



Forging agrarian trajectories through assets, strategies, and values: structural hybridization between agro-extractivism and the socio-biodiversity economy in the Brazilian Amazon

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Abstract

The socio-biodiversity economy is widely regarded as an alternative agrarian pathway to agro-extractivism in the Brazilian Amazon, capable of reconciling conservation, social inclusion, and income generation. Recent research challenges this promise. Agro-extractivist dynamics have been documented in socio-biodiversity markets, while the farming households that sustain this economy remain largely overlooked, and often idealized. This study examines the livelihood configurations and agrarian trajectories of two groups of cocoa farmers in the Transamazon region—one organic, one conventional—affiliated with two regional cooperatives. It adopts a mixed-method design that extends the Sustainable Livelihoods Approach beyond its traditional focus on material assets by integrating values as a key dimension of livelihood strategies. Data were gathered between March and September 2024 through structured questionnaires, semi-structured interviews, and ethnographic observations. Findings show historically produced asset asymmetries between the two groups, alongside a shared condition as petty commodity producers. Divergent agrarian trajectories emerge not only from material conditions but also from the interplay between assets and the values that guide how farmers mobilize their resources. Conventional farmers pursue emancipation from commodity dependence through economic diversification and market upgrading, while their cooperative channels individual pragmatism toward place-based value aggregation. Organic farmers secure their livelihoods through agroecological farming, but their cooperative operates from a weaker position that hinders the translation of these values into economic practice. Both these trajectories reveal the entanglement of agro-extractivist and socio-biodiversity dynamics within the same households, a condition this study terms structural hybridization. More broadly, the study calls for greater analytical attention to the agrarian dynamics unfolding among the smallholders who sustain the socio-biodiversity economy.

Keywords Sustainable livelihoods approach · Values · Socio-biodiversity economy · Agro-extractivism · Cocoa · Brazilian Amazon

Introduction

In the Brazilian Amazon, agro-extractivism has driven the expansion of the agricultural frontier, fueling deforestation and smallholder displacement (Pacheco and

Poccard-Chapuis 2012; Carrero et al. 2020). Within this agrarian pathway, large-scale production of export-oriented commodities has consolidated as the dominant form of territorial occupation (Haddad et al. 2024). Its consequences extend beyond land use change. Smallholder production systems are eroded, and those who are not displaced are pushed to the margins of commercial dynamics driven by agro-industrial accumulation (Svampa 2015; Veltemeyer and Ezquerro-Cañete 2023). In response, the socio-biodiversity economy (SBE) has emerged as an alternative agrarian pathway. Rooted in forest-based and agroforestry production systems, it is widely regarded as capable of reconciling environmental conservation, the social inclusion of family

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farmers, and income generation (da Silva et al. 2017; Cassol and Sellitto 2020). Government programs and civil society initiatives have further consolidated the SBE, which has gained institutional traction as a framework for sustainable regional development (Londres et al. 2023).

Whether the SBE constitutes an inherently transformative pathway, however, has come under increasing scrutiny. Several authors warn that it may remain exposed to the very forces it sets out to overcome, such as market concentration, asymmetric exchange, and external value capture (Bergamo et al. 2022; Clement et al. 2024). As socio-biodiversity products gain commercial traction, commodification and uneven accumulation surface along their value chains (Pegler 2015). Açaí is the clearest case, having shifted from diversified smallholder agroforestry to large-scale monoculture for global markets (Fonseca et al. 2024; Vieira et al. 2024). Taken together, this evidence shows agro-extractivist dynamics surfacing within the SBE markets.

Whether agro-extractivist dynamics emerge within the farming households that practice the SBE has rarely been examined. A recent systematic review concludes that the socioeconomic benefits attributed to the SBE rest largely on assumption rather than on empirical evidence (Rosenfeld et al. 2024). At the same time, the farmers who sustain the SBE are increasingly romanticized as forest guardians set apart from market forces (de Castro et al. 2024), with little examination of the processes that shape their livelihoods.

Cocoa¹ (*Theobroma cacao* L.) offers an illustrative entry point into this debate. In the Brazilian Amazon, cocoa occupies an ambiguous position: it is simultaneously a globally traded commodity, subject to speculation and market volatility, and a product that has been reclaimed locally as a pillar of the SBE (Costa et al. 2021). In the Transamazon region, cocoa is produced almost entirely by smallholders in agroforestry systems intercropped with fruit and timber species (Calvi and Kato 2011), with well documented ecological benefits ranging from carbon sequestration (Gama-Rodrigues et al. 2021) to biodiversity conservation (Schroth et al. 2016). Based on this evidence, agroforestry-based cocoa has been progressively framed as a sustainable alternative to agro-extractivist activities such as cattle ranching. Over the past decades, a process of ‘cocoaization’ has reshaped the region, positioning cocoa at the center of a new development narrative. This expansion has received institutional backing through the Cocoa Route, one of the National Integration Routes Programs established in 2018 to connect local production systems to strategic value chains. The Cocoa Route is explicitly grounded in socio-biodiversity

principles, with its official materials describing agroforestry-based cocoa as “a sustainable alternative for family farmers in the Legal Amazon” that contributes to “the regeneration of the Amazon rainforest” while driving “regional development with a focus on socioeconomic and environmental sustainability” (Government of Brazil 2024b).

While these developments mark a significant shift from the dominant agro-extractivist model, the emphasis on the environmental benefits of agroforestry-based cocoa overlooks the agrarian dynamics that unfold among farming households. This paper addresses this overlooked dimension, arguing that, at the household level, socio-biodiversity and agro-extractivist dynamics entangle. Understanding these processes requires shifting the analytical focus from production systems to the farmers who sustain them.

This study examines the livelihood configurations and agrarian trajectories of cocoa farmers in the Transamazon region. Guided by the Sustainable Livelihoods Approach (SLA) (Scoones 1998, 2009, 2015), it adopts a comparative mixed-method design centered on two regional cooperatives—one organic, one conventional—to analyze how farmers mobilize their economic, human, and social capital. Moving beyond the SLA’s traditional focus on material conditions, the analysis further integrates values, understood as the beliefs, aspirations, and orientations that shape how farmers interpret and pursue their livelihood strategies. This study addresses two research questions: (1) How do cocoa farmers across two cooperative models in the Transamazon region differ in their asset base, asset mobilization strategies, and values? and (2) How do the resulting agrarian trajectories reproduce or recombine agro-extractivist dynamics within the socio-biodiversity economy? Rather than treating the SBE as an inherently transformative pathway, the analysis approaches its relation to agro-extractivism as an empirical question, to be answered at the household level.

Agrarian pathways in the Brazilian Amazon

Agrarian pathways are the historically shaped configurations of land use, labor, markets, and institutions through which rural societies organize production and sustain themselves over time (Bernstein 2010; Scoones 2015). Rather than fixed categories, they are dynamic processes shaped by political-economic forces and farmer agency. In contexts of rapid agrarian transformation, such as the Brazilian Amazon, this perspective helps explain how different agricultural models emerge, coexist, and compete.

For decades, the principal driver of frontier expansion in the Brazilian Amazon has been agro-extractivism. It has progressively incorporated primary forest into the national economy through the extraction of natural resources

¹ Botanical writing uses ‘cacao’ for the tree and its beans, while growers and the trade say ‘cocoa’ (Fairtrade International 2026). Because this study examines farmers as actors in that trade, ‘cocoa’ is used throughout, with ‘cacao’ kept only in the botanical name.

(Bunker 1985), the conversion of forest into pasture, and the expansion of monocrop plantations on already cleared land (Kröger 2022). Its economic logic orients land and labor toward the export of raw commodities at the expense of local development (McKay et al. 2021), relegating smallholders to subordinate positions within markets governed by transnational agri-food companies (Veltmeyer and Ezquerro-Cañete 2023). To remain viable within this model, smallholders intensify family labor, curb household consumption, and rely on off-farm income. Such strategies are characteristic of ‘petty commodity production’, a condition in which households cannot reproduce themselves outside the commodity circuits on which they depend (Bernstein 1986).

Since the early 2000s, the socio-biodiversity economy (SBE) has gained ground as an alternative agrarian pathway. It forms the core of a broader bioeconomy agenda that policymakers and a growing literature frame as a ‘new economy’ for the Brazilian Amazon and as the alternative to agro-extractivism (Abramovay et al. 2021; Nobre et al. 2023). Built on agroforestry and forest-based systems, the SBE promotes conservation and the restoration of degraded landscapes and is sustained primarily by smallholders, whose labor and territorial embeddedness underpin both production and ecological stewardship (Costa et al. 2021; Garrett et al. 2024). Here the farmer is envisioned as an active agent rather than a subordinate supplier of raw commodities, pursuing household reproduction, ecological coexistence, and place-based economies in resonance with agroecology and food sovereignty (Akram-Lodhi 2021; Brondizio et al. 2021). This promise of reconciling conservation with rural livelihoods has translated into institutional recognition, first with the 2009 National Plan for the Promotion of Socio-biodiversity Product Chains (Diniz and van Els 2021), then with the SBE incorporation into the development agendas of the Amazon and the state of Pará (Government of Pará 2023; Government of Brazil 2024a).

The Brazilian Amazon has long been read as a contested arena in which competing political projects dispute land and nature (Schmink and Wood 1992). Within this contestation, agro-extractivism and the SBE can be read as two ideal-typical poles, the first oriented toward accumulation and the second toward autonomy. The same distinction has been drawn in other readings of the regional dynamics, as employer and peasant modes of production (Costa 2021), or as plantation and socio-biodiverse economies (Ollinaho and Kröger 2023). Domingues and Sauer (2023) read the Brazilian Amazon as a contested space between an agrarian extractive frontier that subordinates nature and labor to the export of primary commodities, and a socio-environmental one, formed by environmentalist, Indigenist, and peasant movements demanding another development model.

Census data show that, between 1995 and 2017, capitalized employers and cattle ranchers expanded alongside agroforestry-oriented peasants in the same territories (Costa 2021). Therefore, at the regional scale, agro-extractivism and the SBE coexist and compete as part of the same macro-structural processes.

Beyond competing across the region, the two pathways also entangle. The logic of accumulation can enter the socio-environmental frontier through the financialization of nature (Domingues and Sauer 2023), while plantation dynamics can commodify socio-biodiversity and agroforestry practices (Ollinaho and Kröger 2021, 2023). This tension is sharpest in the SBE markets. On one side, these markets can aggregate value locally, strengthen cooperativism among smallholders, and build local trade channels in which farmers retain greater control (Diniz and Cerdan 2017). On the other, as socio-biodiversity products scale up and enter global commodity circuits, commodification, monoculture drift, and external value capture by transnational corporations appear along their value chains (Pegler 2015; Clement et al. 2024; Vieira et al. 2024). At the market scale, then, the SBE appears as a contested terrain, where movements toward farmer autonomy coexist with agro-extractivist dynamics of accumulation.

When the unit of analysis shifts from the regional and market scales to the farming household, the coexistence of the two pathways takes on a more complex form. Because agrarian pathways carry values as much as material conditions (Leach et al. 2010), each would be expected to organize the farmer’s whole trajectory around its own priorities: accumulation and expansion, or autonomy and livelihood security. However, farm-level studies in the Brazilian Amazon find considerable heterogeneity among households, such that most farms cannot be classified by a single logic or decision-making rule (Browder et al. 2004, 2008). Practices and values of accumulation and autonomy can cut across the same farm, entangling elements of both pathways within a single trajectory. Ploeg and Douwe (2018) captures this condition with the notion of a continuum of farming styles, where farmers range between a peasant and an entrepreneurial pole and may move in both directions. Movement along this continuum is not only market-driven, as the push toward accumulation may arise from within the ranks of family farmers themselves (Jansen et al. 2022).

The coexistence of these logics within SBE households remains largely unexamined. Existing studies tend to depict socio-biodiversity farmers as oriented toward autonomy, ecological coexistence, and sufficiency rather than profit maximization (Diniz and Cerdan 2017; Lopes et al. 2023). These orientations are usually set in sharp contrast with agro-extractivist ones, such as the ‘cattle culture’ described by Hoelle (2014, 2018), where values of status and control

over the land make rising productivity a symbol of progress advancing over the forest. These depictions, however, are drawn more from how the SBE is framed than from close study of what farmers actually do (Rosenfeld et al. 2024; de Castro et al. 2024); the risk is to romanticize the SBE and obscure agro-extractivist dynamics emerging within the ranks of its farmers.

If the entanglement of agro-extractivism and the SBE is already visible at the regional and market scales, it is within the farming household, the primary unit where the SBE is reproduced, that it must finally be examined. This approach follows Goodman et al. (2012), for whom a rigid dichotomy between conventional and alternative agri-food systems obscures how the two continuously shape one another. Regional scholarship shows that farmers forge trajectories that resist any single logic (Browder et al. 2004, 2008; Van-Wey et al. 2007). This study applies the same critical lens to the SBE, without treating it as an inherently alternative pathway. Building on these accounts, it introduces the concept of structural hybridization, defined as a condition in which (1) farming households formally situated within the SBE may nonetheless reproduce agro-extractivist dynamics, and (2) the same households may navigate both pathways

simultaneously, forging their own agrarian trajectories. In this way, the study sets out to move beyond the romanticization of the SBE and to critically examine how farmers navigate the two pathways at the same time, through the assets they hold, their asset mobilization, and the values that sustain their practices.

Materials and methods

Study area

This research was conducted in the Transamazon region, in the state of Pará, in the Brazilian Amazon. The region takes its name from the Transamazon Highway (BR-230), which crosses several municipalities from Pacajá to Placas (Fig. 1). The region lies within the Xingu basin, on undulating uplands rarely exceeding 300 m a.s.l. The climate is tropical monsoon, with annual rainfall of 1,800–2,200 mm and a pronounced dry season between June and October; the dominant native vegetation is dense ombrophilous forest (Schroth et al. 2016). Soils are heterogeneous even at short distances: highly weathered, acidic Latosols and Argisols

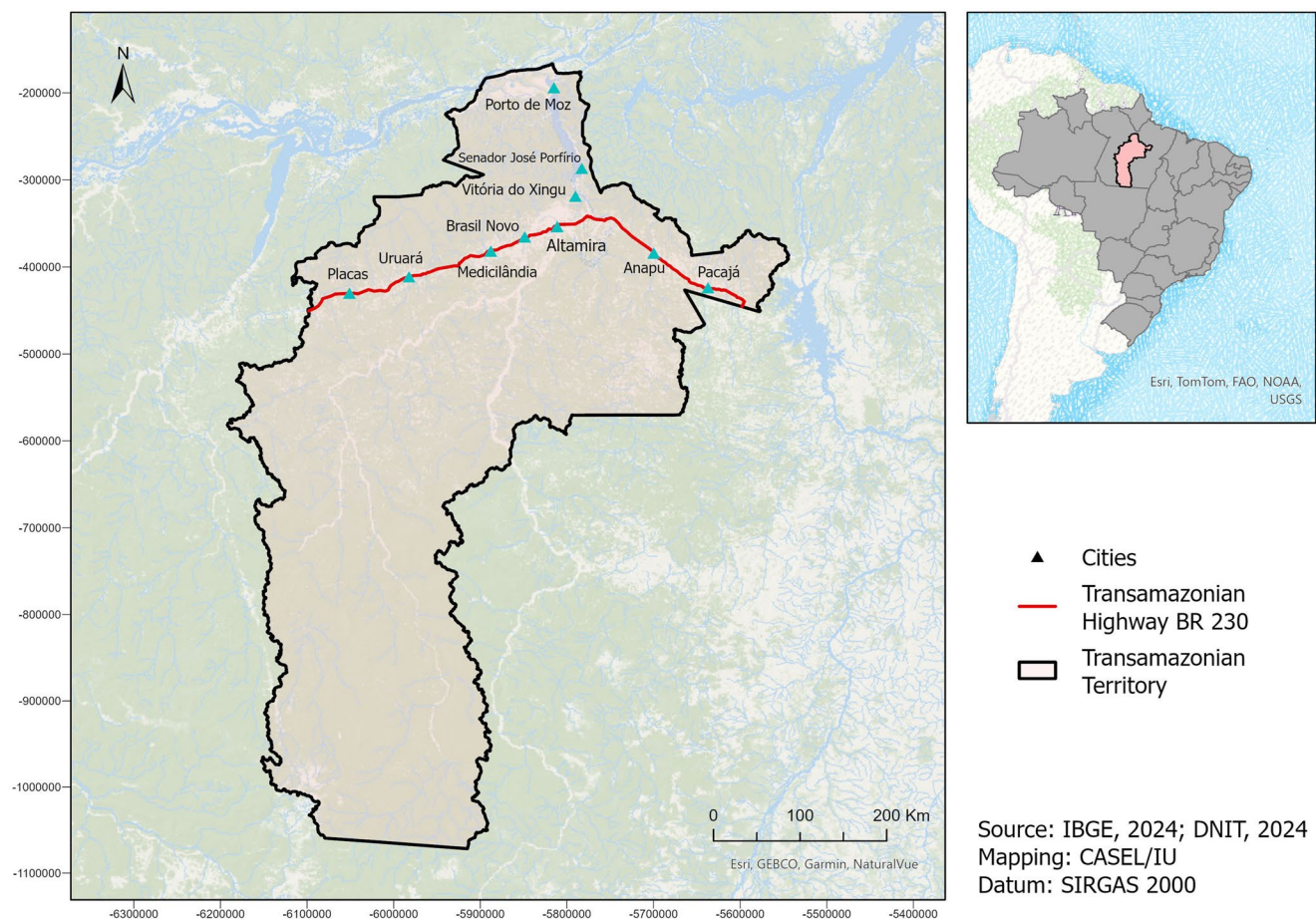


Fig. 1 The Transamazon region

(known locally as *terra amarela* and *terra arenosa*, respectively) dominate the landscape, while patches of fertile, basalt-derived Nitisols (*terra roxa*) concentrate along the BR-230 highway (Carvalho et al. 2026).

The municipalities along the highway were shaped by colonization policies promoted by the Brazilian state beginning in the 1960s. Between 1964 and 1985, under the slogan ‘integrate, not surrender,’ the federal government pursued the integration of remote natural areas into the national economy (Moran 1981). In the early 1970s, the Transamazon Highway was constructed, and the National Integration Policy (NIP) was launched to attract small- and medium-scale farmers to settle in the region. Decree No. 1964/1971 federalized a 100-km corridor along the highway, while the National Institute of Colonization and Agrarian Reform (INCRA) allocated 100-hectare plots to settlers within the first 10 km to the North and South, with the requirement that at least 80% be devoted to commodity production (Godar et al. 2012).

The project attracted tens of thousands of settlers, who engaged in cocoa cultivation or livestock production depending on soil fertility. In the 1970s, the government established a research and technical assistance program under the Executive Commission for Cocoa Cultivation Planning (CEPLAC) and launched the Guidelines for the Expansion of National Cocoa Growing (PROCACAU), intending to transform the Transamazon region into a major national cocoa hub. Fertile soils such as *terra roxa* (nitisols) were earmarked for cocoa, while less fertile *terra amarela* or *terra arenosa* were directed toward livestock production (Braga et al. 2023). Until the early 1980s, the government facilitated agricultural credit and invested in technical assistance to expand cocoa production on *terra roxa* (Filho et al. 2016). After this initial phase, however, public support was gradually withdrawn, leaving farmers to self-organize under sharply reduced institutional assistance. Cocoa production has continued to expand rapidly nonetheless, with annual growth rates of up to 13% between 2006 and 2019 (Anders 2020), and the region now accounts for a substantial share of Pará’s socio-biodiversity GDP (Government of Pará 2023).

This study focuses on cocoa farmers in the municipalities of Altamira, Brasil Novo, and Medicilândia, with farms ranging between 5 and 100 hectares. All farmers are members of one of two regional cooperatives, one organic and one conventional. Farmers produce two types of cocoa. *Bulk* cocoa consists of beans that are sun-dried within hours of harvest and sold in raw form to intermediaries and agri-food traders on global commodity markets. *Fino* cocoa, by contrast, undergoes a fermentation process of at least one week, developing complex aromas and flavors, and is commercialized in niche premium chocolate and cosmetics markets. The organic cooperative was founded in 2005 and

specializes in *fino* cocoa. It operates through five branches across the Transamazon region, with approximately 150 members in total. The analysis focused on the Brasil Novo branch, which comprises approximately 21 members. The conventional cooperative, founded in 2010, also specializes in *fino* cocoa for the premium chocolate sector, with approximately 24 members actively engaged in production and commercialization. It owns a chocolate factory where products are manufactured under its own brand and sold in local and regional markets.

Methodology

This study adopts a mixed-method design structured around the Sustainable Livelihoods Approach (SLA) (Scoones 1998, 2009, 2015). The SLA provides a well-established framework for analyzing rural livelihoods, centered on the resources that farming households can mobilize to sustain, adapt, or improve their conditions over time (Bebbington 1999). However, as Scoones (2009) acknowledges, the SLA has tended to focus on the material dimensions of livelihoods, paying less attention to the meanings, aspirations, and orientations that shape how farmers engage with their resources. To address this critique, the study integrates values as a third analytical dimension alongside material assets and asset mobilization strategies.

The first analytical dimension concerns the capital base of farming households across three domains: economic, human, and social.² Capital indicators were identified based on previous SLA literature (Ellis 2000; VanWey et al. 2007; Jacobi et al. 2015) and subsequently refined through approximately 15 exploratory interviews with local key informants (not part of the 84 interviews described below), which allowed the indicators to be grounded in the specific livelihood features of the Transamazon region. Economic capital indicators encompass (a) land base, revenue composition, and market channels, to capture accumulation, market insertion, and commodity dependence; and (b) labor relations, productive organization, off-farm income, and household self-provisioning, to measure labor regimes, income diversification, and household reproduction. Human capital indicators encompass (a) education and long-term human capital formation and (b) institutional embeddedness and support networks. Social capital indicators encompass cooperative membership and engagement, together with leadership participation. Economic and human capital data

² Natural capital is not included in this analysis, as the socio-ecological dimensions of cocoa expansion in the Transamazon are already well documented (Schroth et al. 2016; Gama-Rodrigues et al. 2021). This study focuses instead on the material and immaterial dimensions that remain underexplored.

were collected through structured questionnaires, social capital data through semi-structured interviews. The construction and operationalization of all indicators are detailed in Annex I.

Rather than testing hypotheses or estimating causal effects, the quantitative analysis uses economic and human capital indicators to characterize and contrast livelihood configurations across the two farmer groups. It examines: (a) central positioning within each indicator (using medians) and (b) relative structural positioning across groups (using percentile-based profiles, IQR). This strategy captures differences that are not simple magnitude gaps but divergent patterns of engagement with labor, markets, and institutions. Indicator construction and analytical procedures are detailed in Annex I.

The second analytical dimension concerns asset mobilization strategies, that is, how farming households deploy their assets in practice (Bebbington 1999). This dimension was captured through semi-structured interviews and ethnographic observation. The analysis examines how farmers mobilize their resources across several domains: diversification and positioning in cocoa markets, the organization of household labor including sharecropping and hired labor, and the role of off-farm income as either a source of accumulation or a mechanism of livelihood stabilization. It also explores how farmers access training and institutional support, and how cooperative membership shapes these dynamics. The selection of asset mobilization strategies is detailed in Annex II.

The third analytical dimension concerns values. Livelihood decisions are also shaped by beliefs, aspirations, and orientations that inform how farmers evaluate their options and give meaning to their practice (Leach et al. 2010). They range from instrumental concerns with accumulation and productivity to relational ones of autonomy and ecological care (Klain et al. 2017). Values are thus understood as the immaterial dimension through which farmers interpret and mobilize their material assets. Rather than coded as a predefined category, values emerged inductively during the abductive coding of interviews and ethnographic notes, as recurrent sub-themes cutting across the three capital domains. The interview guide, the coding procedure, and the coding tree are detailed in Annex II.

Together, capital configurations, mobilization strategies, and values define what this study calls *agrarian trajectory*: the concrete direction that farmer groups forge within broader agrarian pathways (Scoones 2015). This concept moves the analysis beyond the characterization of the SBE as a unified agrarian pathway, examining how households may diverge depending on the resources they mobilize, the strategies they pursue, and the values that inform their practice.

Primary data were collected between March and September 2024 through three complementary methods: (i) 41 structured questionnaires administered to farmers, designed to capture quantitative indicators of economic and human capital; (ii) 84 semi-structured interviews, including: (a) 41 semi-structured interviews with farmers, aimed at capturing social capital indicators and asset mobilization strategies across all three capital domains; (b) 43 interviews with non-farmer actors such as cooperative leaders, buyers, NGOs, and public institutions, aimed at contextualizing household-level findings within the broader regional agrarian dynamics; and (iii) ethnographic observation sustained throughout the six-month fieldwork, through participation in farm work, daily life, cooperative meetings, and community events, grounding the interpretation of the other data in everyday practice. Farmers were recruited based on active cooperative membership, since cooperatives are the primary channel through which Transamazon farmers can sell *fino* cocoa. Recruitment followed a snowball strategy initiated through each cooperative's president and continued until nearly the entire membership of both organizations had been reached: 20 of 21 members of the organic cooperative's Brasil Novo branch, and 21 of the 24 active members of the conventional cooperative, a near-census of both cooperatives. The remaining members were either unreachable during fieldwork or declined to participate. The 43 non-farmer actors were selected purposively for their roles in the regional cocoa economy and their ties to the two cooperatives; the same presidents provided the initial contacts. Interviews were conducted in Portuguese and lasted approximately one hour and a half. They were audio-recorded with informed consent, and manually transcribed. The sampling and recruitment strategy, the overview of research participants, and researcher positionality are detailed in Annex III.

The three strands were integrated following a convergent mixed-methods design, in which quantitative and qualitative data are collected in parallel, analyzed separately, and combined during interpretation (Creswell and Clark 2018). The quantitative indicators were processed in Python (ver 3.x) to build the comparative livelihood profiles of the two groups, while the interview and ethnographic material was coded in ATLAS.ti (ver 23.0.1) through an abductive strategy that combined categories from the analytical framework with sub-themes emerging from the data. The two were then read together: the quantitative profiles established what differs between the groups, and the qualitative data explained why. Direct quotations from participants were included in the manuscript but anonymized to prevent the risk of deductive disclosure.

Results

This section examines how divergent agrarian trajectories emerge among smallholder households formally situated within the socio-biodiversity economy. Rather than pointing to straightforward quantitative gaps between organic and conventional producers, the analysis focuses on systematic contrasts in livelihood configurations across three capital domains. These encompass the organization of production, labor relations, market engagement, access to knowledge, institutional support, cooperative participation, and the values that guide farmers' choices. Together, these dimensions show how households relate differently to agro-extractivism and the SBE.

Economic capital

Differences in economic capital between organic and conventional producers do not emerge as uniform gaps in income or assets, but rather as contrasting configurations of production scale, labor organization, market engagement, and income composition. Table 1 summarizes the economic capital indicators by production type, reporting medians and interquartile ranges alongside structural positioning and prevalence rates where applicable.

Scale, revenue composition and market channels

Conventional producers hold substantially more land (Table 1) and more secure tenure (Fig. 2), a disparity rooted in the region's colonization history. Conventional farmers in Medicilândia were among the first wave of settlers in the 1970s and benefited directly from the National Integration

Table 1 Economic capital: comparative descriptive statistics for organic and conventional cocoa farmers

Panel A. Quantitative indicators

Indicator	Organic (n=20)			Conventional (n=21)		
	Median [IQR]	Prevalence	Structural Positioning	Median [IQR]	Prevalence	Structural Positioning
Land Size (ha)	10 [6–20]	—	P39	40 [13–98]	—	P68
Years on the property	35.5 [32–37]	—	P27	47 [45–51]	—	P76
<i>Terra roxa</i> share of landholding (%)	83.1 [20–100]	80.0%	P46	90.4 [25–100]	90.5%	P54
Total Gross Revenues (R\$)	45,062 [34,750–196,000]	—	P24	190,000 [116,000–266,000]	—	P63
Total Net Revenues (R\$)	45,062 [27,550–167,200]	—	P27	147,800 [101,300–222,000]	—	P63
Bulk Cocoa Gross Revenues (R\$)	24,375 [15,600–39,000]	—	P27	73,500 [39,000–161,400]	—	P73
Sale to Traders Share (%)	0 [0–0]	5.0%	—	20.0 [0–81.8]	71.4%	—
Fino Cocoa/Total Production (%)	38.8 [25.0–60.0]	—	P68	6.3 [0.0–26.3]	—	P32
Fino Cocoa Gross Revenues (R\$)	13,762 [8,750–56,250]	—	P46	20,000 [0–42,000]	—	P54
Household size (members)	3.5 [3–5]	—	P61	2 [2–4]	—	P34
Sharecroppers (n)	0 [0–1]	25.0%	P49	2 [1–3]	76.2%	P83
Daily Worker Costs (R\$)	7,200 [0–10,800]	65.0%	P66	0 [0–18,000]	42.9%	P46
Off-Farm Revenues (R\$)	3,000 [1,500–70,000]	85.0%	P34	70,000 [70,000–70,000]	85.7%	P90
Food self-provisioning (no. of products)	13 [10–16]	100%	P68	11 [8–13]	95.2%	P51
Per-capita weekly food expenditure (R\$)	47.5 [38–75]	—	P27	83.3 [62–100]	—	P71

Panel B. Land Tenure Categorical distribution

Tenure category	Organic (n=20)	Conventional (n=21)
No formal document	25.0%	0.0%
Donation term	50.0%	33.3%
Purchase receipt	10.0%	23.8%
Public deed	10.0%	23.8%
Definitive title	5.0%	19.0%

Panel A reports the quantitative indicators, summarized for each group by the median and interquartile range [IQR], the prevalence (percentage of households reporting a non-zero value, shown only where zero denotes absence of the practice), and the structural positioning (percentile rank of the group median within the pooled distribution, $N=41$). Panel B reports land tenure, a categorical variable, as the percentage distribution of households across documentation categories, ordered from weakest to strongest tenure security

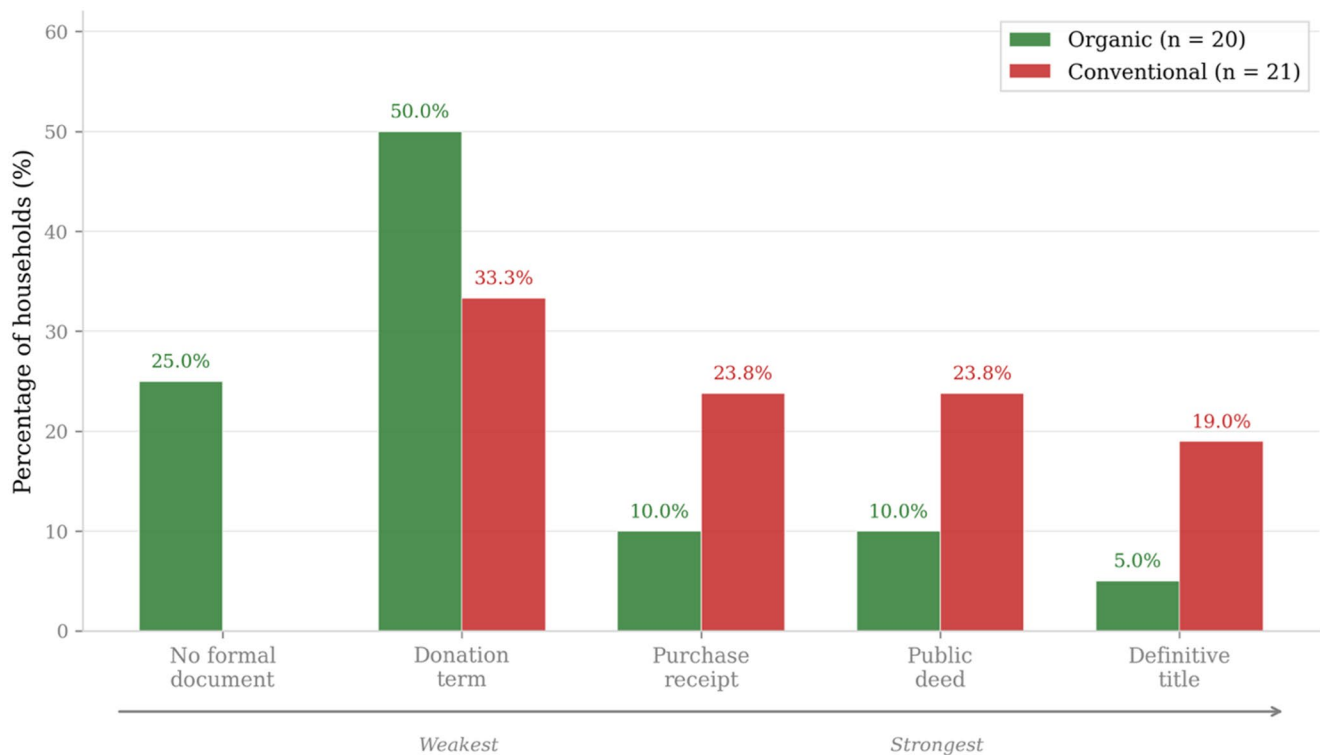


Fig. 2 Land tenure distribution by production type. The figure shows the percentage distribution of households across five categories of land tenure documentation, ordered from weakest (no formal document) to strongest (public deed) tenure security

Program (NIP) and PROCACAU, which granted larger plots alongside bank credit and technical assistance for cocoa cultivation. Organic farmers in Brasil Novo arrived mostly in the late 1980s and early 1990s, after public support had been withdrawn, often acquiring land informally from former beneficiaries. These advantages remain geographically bounded, and the unequal distribution of land and institutional support continues to shape farmers' livelihoods. Settlement histories reconstructed during fieldwork confirm this sequence: conventional farmers have held their land roughly a decade longer than organic ones (Table 1, Panel A). By contrast, soil endowment does not follow this divide. For both groups a similarly high proportion of land is *terra roxa*, the region's most fertile, cocoa-suited soil. What distinguishes them is not soil quality, but the size of their holdings and the institutional support secured by earlier settlement.

These historically rooted differences in land access shape aggregate income outcomes. Both total gross revenues and total net revenues are considerably higher among conventional households, suggesting a greater capacity for accumulation in absolute monetary terms. Yet revenue composition reveals crucial differences in strategic orientation. Conventional producers derive the largest share of their income from *bulk* cocoa, sold mainly to global agri-food traders that opened warehouses in Medicilândia in the

early 2000s. Over time, these traders began supplying farmers with inputs in exchange for exclusive purchase rights, consolidating conventional farmers' integration into commodity circuits. Unlike the one-to-one contracts negotiated for *fino* cocoa, *bulk* cocoa trade remains driven by stock-exchange fluctuations. One conventional farmer described these commercial dynamics: "I've been selling to the same trader for years. They know how much I usually produce, and if I call them, I can always find out the current [cocoa] price. I bring the cocoa; they pay either the same day or the day after on my bank account. If I need inputs for the next season, I take them and pay back in cocoa" (Interview 3, Farmer Conventional Cooperative). These relationships, however, may not be the advantage they appear to be. An NGO officer explained: "The traders have a trap mechanism. They pay immediately, which pushes farmers to sell *bulk* rather than wait and work for *fino*. But even worse, because it's them [traders] who set the *bulk* price globally, the farmer is drawn into a dependency, like gambling. Many farmers are happy to be part of it, but they are clearly in the hands of the traders" (Interview 56, NGO Officer). What looks like privileged access thus operates as a mechanism of lock-in. The barter ties conventional households to a single buyer and to a price they do not control.

While conventional farmers consolidated these commercial relationships over time, organic producers in Brasil

Novo continue to operate under conditions of logistical and market isolation. Without direct access to agri-food traders, they sell their *bulk* cocoa to local intermediaries at lower prices and through informal arrangements. This partly explains their greater orientation toward *fino* cocoa. Unlike *bulk* cocoa, *fino* is commercialized through one-to-one contracts that cooperatives negotiate with bean-to-bar and cosmetics companies, where price reflects quantity and quality rather than stock-exchange fluctuations.

Conventional farmers generate higher *fino* cocoa revenues despite allocating a smaller share of their production to this segment. This discrepancy does not stem from differences in product quality, but from unequal access to favorable selling conditions. Medicilândia, widely known as the ‘national capital of cocoa,’ concentrates a larger number of premium buyers actively sourcing *fino* cocoa, which enables conventional farmers to negotiate more stable contracts and secure higher price premiums. Organic farmers obtain premiums ranging from 30% to 100% above *bulk* prices depending on the buyer. Conventional farmers access higher premiums, between 70 and 150%, and the highest returns come from the conventional cooperative’s chocolate factory, which pays its members prices above those of any other *fino* cocoa buyer in the region.

Labor relations, productive organization and off-farm income

Differences in economic capital are further reflected in contrasting labor regimes. Over three quarters of conventional households engage sharecroppers, compared to only one quarter among organic producers. In the Transamazon, each sharecropper typically manages between 5 and 10 hectares, retaining 40–50% of cocoa earnings, while the landowner provides equipment and chemical inputs. The prevalence of sharecropping among conventional farmers indicates a more complex and externally dependent labor organization that reinforces a managerial role over land. Daily labor hiring patterns further differentiate the two groups: organic households regularly hire workers to supplement family labor for pruning, land preparation, and harvesting, while conventional producers range from full reliance on sharecroppers to large-scale daily worker mobilization during peak periods. Household size differs in line with these labor patterns. Organic households are larger: with more working members, they meet most day-to-day demands of agroforestry management themselves, hiring outside workers only at peak times. Conventional households are much smaller, with little family labor. Together, these indicators point to a labor organization centered on managerial control and delegation among conventional producers, whereas organic

farmers have direct labor engagement with their agroforestry system.

Off-farm income deepens this divide, taking opposite forms in the two groups. About 80% of conventional farmers reside in urban centers such as Altamira and Medicilândia, where they pursue skilled and managerial occupations, delegating agricultural work to sharecroppers. Most return to the farm only on weekends and at peak moments of the cocoa production calendar, such as the harvest, to coordinate sharecroppers and daily workers. Their presence on the production unit is thus limited. Many describe themselves as *gente de cidade* (town people), attached to their land but with no wish to live on it full-time. For these households, farming becomes secondary to urban occupations, and their proximity to commercial hubs facilitates direct commercial relationships with agri-food traders. Their membership in the conventional cooperative further reinforces this access. As the only chocolate manufacturer in the region, the cooperative anchors its members in the local agri-food landscape, opening commercial ties that would otherwise be difficult to establish.

Among organic households, off-farm activities are mainly home-based. More than half of organic farmers produce chocolate and cocoa-based products in small, self-financed processing units. These products are sold directly to consumers at local fairs and municipal markets, outside conventional commercial channels. One farmer explained: “I started making chocolate because I wanted to show that what we grow here can become something people enjoy, not just a commodity in a sack. When I sell at the fair, people taste it and come back” (Interview 6, Farmer Organic Cooperative). Rather than opening access to the broader commercial landscape, off-farm work here keeps organic households close to their production unit.

Beyond cocoa, on-farm production is undiversified in both groups. Few households sell other products, only in small quantities, such as milk, eggs, or fruit pulp. This pattern is structural rather than a matter of individual choice, as a state agency officer explained: “The region was conceived to produce cocoa and livestock, and almost nothing else is produced here. All the food people buy at the local markets is imported from Southern Brazil. I guess cocoa is worth too much for anyone to plant fruit for a few reais instead” (Interview 66, State Agency). Both groups also yield some food besides cocoa, mainly fruit from the shade trees. Organic families, living on their land, pick these products themselves and work a small plot of up to a hectare with rice, beans, and a few animals, resulting in lower food expenditure. Conventional farmers, mostly in town, leave the shade-tree products to their sharecroppers, who pass on only the surplus. The contrast marks two degrees of market dependence in household reproduction: organic households

provide much of their own food; conventional households buy most of theirs.

Taken together, these differences suggest a pattern of cumulative advantage in market terms among conventional producers, whose access to land, labor, and commercial networks compounds over time (Fig. 3). Their landholdings are larger and their tenure more secure, but their integration into commodity circuits ties them to prices they do not control. The livelihood configurations of organic households, by contrast, remain shaped by smaller lands, less secure tenure and tighter revenues, although they have closer ties to the farm and a lower dependence on commodity circuits (Section “Labor relations, productive organization and off-farm income”). Their engagement with niche markets and home-based processing reflects an economic orientation that, while less expansive, is closely embedded in the household’s own productive capacity.

Human capital

Beyond economic capital, organic and conventional producers also diverge in their human capital endowments, particularly in how they access knowledge and engage with institutional networks. Table 2 presents the main human capital indicators by production type, reporting medians

and interquartile ranges alongside structural positioning and prevalence rates where applicable.

Education and long-term human capital

Educational levels differ markedly between the two groups (Fig. 4). Half of organic households reported incomplete primary education. Conventional households are concentrated in the upper segments of the distribution, with over 40% holding complete secondary education and one third postgraduate qualifications. Interviews suggest that access to sharecropping may have shaped these differences. When farm labor could be delegated, conventional farmers explained, children had more room to stay in school and train beyond agriculture. In organic households, direct reliance on family labor often reduced this flexibility. These accounts point to an intergenerational mechanism, where the material conditions of the present household shape the human capital of the next generation. The two groups differ in the direction this takes, as conventional farmers point children beyond the farm and toward urban professions, while organic farmers pass on their knowledge by working the land together.

The two groups also differ in relation to annual training courses. Conventional farmers attend substantially more

Fig. 3 Economic capital: structural positioning by production type. For each indicator, the plotted value represents the percentile rank of the group median within the pooled distribution of the full sample ($N=41$). This percentile-based representation allows heterogeneous indicators measured on different scales to be compared visually. Higher values indicate that the group median occupies a higher position in the overall distribution for that indicator. Three indicators are not plotted: sale to traders share, because its structural positioning values are distorted by the high prevalence of zero values; per-capita food expenditure, because a lower value denotes lower market dependence in household consumption so that the common scale would invert its meaning; total Gross revenues, omitted to avoid redundancy with total net revenues. The full set of values is reported in Table 1

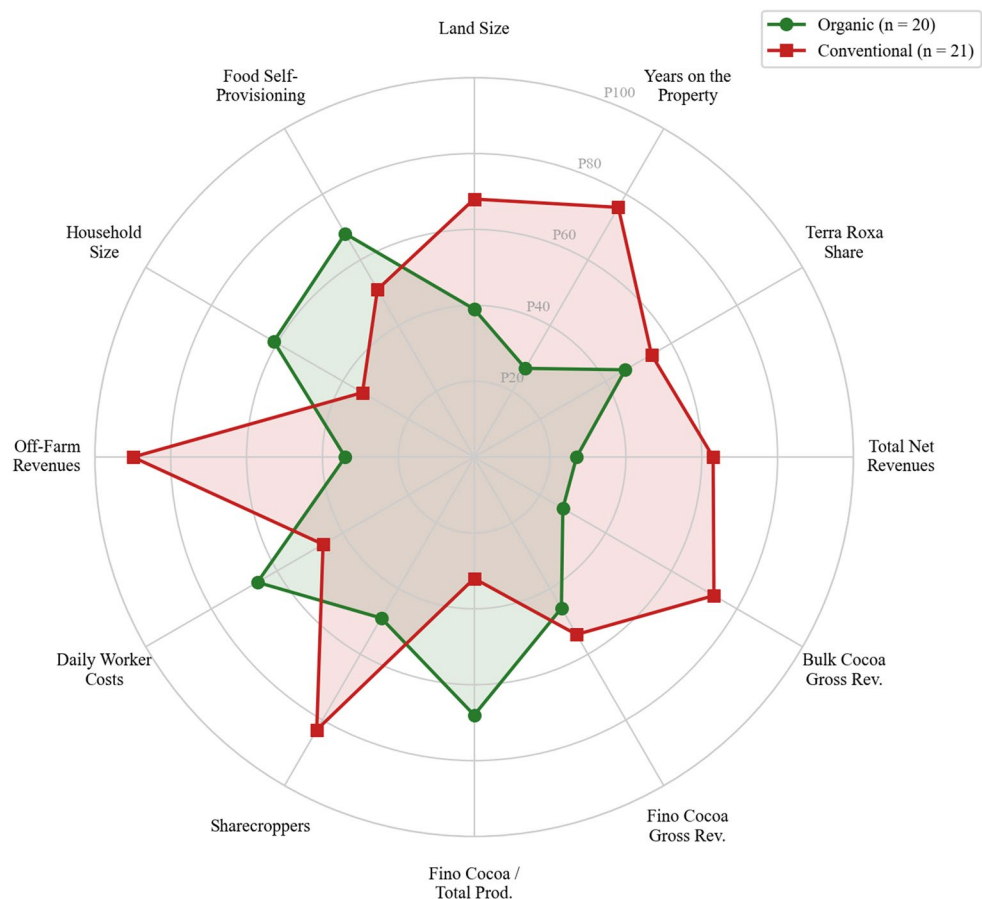


Table 2 Human capital: comparative descriptive statistics for organic and conventional cocoa farmers

Panel A. Quantitative indicators

Indicator	Organic (n=20)			Conventional (n=21)		
	Median [IQR]	Prevalence	Positioning	Median [IQR]	Prevalence	Positioning
Annual training courses (n)	0.5 [0–3]	50.0%	P29	4 [1–5]	90.5%	P78
Formal support from agencies (n)	0.5 [0–3]	50.0%	P29	2 [1–3]	90.5%	P66
Informal support from agencies (n)	1 [1–3]	100%	P44	2 [1–3]	100%	P73

Panel B. Education Level

Education level	Organic (n=20)	Conventional (n=21)
Incomplete primary	50.0%	19.0%
Complete primary	20.0%	0.0%
Complete secondary	20.0%	38.1%
Higher education	5.0%	9.5%
Post-graduate education	5.0%	33.3%

Panel A reports the quantitative indicators by median and interquartile range [IQR], the prevalence, and the structural positioning. Panel B reports education level, a categorical variable, as the percentage distribution of households across categories, ordered from lowest to highest

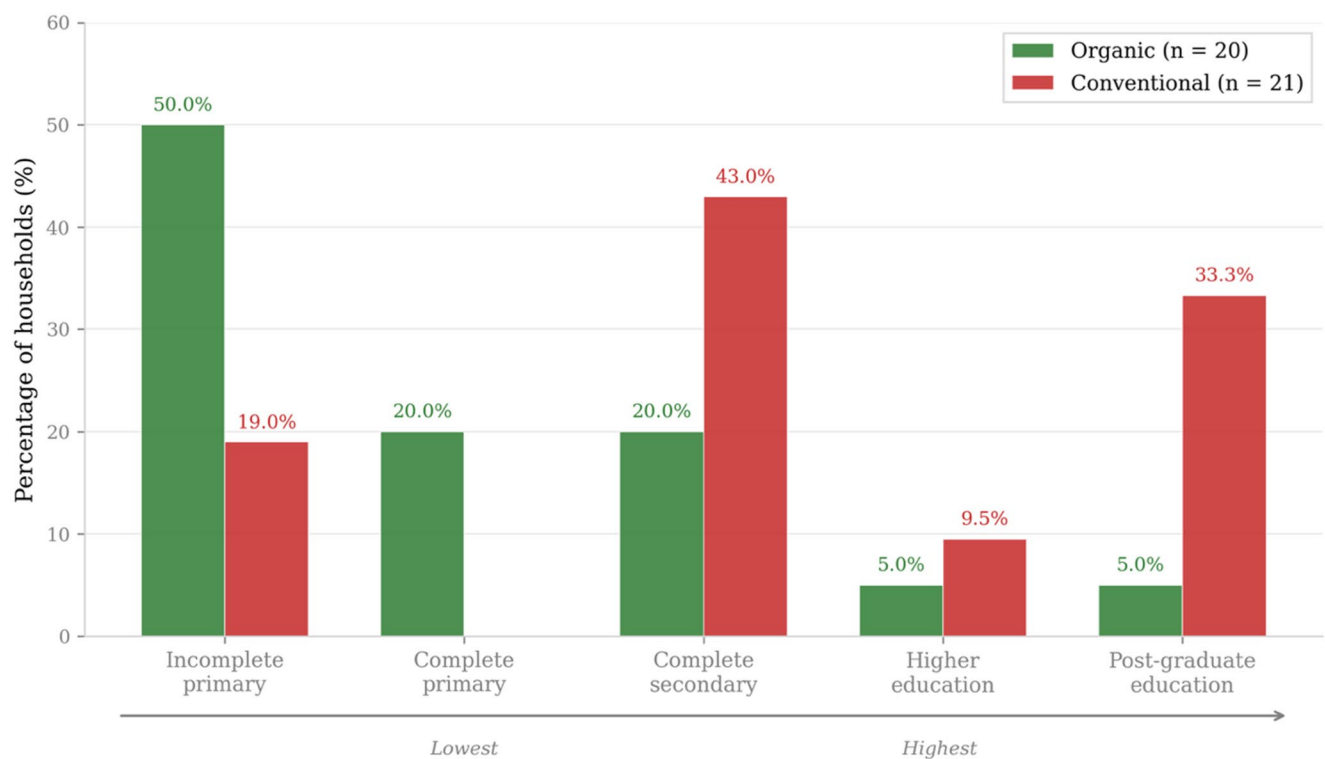


Fig. 4 Education level distribution by production type. The figure shows the percentage distribution of households across five categories of educational attainment, ordered from lowest (incomplete primary) to highest (post-graduate education)

training activities than organic farmers. These courses, largely concentrated in Medicilândia and organized by technical assistance agencies, focus on improving productivity, reducing costs, and facilitating access to niche markets. Several factors contribute to this gap. Conventional farmers live closer to Medicilândia, where most courses take place, and their reliance on sharecroppers allows them to leave the farm more easily. Training is also approached differently: for conventional households, it serves as a strategy to strengthen their market position. Their cooperative

links its members to buyers, technical agencies, and training providers, channels that are less available to organic producers. Conventional producers frequently described these agencies as a useful source of technical and market information. Organic farmers, by contrast, more often reported logistical constraints and limited availability of replacement labor, which restrict participation in training opportunities. Their knowledge is largely self-taught and locally rooted, as they experiment with organic practices on their own plots and exchange advice with neighbors, building practical

know-how that is not directly tied to long-term market positioning.

Institutional embeddedness and (in)formal support

Differences in institutional support further reflect these asymmetries. Conventional producers report more frequent formal support from governmental, private, and non-governmental agencies. Agencies such as CEPLAC and local NGOs offer training programs on agroforestry design and *fino* cocoa quality improvement, with sessions typically organized on a seasonal basis in coordination with municipal extension offices. These programs tend to reach farmers who are geographically accessible and already connected to institutional networks, thus reaching conventional producers near Medicilândia more easily. Agri-food traders also play a supporting role: conventional farmers who hold direct sales contracts with them receive ad hoc training on cocoa production techniques. Organic farmers, by contrast, attend few of these courses, partly for logistical reasons. But even if they were better connected, most of the available knowledge would not suit them, since institutional support has long been built around conventional, input-intensive farming. As the president of the organic cooperative explained: “All the agencies, not just the public ones but the NGOs and traders too, pass on only chemical knowledge. There are no technical-assistance programs for improving organic farming. That is something we must work out for ourselves. It depends only on us” (Interview 26, President Organic Cooperative).

Beyond formal programs, farmers also receive informal support from individual agency officers who assist them outside institutional channels, through personal acquaintance and direct phone contact. Farmers typically reach out to these contacts to seek advice on specific production or marketing problems. The nature of these exchanges diverges: conventional farmers often approach these agencies to obtain technical advice or access to new market channels. The conventional cooperative plays a key role here, as its institutional ties with agencies open informal channels that broaden its members’ contact networks. Organic farmers, by contrast, more often reach out in response to immediate problems such as disease or climate stress, and typically consult neighbors before contacting external technicians. As one organic farmer explained: “My neighbor has been farming here since before I arrived. If my cocoa starts looking sick, I walk over and ask him first, he’s seen it all. Only if he says ‘I don’t know this one’ do I pick up the phone and try the technician, but out here you never know when they’ll manage to come” (Interview 11, Farmer Organic Cooperative).

Rather than a simple gap in human capital, these patterns reveal two distinct modes of knowledge acquisition (Fig. 5). Conventional farmers acquire skills through formal training, institutional support, and direct engagement with external agencies. Among organic households, knowledge circulates through more informal and localized channels, shaped by proximity and everyday practice rather than by institutional design.

Social capital

Differences in social capital further distinguish the two groups. Rather than in levels of participation or network density, these differences emerge in the motivations for collective engagement, the strategic orientations of cooperative leadership, and the values expressed by farmers. Table 3 provides a comparative overview of these qualitative dimensions.

Cooperative membership and development pathways

In both groups, cooperative membership appears primarily economically motivated. Most members belong to the founding cohort (13 of 20 organic, 12 of 21 conventional), with a further wave joining up to 2022. Both cooperatives were founded for economic reasons: the organic founders to add value through collective organic certification, the conventional founders to add value by processing cocoa locally. Later members joined in pursuit of the same economic returns. Farmers use cooperatives as a channel to access premium markets for *fino* cocoa that would otherwise remain largely inaccessible at the individual level.

Across both groups, farmers reported limited engagement beyond the commercial function of the cooperative. Attendance at meetings and participation in governance remain low, with members treating the cooperative largely as an economic facilitator rather than as a space of collective deliberation. This instrumental orientation is reflected in membership fluctuations, particularly among conventional farmers. When *bulk* cocoa prices rise, farmers tend to exit the cooperative; when prices decline, they are more likely to re-enroll. This pattern has been especially visible over the past five years, in response to rising global cocoa prices. Cooperative participation thus appears contingent on market convenience rather than on sustained collective commitment. Notably, these fluctuations concern membership alone: farmers move in and out of their cooperative, but none reported ever switching between conventional and organic production.

Although members often engage with cooperatives instrumentally, both organizations display active leadership and clearly articulated strategic orientations. The leadership

Fig. 5 Human capital: structural positioning by production type. For each indicator, the plotted value represents the percentile rank of the group median within the pooled distribution of the full sample ($N=41$). Education level is excluded from this figure due to its categorical nature. Higher values indicate that the group median occupies a higher position in the overall distribution

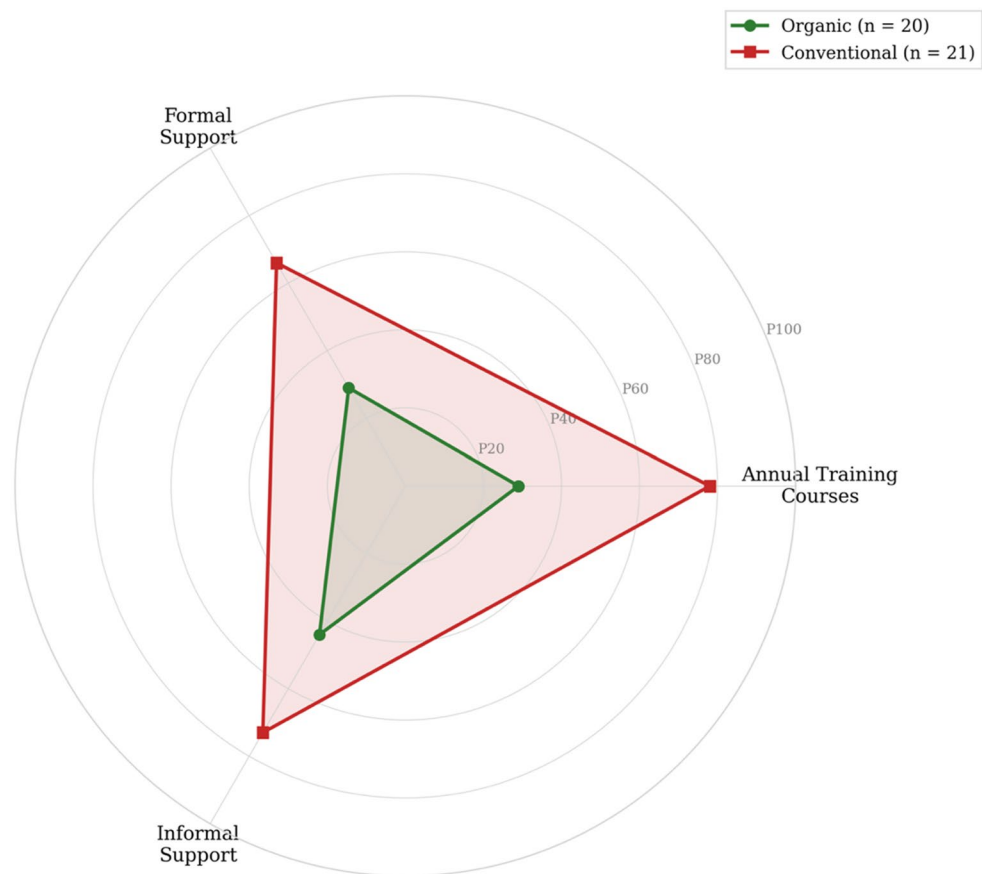


Table 3 Social capital: comparison by production type

Dimension	Organic (n=20)	Conventional (n=21)
<i>Membership motivation</i>	Price premiums; collective organic certification	Commercial relationships with traders; cooperative processing
<i>Membership duration</i>	19 [6–19]	14 [6–14]
<i>Member engagement</i>	Instrumental; contingent on market convenience	Instrumental; contingent on <i>bulk</i> cocoa prices
<i>Leadership orientation</i>	Agroecological, redistributive; “slow life”	Modernizing, entrepreneurial; regional industrialization;
<i>Development model</i>	Place-based; autonomy from commodity circuits	Industrialization to overcome commodity circuits; place-based but market-driven
<i>Conception of well-being</i>	Harmony with nature; “happy oasis”	Innovation and growth
<i>Orientation toward production</i>	Preservation; scaling up undesirable	Intensification; expansion

The table synthesizes the main qualitative dimensions of social capital emerging from semi-structured interviews and ethnographic observation, organized around cooperative dynamics and farmer values and orientations. It also reports membership duration as a median and interquartile range [IQR]

of the organic cooperative pursues agroecological objectives, promoting an alternative economic vision centered on niche markets, ecological care, and what members often describe as a ‘slow life.’ In their view, agroecology offers smallholders a way out of global commodity dependence. The leadership of the conventional cooperative, by contrast, advocates for the industrialization of the Transamazon region. Local cocoa processing, embodied by their chocolate factory, is framed as a means to shift the region from a raw commodity frontier toward an industrialized territory. The

two leaderships thus articulate distinct visions of regional development, one centered on ecological care, the other on local value aggregation, each implying a different role for smallholders in the region’s transformation.

Farmers’ values, orientations, and everyday imaginaries

Interviews also reveal contrasting individual values and orientations. Organic farmers frequently associate well-being with ‘slow living,’ self-production, and harmony

with nature, treating their small farming scale not as resignation but as a choice of a good life. During field visits, organic farmers consistently pointed to wildlife nesting in agroforestry systems, pollinating insects, and fruits obtained through ecological cycles as tangible signs of success and sources of pride, and as indicators of a desirable way of life. These farmers repeatedly expressed a desire to preserve their production model and protect what several referred to as their ‘happy oasis,’ emphasizing continuity, stability, and balance rather than expansion. As one organic farmer reflected during a field visit: “You see that bird nesting up there? That means the system is working. I don’t need to produce more, I need to keep this alive” (Interview 2, Farmer Organic Cooperative). Scaling up through additional inputs is widely seen as unnecessary, even undesirable, where it might compromise ecological integrity or quality of life. A farmer explained: “You can live well on a small piece of land, without being subjugated to it [*bulk* market]. We are content as we are, not too much work, doing what we love, the best thing one can choose in life” (Interview 9, Farmer Organic Cooperative). From this perspective, their economically motivated engagement with the cooperative and the higher returns of *fino* cocoa is not a drive to expand but a way to protect their autonomy.

Conventional farmers, by contrast, tend to frame success in terms of innovation, growth, and personal advancement. Among conventional farmers, recurring themes included saving capital to purchase plots for livestock production and adopting high-yield cloned cocoa in monoculture systems as part of a broader strategy of economic diversification. Others proudly introduced their sharecroppers as evidence of what they framed as ‘modern management,’ presenting labor delegation as a marker of progress. One conventional farmer, showing his recently planted monoculture plot, explained: “My father cleared this land with a machete. Now look what I’ve done, look how many [cocoa pods] are there. That’s progress, isn’t it? My children will go even further” (Interview 19, Farmer Conventional Cooperative). Participation in cocoa fairs and engagement in urban entrepreneurship are likewise presented as milestones of individual achievement and upward mobility.

These orientations are not merely discursive. The livelihood configurations documented across the three capital domains show that values find expression in concrete material choices. They drive how farmers organize labor, engage with markets, and relate to their land. What farmers say and what they do point in the same direction, producing two coherent yet divergent trajectories.

Discussion

In the Transamazon region, agroforestry-based cocoa has been incorporated into the socio-biodiversity economy (SBE). The Cocoa Route program promotes its production as a sustainable alternative to agro-extractivism, largely on environmental grounds (Government of Brazil 2024b). The SBE principles, however, extend beyond ecological benefits, encompassing the social inclusion and economic autonomy of smallholders (Brondizio et al. 2021). Environmental performance alone does not make cocoa a social and economic alternative to agro-extractivism. As Ollinaho and Kröger (2021) show, the same agroforestry practices can strengthen farmers’ autonomy or reproduce the extractivist dynamics they are meant to displace, depending on the social and economic relations in which they are embedded. While agro-extractivist dynamics have been observed to emerge in the SBE at the market level (Pegler 2015; Fonseca et al. 2024), this study has turned to the household, the basic unit in which the SBE is reproduced.

The results presented above reveal that, among the cocoa farmers in the Transamazon, agro-extractivist and socio-biodiversity dynamics entangle at the household level. This entanglement arises from the material conditions farmers inherited, their asset mobilization strategies, and, notably, the values that shape their practice. Table 4 synthesizes the results by mapping the livelihood configurations of conventional and organic farmers against the analytical dimensions of agro-extractivism and the SBE.

The table reveals a spectrum of positions in which both groups combine elements of agro-extractivism and the SBE in distinct configurations. This study refers to this process as structural hybridization, a condition in which the boundaries between the two pathways blur within the same households. The following sections examine how this hybridization unfolds at the household level (Section “[Agrarian trajectories: the interplay of material conditions, strategies and values](#)”), and how it complicates the framing of the SBE (Section “[Cooperatives, structural hybridization and the socio-biodiversity economy](#)”).

Agrarian trajectories: the interplay of material conditions, strategies and values

The agrarian differentiation observed between the two farmer groups has its roots in the Transamazon colonization project, which aimed to integrate natural lands into the national economy as commodity frontiers, and settlers as commodity producers (Moran 1981; Godar et al. 2012). Within this configuration, resources were not distributed uniformly. Farmers who settled in the 1970s in *terra roxa* areas designated for cocoa production, particularly around

Table 4 Comparative mapping of livelihood configurations

Dimension	Agro-extractivism Framework	Socio-biodiversity Framework	Conventional Farmers	Organic Farmers
Scale and land	Large-scale; land expansion ^{a,b}	Small-scale; agroforestry ^{c,d}	Small-scale Agroforestry	Small-scale Agroforestry
Market channels	Raw commodities; global markets ^{b,e}	Niche markets ^{d,f}	Raw commodities (<i>bulk</i>) (Prevalence) Niche markets (<i>fino</i>)	Niche markets (<i>fino</i>) (Prevalence) Raw commodities (<i>bulk</i>)
Accumulation	Capital accumulation; cumulative advantage; investments ^{g,h}	Household reproduction; Livelihood security ^{d,i}	Cumulative advantage Investments	Household reproduction Livelihood security
Labor	Hired labor; managerial delegation ^b	Family labor; embodied engagement ^d	Hired Labor Managerial delegation	Family labor Embodied engagement
Position of the farmer	Entrepreneur OR Petty Commodity Producer ^{b,h}	Place-embedded agent ^{d,j}	Entrepreneur AND Petty Commodity Producer	Place-embedded agent AND Petty Commodity Producer
Off-farm labor	Urban employment; hired farm labor ^{b,h}	Farm-adjacent activities; local markets ^{d,f}	Urban employment	Farm-adjacent activities
Knowledge	Productivity-oriented; commodity-oriented ^{k,l}	Practice-oriented; value aggregation-oriented ^{f,l}	Productivity-oriented Value aggregation-oriented	Practice-oriented
Farmer Orientations	Expansion; Commodity Intensification ^{m,n}	Livelihood security; preservation; livelihood diversification ^{i,o}	Expansion Livelihood diversification	Livelihood security Preservation Livelihood diversification
Development model	Global commodity markets ^{a,e}	Food sovereignty; place-based economies ^{d,i}	Place-based economies Industrialization	Food sovereignty

Columns 2–3 characterize each dimension deductively from the agro-extractivism and SBE literature, with sources listed in the legend below; columns 4–5 report the configurations observed among conventional and organic farmers (Section “Results”)

Sources. ^a Domingues and Sauer (2021); ^b McKay (2017); ^c Costa (2021); ^d Costa et al. (2021); ^e Ye et al. (2020); ^f Saes et al. (2023); ^g McKay et al. (2021); ^h Veltmeyer and Ezquerro-Cañete (2023); ⁱ Garrett et al. (2024); ^j Ollinaho and Kröger (2023); ^k Vieira et al. (2024); ^l Ollinaho and Kröger (2021); ^m Hoelle (2014); ⁿ Hoelle (2018); ^o Lopes et al. (2023)

Medicilândia, received preferential access to land, credit lines, and institutional extension services. Those who arrived in subsequent waves found fewer resources and weaker institutional support. Regional research had traced this asymmetry long before the area was read through the lens of the SBE (Moran et al. 2005). Over time, these disparities laid the groundwork for a pattern of cumulative advantage for conventional farmers that manifests across all three capitals examined in this study.

These asset asymmetries, however, do not fully explain why each group follows the trajectory it does. For example, despite their privileged access to *fino* buyers, conventional farmers continue to derive most of their income from *bulk* cocoa, which binds them to a trader’s ‘trap’ (Interview 56) and to prices they do not control. Organic households follow the opposite course, sustaining *fino* production and home-made chocolate even where premiums are lower and outlets few. Studies of colonist farming in the Amazon document the same pattern, with no single structural variable accounting for the course a household takes (Browder et al. 2004, 2008; VanWey et al. 2007). The divergence depends equally on how each group mobilizes its resources and on the goals it pursues.

In both groups, farmers exercised agency over the material conditions they inherited. The fact that, decades after settlement, conventional farmers still hold significantly greater assets suggests that initial advantages were actively

reinvested rather than passively retained. This pattern resonates with what Cousins (2013) terms ‘accumulation from below,’ a process in which agrarian differentiation emerges not from external capitalist penetration but from within the ranks of smallholders. Similar dynamics have been documented across the Global South, where initial institutional advantages tend to consolidate over time into durable asset asymmetries (Soper 2020; Castañón Ballivián 2024). In the Amazon, capital accumulation has been shown to result not only from institutional inclusion but also from households’ own strategies (Oestreicher et al. 2018). Conventional farmers have mobilized their inherited assets in pursuit of accumulation, selling *bulk* but also diversifying into *fino* and the chocolate factory. Organic households, though marginalized by weaker institutional support and material conditions, have not remained passive. They have used the resources at their disposal to build a livelihood oriented toward autonomy and sufficiency rather than accumulation.

The agency guiding these strategies is rooted in the values farmers embody. Values have long been recognized as central drivers of agrarian dynamics in the Brazilian Amazon, particularly in relation to cattle ranching and deforestation (Hoelle 2018; de Waroux et al. 2021), but also to ecological care and environmental conservation (Lopes et al. 2023). This study suggests that values play a comparable structuring role within the Transamazon cocoa economy.

Conventional farmers mobilize their cumulative advantages toward growth, productive achievement, and economic advancement. In this, they come close to what Ploeg and Douwe (2018) terms the entrepreneurial mode of farming, built on capital, market dependence, and scale enlargement. They leverage the hierarchization of their labor structure to withdraw from agricultural work, engage in skilled urban employment, and secure better positions in premium markets. This orientation resonates with what Hoelle (2018) describes as the cultural attitude of Amazonian settlers, for whom productive landscapes are associated with progress and development. Yet the conventional farmers' aim is not accumulation for its own sake but emancipation from their dependence on the *bulk* commodity market. This emancipation is pursued through income diversification, market upgrading, and value aggregation in the chocolate industry.

Among organic farmers, material constraints intersect with values grounded in livelihood security and what farmers describe as 'slow living.' Their strategies are first and foremost mechanisms of livelihood defense against the pressures of a commodified cocoa market, embodying what Ploeg and Douwe (2018) calls the peasant mode of farming. Home-based chocolate production exemplifies this logic. By transforming their cocoa into a finished product, organic farmers give meaning to what they grow while connecting directly to consumers through fairs and local markets. The commitment to organic production and the preservation of what they refer to as their 'happy oasis' emerges from this daily negotiation between material constraints and values. These values help organic farmers navigate scarcity and resist commodity market pressures, functioning as deep leverage points within livelihood configurations (Abson et al. 2017).

Although conventional and organic farmers hold their capitals asymmetrically, mobilize their assets in different directions, and are driven by distinct values, they share a fundamental condition that limits the scope of this agrarian differentiation. Both derive a significant share of their revenues from the sale of *bulk* cocoa to intermediaries and agri-food traders, a market channel in which price formation remains entirely external to producers. Their condition closely resembles that of petty commodity producers (Bernstein 1986), who participate in markets while remaining structurally subordinate within them. The colonization project thus produced a dual legacy. It distributed resources unevenly, creating the conditions for agrarian differentiation. At the same time, all settlers were oriented toward the same function: producing commodities for the national economy.

Farmers in both groups thus forge their trajectories through the interplay of material conditions, strategies, and values, generating divergent paths within a shared condition

of commodity dependence. Within these trajectories, both groups seek to move beyond petty commodity production. Conventional farmers convert their advantages into a partial integration into the broader economic structure, diversifying income and accessing higher-value markets. Organic farmers, operating at the margins of the economic system, defend their livelihoods through agroecological practice and relational engagement with the land.

Cooperatives, structural hybridization and the socio-biodiversity economy

The trajectories described above are not shaped by individual orientations alone. Cooperatives act as institutional arenas that mediate between the values of their members and the structural conditions in which they operate, channeling individual orientations into collective strategies that may reinforce, redirect, or constrain the agrarian trajectories of their members. Positioned between the household and the SBE markets, cooperatives are also the level at which the entanglement of the two pathways can be contained or amplified. Cooperative arrangements are credited with keeping smallholders from differentiating into unequal producer classes (Ollinaho and Kröger 2021, 2023) and are regarded as a precondition for forest-product economies to deliver their promised socioeconomic benefits (Rosenfeld et al. 2024). The two cooperatives examined here perform this role in markedly different ways.

In the conventional cooperative, members lean toward economic pragmatism and market integration, and their entrepreneurial orientations tend to drive both emancipation from petty commodity production and private economic advancement. Yet the cooperative channels these individual drives toward broader goals. Its chocolate factory embodies this mediating role: conceived to develop a place-based economy in the region, it works to move the Transamazon beyond its condition as a raw commodity frontier (Brondizio et al. 2021; Londres et al. 2023). This mediating capacity, however, also presupposes the more advantaged material conditions of its members. What the conventional cooperative case shows is what collective action can achieve when it builds on an already consolidated asset base.

The organic cooperative presents a different configuration. Here, the values of individual members and the strategic vision of the leadership converge around agroecological principles, livelihood security, and autonomy from commodity circuits. The leadership channels these shared orientations into collective action grounded in food sovereignty (Ploeg and Douwe 2014) and ecological care. Yet this convergence in values does not translate into strategies for productive emancipation from commodity dependence. Beyond the specialization in *fino* cocoa, the cooperative does

not engage in local processing or the development of place-based economies. Even where members produce chocolate at home, these remain individual initiatives disconnected from the cooperative's strategy. Its members thus continue to depend on cocoa production without concrete prospects for local economic diversification. This gap reflects a structural position common across the SBE, where community enterprises often face limited access to finance and business training (Garrett et al. 2024). Under these conditions, turning shared values into a collective economic strategy is far more difficult than it was for the conventional cooperative. Its agroecological practice resists agro-extractivism, yet its economic practice remains at the margins of the broader economic structure.

These two configurations challenge the interpretation of the SBE as a uniform alternative pathway. Among conventional farmers, individual orientations toward growth and market integration resemble the logic of agro-extractivism (McKay et al. 2021). Yet these same farmers actively pursue economic diversification and market upgrading, moving beyond raw commodity production in ways that already depart from agro-extractivist patterns. Their cooperative further channels this drive toward place-based development and value aggregation, operating in line with the goals of the SBE (Londres et al. 2023). Among organic farmers, individual values of ecological care and livelihood security align with the normative foundations of the SBE (Ollinaho and Kröger 2023). However, their cooperative lacks the economic practice to advance beyond commodity dependence. The two cooperatives thus mirror each other, as the conventional one enacts the SBE economic practice while remaining detached from the values that define it, whereas the organic one embodies those values without the economic practice.

In the case examined here, the SBE does not operate as a unified pathway but as a terrain of structural hybridization, where some practices resemble the very agro-extractivist dynamics it seeks to overcome. In the Transamazon region, neither farmer group fits the SBE in its romanticized form, nor agro-extractivism in its classical characterization. What emerges is a spectrum of positions shaped by everyday practice. These findings carry implications for how the SBE is framed in policy. By positioning agroforestry-based cocoa as an inherently sustainable alternative, initiatives such as the Cocoa Route may overlook the very processes through which agro-extractivist patterns reproduce at the household level.

The dynamics documented here are unlikely to be confined to the Transamazon region. Wherever alternative and dominant agrarian models coexist within the same territory, farming households may navigate between them rather than aligning neatly with one (Goodman et al. 2012). What

structural hybridization adds to these insights is the attention to the household level, where the interplay between assets, strategies, and values produces trajectories that neither macro-level categories nor market-level analyses can fully capture.

Conclusions

This study examined the livelihood configurations and agrarian trajectories of cocoa farmers in the Transamazon region, comparing organic and conventional producers through a mixed-method design grounded in the Sustainable Livelihoods Approach (SLA). By integrating an analysis of values into the SLA's focus on material assets, the study shows that agro-extractivism and the socio-biodiversity economy (SBE) do not map onto separate groups or markets but coexist within the same households and economy. This study contributes to the debate on agrarian pathways in the Brazilian Amazon by moving beyond the environmental and social dimensions of the SBE to critically examine the agrarian dynamics unfolding among the smallholders who sustain it.

Findings reveal a process of structural hybridization, in which both farmer groups forge their agrarian trajectories by combining elements of agro-extractivism and the SBE in different configurations. Asset asymmetries originating in the colonization of the Transamazon have generated a cumulative advantage among conventional farmers across all three capital domains, leaving organic farmers to build their livelihoods from a narrower asset base. Both groups, however, remain inserted into commodity circuits as petty commodity producers, reproducing within the SBE the very dependence it set out to overcome. What differentiates their agrarian trajectories is the interplay between their material conditions and the values through which farmers mobilize their assets. Conventional farmers pursue emancipation from petty commodity production through economic diversification, while their cooperative channels individual pragmatism into economic practice aimed at place-based value aggregation. Organic farmers pursue the same emancipation through agroecological farming and livelihood security; their cooperative shares these values but, from its weaker structural position, has yet to turn them into economic practice.

This study suggests that the SBE should not be understood as a unified agrarian pathway but as a contested terrain where alternative and dominant logics coexist, interact, and recombine. The concept of structural hybridization captures this condition by directing analytical attention to the household level, where farming trajectories are forged through the interplay of historically produced capitals, asset

mobilization strategies, and values. This perspective challenges romanticized interpretations of the SBE and other forest-based alternatives to agro-extractivism. It also suggests that agrarian transitions toward more sustainable and equitable food systems are unlikely to follow a single trajectory, and that the values through which farmers interpret and mobilize their assets deserve greater attention in livelihood analysis.

Because both groups combine elements of both pathways, this hybridization is not fixed. There is space for it to shift toward the SBE. The findings point to three dimensions where such shifts might originate. The first is the asset base. The cumulative advantage of conventional farmers did not emerge from market competition but from state resource allocation during colonization. Recognizing the institutional origin of these asymmetries opens the possibility of redistributive interventions in land access, credit, and extension services. The second is cooperative capacity. While the conventional cooperative translates individual pragmatism into collective value aggregation, the organic cooperative faces that task from a much weaker position. Strengthening cooperatives as arenas of value aggregation and place-based development could provide farmers with concrete pathways out of petty commodity production. The third is access to knowledge and institutional support. Formal training, technical assistance, and agency support are disproportionately concentrated among better-positioned farmers due to geographical proximity. Extending these channels, and reorienting their content toward organic and agroecological production, could broaden the base from which the socio-biodiversity trajectories emerge.

As a study focused on two cooperatives within a specific regional context, these findings reflect the institutional, market, and historical conditions of the Transamazon. The patterns identified here may manifest differently in other regions or among other socio-biodiversity economies. Future research could extend this analysis to other Amazonian contexts to assess whether comparable dynamics emerge, and explore the conditions under which cooperatives can effectively counteract agro-extractivist pressures at broader scales.

Declarations

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Author contributions Vincenzo Carbone is the sole author of this work. The author was responsible for the conceptualization, methodology, data collection, formal analysis, investigation, writing, and revision of the manuscript.

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Data availability The datasets generated and analyzed during the current study are not publicly available due to the confidential nature of participant information but are available from the corresponding author on reasonable request. The dataset used to perform quantitative analysis is provided, fully anonymized, in Supplementary Materials.

Declarations

Ethical approval This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the Faculty of Humanities, University of Amsterdam (Ethics Protocol: FGW-1631_2023) on 20 October 2023.

Informed consent All participants were fully informed about the nature of the study and gave their written informed consent to participate.

Use of large language models A large language model (Claude Opus 4.8, Anthropic) was used for editorial assistance, including language revision and formatting of supplementary materials. The author assumes full responsibility for the content.

Competing interests The author has no competing interests to declare.

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