Forest Policy and Economics 173 (2025) 103470

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

Sustainability performance of community forest enterprises (CFES) in Cameroon: Pathways to viable business models

Serge Mandiefe Piabuo [a,d,*], Marjanke Hoogstra-Klein [a], Verina Ingram [a], Divine Foundjem-Tita [b], Peter A. Minang [b], Lalisa Duguma [b], Hens Runhaar [c]

[a] Wageningen University and Research, the Netherlands
[b] World Agroforestry Centre, Kenya
[c] Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, the Netherlands
[d] World Bank, United States of America

ARTICLE INFO

Keywords:
Economic performance
Social performance
Environmental performance
Community enterprise
And community development

ABSTRACT

Community forestry has evolved from devolved forest management to the valorisation of forest resources for community development. Community forest enterprises (CFEs) now apply business approaches to enhance economic, social, and environmental outcomes. However, limited research has evaluated CFE performance in tropical countries across these dimensions. This paper proposes a contextualized multi-dimensional framework to evaluate CFEs' performance and applies it to nine CFEs in Cameroon. Data were collected from income and expenditure statements, forest land-use transects, satellite image analysis, and focus group discussions. The study evaluates the performance of Community Forest Enterprises (CFEs) in Cameroon using a multi-dimensional framework. The majority (66.67 %) are intermediate performers, with scores between 2.5 and 3. However, they score poorly on the economic dimension, making them intermediate but skewed performers with better scores on social and environmental dimensions. Only 11.11 % CFE is classified as an effective performer, with scores of three or above on all dimensions. The study found that CFEs face significant challenges in effectively allocating resources to trade in forest products and generating profits, resulting in poor economic performance. However, they perform better in investing in social projects, employing community members, and reducing illegal logging and agricultural expansion. Financial and technical support, policy coordination, and institutional collaboration are needed to improve performance.

1. Introduction

Since the 1980s, community-based forest management has been widely adopted to enhance sustainable natural resource management, reduce deforestation, and involve local communities in forest management (Bray et al., 2005; Engbring and Hajjar, 2022). Community Forest Enterprises (CFEs) apply business approaches to enhance economic, social, and environmental outcomes (Di Girolami et al., 2023). Despite their potential for job creation and community development, scientific evidence on CFE performance is limited and mixed (Foundjem-Tita et al., 2018; Lescuyer et al., 2015; Humphries et al., 2012). For instance, Mexico reported improved livelihoods through CFEs (Cubbage et al., 2015; Siegner et al., 2022a), while Nepal's CFEs improved incomes but required external support (Shrestha et al., 2022). Other studies show little change or negative outcomes like elite capture and poor governance (Assembe, 2006; Piabuo et al., 2018). Scholars emphasize that CFE performance evaluation should include the multiple objectives of a CFE, not only "standard" economic/financial dimensions, such as revenue and profit generation, but also the social and environmental objectives (Ebrahim and Rangan, 2014; Arena et al., 2015). Di Girolami et al. (2023) also emphasize this need to combine economic, social, and environmental analyses of community forestry as different aspects can have synergies and trade-offs among each other and analysing only one dimension *"provides only a tiny part of a much bigger picture."* (ibid, p13).

So far, the different indicators and dimensions developed to evaluate CFE performance have focused primarily on one or a few objectives for performance evaluation; thus, a bigger picture needs to be included (Piabuo et al., 2021; Cubbage et al., 2015). Most papers evaluating CFE performance focused on the economic aspect (Antinori and Bray, 2005; Humphries et al., 2012; Vega and Keenan, 2014), while others have

* Corresponding author at: Wageningen University and Research, the Netherlands.
E-mail address: spiabuo@worldbank.org (S.M. Piabuo).

https://doi.org/10.1016/j.forpol.2025.103470
Received 11 February 2025; Accepted 28 February 2025
Available online 17 March 2025

concentrated on the social and environmental dimensions (Maldonado et al., 2017; Hajjar and Oldekop, 2018). Studies employing the economic, social, and environmental dimensions have used qualitative indicators, often very context-specific, liable to judgment bias, and are challenging to apply in different contexts (Siegner et al., 2022a; Siegner et al., 2022b). Therefore, a performance evaluation framework with quantitative indicators that allows for easy application in different contexts and comparisons is lacking.

Researchers emphasize the need for a multi-dimensional performance evaluation framework that includes economic, social, and environmental objectives (Ebrahim and Rangan, 2014; Arena et al., 2015). This study aims to fill this gap by proposing a multi-dimensional performance framework for CFEs and empirically applying it to a sample of nine CFEs in Cameroon. The framework uses quantitative indicators and a rating system to evaluate performance as "low performers," "intermediate performers," and "effective performers." This evaluation helps CFE managers make informed decisions and ensures accountability to stakeholders (Arena et al., 2015). The study also examines internal and external factors influencing CFE performance, such as market knowledge, income generation capacity, collaboration, community engagement, taxation, market prices, and market proximity (Piabuo et al., 2019; Di Girolami et al., 2023). Against this background, this paper has the following objectives:

i) Develop a framework for evaluating the economic, social, and environmental performance of CFE.
ii) Empirically apply the framework and identify factors that influence CFE performance.

Cameroon was chosen as a case study due to its evolving community forestry sector and the presence of various CFEs trading in timber, non-timber forest products, and agricultural products (Minang et al., 2019; Foundjem-Tita et al., 2018). The analysis includes different CFE products, such as timber, non-timber forest products, and agricultural activities like maize cultivation and fishing.

The remainder of this paper is structured as follows: Section 2 describes the multi-dimensional contextual framework developed for this research. Section 3 details the methodology applied to collect data for implementing the framework. Section 4 presents the results. The paper concludes with a discussion (Section 5) and a conclusion (Section 6).

2. A conceptual framework for performance evaluation of CFEs

This paper builds on the literature of Social Enterprises (SEs) and CFEs to develop a contextualized framework for evaluating CFE performance. The SE literature emphasizes the multiple objectives of social enterprises as a critical defining factor (Ebrahim and Rangan, 2014; Arena et al., 2015). Social enterprises operate in diverse sectors with varying legal and organizational structures, making it challenging to create a universally applicable framework (Bull et al., 2007; Arena et al., 2015). Measuring performance requires quantification, which is often difficult for intangible social and environmental values (Bull et al., 2007). Process-based measurement models suggest that performance measurement should consider the processes leading to outputs, outcomes, and impact, following the logic chain of results (Ebrahim and Rangan, 2010). Dashboard and scorecard models capture financial and non-financial aspects of social enterprises and can be adapted to specific configurations (Kaplan and Norton, 2001; Papalexandris et al., 2005; Millar and Hall, 2013).

This study employs the triple bottom line (TBL) framework as a form of dashboard model because it can be easily adapted to different organizations and fits enterprises in the forest sector, which must respect economic, social, and environmental conditions (Foundjem-Tita et al., 2018). The TBL framework, widely used for evaluating social enterprises, is simple and practical (Gillis and James, 2015; Satar, 2022; Ho and Taylor, 2007; Hubbard, 2006). It represents the three key pillars of sustainability[1]: economic (Profit), social (People), and environmental (Planet) dimensions (Elkington, 1997; Strezov et al., 2013). The economic dimension refers to the organization's ability to increase shareholder value or profit (Dočekalová and Kocmanová, 2016; Elkington, 1997). The social dimension involves contributing to equality in education, health, access to social resources, and overall quality of life (Journeault, 2016; Chalmeta and Palomero, 2011; Elkington, 1997). The environmental dimension focuses on sustainability, including monitoring air quality, water, energy consumption, natural resource management, and land use (Elkington, 1997; Hsu et al., 2011).

To capture the economic/financial dimensions of CFEs, this paper adopts operating efficiency ratio, operating profit and net profits as indicators of resource allocation for CFEs:

The operating efficiency ratio is a measure of a company's efficiency in using resources to generate revenue and profits. It compares revenue to operating expenses, including goods sold, workforce, and overhead. A lower ratio indicates a financially healthy business, offering better returns on investment and a competitive advantage. An efficiency ratio of 50 % or less is considered excellent (Jacewitz and Kupiec, 2012; Hays and Lurgio, 2009). Understanding operational efficiency enhances a company's efforts and helps make strategic decisions (Hays and Lurgio, 2009).

Operating profit is the total income earned from a company's operations before taxes, interest charges, and other expenses (Jayathilaka, 2020; Nadiyah et al., 2024). It provides a clear picture of a company's core business profitability, enabling informed decision-making about cost control, investment strategies, and overall business health (Nadiyah et al., 2024). It is important because it focuses on core operations, compares with competitors, identifies areas for improvement, and is a key indicator of a company's financial health and potential for growth. Understanding operating profit trends helps businesses make informed decisions about pricing strategies, product offerings, marketing campaigns, and resource allocation (Armono, 2024).

Net profit is the remaining amount after deducting a company's total expenses from its total revenue for a given accounting period (Jayathilaka, 2020; Nadiyah et al., 2024). It is a crucial metric for business owners, investors, lenders, and managers (Handayani and Winarningsih, 2020). It indicates a company's profitability and can be used to plan for growth, marketing, or hiring. A consistently positive net profit attracts investors and helps lenders determine loan repayment (Handayani and Winarningsih, 2020). Net profit margin also indicates the overall management of a company's resources, with sound inventory and expense management contributing to growth or downfall. Table 1 summarises the dimensions and indicators used in this paper for CFE performance evaluation.

This paper explores the social dimensions of CFEs in Cameroon, using indicators from CFE literature to align with their objectives (Awono et al., 2012). CFEs are considered social enterprises because they reinvest profits into social projects, limiting profit distribution (Piabuo et al., 2022). Community forestry scholars note that CFEs aim to provide local employment, public goods, and services to their communities (Antinori and Bray, 2005; Cubbage et al., 2015). Based on this literature, the two indicators considered for the social dimension are investment in community (social) projects and employment creation. The percentage of women employed by CFEs is also used to measure labour inclusivity and female empowerment (Piabuo et al., 2020).

[1] The three key pillars of sustainability defined here have been contextualized to the CFE context and used throughout this paper as multi-dimensions of CFE performance

Table 1
A performance dashboard for CFE evaluation in Cameroon.

Dimension	Objective	Criteria	Definition
Economic/ Financial	In the immediate term, CFEs seek to allocate their resources efficiently and cover operational costs; in the medium term, they aspire to cover the total cost and make profits.	Operating efficiency ratio	$\sum_{i=1}^{n} \frac{operating\ expenses + cost\ of\ goods\ sold}{net\ sales}$ X 100[a]
		Operating profit	Revenue – (cost of goods sold + Operating Expenses
		Net profits	Difference between the total revenue and the total cost over the evaluation period minus taxes.
Social	As CFEs continue operating, they seek to promote female and youth employment within the community and use profits from CFE activities for social investment.	The proportion of female employees	Percentage of female employees
		Value of employment created	Represents the total salary paid to employees
		Investments in community projects	Amount spent by CFE on social projects such as health, education, and access to electricity and water.
Environmental	CFEs seek to enhance sustainable forest management by reducing illegal logging and agricultural expansion into the community forest.	Incidences of illegal logging	Frequency of illegal logging incidents reported.
		Deforestation because of economic activity	The forest area (in Ha) cleared for economic activities such as agriculture.

Source: Adapted from the triple bottom line framework (Elkington, 1997).
[a] The number of operations warranting expenditure and generating revenue is captured from 1 to n.

Investments in community development initiatives, such as improving access to water, education, healthcare, and electricity, are considered social contributions and not part of enterprise costs since they benefit community wellbeing. When investments are done by the CFE for product development and sales, its captured under the cost of production.

To reflect the environmental dimension of CFEs, various indicators from the literature were assessed, including forest cover and quality, carbon sequestration, changes in biodiversity, and forest area (Sunderland et al., 2013). However, aspects like carbon sequestration were not used due to their measurement complexity for CFE managers. Instead, based on regular forest monitoring, incidences of illegal logging and agricultural expansion into forests were adopted due to data availability. The trend of these indicators from baseline year, 2017 to 2019 was used. These indicators were retained because they are pressing environmental challenges faced by community forests in Cameroon (Ndoye and Awono, 2005; Lescuyer et al., 2021).

As shown in Table 1, the environment/planet dimension of the TBL framework is adapted to CFEs by linking it to their objectives of enhancing sustainable forest management by reducing illegal logging and agricultural expansion into community forests (Piabuo et al., 2019; Piabuo et al., 2021). This is achieved through monitoring and reporting by community members, management committee members, and CFE staff, often in collaboration with local government forestry staff to ensure activities respect the CF simple management plan (SMP).

One strength of this framework is that it includes indicators that CFEs can easily measure after a year of operation. Environmental indicators can show changes over short time frames, unlike those requiring longer periods, such as forest cover change. This makes the framework applicable to CFEs in Africa and other developing countries. While aspects like poverty reduction are difficult to measure and attribute directly to CFE activities, the framework reflects a CFE's financial health and its contributions to employment and community projects, which are core objectives of CFE. Also, this paper presents indicators and dimensions for creating a dashboard for CFEs to reflect their economic, social, and environmental objectives. These dashboards help CFEs communicate their performance to stakeholders, build trust, and monitor progress, enabling informed resource allocation and achieving Total Business Benefits (TBL) goals.

3. Methodology

3.1. Research approach

This paper sampled CFEs supported by the Dryad project "Financing Sustainable Community Forest Enterprises in Cameroon," implemented between 2016 and 2020 by the World Agroforestry. The project provided financial and technical support to CFEs based on timber, aquaculture, agricultural, and NTFP products. A mixed research method was employed because the research questions have quantitative and qualitative variables (Johnson and Onwuegbuzie, 2007). This approach permits expansion and allows for the triangulation of information, complementarity, and the development of new knowledge to enrich literature (Greene, 2007). Quantitative methods were employed for cost-benefit analysis and social and environmental performance calculation, while qualitative methods were used to understand the internal and external factors that explain CFE performance levels.

3.2. Sample

A sample of nine CFEs was selected from 34 CFEs supported by the Dryad project (see Table 2). These CFEs were selected based on two criteria: (1) the selected CFEs exploit a range of product types (timber, non-timber Forest Products (NTFPs), agroforestry, and aquaculture), and (2) they had available data.

- **Timber-based CFEs**: Three CFEs focusing on timber exploitation are in the Ngamber-Tikar sub-division of the centre region of Cameroon. These CFEs negotiate with timber buyers and receive orders with specifications of the timber species, agreed price, and quantity. They selectively log the required species and quantities and sell them to their customers. Since 2017, these timber enterprises have been supported with timber exploitation equipment, capacity building, and running capital to exploit their forests without sub-contracting to third parties. A mobile saw, which is the most expensive equipment required, was purchased under a cost-sharing scheme between the three CFEs due to their proximity to enhance profitability and reduce fixed costs. A joint management system of the mobile saw by the CFEs was adopted. These CFEs were chosen to understand the performance of timber-based CFEs and the effectiveness of cost-sharing in enhancing CFE performance.
- **Non-Timber Forest Products (NTFPs) based CFEs**: An evaluation of 44 communities in Cameroon revealed that 26 % were interested in developing NTFPs-based enterprises (Piabuo et al., 2019). Three from a total of eleven NTFP-based CFEs were selected. They focus on njangsang (Ricinodendron heudelotii) nuts, purchasing them from community members, processing them, and selling them to customers in major cities or neighbouring countries.
- **Agroforestry-based enterprises**: Two CFEs were engaged in the cultivation and commercialisation of maize (*Zea mays*) and had detailed data on costs, revenues, and incidents of illegal logging. The

Table 2
Characteristics of sampled CFEs.

CFE Identifier	Enterprise	Business Type	Population of community	Department	Area (ha) of CF	Area (ha) used by CFE	Comment
CFE1	Artisanal timber logging	Timber	350	Mbam-et-Kim	4998	200	Timber is exploited based on an annual exploitation permit; the average authorized area ranges between 150 and 200 ha.
CFE2	Artisanal timber logging	Timber	1200	Mbam-et-Kim	5000	200	
CFE3	Artisanal timber logging	Timber	1200	Mbam-et-Kim	4683	150	
CFE4	Collection, processing, and commercialisation of njangsang	NTFP	350	Mbam-et-Kim	4998	4998	NTFPs can be collected throughout the forest
CFE5	Collection, processing, and commercialisation of njangsang	NTFP	1500	Mbam-et-Kim	4683	4683	
CFE6	Collection, processing, and commercialisation of njangsang	NTFP	1800	Meme	2554	2554	
CFE7	Cultivation and commercialisation of maise	Agroforestry-based enterprises	508	Mbam-et-Kim	5000	15	Area of farmland created by the CFE
CFE8	Cultivation and commercialisation of maise	Agroforestry-based enterprises	5000	Mbam-et-Inoubou	5000	15	
CFE9	Cultivation, smoking, and Commercialisation of Tilapia	Aquaculture	2400	Nyong-et-Mfoumou	1700	0.01	The area used for the CFE fish pond

availability of fertile land and knowledge of market outlets were crucial motivations for the communities.

- **Aquaculture-based CFEs**: One CFE was involved in aquaculture (tilapia). This CFE was included because it is located within the forest, with the aquaculture area protected by the community from logging and agricultural expansion. The CFE is close to a city and has been subject to large-scale illegal expansion of agricultural farms by elites in the community forest. Because one of the CFEs did not have abundant timber trees in its forest or NTFPs, they decided to valorise water resources in the forest by creating fishponds. The availability of a permanent running stream and easy access to the market were motivating factors for the CFE.

3.3. Measurement of CFE performance indicators

Building on the TBL framework (Table 1), different indicators were used to capture the criteria for the TBL dimensions of CFEs. To have a clear overview of CFEs' overall performance, a scoring system is summarised in Table 3, indicating the scores for different dimensions. In this paper, equal weights are assigned to each dimension because CFEs allocate equal importance to all dimensions. If CFEs prioritize a

Table 3
Summary of performance indicators and analysis techniques.

Performance dimension	Criteria	Indicator	Variables	Data sources	Overall performance scoring criteria (1 = very low 2- low, 3 = good, 4 = very good)
Economic/financial performance	Operating efficiency ratio	Revenues/labour cost, inputs	Labour cost Inputs Total revenue	Income/expenditure statements, FGDs	1 = CFE's operating efficiency ratio > 100 %, operational losses, net loss 2 = CFE's operating efficiency ratio is between 50 % and 100 %, operationally profitable, and net losses. 3 = CFE's operating efficiency ratio between 50 % and 100 %, operationally profitable, net profits 4 = CFE's operating efficiency ratio is <50 %, operationally profitable, net profits.
	Operational profit/ loss	Revenues/labour cost, inputs	Labour cost Inputs Total revenue	Income/expenditure statements, FGDs	
	net profits/loss	Revenue: total cost	Total revenue Total cost Taxes	Income/expenditure statements, FGDs	
Social performance	Job creation	Number of CFE employees by gender Amount paid to CFE employees	Number of male and female CFE employees The total amount paid to CFE employees	Income/expenditure statements, FGDs Income/expenditure statements, FGDs	1 = no jobs created and no social projects executed 2 = jobs created (<40 % female) or social projects executed 3 = jobs created (<40 % female) and social projects executed or jobs created (>40 % female) 4 = jobs created (> 40 % female) and social projects executed
	Investment in social projects	Total spent on social projects	Social projects executed by CFE Amount spent per project	Income/expenditure statements, FGDs	
Environmental performance	Incidences of illegal logging Deforestation due to economic activities	Number of incidences of illegal logging Area of forest (ha) cleared for economic uses (e.g. agriculture)	Number of incidences of illegal logging per year Area of forest (ha) cleared for economic uses (e.g. agriculture) per year	CFE environment indicator survey Satellite imagery and transect sampling in the CF	1 = Rising trends in illegal logging incidents and the area of forest area cleared for economic uses 2 = No change in the trends of illegal logging incidents and forest area cleared for economic uses. 3 = reduction in trends of either incidence of illegal logging or area of forest cleared for economic uses 4 = reduction in trends of both incidences of illegal logging and area of forest cleared for economic uses

particular dimension, different weights can be assigned. A summary of the performance indicators used under each dimension is highlighted below.

3.3.1. Economic/financial performance of CFEs

The operating efficiency ratio, a key metric for assessing day-to-day company performance, measures management efficiency by comparing total operating expenses and cost of goods sold to net sales, excluding debt, to show how well costs are kept low while generating revenue. Operating expenses in this context include labor costs, consumable equipment, truck rentals, fuel, and transport costs. The cost of goods sold applies only to njangsang CFEs, as they purchase njangsang from the community. Net sales represent the total revenue CFEs generate after accounting for discounts, customer returns, and deductions, calculated by subtracting these deductions from gross sales.

Operating profits are calculated as CFE earnings after subtracting operating expenses and the cost of goods sold (COGS). Net profits are captured as CFE total revenue minus the cost of goods sold, operating expenses, depreciation, interest, and taxes over the accounting period.

3.3.2. Social performance

The social dimension of CFEs is measured using two indicators: investment in social projects and job creation. Job creation includes the number of community members employed full-time and part-time, and the monetary value of their employment, reflecting the number of beneficiaries. The percentage of jobs occupied by women is also considered to reflect inclusion and empowerment. These indicators are rated based on job creation (number and value) and the percentage of women employed. The employment value also indicates the CFE's contribution to the local economy. Higher scores are given to CFEs that invest in social projects.

3.3.3. Environmental performance

The environmental dimension was assessed using two indicators: the number of reported illegal logging incidents and the agricultural area cleared for economic uses. Illegal logging data was collected through an enterprise environmental survey and cross-checked during focus group discussions. The agricultural area cleared for economic uses was reported using the environmental survey and confirmed through the analysis of land-use change maps from satellite images and field transects. The trend from the baseline year (2017) to 2019 was established to capture the evolution over time for both indicators.

3.3.4. Overall rating of CFE performance

As shown in Table 3, the scoring system visualises multi-dimensional CFE performance using economic, social, and environmental dimensions. While some scholars have used arbitrarily defined weights to maximize scores in performance evaluation (Neykov et al., 2021; Kao et al., 1993), this method can diminish the importance of performance metrics to the entities. In this paper, equal weights(1) are assigned to each dimension because CFEs allocate equal importance to all dimensions. If CFEs prioritize a particular dimension, different weights can be assigned. The objective is not to follow a statistical approach but to provide scores based on literature in enterprise development and community forestry, ranging from the worst (1) to the best (4) outcomes for each dimension. To cluster the CFEs further based on performance levels, Siegner et al. (2022a) definition was used to cluster CFEs into:

(i) Effective performers: average overall score greater than 3 on all three (economic, social, and environmental) dimensions, balancing their plural goals
(ii) Intermediate but not skewed performers: score average between 2.5 and 3 on all dimensions
(iii) Intermediate and skewed performers: score between 2.5 and 3 on economic or social/environmental dimensions
(iv) Low performers: score under 2.5 on economic, social, and environmental dimensions

3.4. Data collection and analysis

Data was collected from CFE records, focus group discussions, satellite imagery, and plot transects. Field data for this study were collected between 2018 and 2020, representing a complete cycle (production to sales) for most CFEs.

CFE records: Production costs and expenditures data were obtained from expenditure statements and supporting documents such as receipts. CFE revenue/cost data was obtained from CFE income and expenditure statements, and supporting documents were used to cross-check values. Data on environmental performance was obtained through the environmental incident report on illegal logging within the CF.

Focus Group Discussions (FGDs): One FGD per CFE, comprising five key staff members (such as the CFE manager, accountant, and secretary), was conducted for all nine CFEs. These FGDs aimed to understand the internal and external factors affecting CFE performance. Discussions covered CFE income/expenditure, key cost elements, challenges related to reducing costs and maximizing revenue, illegal logging, agricultural expansion into the forest, actions to curb these issues, and key internal and external factors affecting the three dimensions. The contribution of CFEs to local employment and social projects financed from CFE profits was also discussed.

Satellite imagery and ground truthing using transects: Landsat images from 2016 to 2020 captured land-use changes within the CF. Field transects facilitated the classification of land uses. Two transects (one in areas with low human activity and another with considerable activity) were laid out with seven plots, each covering about 625 m^2.

4. Results

This section summarises the results of economic, social, and environmental dimensions and the internal and external factors affecting the performance of CFEs.

4.1. Economic/financial dimension

To capture the CFE economic performance dimension, performance scores based on the indicators in Table 3 and factors influencing the economic dimension from FGDs are presented.

4.1.1. Economic/financial performance scores

Table 4 summarises the economic performance of CFEs, focusing on operational efficiency, operational profits/loss, and net profit/loss.

All timber CFEs were operationally efficient and made operating profits; however, their operating efficiency did not meet the recommended 50 %. Although they were profitable, the revenue generated was insufficient to cover the total costs, resulting in net losses. High production costs were attributed to various factors, including the expenditure on regulatory documents, which accounted for 10 % of the total cost. Material and equipment costs made up 14 %, while labor costs accounted for 23 %. The equipment cost per CFE was reduced as three CFEs shared the cost of a mobile saw at $9926 each, significantly lowering the fixed cost per CFE. Despite effectively rotating the use of the mobile saw, there is room for improved efficiency through better planning and adherence to deadlines. Timber enterprises also incurred high costs for truck rentals to transport timber from the forest to the village, accounting for 15 % of their total expenditure. Although timber CFEs invested heavily in production, the quantity produced was insufficient to cover the high production costs, resulting in a performance score of two for the economic dimension.

Out of the three NTFP CFEs in the sample, only one was operationally efficient, profitable, and made net profits. The other two were not

Table 4
Performance score of CFEs on their economic/financial dimension.

CFE	Operating efficiency ratio	Operating profits	Net profits	Performance score
Timber CFE1	75.50 % (efficient, but not the recommended 50 % level)	2957 USD	−5477 USD	2
Timber CFE2	87.76 % (efficient, but not the recommended 50 % level)	2543.50 USD	−2780.5 USD	2
Timber CFE3	83.48 % (efficient, but not the recommended 50 % level)	1781.00 USD	−571 USD	2
Njangsang CFE1	113.25 % (inefficient)	−955. USD	−2414 USD	1
Njangsang CFE2	96.24 % (efficient, but not the recommended 50 % level)	186 USD	143. USD	3
Njangsang CFE3	112 % (inefficient)	−1086.00 USD	−1212 USD-	1
Maize CFE1	129.1 % (inefficient)	−1562 USD	−2158USD	1
Maize CFE2	800.2 % (inefficient)	−7002 USD	−7753USD	1
Aquaculture (tilapia) production CFE	370.2 % (inefficient)	−3348 USD	−3817USD	1

operationally efficient and incurred operational and net losses. Although NTFPCFE2 produced a lower quantity of njangsang than NTFPCFE1 and NTFPCFE3, they had better control over their production costs. The purchase of raw materials for NTFPs is a major cost element, representing 53 % of the total cost, followed by labor costs at 28.8 %. In communities where middlemen (buyam-sellam) frequently buy, there is high competition for resources, increasing the purchasing price for NTFP CFEs. Communities reported an average increase of 18 % compared to their projected purchasing price. Due to this competition, some communities had to source products from neighbouring villages, leading to increased transport and labor costs. At times, the poor condition of the roads caused the extra transport costs to equal or exceed expected profits, pushing the CFE into losses.

The two maize CFEs in the sample made losses at all levels and were not operationally efficient. Maize CFE2 experienced worse losses. Labor costs, representing 78 % of total costs, varied with labor availability. During peak agricultural seasons, high demand increased labor costs, and sometimes labor was scarce as members preferred working on their farms. This was particularly true for maize enterprises operating on over 10 ha of land, leading CFEs to hire external labor for the production season. CFE management indicated that climate change significantly affected production, especially in the forest-savanna transition zone. Maize CFE2 reported losses of over 70 % of expected yields due to delayed rainfall. Maize CFE1 also suffered from natural hazards, with savannah birds consuming almost 65 % of production. These challenges and high labor costs resulted in poor scores for maize CFEs on this dimension.

The aquaculture production CFE was operationally inefficient, resulting in both operational and net losses, leading to a poor economic score. Aquaculture (tilapia) production required significant investment in equipment, such as constructing fishponds and enterprise premises. Labor costs accounted for 43.4 % of their total costs, while inputs, especially food for tilapia, made up 23.3 % of expenditures. Improved food management at later stages helped reduce food costs.

4.1.2. Factors influencing the economic/financial dimension

The findings from FGDs with CFE management identified five key internal and external factors affecting the economic performance of CFEs. Some factors are specific to certain types of CFEs.

The first factor is the taxation of timber CFEs. The Republic of Cameroon's Finance Law for 2019 increased the timber felling tax from 2.5 % to 4 %, based on the FOB value of logs. CFs are exempt from this tax if the community exploits them directly, but the tax applies when subcontracted. One CFE reported paying $1376 in taxes, representing 7.8 % of revenue. However, CFEs can be exempted if they prove direct exploitation.

The second factor is market knowledge. CFEs with better market understanding and a network of buyers reported higher sales prices for the same products compared to neighbouring CFEs. For example, timber CFE2 sold Iroko at $231/m^3, while timber CFE1 sold it for $224.7/m^3.

Market prices emerged as the third factor. Prices vary based on product seasonality and trade relations with neighbouring countries. When borders with Nigeria and Gabon were closed due to the anglophone crisis and the COVID-19 pandemic, prices of agricultural products and NTFPs dropped significantly. For NTFPs, sales prices depend on the season and market knowledge. Low productivity seasons see higher prices due to greater demand, while high production seasons can lead to lower prices. CFEs can benefit by storing products and selling them at higher prices during the off-season.

The fourth factor is administrative delays in processing documents for transporting forest products. CFEs require certain documents to legally transport and commercialize NTFPs and timber products. Besides the cost, obtaining these documents is time-consuming. They are provided for 12 months, but CFEs often receive them in late March or early April, coinciding with the rainy season. This delays timber logging until June, leaving only five months of production and reducing the chance of full capacity exploitation. This explains why CFEs do not exploit more than half of the quantity authorized in the annual exploitation permit.

The fifth factor is market access. Most CFEs are in rural areas with roads that become inaccessible during heavy rains, making it difficult for buyers to reach the community and reducing the CFEs' negotiation power. Agriculture and aquaculture CFEs often have only two major buyers, who dictate prices due to the lack of proper post-harvest storage facilities. Communities with good roads receive better prices and higher revenues than landlocked ones. However, maize enterprises can store their products for extended periods due to constructed storage facilities and good post-harvest handling.

4.2. Social dimension

The social performance dimension of CFEs reflects how well they score on the performance indicators highlighted in Table 3 and the factors influencing their social performance.

4.2.1. Performance scores

This dimension captures the number of CFE employees, and the value of the jobs created, as well as the community projects executed by CFEs. Before the development of these CFEs, consistent income was a major issue for youths, leading to high rural-urban migration. However, as shown in Table 5, CFEs significantly contributed to job creation by providing full-time and part-time jobs, varying by CFE type. Some CFEs created more jobs for women than men.

NTFP CFEs created 153 part-time and 12 full-time jobs through women's involvement in purchasing, cracking, and drying njangsang nuts. Timber CFEs created 80 part-time jobs at various stages of timber production and 13 full-time positions for daily activities like recording sales, purchases, quality control, and financial management. Agricultural enterprises (maize and aquaculture) also contributed by creating 59 part-time and nine full-time job.

In terms of total wages paid, timber enterprises spent the most, with the three timber CFEs paying $12,300 in wages. However, agricultural

Table 5
Performance score of CFEs on their social dimension.

CFE	Job creation					Investment social project	Performance scores
	Number employed	Fulltime		Part-time	Employment value		
		Male (%)	Female (%)				
Timber CFE1	27	1(25 %)	3(75 %)	23	3715 USD	0	3
Timber CFE2	33	4(80 %)	1(20 %)	28	5945 USD	Education ($645) Access to a communication network ($744.5)	3
Timber CFE3	33	2(50 %)	2(50 %)	29	2640USD	0	3
Maize CFE1	18	2(50 %)	2(50 %)	14	5936 USD	Donation of pharmaceutical products to the integrated health Centre($626	4
Maize CFE2	21	3(100 %)	0	18	6900 USD	0	2
Njangsang CFE1	64	1(25 %)	3(75 %)	60	2416.USD	0	3
Njangsang CFE2	44	1(25 %)	3(75 %)	40	1245 USD	Financial support to the old($902) Scholarship to females from the community ($901)	4
Njangsang CFE3	57	3(75 %)	1(25 %)	53	3454USD	Donation of pharmaceutical products to the integrated health Centre($626)	3
Aquaculture (tilapia) CFE	31	2(50 %)	2(50 %)	27	2192 USD	0	3

enterprises had the highest ratio of total expenditure per production cycle to wages, with 79 % of every dollar spent on wages due to their labour-intensive nature. Aquaculture (tilapia) production CFEs followed, with 43 % of every dollar spent on wages, while timber and NTFP CFEs spent 23 % and 22 %, respectively. If we include the money spent on purchasing raw materials from the community, the contribution of NTFP CFEs to the local economy increases to 85 %.

According to the 1994 Forest Law, proceeds from CFEs should be used for social development, such as education, health, and access to clean water. Timber CFE2 used part of its revenue to pay the salaries of four primary school teachers ($645) and to purchase a network antenna ($744.5) to connect the village to the telephone network. Additionally, 16 sick and elderly community members received financial support. Njangsang CFE2 supported two young girls from the community by sending them for medical training in Buea.

4.2.2. *Factors influencing the social dimension of CFEs*

During FGDs with CFE management, two key factors influencing social performance were identified.

The first factor is the income generation capacity of the CFE. CFEs noted that their ability to meet social needs depends on income from trading forest products. When CFEs are operational, they create jobs for community members, with the number and value of jobs varying by CFE type. Investment in social projects depends on production outcomes; profits enable community development, while losses prevent it. High-capital projects can only be financed when CFEs mature and make significant profits, explaining why initial investments low-budget were. Larger projects, like constructing classrooms and health centers, were proposed for future seasons with better profitability.

The second factor is the type of product traded. Labor-intensive products provide more employment and higher social performance due to job creation. In contrast, capital-intensive products like timber require high investment in machinery and create fewer jobs but generate higher revenue and profits, enabling more significant social projects. NTFPs and agricultural CFEs create more jobs but generate less profit for social projects. Some CF management committees aim to balance social objectives by developing both capital-intensive and labour-intensive CFEs.

4.3. *Environmental dimension*

The environmental dimension and factors influencing the environmental performance of CFEs are presented in the following section.

4.3.1. *Performance scores*

The results indicate a reduction in illegal logging incidents for all sampled CFEs and a decrease in agricultural area cleared for economic uses account for 55.55 % of the sample. This explains the higher environmental scores attributed to CFEs. The average number of illegal logging incidents reduced from 12 at baseline to two in 2019, showing significant improvement in community action due to CFE activities. The agricultural area cleared for economic uses also decreased from an average of 34 ha at baseline to 18 ha in 2019. Although this reduction is not as significant as the decrease in illegal logging incidents, it demonstrates progress by CFEs in controlling agricultural expansion within community forests. Consequently, 55.56 % of the sampled CFEs received a high environmental score of four, while 44.46 % received a score of three.

4.3.2. *Factors influencing the environmental dimension*

Following FGDs, three factors influence the performance of the environmental dimension of CFEs. These factors are common to all CFEs, but they were more influential in certain CFEs in the sample.

Community engagement emerged as a key factor influencing CFE's environmental performance. All community members are responsible for monitoring and reporting illegal activities within the forest. This engagement enhances the CFE team's ability to quickly detect and stop illegal activities with the help of administrative authorities. Some CFEs created a forest monitoring committee with regular checks, and all community members reported illegal logging or encroachments to the forest management committee. The ability of CFEs to enhance sustainable forest management and respect the SMP depends on the capacity of the CFE management team and collaboration with community members. Sensitization efforts by CFEs have significantly reduced illegal logging. Table 6 shows a significant reduction in illegal logging cases over the years. Community sensitization and collective action have also significantly reduced agricultural expansion inside the forest. The forest monitoring committee and community members quickly detected and reported new farm creations to the community forest management committee, leading to better control over the allocation of hectares and enhancing sustainable forest management.

Collaboration with the local government administration is the second factor influencing the environmental performance of CFEs. Most CFEs improved their collaboration with the decentralized forest control committee to curb illegal logging. For the seven relatively landlocked CFEs, agricultural encroachment by community members was significantly reduced through mass sensitization on agricultural zones. CFE management often invited the district delegate of agriculture to enforce

Table 6
Results of the environmental dimension of CFEs.

CFE type	Incidences of illegal logging			Trend from baseline	Agricultural area (ha) of CFE cleared for economic reasons			Trend from baseline	Performance scores
	Baseline	2018	2019		Baseline	2018	2019		
Timber CFE1	11	1	0	−5.5	10	25	16	3	3
Timber CFE2	1	0	0	−0.5	0	0.28	0.5	0.25	3
Timber CFE3	4	0	0	−2	4	2	1	−1.5	4
Maize CFE1	21	1	1	−10	96	38	53	−21.5	4
Maize CFE2	24	2	1	−11.5	82	113	33	−24.5	4
Njangsang CFE1	2	0	0	−1	9	4	2	−3.5	4
Njangsang CFE2	3	0	0	−1.5	0	0.1	0.5	0.25	3
Njangsang CFE3	16	2	4	−6	26	11	28	1	3
Aquaculture (tilapia) CFE	32	7	11	−10.5	79	38	34	−22	4

these sensitizations and explain potential penalties to offenders. Therefore, community collaboration and partnership with the local government administration are critical in curbing illegal logging and agricultural encroachment. Collaboration with local forestry officials and community sensitization intensified reporting of illegal logging cases. Regular forest patrols by CF members also reduced illegal logging. Effective administrative bodies ensured that private partners and community members needing timber went through the community forest management committee, reducing illegal logging cases. CFEs developed environmental impact notices to identify mitigation actions.

Proximity to major cities emerged as the third factor influencing the environmental performance of CFEs. CFEs near major cities face pressure from agricultural expansion and illegal logging by urban and peri-urban dwellers. For example, the aquaculture production CFE has suffered from encroachment by elites, with large farms and illegal logging in the forest. The proximity to a major city attracts elites and businessmen involved in peri-urban agricultural activities. Reducing illegal logging is more challenging in communities close to cities and highways due to easy accessibility and high demand for wood products from neighbouring towns. In 2019, two CFs near major cities reported a high number of illegal logging cases, which were addressed by the subdivisional delegate and forest administration. Ensuring sustainable forest management and exploitation of CFE is crucial for timber exploitation to prevent the loss of high-market-value species. As part of management strategies, logged timber species are registered, and the enterprise promotes natural regeneration and the creation of nurseries for high-value tree species. To maximize benefits from water resources, diversify income sources, and reduce pressure on timber, the community developed an aquaculture (tilapia) production CFE. This initiative has helped reduce agricultural expansion, as evidenced by the increase in private fishponds and the reduction in agricultural lands within the forest.

4.4. Overall performance

The overall performance of CFEs indicates that the majority of the sampled CFEs (66.67 %) are intermediate performers, with scores ranging between 2.5 and 3 (see Table 7). However, they all score poorly (<2.1) on the economic dimension, making them intermediate but skewed performers with better scores on the social and environmental dimensions. Only one CFE is classified as an effective performer, with scores of three or above on all dimensions. The sample also includes two low performers, with average scores of less than 2.5.

In terms of overall performance across dimensions, the average score for the economic dimension is relatively low (1.55) compared to higher scores for the social (3.11) and environmental (3.55) dimensions. This suggests that CFEs still face significant challenges in effectively allocating resources to trade in forest products and generating operating and net profits, resulting in poor performance on the economic dimension. Conversely, CFEs show better performance in investing in social projects, employing community members, and reducing incidences of illegal logging and agricultural area cleared for economic uses.

The overall performance of CFEs is influenced by both internal and external factors (Shrestha et al., 2022). Key internal factors include the market knowledge of CFE members, their income generation capacity, the type of products traded, community engagement, and collaboration with local government administration. External factors affecting performance are market prices, administrative delays, market access, and proximity to major cities.

5. Discussion

5.1. CFE performance

The findings from this paper contribute to the empirical literature on CFEs in three keyways. Economically, it looks at the economic health of CFEs by breaking profitability analysis into operating efficiency ratio, operating profits, which permits to enhance CFEs operational efficiency in the short-term, and net profits. This is very different from other studies in the forest sector that focused on cost-benefit analysis without this breakdown. The findings also illustrate that CFEs are relatively poor at efficiently allocating resources to trade in forest products for operating and net profits. The paper notes that while one NTFP CFE was operationally efficient and made net profits, these profits were minimal, putting the enterprise at risk if operational costs increase. In contrast, timber CFEs with net losses can better absorb operational changes due to higher operational profits. This poor economic performance is consistent with Adhikary (2019), who highlighted that CFEs in Nepal exhibited poor economic performance. Frey et al. (2021) observed that CFE costs are initially 2.5 times higher than revenue but gradually decrease over time. Humphries et al. (2020) noted that economic performance expectations should vary based on the CFE's development stage; young CFEs (1–3 years) may incur losses but should cover operational costs, while older CFEs are expected to break even and make profits. Humphries et al. (2020) demonstrated this by applying a financial analysis tool to Brazilian CFEs over six years, showing gains in efficiency and labour productivity, resulting in increased revenue and labour payments to local communities. The sampled CFEs in this study are less than three years old, making them relatively young compared to established CFEs in Asia and America. The low economic performance scores suggest that some CFEs may prioritize goals other than revenue generation, such as employment creation or sustainable forest management (Piabuo et al., 2018). One key assumption of this paper's methodology is that CFEs equally prioritize their economic, social, and environmental dimensions. Adjusting the weights of different indicators to align with the specific objectives of CFEs could provide more insightful results for the overall CFE performance rating.

The second contribution of this study is expanding the view of CFE performance from a social dimension by not only focusing on social projects and amounts spent on them, but by looking at involvement of women in the workforce. Also, the paper also contributes empirically by showing that communities often misunderstand the concept of

Table 7
Overall performance[a] of sampled CFEs.

CFEs	Economic performance	Social performance	Environmental performance	Overall performance (average)
Effective performers (11.11 %)				
Njangsang CFE2	3.00	4.00	3.00	3.33
Intermediate performers, skewed (66.67 %)				
Timber CFE1	2.00	3.00	3.00	2.67
Timber CFE2	2.00	3.00	3.00	2.67
Timber CFE3	2.00	3.00	4.00	3.00
Njangsang CFE1	1.00	3.00	4.00	2.67
Maize CFE1	1.00	4.00	4.00	3
Aquaculture (tilapia) CFE	1.00	3.00	4.00	2.67
Low performers(22.22 %)				
Njangsang CFE3	1.00	3.00	3.00	2.33
Maize CFE2	1.00	2.00	4.00	2.33
Average	**1.55**	**3.11**	**3.55**	**2.74**

[a] (i) Effective performers: average overall score greater than 3 on all three (economic, social, and environmental) dimensions, balancing their plural goals, (ii) Intermediate but not skewed performers: score average between 2.5 and 3 on all dimensions, (iii) Intermediate and skewed performers: score between 2.5 and 3 on economic or social/environmental dimensions, (iv)Low performers: score under 2.5 on economic, social, and environmental dimensions.

reinvesting net profits into social projects. Despite not making profits, CFEs are expected not to invest in social projects, but they still spend on community projects. This behaviour is attributed to two main reasons: first, CFEs often confuse revenues with profits and proceed with community investments without considering fixed costs and equipment amortization, leading to poor investment decisions. Second, CFE managers often succumb to community pressure to invest in social projects, resulting in limited funds for enterprise development and growth. Additionally, some CFE managers cannot accurately determine their profits, further complicating the issue. This paper supports the findings of Piabuo (2023), who noted that community pressure often pushes CFE managers to invest revenue into social projects due to the performing paradox. Therefore, further training of CFE managers on financial discipline and communication with community members is essential.

From an environmental perspective, this paper enhances understand of how to view CFE environmental dimension by looking at two key drivers, agricultural expansion into forest for income-generating activities and illegal logging, this is an improvement to the popular concentration on illegal logging. CFEs in Cameroon have made significant strides in reducing illegal logging. Efforts to control agricultural expansion into forests have seen only mild success, as community members often prioritize livelihood needs. Over the years, illegal logging by commercial timber companies has significantly decreased in Cameroon. However, increasing population and demand for food have put pressure on forest land within community forests. The good scores on the social and environmental dimensions after two years are promising, indicating that CFEs can facilitate rural development and enhance sustainable management and community well-being.

Balancing economic, social, and environmental dimensions is critical for CFEs. Siegner et al. (2022b) highlight that the strategy employed by CFEs influences their performance across these dimensions. They suggest that a differentiation strategy is best suited for CFEs aiming to meet their economic, social, and environmental goals simultaneously. However, few CFEs can effectively apply a pure differentiation strategy; a more practical approach of learning by doing has been reported as an option to help CFEs meet their triple objectives.

5.2. Factors influencing CFE performance

To improve CFE performance, this research shows that the influencing factors are mostly context-specific and even CFE-specific. Climate change and labor availability are critical for agricultural CFEs, while complex administrative procedures are crucial for timber CFEs. Recent studies also highlight the importance of the community's history with CFEs. Understanding the context in which CFEs operate is essential for developing effective performance improvement strategies, as the influence of different factors changes as CFEs evolve. Continuous assessment of these factors at different stages (start-up, growth, maturity, decline) is necessary. This paper classifies the factors influencing CFE performance into three categories: policy support, institutional support through continuous capacity building, and community engagement.

The overall low economic performance of CFEs suggests a combination of poor business management knowledge among CFE managers and external factors such as competition and market price fluctuations. This is evident in the Aquaculture CFE, which incurred losses due to capacity issues. While the current performance evaluation provides valuable insights for learning-by-doing, it is crucial to apply the same framework regularly to track CFE performance over time. CFEs should continuously evaluate their performance, understand the factors affecting their economic dimension, and act accordingly (Meijaard et al., 2020).

The paper highlights the need for financial support through grants and technical assistance to help CFEs overcome capacity challenges and reduce internal factors affecting performance (see Table 8). Improving the business environment and mitigating the adverse effects of external factors are critical. External financing of start-up costs and continuous technical support are essential for long-term CFE performance (Humphries et al., 2020). Community engagement is crucial for forest monitoring, labour provision, and interactions with local administration. CFEs with strong community cultures are more likely to succeed (Carías Vega, 2019). Humphries et al. (2020) emphasize the importance of grants, technical support, and cooperation in the early stages of CFE development, noting that CFEs improve through learning by doing.

Policy support, such as tax rebates for the social contributions of CFEs, has been discussed, but qualifying conditions vary by country (Baldini et al., 2018; Sheila and O'Regan, 2018; Hemels, 2023). This means some small community social businesses may not benefit from tax incentives due to difficulties meeting these conditions (Sheila and O'Regan, 2018). Creating an enabling environment for CFEs requires cross-collaboration between institutions to provide policy, financial, and

Table 8
Factors influencing CFE performance by category.

Category	Internal	External
Policy support		• Taxation. • Market prices
Institutional and capacity building	• Market knowledge. • Income generation capacity	• Administrative delays. • Access to markets
Community engagement	• Collaboration with the local government administration • Engagement with community members	• Proximity to major cities

technical support packages1. Institutional support through partnerships is critical to enhance CFE capacity, facilitate market knowledge, and promote vertical integration (Siegner et al., 2022b; Humphries et al., 2020).

6. Conclusions

The objective of this paper was to evaluate the performance of CFEs in Cameroon from economic, social, and environmental dimensions and to understand the factors influencing their performance. This study contributes to the scholarship on CFE performance evaluation by proposing a contextualized multi-dimensional framework and empirically testing it using nine CFEs in Cameroon as a case study.

The CFEs varied in overall performance: 66.67 % were intermediate performers, 22.22 % were low performers, and 11.11 % were effective performers. Performance levels were influenced by context-specific factors. Internal factors included market knowledge, income generation capacity, collaboration with local government, and community engagement. External factors included taxation, market prices, administrative delays, market access, and proximity to major cities1.

Although the findings are not representative of all CFEs in Cameroon due to the sample size, they provide insights into the varying performance levels and influencing factors. Further research is needed to apply this framework to a more representative sample of CFEs. Considering the sampled CFEs are relatively young, their performance is expected to improve over time, especially if key influencing factors are addressed. Therefore, the application of this framework within the context of a panel data would provide better outcomes over time. The results indicate that for every CFE, it is crucial to have good market access, information on market prices, streamlined administrative procedures, strong relationships with government agencies, and community engagement. Additionally, policy support through favourable regulations and investments in improving the business environment is necessary.

This paper's significant scientific contribution is the introduction of a CFE performance evaluation framework suitable for small CFEs. However, applying this framework on a large scale requires certain prerequisites. CFEs that do not differentiate their fixed costs from operating costs or keep records of their income and expenditure will face challenges using this framework. The framework's main strength lies in its objectivity, unlike many CFE performance evaluation frameworks that rely on subjective assessments by CFE and community members. However, this objectivity is also a weakness, as subjective assessments offer a nuanced perspective that objective indicators cannot provide. Therefore, it is recommended that the application of this framework be complemented with an assessment of subjective factors influencing CFE performance and events that occurred during the assessment period to capture the operational context adequately.

Funding

This work was supported by the Department for International Development (DFID) within the framework of a 05-year funded project (2015–2020) in Cameroon called Dryad" Financing Community Forest Enterprises in Cameroon".

CRediT authorship contribution statement

Serge Mandiefe Piabuo: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Marjanke Hoogstra-Klein:** Investigation, Project administration, Supervision, Writing – review & editing. **Verina Ingram:** Project administration, Supervision, Validation, Writing – review & editing. **Divine Foundjem-Tita:** Conceptualization, Methodology, Resources, Validation. **Peter A. Minang:** Conceptualization, Funding acquisition, Resources. **Lalisa Duguma:** Conceptualization, Funding acquisition, Investigation, Project administration, Resources. **Hens Runhaar:** Project administration, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This paper builds on a UK Aid Department for International Development (DFID) funded project, "DRYAD: Financing Sustainable Community Forest Enterprises in Cameroon" research and development project. The authors also thank participants and implementing organizations such as ERuDeF (Environment and Rural Development Foundation), Centre D'appui aux Femmes Et Aux Ruraux (CAFER), Cameroon Ecology (Cam-Eco) and Coopérative agroforestière de la Trinationale (Cameroun) (CAFT) for their support during data collection. The authors acknowledge the support of the CGIAR program, Forests Trees, and Agroforestry (FTA) research program.

Appendix A. Detailed Economic/financial calculation of CFEs[2]

Element	Timber CFE1	Timber CFE2	Timber CFE3	Njangsang CFE1	Njangsang CFE2	Njangsang CFE3		Maize CFE1	Maize CFE2	Fish production CFE	
Regulatory and administrative cost (US $)			2309.00	1727.00	134.00	281.00	–	–	33.00	122.00	–
Revision SMP (US$)			570.00	590.00	546.00	–	–	–	–		–
Annual exploitation permit (US$)			497.00	330.00	514.00	–	–	–	–		–
Renewal waybills (US$)			660.00	670.00	153.00	–	–	–	–		–
Administrative expenses (US$)			–	–	–	306.00	43.00	126.00	21.00	81.00	–
Certificate of extension of activities (US $)			479.00	–	–	–	–	–	–		–
Materials and equipment (US$)			2540.00	2007.00	1005.00	872.00	–	–	542.00	548.00	469.00
Fixed cost			**7055.00**	**5324.00**	**2352.00**	**1459.00**	**43.00**	**126.00**	**596.00**	**751.00**	**469.00**
Labour (US$)			3715.00	5945.00	2640.00	2416.00	1245.00	3454.00	5936.00	6900.00	2192.00
Equipment consumables (US$)			452.00	778.00	352.00	240.00	278.00	278.00	–	–	–
Renting truck (US$)			2075.00	3559.00	2530.00	–	–	–	–	–	–
inputs (US$)			1832.00	3995.00	1756.00	32.00	32.00	38.00	498.00	598.00	1179.00

(*continued on next page*)

[2] Values were converted to USD at $1 = 604.508 XAF on 05/03/2023

(*continued*)

Element	Timber CFE1	Timber CFE2	Timber CFE3	Njangsang CFE1	Njangsang CFE2	Njangsang CFE3		Maize CFE1	Maize CFE2	Fish production CFE	
Cost of goods sold (US$)			–	–	–	4826.00	2545.00	5656.00	–	–	–
Transport (US$)			1039.00	3956.00	1720.00	650.00	664.00	690.00	478.00	504.00	1216.00
Operating expenses (US$)			**9113.00**	**18,233.00**	**8998.00**	**8164.00**	**4764.00**	**10,116.00**	**6912.00**	**8002.00**	**4587.00**
Tax (US$)			1379.00	–	–	–	–	–	–	–	–
Variable cost (US$)			**10,492.00**	**18,233.00**	**8998.00**	**8164.00**	**4764.00**	**10,116.00**	**6912.00**	**8002.00**	**4587.00**
Total cost (US$)			**17,547.00**	**23,557.00**	**11,350.00**	**9623.00**	**4807.00**	**10,242.00**	**7508.00**	**8753.00**	**5056.00**
Total revenue (US$)			**12,070.00**	**20,776.50**	**10,779.00**	**7209.00**	**4950.00**	**9030.00**	**5350.00**	**1000.00**	**1239.00**
Operational efficiency ratio (%)			**75.50**	**87.76**	**83.48**	**113.25**	**96.24**	**112.03**	**129.20**	**800.20**	**370.22**
Operational profit (US$)			**2957.00**	**2543.50**	**1781.00**	**−955.00**	**186.00**	**−1086.00**	**−1562.00**	**−7002.00**	**−3348.00**
Net profits (US$)			**−5477.00**	**−2780.50**	**−571.00**	**−2414.00**	**143.00**	**−1212.00**	**−2158.00**	**−7753.00**	**−3817.00**

Data availability

Data will be made available on request.

References

Antinori, C., Bray, D.B., 2005. Community Forest enterprises as entrepreneurial firms: economic and institutional perspectives from Mexico. World Dev. 33, 1529–1543.

Arena, M., Azzone, G., Bengo, I., 2015. Performance measurement for social enterprises. Voluntas 26 (2), 649–672.

Armono, D., 2024. Profitability ratio analysis as a basis for financial performance assessment. Proc. Int. Conf. Account. Fin. 2, 205–209.

Assembe, S., 2006. Forestry income management and poverty reduction: empirical findings from Kongo, Cameroon. Dev. Pract. 61, 67–72.

Awono, A., Ndoye, O., Eyebe, A., 2012. How do communities benefit from forest management? A comparative study of community forests in Cameroon and Gabon. Int. For. Rev. 14, 1–10.

Bray, D.B., Merino-Pérez, L., Bray, D. (Eds.), 2005. The Community Forests of México: Managing for Sustainable Landscapes. University of Texas Press, Austin, 241p.

Bull, G., Schwab, O., Jayasinghe, P., 2007. Economic indicators and their use in sustainable forest management. BC J. Ecosyst. Manag. 8 (2), 37–45.

Carías Vega, D., 2019. Community-based forestry and community forestry enterprises in quintana roo, mexico and petén, guatemala: how have policies, history, and culture shaped their trajectories? J. Sustain. For. 38 (7), 651–669. https://doi.org/10.1080/10549811.2019.1598875.

Chalmeta, R., Palomero, S., 2011. Methodological proposal for business sustainability management by means of the balanced scorecard. J. Oper. Res. Soc. 62, 1344–1356.

Cubbage, F.W., Davis, R.R., Rodríguez Paredes, D., Mollenhauer, R., Kraus Elsin, Y., Frey, G.E., González Hernández, I.A., Albarrán Hurtado, H., Cruz, A.M.S., Salas, D.N. C., 2015. Community forestry Enterprises in Mexico: sustainability and competitiveness. J. Sustain. For. 34 (6–7), 623–650. https://doi.org/10.1080/10549811.2015.1040514.

Di Girolami, E., Kampen, J., Arts, B., 2023. Two systematic literature reviews of scientific research on the environmental impacts of forest certifications and community forest management at a global scale. Forest Policy Econ. 146, 102864. https://doi.org/10.1016/j.forpol.2022.102864.

Dočekalová, M.P., Kocmanová, A., 2016. Composite indicator for measuring corporate sustainability. Ecol. Indic. 61, 612–623. https://doi.org/10.1016/j.ecolind.2015.10.012.

Ebrahim, A., & Rangan, V.K. (2010). The Limits of Nonprofit Impact: A Contingency Framework for Measuring Social Performance, Working Paper 10–099. Boston, MS: Harvard Business School. HYPERLINK "https://www.hbs.edu/ris/Publication%20Files/10–099_0b80d379-8e88–4992-9e8f-4b79596b1ff9.pdf" https://www.hbs.edu/ris/Publication%20Files/10–099_0b80d379-8e88–4992-9e8f-4b79596b1ff9.pdf.

Ebrahim, A., Rangan, V.K., 2014. What impact? A framework for measuring the scale and scope of social performance. Calif. Manag. Rev. 56 (3), 118–141.

Elkington, J., 1997. Cannibals with Forks: The Triple Bottom Line of 21st Century Business. Capstone, Oxford, UK.

Engbring, G., Hajjar, R., 2022. Conflicts between core purposes: trade-offs associated with organisational shifts in Mexican community forest enterprises. World Dev. 160, 106078. https://doi.org/10.1016/j.worlddev.2022.106078.

Foundjem-Tita, D., Duguma, L.A., Speelman, S., Piabuo, S.M., 2018. Viability of community forests as social enterprises: a Cameroon case study. Ecol. Soc. 23 (4), 50. https://doi.org/10.5751/ES-10651-230450.

Frey, G., Charnley, S., Makala, J., 2021. Economic viability of community-based forest management for certifed timber production in southeastern Tanzania. World Dev. 144, 105491.

Gillis, Wendy, James, Matrecia, 2015. The impact of the triple bottom line on social entrepreneurship. In: 5th International Conference on Engaged Management Scholarship: Baltimore, Maryland. https://doi.org/10.2139/ssrn.2676325. September 10-13, 2015, Available at SSRN:. or https://ssrn.com/abstract=2676325.

Greene, J.C., 2007. Mixed methods in social inquiry. Jossey-Bass.

Hajjar, R., Oldekop, J.A., 2018. Research frontiers in community forest management. Curr. Opin. Environ. Sustain. 32, 119–125.

Handayani, N., Winarningsih, S., 2020. The effect of net profit margin and return on equity toward profit growth. Jurnal Akuntansi Dan Keuangan 7 (2). http://ejournal.bsi.ac.id/ejurnal/index.php/moneter198.

Hays, F.H., Lurgio, De, Gilbert, Jr., 2009. Efficiency ratios and community Bank performance. J. Financ. Account. 1–15.

Ho, C.J., Taylor, M.E., 2007. An empirical analysis of triple bottom-line reporting and its determinants: evidence from the United States and Japan. J. Int. Financ. Manag. Acc. 18 (2), 123–150. https://doi.org/10.1111/j.1467-646X.2007.01010.x.

Hsu, C.-W., Hu, A.H., Chiou, C.-Y., Chen, T.-C., 2011. Using the FDM and ANP to construct a sustainability balanced scorecard for the semiconductor industry. J. Clean. Prod. 38, 12881–12889.

Hubbard, G., 2006. Measuring organisational performance: beyond the triple bottom line. Bus. Strateg. Environ. 18, 177–191.

Humphries, S., Holmes, T.P., Kainer, K., Koury, C.G.G., Cruz, E., de Miranda Rocha, R., 2012. Are community-based forest enterprises in the tropics finically viable? Case studies from the Brazilian Amazon. Ecol. Econ. 77, 62–73.

Humphries, S., Holmes, T.P., De Andrade, D.F.C., McGrath, D., Dantas, J.B., 2020. Searching for win-win forest outcomes: learning-by-doing, financial viability, and income growth for a community-based forest management cooperative in the Brazilian Amazon. World Dev. 125, 104336. https://doi.org/10.1016/j.worlddev.2018.06.005.

Jacewitz, S., Kupiec, P., 2012. Community Bank Efficiency and Economies of Scale. http://www.fdic.gov/regulations/resources/cbi/report/cbi-full.pdf.

Jayathilaka, A.K.K.R., 2020. Operating profit and net profit: measurements of profitability. Open Access Library J. 7, e7011. https://doi.org/10.4236/oalib.1107011.

Johnson, R.B., Onwuegbuzie, A.J., 2007. Toward a definition of mixed methods research. J. Mixed Methods Res. 1 (2), 112–133. https://doi.org/10.1177/1558689806298224.

Journeault, M., 2016. The integrated scorecard in support of corporate sustainability strategies. J. Clean. Prod. 182, 214–229.

Kaplan, R.S., Norton, D.P., 2001. The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment, 1st edition. In: Soundview Executive Book Summaries. Harvard Business School Press, Concordville, pp. 148–159.

Lescuyer, G., Tsanga, R., Essiane, Mendoula E., Ndume Engone, H.C., 2015. Stocktaking of Small-Scale Forest Enterprises Involved in the Commercialisation of Timber in Central Africa. Technical report for FAO, Rome, Italy.

Lescuyer, G., Tsanga, R., Nziengui, S., Forni, E., Romero, C., 2021. Influence of FSC certification on the governance of the logging sector in the Congo basin. Natural Resources Forum 45 (3), 289–304. https://doi.org/10.1111/1477-8947.12231.

Maldonado, J.R., Wen, Y., Cubbage, F., Maldonado, P.R., 2017. Forest resources in the performance of Mexican community forest Enterprises in a vertical integration system. Int. J. Sci. 3, 1–15.

Millar, R.B., Hall, K., 2013. Social return on investment (SROI) and performance measurement. Public Manag. Rev. 15, 923–941.

Minang, P.A., Duguma, L., Bernard, F., Foundjem-Tita, D., Tchoundjeu, Z., 2019. Evolution of community forestry in Cameroon: an innovation ecosystems perspective. Ecol. Soc. 24.

Nadiyah, I.R.F., Rohmah, L., Haryadi, D., Wahyidi, W., 2024. Profitability ratios to assess the financial performance. Int. J. Appl. Fin. Bus. Stud. 11 (4), 964–969.

Ndoye, O., Awono, A., 2005. The Markets of Non-timber Forest Products in the Provinces of Equateur and Bandundu. DRC. CIFOR, Central Africa Regional Office, Yaounde, Cameroon, 57p.

Papalexandris, A., Ioannou, G., Prastacos, G., Soderquist, K.E., 2005. An integrated methodology for putting the balanced scorecard into action. Eur. Manag. J. 23 (2), 214–227.

Piabuo, S.M., Foundjem-Tita, D., Minang, P.A., 2018. Community forest governance in Cameroon: a review. Ecol. Soc. 23.

Piabuo, S.M., Minang, P.A., Foundjem-Tita, D., Duguma, L., 2019. Developing sustainable community forest enterprises (CFEs): Lessons from Dryad project in Cameroon. *Technical brief 2*. Nairobi, Kenya. The World Agroforestry (ICRAF) and ASB Partnership for Tropical Forest Margin.Piabuo et al., 2020.

Piabuo, S.M., Tsafac, S., Minang, P.A., Foundjem-Tita, D., Guimke, G., Duguma, L., 2021. Effect of COVID-19 on rural community enterprises: the case of community forest enterprises in Cameroon. Working Paper 314. World Agroforestry (ICRAF), Nairobi, Kenya.

Piabuo, S.M., Hoogstra-Klein, M., Ingram, V., Foundjem-Tita, D., 2022. Community forest enterprises (CFEs) as social enterprises: empirical evidence from Cameroon. Forest Policy Econ. 135, 102664. https://doi.org/10.1016/j.forpol.2021.102664.

Piabuo, S.M., Yakan, H.B., Puatwoe, J.T., Nonzienwo, V.Y., Mamboh, T.R., 2020. Effect of rural farmers' access to information on price and profits in Cameroon. Cogent Food & Agriculture 6 (1), 1799530. https://doi.org/10.1080/23311932.2020.1799530.

Satar, Mir Shahid, 2022. Sustainability and triple bottom line planning in social enterprises: developing the guidelines for social entrepreneurs. Int. J. Sustain. Dev. Plan. 17, 813–821.

Shrestha, K.K., Paudel, G., Ojha, H., Paudel, N.S., Nuberg, I., Cedamon, E., 2022. Community entrepreneurship: lessons from Nepal's Chaubas community forestry sawmill. Forest Policy Econ. 141, 102779.

Siegner, M., Kozak, R., Panwar, R., Nelson, H.W., 2022a. How does strategic choice affect the performance of community forest enterprises? A study in the Cascadia region. Can. J. For. Res. 52 (2), 227–236. https://doi.org/10.1139/CJFR-2021-0063.

Shrestha, K.K., Paudel, G., Ojha, H., Paudel, N.S., Nuberg, I., Cedamon, E., 2022. Community entrepreneurship: Lessons from Nepal's Chaubas community forestry sawmill. Forest Policy and Economics 141, 102779. https://doi.org/10.1016/j.forpol.2022.102779.

Siegner, M., Kozak, R., Panwar, R., 2022b. The effect of managers' personal characteristics on the performance of community forest enterprises. Small Scale Forestry 22, 381–399.

Strezov, V., Evans, A., Evans, T., 2013. Defining sustainability indicators of iron and steel production. J. Clean. Prod. 51, 66–70.

Sunderland, K., Woolmington, T., Blackledge, J., Conlon, M., 2013. Small wind turbines in turbulent (urban) environments: a consideration of normal and Weibull distributions for power prediction. J. Wind Eng. Ind. Aerodyn. 121, 70–81.

Vega, D.C., Keenan, R.J., 2014. Transaction cost theory of the firm and community forestry enterprises. Forest Policy Econ. 42, 1–7.