的互動系統。例如，提升社區的人力資本不僅包括技術技能培訓，還包括加強社會網絡(社會資本)和融入當地文化背景(文化資本)。人力能力、社會網絡和技術應用是專案發展的核心驅動力，而這些驅動力深受社區文化背景和自然資源的影響和塑造。

結論

臺灣社區林業計畫推動逾20年，本研究以社區資本架構分析社區層級的實踐經驗與限制。結果顯示，計畫推動以人力資本與社會資本為核心，並與技術、文化及自然資本交互作用；財務與基礎設施資本則主要扮演支撐角色，反映政策「輕資產」與「小額補助」的設計邏輯。就行動者差異而言，公部門較重視信任重建與社會資本累積，社區及中介團隊則較聚焦人力培力。整體而言，臺灣社區林業計畫的實踐成果並非源自單一政策工具，而是建立在人力與社會資本的持續累積，以及公部門、社區與中介團隊長期互動所形塑的協力關係，與中介團隊橋接下之信任重建、知識轉譯與彈性共管實作之上。

本研究之貢獻在於，透過社區資本架構與關鍵行動者視角，凸顯中介團隊作為橋接公部門與社區之樞紐角色，此發現有助於深化對社區林業計畫長期治理機制之理解，並為後續政策設計提供實證依據。本研究採質性取徑，且以獲得特優社區獎項之社區為主，較難比較不同類型社區差異；未來可擴大樣本，發展在地化資本指標，並探討中介組織能力及原住民與非原住民社區之文化資本差異。

關鍵詞：社區林業、社區資本架構、共同管理、社會資本、臺灣

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