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From Global Standards to Local Compliance: Implementation Heterogeneity in Cocoa Certification in Indonesia

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ABSTRACT

Certified companies translate voluntary sustainability standards (VSS) into local practice, yet little is known about how company-level implementation of VSS relates to farmer compliance. This paper examines Rainforest Alliance (RA) implementation by three certified companies in the Indonesian cocoa sector. Drawing on compliance and regulatory intermediation theories, we distinguish the following three compliance mechanisms: enforcement, incentives, and capacity-building. Although VSS define general rules on these mechanisms, certified companies exercise substantial discretion in how they implement them, potentially generating heterogeneous compliance outcomes. We combine original quantitative survey data from 458 farm-households with qualitative data from 43 interviews and three focus groups to assess variation in company implementation and certified farmers' compliance with seven RA-related indicators. We find substantial implementation heterogeneity across companies and show that enforcement, capacity-building, and incentives can each support compliance, but for different types of indicators: Enforcement is most useful for visible and auditable practices, capacity-building for teachable and low-cost practices, and incentives for practices requiring investment. However, these mechanisms remain insufficient where compliance is constrained by productivity pressures, low or volatile prices, and limited access to suitable inputs. Our findings highlight companies' crucial role in mediating global standards and warrant stronger attention to implementation rules and accountability.

1 | Introduction

Voluntary sustainability standards (VSS) emerged in the 1990s as private governance instruments to support business actors in addressing sustainability issues embedded in global production systems, such as environmental degradation, human and labor rights violations, or unfair remuneration practices (Auld et al. 2008; Marx et al. 2024). By defining global rules for sustainable production, VSS offer producers and value chain actors enhanced market access and the possibility to obtain price premiums (UNCTAD 2022; UNFSS 2013). While active across a variety of sectors, VSS have gained particular traction in tropical agricultural sectors where they certify an increasing share of global production (Kemper et al. 2025; Tayleur et al. 2017).

However, the evidence on VSS effectiveness remains inconclusive. Some studies identify positive effects on specific sustainability outcomes, while others find no or even negative effects (DeFries et al. 2017; Dietz et al. 2022; Meemken 2020; Oya et al. 2018; Schleifer and Sun 2020). A commonly recognized explanation of VSS impact heterogeneity is that formal certification does not necessarily imply compliance with prescribed sustainable production practices, as noncompliance is typically difficult to identify and sanction—a problem commonly theorized as

"policy-practice decoupling" (Bromley and Powell 2012; Meyer and Rowan 1977; Wijen 2014). However, the understanding of how compliance is ensured or constrained when VSS are implemented locally remains limited.

A critical but understudied factor of compliance gaps is the heterogeneity in how VSS are implemented by certified companies. In group certification, the dominant certification model in smallholder-driven agricultural sectors (Kemper et al. 2025), it is often midstream actors, such as trading or processing companies, that adopt VSS as part of their sustainability strategy (Thorlakson 2018). They thereby act as intermediaries transmitting VSS's global rules to producers in local contexts (Aravind and Christmann 2011; Dietz et al. 2022; Meemken 2020; Oya et al. 2018). Drawing on theories of compliance and regulatory intermediation, three mechanisms can be identified through which VSS are implemented and compliance can be fostered: enforcement (e.g., compliance assessments), incentives (e.g., price premiums), and capacity-building (e.g., training) (Depoorter and Marx 2023). While VSS define general principles for these mechanisms, they also leave significant discretion to certified companies, potentially leading to heterogeneous compliance outcomes.

This paper addresses the following question: How does VSS implementation heterogeneity across different certified companies matter for compliance? We study Rainforest Alliance (hereafter "RA") implementation by three certified companies in the cocoa sector in South Sulawesi, Indonesia. We use original quantitative survey data from 230 noncertified and 228 RA-certified farm-households (across three certified groups) and qualitative data from 43 interviews and three focus group discussions (FGDs) collected in 2022. We document differences in how companies implement RA along the three compliance mechanisms (enforcement, incentives, and capacity-building) and analyze how certified farmers' exposure to these compliance mechanisms relates to their compliance with seven selected indicators related to RA requirements on sustainable production practices.

We find substantial heterogeneity in VSS implementation by companies and show that the resulting variation in farmers' exposure to distinct compliance mechanisms matters for compliance. The respective effect of each compliance mechanism depends on the type of indicator, which calls for a combination of mechanisms. This paper makes several contributions. Conceptually, we operationalize how company-led implementation can vary, helping us understand heterogeneity in compliance with VSS, which could potentially contribute to explaining heterogeneity in VSS sustainability outcomes. Empirically, we provide farm-level evidence showing how variation in company-led implementation under the same VSS is associated with differences in farmers' compliance. This responds to growing calls for research on the role of midstream actors, including trading and processing companies, in sustainability governance (Grabs et al. 2024; Grabs and Carodenuto 2021).

The paper is structured as follows: In the next section, we set out the conceptual framework related to compliance mechanisms and implementation heterogeneity. In Section 3, the case study is presented. Section 4 details the data and methods used. Section 5presents the results, which are further discussed in Section 6. Section 7 concludes by highlighting implications for VSS organizations and certified companies, and proposes avenues for future research.

2 | Conceptual Framework: Compliance Mechanisms and Implementation Heterogeneity

Recent advancements in the VSS literature have enhanced the understanding of how they are implemented through compliance mechanisms, that is, the channels through which global VSS requirements on sustainable production practices are conveyed to producers in local contexts. In particular, three compliance mechanisms are commonly identified: enforcement, incentives, and capacity-building (Auld et al. 2015; Bemelmans et al. 2026; Boonaert et al. 2024; Depoorter et al. 2025; Depoorter and Marx 2023; Dietz et al. 2019; Grabs 2020; Oya et al. 2018; Tröster and Hiete 2018). They represent different but not mutually exclusive approaches through which compliance can be fostered by addressing different root causes of noncompliance.

First, the enforcement mechanism, or "command and control," consists of monitoring rule implementation and sanctioning noncompliance. It assumes utility-maximizing actors comply when sanctions outweigh the benefits of noncompliance (Becker 1968; Downs 1997; Wijen 2014) and therefore relies on strong monitoring systems to detect noncompliance (Gunningham 2010; Locke 2013). In practice, VSS often require certified entities to hire external auditors to conduct regular on-site compliance assessments of (a sample of) the farms in their certificates, and to conduct internal assessments to monitor compliance (LeBaron et al. 2017; Loconto 2017). Some schemes mandate unannounced audits, transparency of audit reports, oversight of auditors' competence and independence, and accessible complaint mechanisms (Marx 2013; UNCTAD 2022). While strict auditing and monitoring enforcement systems are considered crucial to deter noncompliance (Aravind and Christmann 2011; Blackman and Naranjo 2012; Giuliani et al. 2017; Ibanez and Blackman 2016; LeBaron et al. 2017), the few studies testing this relationship in VSS contexts (Christmann and Taylor 2006; Dietz et al. 2019; Grabs 2020) operationalize enforcement at the VSS design level rather than farm level. Based on this literature, we expect greater exposure to enforcement to be positively associated with compliance, especially for practices that are visible and auditable.

Second, the incentives mechanism involves providing rewards, such as cash or in-kind premiums (e.g., agricultural inputs or community investments) to compensate producers for the cost of producing more sustainably. Rooted in the positive enforcement school, it addresses the lack of financial or material capacity of producers, and/or their lack of motivation to implement prescribed sustainable production practices as root causes of noncompliance (May 2005; Wijen 2014). While VSS generally rely on market forces and supplier–buyer dynamics to generate incentives, some VSS, such as RA or Fairtrade International, impose both the presence and amount of cash premiums to be paid to farmers by specific value chain actors (Depoorter and Marx 2023). Several studies link (cash) premiums to improved economic outcomes (Bemelmans et al. 2025; Bemelmans and Maertens 2025; Boonaert et al. 2024; Galati et al. 2017;

Rossi 2013; Vicol et al. 2018), but few explicitly test their effect on compliance (see Dietz et al. 2019; Grabs 2020). Based on this literature, we expect greater exposure to incentives to be positively associated with compliance, especially for practices requiring material investment or compensation for opportunity costs.

Third, the capacity-building mechanism draws on developmental and managerial approaches and focuses on strengthening producers' knowledge of VSS requirements and ability to comply (Auld et al. 2015; Nava and Tampe 2023; van Rooij 2021). It targets noncompliance rooted in limited knowledge or technical capacity. VSS often require certified companies to provide regular and adequate training, awareness-raising activities, and documentation to farmers to overcome these barriers. Some studies suggest certification effects on sustainability outcomes may stem from such support (Boonaert et al. 2024; Elder et al. 2013; McDermott 2006; Nava and Tampe 2023; Rueda and Lambin 2013), although evidence on compliance specifically remains mixed (Dietz et al. 2019; Grabs 2020; Tampe 2021). Based on this literature, we expect greater exposure to capacity-building to be positively associated with compliance, especially where compliance requires awareness, knowledge or skill acquisition.

These three mechanisms can also be understood through a power lens. Research on sustainability transitions emphasizes that transformative change is shaped by power relations between actors and by the uneven distribution of resources, knowledge, authority, and agency (Avelino 2017, 2021; Avelino and Rotmans 2009; Avelino and Wittmayer 2016). Partzsch (2017) distinguishes between three forms of power in sustainability transitions: *power-over*, referring to coercion and control; *power-to*, referring to actors' capacities, empowerment and ability to act; and *power-with*, referring to cooperation and collective learning. Applied to VSS implementation, the three compliance mechanisms embody different forms of power. The enforcement mechanism is most closely associated with *power-over*, as certified companies and auditors monitor producers' practices, evaluate compliance, and can exclude producers in case of noncompliance. The capacity-building mechanism primarily aims to strengthen producers' *power to* comply by enhancing their knowledge, technical skills, and capacities to adopt sustainable practices. The incentives mechanism occupies a more ambiguous position: premiums may enhance farmers' *power to* comply, but they can also operate as *power-over* when companies control the amount, timing, and form of such support. Finally, *power-with* becomes relevant when producers participate in defining requirements and implementation modalities or in shaping accountability and learning processes within certification systems. This power lens also points upwards: companies may exercise *power over* VSS organizations as VSS existentially depend on them (Auld et al. 2015; Dietz and Grabs 2022; Haack and Rasche 2021; Saffer et al. 2018; Schuster and Mossig 2025).

This perspective helps clarify why implementation heterogeneity matters. VSS define global rules on sustainable production and on compliance mechanisms (Depoorter and Marx 2023), but certified companies often act as intermediaries translating these rules into local practice (Depoorter et al. 2025). The regulatory intermediation literature shows that the resources, capacities, interests, and relationships of such intermediaries shape regulatory effectiveness (see, for example, Abbott et al. 2017; Auld and Renckens 2017; Brès et al. 2019; Loconto 2017; Marx and Wouters 2017). Implementation can therefore vary substantially among certified firms even operating under the same VSS (Depoorter et al. 2025). This implementation heterogeneity is increasingly recognized as an important determinant of VSS effectiveness because it can generate compliance gaps (DeFries et al. 2017; Oya et al. 2018; Traldi 2021; Wijen 2014), yet it remains underexplored, with only a single exception examining how cooperative characteristics influence Fairtrade effects on farm-level economic outcomes (Sellare et al. 2020). To the best of our knowledge, no previous study has examined all three compliance mechanisms simultaneously to provide a more complete picture of the effect of VSS governance and companies' implementation on farm-level compliance with VSS requirements. We address this gap through a case study of RA implementation by three companies in the Indonesian cocoa sector.

3 | Study context: Rainforest Alliance Certified Cocoa in South Sulawesi, Indonesia

With over 667 thousand tons of raw beans produced in 2022, Indonesia is the third-largest producer of cocoa (*Theobroma cacao*) after Ghana and Côte d'Ivoire (FAO 2023). The Indonesian cocoa sector is characterized by smallholder-dominated production (< 2 ha per farm), which accounts for 99.81% of the national production volume, over 60% of which is grown on the island of Sulawesi (BPS 2023b). The Indonesian cocoa value chain is largely buyer-driven and export-oriented (BPS 2023b), with a strong presence of multinational trading and processing companies in the field sourcing directly from local (micro-)collectors. Globally, sustainability programs and VSS adoption have been largely driven by multinational companies and have been geared toward tackling pervasive issues of deforestation and child labor associated with cocoa production, as well as addressing the vulnerability of the sector to climate change, pests, and diseases undermining productivity (IISD 2022; Ingram et al. 2018; Nelson and Phillips 2018; Parra-Paitan et al. 2023; Thorlakson 2018). In total, 41.8% of the global cocoa production volume was certified in 2022 (Kemper et al. 2025). In Indonesia, sustainability programs were introduced in the early 2000s to tackle pervasive productivity decline. After two decades of expansion in the 1980s and 1990s (Ruf et al. 1996), yields have diminished due to ageing trees, pest outbreaks, and declining soil fertility (Clough et al. 2009). Between 2012 and 2022, production volume and production area decreased by 10% and 22%, respectively (FAO 2023), partly due to conversion to other crops such as oil palm, rice and maize (Supriana et al. 2020), as well as to labor shifts away from cocoa production (and from agriculture more broadly) as a result of low and volatile market prices, low accessibility of agricultural inputs, and a lack of government support for the sector.

To address these issues and respond to growing demand for sustainable products, two VSS have gained prominence in the Indonesian cocoa sector: RA and UTZ (O'Rourke 2012; UNCTAD 2022; Wijaya et al. 2018). These two VSS recently merged into the 2020 RA Sustainable Agriculture Standard and certified 45,833 tons of cocoa (7% of national production volume) across 26,342 farms in 2022 (Rainforest Alliance 2023).

RA includes requirements related to sustainable agricultural production that certified farmers need to comply with and, in the case of group certification, requirements for certified companies related to the implementation of RA. These latter include requirements related to enforcement (regular internal and external audits), incentives (mandatory cash premium of 70 USD/ton[1] of cocoa for certified farmers as well as additional community investments), and capacity-building (regular and adequate training, documentation and awareness-raising activities) (Rainforest Alliance 2024).

In this paper, we focus on RA-certified cocoa in South Sulawesi, one of the largest cocoa-producing provinces in Indonesia (BPS 2023b), more specifically on the "cocoa belt" located in the districts of Luwu, East Luwu, and North Luwu. In this area, three multinational companies implement RA group certification as part of their sustainable sourcing strategy: Mars, Cargill, and Olam (now Olam Food Ingredients [OFI]). While Mars includes producers across the three districts in its RA certificate, Cargill's certified producers are concentrated in East Luwu and Olam's producers in North Luwu. Hereafter, we refer to these distinct certified groups as RA-Mars, RA-Cargill, and RA-Olam. We investigate how these companies differ in the way they implement RA certification (through enforcement, incentives, and capacity-building mechanisms) and how this relates to farm-level compliance with RA requirements.

4 | Data and Methods

4.1 | Data

To analyze how RA is implemented locally, including actors' roles, activities, perceptions, and implementation challenges, and to understand the broader context of cocoa production and certification in the region, we collected qualitative data through interviews and FGDs during an exploratory field visit in May–June 2022 (interviews) and during a systematic data collection campaign in October–December 2022 (interviews and FGDs). We conducted 43 semistructured interviews with different stakeholders in the Indonesian cocoa sector, including representatives from RA and from RA-certified companies, certification bodies, local collectors, farmers, a cocoa sustainability association, local government representatives, NGOs, cooperatives, and other implementing partners. Three FGDs were organized with groups of eight to 10 RA-certified farmers, corresponding to the three certified groups. The FGDs were designed to explore farmers' experiences with certification, including their understanding of RA, their interactions with the companies driving certification, and their exposure to enforcement, incentive, and capacity-building mechanisms. We asked how these mechanisms were operationalized in practice and by whom (e.g., who provided training, how often training took place, what type of support or monitoring they received, and how compliance requirements were communicated and enforced). The FGDs were assisted by local translators and followed a semistructured, participatory approach that encouraged group reflection on shared and divergent experiences. Table S1 provides an overview of the qualitative data collected and the associated codes used for in-text reference.

To study how farmer exposure to compliance mechanisms relates to compliance with RA requirements, we use quantitative data derived from an original farm-household survey administered in Luwu, East Luwu, and North Luwu districts between October and December 2022. The data are derived from 458 smallholder cocoa farmers, of which 228 are RA-certified (in three groups: RA-Mars, RA-Cargill, and RA-Olam) and 230 are noncertified, sampled through a purposive two-stage stratified sampling design. In the first stage, we created one stratum of villages for each of the certified groups, containing all known villages where certified farmers were located. For RA-Cargill and RA-Olam groups, which are district-constrained (to East Luwu and North Luwu, respectively), we randomly selected seven villages within the associated stratum. For RA-Mars (present in the three districts), we randomly selected three villages in each district within its stratum. In the second stage, 10 certified and 10 noncertified cocoa-producing households were randomly sampled in each village to participate in the survey. Two households (one in RA-Cargill and one in RA-Olam) were excluded as they did not harvest or sell cocoa in the 12 months prior to the survey. Table 1 provides an overview of the sample structure.

A group of trained enumerators administered a structured questionnaire using tablets and the software SurveyCTO. The questionnaire covered questions on demographic and socioeconomic data, cocoa production and practices, as well as certification-related questions for the certified farmers. We first use the full sample, including noncertified and RA-certified farmers ($N = 458$), to provide summary statistics on household-level characteristics and on compliance with selected indicators. We then use the sample of RA-certified farmers ($n = 228$) to provide summary statistics on their exposure to the compliance mechanisms and to test how exposure to these mechanisms relates to compliance.

TABLE 1 | Sample structure overview.

		RA-certified				
District	Noncertified farmers (#villages)	RA-Mars farmers (# villages)	RA-Cargill farmers (#villages)	RA-Olam farmers (#villages)	Total #farmers	Total #villages
Luwu	30 (3)	30 (3)			60	3
East Luwu	100 (10)	30 (3)	69 (7)		199	10
North Luwu	100 (10)	30 (3)		69 (7)	199	10
Total	230	90	69	69	458	23

4.2 | Variables

4.2.1 | Dependent Variables: Compliance With RA Requirements

To measure farmer compliance with sustainable production practices, we drew from the RA Sustainable Agriculture Standards 2020 Farm requirements (Version SA-S-SD-1-V1.2) applicable at the time of data collection in 2022. We derived a list of selected compliance indicators that are (1) applicable to smallholder farms, (2) mandatory from the moment of entry in RA certification (i.e., "core" requirements, as opposed to "continuous improvement" requirements allowing for gradual compliance over time), (3) measurable through survey data, and (4) relevant from a sustainability perspective for both certified and noncertified farmers. The resulting seven compliance indicators mostly relate to good agricultural practices (GAP), pesticide use, and labor rights, and include the following: (1) pruning of cocoa trees; (2) use of organic fertilizers and pesticides or manual pest control before applying agrochemicals; (3) no use of prohibited pesticides (as defined by RA[2]); (4) safe storage of pesticides; (5) systematic use of personal protective equipment (PPE) when applying pesticides; (6) record-keeping of pesticide applications; and (7) payment of minimum wage to hired labor. Compliance is measured at the farm level using binary compliance indicators, with 1 indicating compliance and 0 indicating noncompliance, that are constructed from survey data on the implementation of specific agricultural practices or on self-assessed compliance. The list of indicators, excerpts of the related RA requirements, and their measurement based on survey data are detailed in Table 2.

4.2.2 | Independent Variables: Exposure to Compliance Mechanisms

We measure exposure to the three respective compliance mechanisms described in Section 2 at farm level using survey data from the certified sample, as detailed in Table 3. For the capacity-building indicator, the component "training on relevant topic" was coded separately for each compliance indicator. Certified farmers were asked whether they had received RA-related training on a predefined list of topics. We then matched each training topic to the corresponding compliance indicator, as shown in the last column of Table 2. Thus, training on GAP was treated as relevant for pruning and for the use of organic inputs or manual pest control before agrochemical application; training on agrochemical use was treated as relevant for avoiding prohibited pesticides and safe pesticide storage; and specific training on PPE use, record-keeping, and wages respectively were matched to the corresponding compliance indicators.

4.3 | Regression Analysis

We estimate the relationship between exposure to the compliance mechanisms and compliance with each of the seven compliance indicators separately, for the certified sample ($n = 228$), through the following equation:

$$Y_i = \alpha_0 + \beta P_i + \gamma X_i + \varepsilon_i$$

where Y_i is the outcome variable for farmer i for the compliance indicator in question as defined in Table 2; P_i is a vector of the compliance mechanisms variables (enforcement, cash premium, in-kind premium, and capacity-building); and X_i is a vector of farm-level control variables including household head age (years), high school education of the household head (0/1), total area of cocoa plots (ha), membership in a cocoa farmer organization (0/1), distance between the main cocoa plot and the Trans-Sulawesi highway (main provincial road) (km), ownership of the main cocoa plot (0/1), elevation of the homestead (meters above sea level, m.a.s.l.), and district (categorical). The error term is captured by ε_i. Robust standard errors clustered at the village level are reported to allow the error terms to be (i) heteroskedastic and (ii) correlated within the village due to our sampling strategy (Abadie et al. 2023; Wooldridge 2010). Equations are estimated using a probit maximum likelihood estimator. We report average marginal effects to understand how an increase in exposure to the respective compliance mechanisms affects the likelihood of complying with the respective compliance indicators.

It is important to note that companies originally recruited farmers into certification schemes through their own sourcing networks, including field staff, collectors, and farmer organizations. Qualitative interviews indicate that companies may have targeted particular villages or producers on the basis of cocoa production potential, proof of land ownership, location outside protected areas, existing field infrastructure, sourcing relationships, and accessibility. As a result, farmers recruited by different companies may differ systematically in observed and unobserved characteristics associated with compliance. In addition, companies operate in different geographic contexts. Consequently, the estimated relationships should be interpreted as conditional associations rather than causal effects. While observable farm characteristics and location are controlled for, unobserved differences between farmers and locations may still influence the estimated relationships.

As a robustness check, we control for inclusion in company-specific RA certificates to account for unobserved differences in implementation context, recruitment strategies, and farmer composition across groups, thereby reducing bias from between-group differences. We do not include these controls in the main specification because the compliance mechanisms are partly organized at the certificate scheme level, such that group controls absorb a substantial share of the relevant variation. The resulting estimates are therefore more conservative and may underestimate the associations of interest. Additionally, we assess the sensitivity of the baseline estimates to potential omitted variable bias using the coefficient stability approach proposed by Oster (2019). This method evaluates how strong selection on unobservables would need to be, relative to selection on observables, to overturn the model's results.

5 | Results

5.1 | Qualitative Insights

Interview and FGD data disclose that the three companies differ in their compliance procedures (see Table S1 for definition of the codes referenced in text). Mars relies on its own field staff to

TABLE 2 | Binary compliance indicators.

	Excerpt of related Rainforest Alliance SAS 2020 requirements (applicable to Small farms[a])	Measurement in the survey	Relevant RA-related training topic
(1) Pruning of cocoa trees	*"4.2.1. Management implements a pruning cycle for adequate formation, maintenance and rejuvenation pruning according to crop needs, agroecological conditions and applicable pruning guidelines."* *"4.2.2. Producers carry out pruning according to the requirement in 4.2.1."*	Whether pruning of cocoa trees was done in the last 12 months. Coded 1 if yes; 0 if no.	GAP
(2) Use of organic fertilizers and pesticides or manual pest control prior to agrochemical application	*"4.4.4. When available, producers use by-products including organic fertilizers produced on the farm first. If more nutrients are needed, these are supplemented where possible by other organic fertilizers, or by inorganic fertilizer."* *"4.5.3. For pest prevention and control, producers use biological, physical, and other non-chemical control methods first, and document the use and the effectiveness of these methods."*	Whether organic fertilizers and pesticides or manual control of pests have been applied first before using agrochemicals in the last 12 months. Coded 1 if the answer is yes for both fertilizers and pesticides; 0 otherwise; NA if neither fertilizers nor pesticides are used.	GAP
(3) No use of prohibited pesticides	*"4.6.1. No agrochemicals are used that are: on the Rainforest Alliance List of Prohibited Pesticides or List of Obsolete Pesticides; prohibited by applicable law; not legally registered in the country where the farm is located."*	What pesticides have been used in the past 12 months. Coded 1 if the pesticides used are not prohibited; 0 if at least one pesticide used is on the list of RA prohibited pesticides[b]; NA if no pesticides are used.	Agrochemical use
(4) Safe storage of pesticides	*"4.6.10. Agrochemicals and application equipment are stored in accordance with the label instructions and in a way that minimizes negative impact on the environment and human health. (...) Facilities for storing agrochemicals and application equipment are: dry, clean, well-ventilated; made from non-absorbent material; safely locked and accessible only by trained handlers; not accessible to children; separated from crop, food products, and packaging materials."*	Where pesticides are stored (from a list of options). Coded 1 if stored in a closed place separate from crops, food products, and packaging material; 0 otherwise; NA if no pesticides are used.	Agrochemical use

(Continues)

TABLE 2 | (Continued)

	Excerpt of related Rainforest Alliance SAS 2020 requirements (applicable to Small farms[a])	Measurement in the survey	Relevant RA-related training topic
(5) Systematic use of PPE	*"4.6.3 Persons handling pesticides are skilled in the preparation and application of pesticides, and receive annual training. Persons handling pesticides use PPE as prescribed in the product's label or Material Safety Data Sheet (MSDS). If there is no information, basic protective clothing with additional items is worn according to the potential risk and as recommended by a competent technician."* *"5.6.9. Persons that work in hazardous situations (e.g., under challenging terrains, with machines or with hazardous materials) use appropriate PPE. These persons are trained in the use of the PPE and have access to the PPE free of charge."*	How often PPE is used when applying pesticides (from a list of options). Coded 1 if PPE is used *always*; 0 otherwise; NA if no pesticides are used.	PPE use
(6) Record-keeping of pesticide applications	*"4.5.7. Producers monitor and reduce the use of pesticides."* *"4.6.8. Pesticide applications are recorded."*	Whether records of pesticide application are kept. Coded 1 if yes; 0 if no; NA if no pesticides are used.	Record-keeping
(7) Payment of minimum wage to hired labor	*"5.3.3. Workers receive at least the applicable minimum wage, or the wage negotiated in a Collective Bargaining Agreement (CBA), whichever is higher."*[c]	Average hourly wage of hired labor in the last 12 months.[d] Coded 1 if equal to or greater than the legal minimum wage applicable in South Sulawesi in 2022[e]; 0 otherwise; NA if no labor is hired.	Wages

Note: Indicators based on RA Sustainable Agriculture Standard 2020[f]; operationalization in the farmer survey by the authors.
[a]Defined by RA as farms with less than 10 permanent workers.
[b]Support from RA local staff was obtained to categorize local names of pesticides accordingly.
[c]Following RA requirements, payment of minimum wage is only applicable to smallholders when the number of temporary workers (working for three consecutive months or more) is equal to or greater than 10, and/or when the number of temporary workers per calendar year is equal or greater than 50. Strictly speaking, this criterion is not applicable to farmers in our sample but is nonetheless relevant to measure from a sustainability perspective.
[d]Weighted average per number of hours worked in each hired labor category (male, female, and children).
[e]Monthly minimum wage applicable = IDR 3,165,876 (Ministry of Manpower of the Republic of Indonesia 2022) equivalent to 18,265 IDR/h for 40-h weeks (i.e., 1.23 USD/h; average 2022 exchange rate: USD 1 = IDR 14,850) (IMF 2024).
[f]Available at https://www.rainforest-alliance.org/wp-content/uploads/2022/06/SA-S-SD-1-V1.3-2020-Sustainable-Agriculture-Standard-Farm-Requirements_Rainforest-Alliance.pdf.

TABLE 3 | Compliance mechanisms indicators.

Compliance mechanism		Indicator	Measurement in the survey
Enforcement		Enforcement = audit frequency + unannounced audit received + audit report received *(categorical, 0–5)*	Audit frequency (0–3): 0 = never received an audit; 1 = received an audit but not in the last 12 months; 2 = audit received in the last 12 months; 3 = receives audits more than once a year Unannounced audit (0/1): Whether an unannounced audit was ever received Audit report (0/1): Whether an audit report was ever received
Incentive	**In cash**	Cash premium *(IDR/kg)*	Cash premium (IDR/kg): Reported amount of the cash price premium received in the last 12 months, per kilogram of dry bean equivalent (IDR/kg); conversion factor from wet beans to dry beans of 40%[a]
	In-kind	In-kind premium *(0/1)*	In-kind premium (0/1): Whether an in-kind premium (in the form of agricultural inputs) was received in the last 12 months[b]
Capacity-building		Capacity-building = training frequency + training on relevant topic + perceived learning benefit + documentation received *(categorical, 0–6)*	Training frequency (0–3): 0 = never participated in a training about RA requirements; 1 = has once participated in training; 2 = participates in training once a year; 3 = participates in training more than once a year Training on relevant topic (0/1): Whether training received was on the relevant topic for the respective compliance indicators (based on the topic-indicator matching described in Table 2) Perceived learning benefit (0/1): Whether "a lot" was learned from training (as a proxy, although subjective, for the quality of training) Documentation received (0/1): Whether written documentation or guidance on RA requirements was ever received by the farmer or a member of the household

[a]World Bank (1986).
[b]We were unable to confidently derive the cash value of in-kind premium received.

enforce compliance with RA requirements through internal monitoring and assessments. In terms of incentives, Mars distributes the mandatory RA price premium in-kind, in the form of agricultural inputs, rather than in cash, on the basis of an exception granted by RA (MAR-1 and RA-3). An interviewee explained this exception as follows: "Mars is one of RA's biggest clients, so business-wise, RA had to find a solution. (...) It is always difficult to deal with the big buyers" (RA-3). From a company perspective, in-kind premiums were presented as a way to ensure resources are reinvested in cocoa production (MAR-1 and RA-3). From a farmer perspective, in-kind premiums can facilitate access to agricultural inputs but can also reduce farmers' discretion and make the value of the premium less transparent (FAR-1, FAR-2, and FGD-M). One local collector for Mars noted that "all farmers around here want cash and not in-kind premium," partly because they wanted to choose which fertilizers to buy and when to buy them (COL-6). As for capacity-building, Mars provides training through a "train-the-trainer" approach (MAR-1 and MAR-2) which was sometimes criticized by farmers as diluting expertise and legitimacy along the chain (FAR-4 and FGD-M).

Cargill relies on an external specialized service provider company and on independent collectors to enforce compliance with RA requirements through audits and to conduct capacity-building through training (CAR-1, COL-8, and SER-1). As one interviewee expressed: "Collectors are the main actors [implementing RA], the middlemen, they are close to farmers and have a long-standing relationship with them. They have independence and knowledge of the field" (CAR-3). As for incentives, Cargill distributes the RA cash premium to farmers directly through bank transfer (or through local collectors with an acknowledgement of receipt mechanism for farmers who do not have a bank account) (CAR-1, CAR-3, COL-1, and FGD-C). While they require payment infrastructure and reliable records,

cash payments were described as increasing transparency and farmer discretion (CAR-2, COL-1, and FGD-C).

Olam relies on its own field staff for compliance enforcement, and for providing incentives and capacity-building (OLA-1), but interview and FGD participants reported staff shortages (CB-2, FGD-O, and RA-5). It distributes the mandatory RA premium both in cash and in kind (OLA-2), although it was not granted an exception from RA to deviate from the cash premium requirement (RA-3, FGD-O), and issues of premium capture were reported (GOV-4 and FGD-O). This heterogeneity in RA implementation across companies leading group certificates, hence, constitutes a potential source of variation in farmer compliance.

5.2 | Descriptive Statistics

Summary farm-household statistics in Table 4 show that certified and noncertified farms are, on average, relatively comparable on a range of characteristics. However, certified farms have on average a significantly larger cocoa area (1.72 ha compared to 1.16 ha for noncertified farms). This might illustrate either selection bias by companies when recruiting farms or certification encouraging agricultural expansion. In addition, membership in a cocoa farmer organization is almost twice as high for certified farms (93%) as for noncertified farms (50%). Certified farms also tend to be slightly more experienced in cocoa farming. RA-Olam farms are on average located further away from the closest town compared to other groups. RA-Mars farms are located at a lower elevation, which, in our study context, corresponds to being further away from forests.

Descriptive statistics for the certified sample on farmers' exposure to the three compliance mechanisms corroborate this heterogeneity in RA implementation across groups (Table 5). RA-Cargill farms are on average more exposed to the enforcement mechanism with an average score of 3.13. This is significantly higher than RA-Mars (1.92) and RA-Olam (1.35) farms. As for the incentives mechanism, the average cash premium received by RA-Cargill farms in the 12 months prior to the survey amounts to 796.04 IDR/kg (equivalent to 53.6 USD/ton; with 96% of RA-Cargill farms receiving a premium regardless of the amount, statistics not reported), while the average for RA-Mars farms is 9.72 IDR/kg (with only 3% of farmers receiving a cash premium) and for RA-Olam farms 70.27 IDR/kg (with only 7% receiving a cash premium). Conversely, 73% of RA-Mars farms received an in-kind premium in the 12 months prior to the survey, while only 6% of RA-Cargill and 16% of RA-Olam farms had. These stark differences across groups reflect the differences in premium distribution across the three companies as described in Section 5.1. Lastly, we find that RA-Cargill farms are also more exposed to capacity-building (3.57) compared to RA-Mars (2.80) and RA-Olam (2.41) farms.

TABLE 4 | Household descriptive statistics per certification status.

			RA-certified			
	Full sample $N=458$	**Noncertified** $n=230$	**Total** $n=228$	**RA-Mars** $n=90$	**RA-Cargill** $n=69$	**RA-Olam** $n=69$
Household size (#)	3.98 (1.59)	4.01 (1.57)	3.94 (1.61)	4.19 (1.61)	3.68 (1.56)	3.88 (1.65)
Age of household head (years)	51.19 (11.41)	51.08 (11.76)	51.31 (11.06)	51.44 (11.02)	52.41 (10.91)	50.03 (11.29)
Female household head (0/1)	0.07	0.09	0.05*	0.06	0.03*	0.06
High school education of household head (0/1)	0.35	0.34	0.36	0.42	0.32	0.30
Total cocoa area (ha)	1.44 (1.12)	1.16 (0.90)	1.72*** (1.24)	1.83*** (1.30)	1.45** (0.91)	1.86*** (1.40)
Membership in cocoa farmer organization (0/1)	0.71	0.50	0.93***	0.86***	0.99***	0.96***
Distance to Trans-Sulawesi highway (km)	5.69 (5.31)	5.44 (5.50)	5.95 (5.11)	5.60 (5.96)	5.58 (5.02)	6.79* (3.79)
Distance to closest provincial town (km)	13.77 (6.57)	13.56 (6.58)	13.98 (6.56)	12.32 (6.44)	12.30 (6.32)	17.82*** (5.31)
Experience in cocoa production (years)	16.37 (10.43)	15.27 (10.62)	17.48** (10.14)	17.64* (10.74)	16.77 (10.14)	17.97* (9.42)
Ownership of main cocoa plot (0/1)	0.91	0.90	0.93	0.96*	0.94	0.90
Elevation (m.a.s.l.)	54.80 (61.56)	57.76 (74.13)	51.82 (45.46)	41.19** (29.36)	69.58 (57.93)	47.92 (43.93)

Note: Standard deviations for nonbinary variables in parentheses. Comparison between the noncertified group and the certified group and subgroups is based on Student *t*-tests or χ^2 tests. Significant differences in the mean of the certified group and subgroups compared to the noncertified group are shown with
*$p<0.1$.
**$p<0.05$.
***$p<0.01$.

TABLE 5 | Descriptive statistics of exposure to compliance mechanisms by certification status.

	RA-certified			
	Total $n = 228$	**RA-Mars $n = 90$**	**RA-Cargill $n = 69$**	**RA-Olam $n = 69$**
Enforcement (0–5)	**2.11 (1.55)**	**1.92 (1.62)**	**3.13*** (1.16)**	**1.35**^{xxx} (1.24)**
Audit frequency (0–3)	1.58 (1.07)	1.44 (1.16)	2.25*** (0.69)	1.09**^{xxx} (0.92)
Unannounced audit received (0/1)	0.34	0.30	0.59***	0.14**^{xxx}
Audit report received (0/1)	0.19	0.18	0.29*	0.12^{xx}
Incentives				
Cash premium value (IDR/kg)	266.01 (463.15)	9.72 (59.93)	796.04*** (434.49)	70.27*^{xxx} (334.26)
In-kind premium (0/1)	0.36	0.73	0.06***	0.16***^{x}
Capacity-building (excl. Training specific topics) (0–5)	**2.91 (1.69)**	**2.80 (1.54)**	**3.57*** (1.52)**	**2.41**^{xxx} (1.86)**
Training frequency (0–3)	1.80 (1.17)	1.83 (1.08)	2.16* (1.04)	1.41**^{xxx} (1.30)
Perceived learning benefit (0/1)	0.61	0.58	0.74**	0.52^{xxx}
Documentation received (0/1)	0.50	0.39	0.67***	0.48^{xx}
Training on relevant topic:				
GAP (0/1)	0.29	0.46	0.19***	0.19***
Agrochemical use (0/1)	0.72	0.79	0.84	0.52***^{xxx}
PPE use (0/1)	0.46	0.39	0.64***	0.38^{xxx}
Record-keeping (0/1)	0.06	0.12	0.00***	0.04*^{xx}
Wages (0/1)	0.06	0.07	0.12	0.00**^{xxx}

Note: Standard deviations for nonbinary variables in parentheses. Comparison between the certified groups is based on Student *t*-test or χ^2 test. * indicates significant difference in means compared to the sample of RA-Mars producers, ^{x} compared with the sample of RA-Cargill producers. For the cash premium value variable, $n = 67$ for RA-Olam due to missing data.
*$p \leq 0.10$.
**$p \leq 0.05$.
***$p \leq 0.01$.

Descriptive statistics on compliance (Table 6) illustrate that, on average, certified farms do not show significantly different compliance levels compared to noncertified farms for most indicators, except for record-keeping of pesticide application, for which certified farms show higher compliance. However, within the certified sample, substantial variation emerges across the three certified groups. While pruning is widely applied across all groups, RA-Mars and RA-Cargill farmers are slightly more likely to prune their cocoa trees. RA-Mars and RA-Olam farmers are, on average, also more likely to use organic inputs or manual pest control before applying agrochemicals. Fewer RA-Olam farms use prohibited pesticides compared to the other groups—although compliance with this indicator is alarmingly low for all groups. This means that the majority of farmers have applied, in the 12 months prior to the survey, at least one kind of pesticide that is prohibited by RA for being considered highly hazardous, presenting major human health and environmental risks, or being widely banned. RA-Mars farms show higher compliance with the safe storage of pesticides, while RA-Cargill farms show on average lower compliance with this indicator. RA-Mars and RA-Cargill farms are also more likely to record pesticide application than RA-Olam and noncertified farmers. Finally, RA-Olam farms show, on average, lower compliance with the minimum wage requirement, although sample sizes are relatively small as only 40% of the farmers in our full sample hired labor in the past 12 months.

5.3 | Regression Results

Figure 1 presents the average marginal effects from the probit regressions estimating the relationship between certified farmers' exposure to the compliance mechanisms and their likelihood of compliance with each of the selected compliance indicators. The full regression table is provided in Table S2.

Figure 1 shows that increased exposure to compliance mechanisms is related to higher compliance with some indicators. A one-unit increase in exposure to enforcement (panel A), for example through more frequent audits or receipt of an unannounced

TABLE 6 | Descriptive statistics on the share of farms complying with selected compliance indicators per certification status.

			RA-certified			
	Full sample $N=458$	**Noncertified** $n=230$	**Total** $n=228$	**RA-Mars** $n=90$	**RA-Cargill** $n=69$	**RA-Olam** $n=69$
Pruning of cocoa trees (0/1)	0.95	0.93	0.96	0.98*	0.99*	0.91
Use of organic inputs or manual control first (0/1)	0.08 ($n=455$)	0.07 ($n=228$)	0.12 ($n=227$)	0.14*	0.09	0.12* ($n=68$)
No use of prohibited pesticides (0/1)	0.05	0.04	0.06	0.02	0.04	0.12
Safe storage of pesticides (0/1)	0.31 ($n=455$)	0.32 ($n=228$)	0.30 ($n=227$)	0.43*	0.17**	0.26 ($n=68$)
Systematic use of PPE (0/1)	0.38 ($n=455$)	0.35 ($n=228$)	0.41 ($n=227$)	0.38	0.42	0.46 ($n=68$)
Record-keeping of pesticide application (0/1)	0.17 ($n=455$)	0.13 ($n=228$)	0.22*** ($n=227$)	0.27***	0.32***	0.06 ($n=68$)
Payment of minimum wage to hired labor (0/1)	0.38 ($n=184$)	0.44 ($n=89$)	0.33 ($n=95$)	0.37 ($n=41$)	0.40 ($n=20$)	0.24** ($n=34$)

Note: Comparison between the noncertified group and the certified group and subgroups is based on χ^2 tests. Significant differences in the mean of the certified group and subgroups compared to the noncertified group are shown with
*$p<0.1$.
**$p<0.05$.
***$p<0.01$.

audit, raises the likelihood of using PPE and of keeping records of pesticide application by 7 and 6.4 pp., respectively. However, it also decreases the likelihood of applying organic inputs or manual control of pests first by 2.8 pp., which is already very low in our sample. For the incentives mechanism (panel B), an increase of 1000 IDR/kg in the cash premium received increases the likelihood of safely storing pesticides by 11.4 pp., but decreases the likelihood of applying organic inputs or manual control first by 12.4 pp. Receiving an in-kind premium (panel C) significantly decreases the likelihood of avoiding prohibited pesticides by 11 pp. (a strong effect considering the low share of compliant farmers in our sample), but increases the likelihood of safely storing pesticides by 12.5 pp. Capacity-building (panel D) is positively associated with three compliance indicators: a one-unit increment in exposure, for example, by receiving more frequent training or by receiving documentation about RA requirements, is associated with a 1.5, 4.8, and 4.4 pp. increase in the likelihood of pruning (a small effect size, but pruning is already widely applied in our sample), of systematically using PPE, and of record-keeping of pesticide application, respectively.

Results are robust when controlling for the certified group to which farmers belong (Table S3), except for the relationship between in-kind premium and safe storage of pesticides, which loses significance, possibly because of endogeneity between in-kind premium and the RA-Mars group. Additionally, Oster's (2019) coefficient stability test suggests that the estimated effects are relatively robust to unobserved confounding, although the degree of robustness varies across outcomes (Table S4). For most compliance outcomes, breakdown points exceed 100%, implying that selection on unobservables would need to be at least as strong as selection on observables to eliminate the estimated effects. For the interdiction to use prohibited pesticides and safe storage of pesticides, breakdown points are somewhat lower (53.9% and 83.3%, respectively), indicating that these estimates are more sensitive to omitted-variable bias, although they still indicate a moderate level of robustness.

6 | Discussion

This study shows that company-led implementation is an important source of heterogeneity in VSS compliance (Bemelmans et al. 2025; Depoorter et al. 2025; Sellare et al. 2020). Even under the same VSS, certified companies differ significantly in how they organize monitoring, distribute premiums, and deliver capacity-building, which in turn shapes compliance. This aligns with the regulatory intermediation literature's claim that intermediaries do not merely transmit rules but actively interpret them and shape how they travel along supply chains (Abbott et al. 2017). Our contribution is to show that such implementation heterogeneity is associated with variation in farmers' exposure to compliance mechanisms and farm-level compliance.

The *enforcement mechanism* is most strongly associated with practices that are visible and relatively easy to monitor, such as PPE use and record-keeping of pesticide application (Ingram et al. 2018; Tampe 2021), a pattern supported by our interview and FGD data (FGD-M, FGD-C, and SER-1). This suggests that enforcement works best when compliance can be translated into observable audit topics. By contrast, enforcement appears less effective where compliance is costly and faces contextual constraints, which helps explain the absence of a relationship with the interdiction to use prohibited pesticides, safe pesticide storage, and minimum wage payment. Interviews and FGDs repeatedly pointed to pest pressure, declining productivity, low or volatile prices, and limited access to suitable inputs: farmers described difficulties abandoning agrochemical products

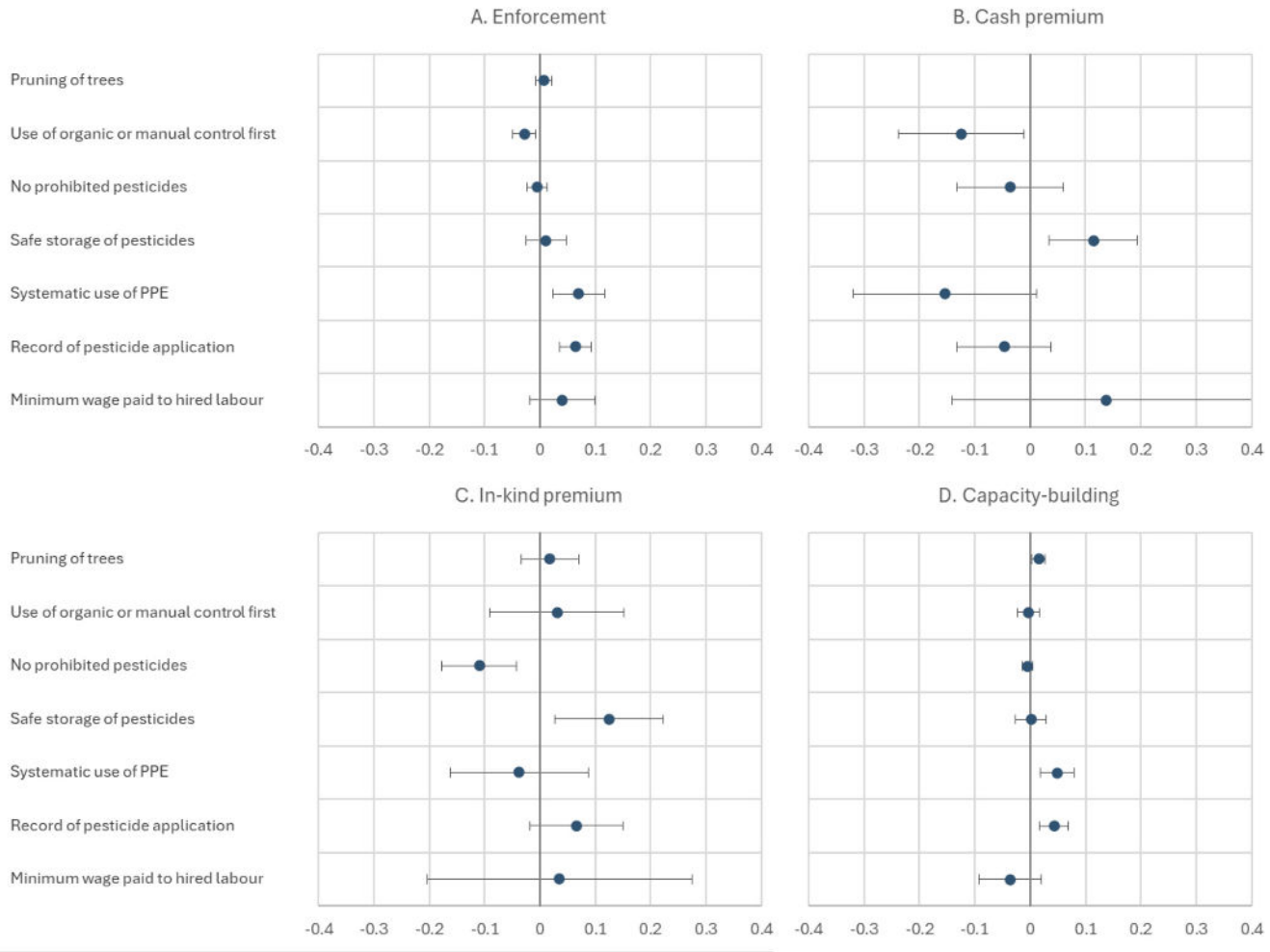

FIGURE 1 | Marginal effects of exposure to compliance mechanisms on selected compliance indicators. Note: Dots report average marginal effects from probit regressions. Missing dots indicate variables excluded due to perfect prediction. Error bars show 90% confidence intervals based on robust standard errors clustered at the village level and calculated using the Delta method. Control variables are included in the models but omitted from the figure. Full regression results are provided in Table S2.

they had long relied on and emphasized that fertilizer access remained their main problem despite certification (FGD-M, FGD-C, and FGD-O). Relatedly, the negative association between enforcement and using organic inputs or manual control before agrochemicals is puzzling but may reflect strategic compliance: farmers may comply with more visible requirements, such as PPE use and record-keeping, while continuing to rely on agrochemicals when pest pressure, yield risks, and limited access to viable alternatives make behavioral change more costly.

The results for the *incentives mechanism* suggest that premiums can support compliance where practices involve clear investment costs, but that their effects are also limited by broader economic and productivity constraints. Cash and in-kind premiums are positively associated only with safe pesticide storage, a practice that requires upfront investment, which premiums may help compensate for (Christmann and Taylor 2006; Dietz et al. 2019). By contrast, no significant relationship is found with PPE use, even though Dietz et al. (2019) identify such an effect. This may be because many farmers reported receiving PPE for free from their buyer companies, reducing the relevance of premiums for this practice (FGD-M and FGD-O). Similarly, while the estimates for minimum wage payment point in the expected positive direction, in line with Dietz et al. (2019), the effect is not statistically significant, plausibly because high price volatility, productivity challenges, and insufficient cocoa income limit farmers' ability to absorb recurrent labor costs. These contextual constraints also help explain the negative associations with some production practices. Cash premiums may be used to prioritize short-term productivity (CSA-1), including agrochemical use, rather than labor-intensive practices such as organic inputs or manual control first, as also suggested in previous studies (Rueda and Lambin 2013; Wijaya et al. 2018). In-kind premiums may similarly free up resources that farmers reinvest in agrochemicals or encourage agricultural intensification, leading to an increased likelihood of using pesticides (possibly including prohibited ones) (Vanderhaegen et al. 2018). While we lack systematic data on the inputs distributed as in-kind premiums, field observations and qualitative data collected indicate that these sometimes included pesticides (COL-6, COL-7, and FGD-M), though we could not verify whether any were prohibited.

The *capacity-building mechanism* is positively associated with pruning, PPE use, and pesticide record-keeping, suggesting that training is most effective when practices are relatively easy to learn and linked to tangible benefits. This is consistent with Wijen and Flowers' (2022) argument that learning is more likely to translate into behavioral change when the link between practice and outcome is clear and implementation is feasible. Qualitative evidence supports this point: farmers criticized training as too theoretical and rather valued more practical, plot-specific advice (FGD-M and FGD-O). More specifically, pruning is easy to learn and has clear benefits for tree health and productivity, which farmers recognized during the FGDs, aligning with findings by Obeng Adomaa et al. (2022) on cocoa in Ghana. Farmers similarly linked PPE use to visible health benefits (FGD-C and FGD-O). Record-keeping follows the same logic, as it is relatively easy to learn and involves limited material costs. This also suggests complementarity between capacity-building and enforcement, as training can explain why rules matter while monitoring reinforces their uptake, a pattern also observed by Tampe (2021) and Ingram et al. (2018). However, capacity-building shows no significant association with more costly or structurally constrained practices, such as using organic inputs or manual control first, avoiding prohibited pesticides, ensuring safe pesticide storage, or paying minimum wages.

Overall, the results call for a more differentiated understanding of compliance mechanisms. Distinct mechanisms increase the likelihood of compliance with some indicators more than others, which supports the need for combined approaches (De Bakker et al. 2019; Rueda and Lambin 2013; Tallberg 2010; Wijen and Flowers 2022). Enforcement appears useful for observable practices, especially when combined with capacity-building; capacity-building is most effective when practices are easy to learn, beneficial, and low-cost; and incentives are most useful where compliance requires investment, although the form of incentives matters: Cash premiums may strengthen farmer discretion, whereas in-kind support can steer practices and reduce transparency. However, some practices cannot be governed through enforcement, incentives or capacity-building alone, particularly where productivity pressures, price volatility, and limited access to suitable inputs constrain farmers' choices. This suggests that implementation mixes should be tailored not only to the type of practice, but also to the structural constraints farmers face, and to the power relations through which support and monitoring are delivered.

Interpreting the results through a power lens thereby provides useful insights. Through enforcement, VSS and companies implementing them exercise *power-over* farmers by defining how compliance is assessed and which forms of noncompliance become visible. Through capacity-building, they may enhance farmers' *power-to* comply by improving knowledge and practical skills, although this depends on the quality and accessibility of training. Incentives sit between these two forms of power: They can expand farmers' capacity to comply (*power-to*), but they also allow companies to steer behavior through control over the form, value, timing, and conditions of premium distribution (*power-over*). The comparison between cash and in-kind premiums illustrates this ambiguity. Cash premiums leave farmers more discretion, while in-kind premiums can solve input-access constraints but also make value less transparent and reinforce company control over farmers' production decisions. The lack of farmer involvement in standard-setting and implementation design suggests that *power-with* remains weak. In addition, power relations do not only run from companies to farmers, but also between companies and VSS. The exception that Mars obtained from RA to deviate from the mandatory cash premium to distribute it in kind illustrates that large certified companies are not passive intermediaries but actively shape how standards are operationalized in practice by exercising *power over* VSS. This matters because the effectiveness of VSS in generating sustainability transitions depends not only on compliance but also on who has the authority to define standards and benefit from them in practice.

This study entails several limitations. First, most compliance indicators rely on farmer-reported information. Several were constructed indirectly rather than through direct questions about compliance, which reduces the risk of direct social desirability bias but does not eliminate recall error, incomplete reporting, or possible underreporting of sensitive practices. Second, several indicators simplify complex practices into binary measures. For example, compliance indicators on prohibited pesticides and PPE use do not capture potential variation in the frequency and amounts of prohibited pesticides used or variation in PPE quality. Similarly, the variables on compliance mechanisms capture farmers' reported exposure but not necessarily their depth or quality. For example, audit variables do not necessarily reflect audit quality, and training variables do not necessarily reflect knowledge acquisition or farmers' ability to apply the training in practice. Third, despite the inclusion of various control variables, selection bias (as farmers were not randomly recruited into certification schemes) and omitted variable bias prevent us from claiming causality—rather, our estimates should be interpreted as conditional associations between exposure to compliance mechanisms and compliance. While we conducted robustness checks controlling for company-specific RA certification, we cannot fully account for unobserved heterogeneity. Stronger identification methods were not feasible in this setting; for example, instrumental variable approaches would require valid and sufficiently strong instruments for all the different compliance mechanisms, which was not possible. Propensity or other matching approaches would require larger subsamples of farmers in different compliance combination groups as the different compliance mechanisms cannot be assumed to be conditionally independent. Lastly, we focus on the implementation of a single VSS in a single context and on seven compliance indicators. While this provides advantages to estimate the effect of implementation heterogeneity and compliance mechanisms on compliance while controlling for heterogeneity in VSS rules and contextual factors, it calls for further research to increase external validity.

7 | Conclusion

This paper advances the literature on VSS effectiveness by moving beyond certified versus noncertified comparisons and beyond standard-level design features to show how company-level implementation shapes farm-level compliance under the

same VSS. Differences in how companies, acting as intermediaries transmitting global standards to local contexts, operate compliance mechanisms may partially explain variation in farm-level compliance and, in turn, the sustainability impacts of VSS. They are therefore crucial actors in sustainability governance that need to be better understood (Dauvergne and Lister 2012; Grabs et al. 2024). This study also shows how distinct compliance mechanisms—enforcement, incentives, and capacity-building—shape farmers' compliance with sustainability standards. Based on a case study of RA implementation by three companies in the cocoa sector in South Sulawesi, Indonesia, the paper shows that while each mechanism can enhance compliance, their effectiveness in doing so varies across indicators. Enforcement appears effective for easily observable practices, whereas capacity-building works best when behaviors are clearly linked to tangible outcomes. Incentive mechanisms, by contrast, are limited in their effectiveness when contextual constraints such as volatile prices and productivity pressures undermine farmers' capacity to comply (De Bakker et al. 2019; Rueda and Lambin 2013; Tallberg 2010; Wijen and Flowers 2022). These insights suggest that no single mechanism is sufficient to foster broad-based compliance, underscoring the need for a complementary mix of approaches tailored to the type of practice and the socio-economic realities of farmers.

Several policy implications can be delineated to enhance VSS implementation. First, VSS organizations should specify clearer minimum requirements for company-level implementation and monitor certified companies' practices more closely (Auld 2014). This could include verifying the frequency, independence, and quality of internal audits; requiring traceable records of premium amounts, timing, recipients, and forms of distribution; and assessing training not only by the number of sessions delivered but also by its relevance, accessibility, and contribution to farmers' knowledge and ability to implement required practices. Monitoring should draw on farmer interviews, confidential feedback or grievance mechanisms, and periodic field-level verification rather than relying primarily on company-reported information. Where shortcomings are identified, VSS organizations could require time-bound corrective action plans and follow-up assessments. Such measures could strengthen companies' accountability to VSS organizations and producers for the fair and effective implementation of global rules in local contexts (Grabs et al. 2024). Second, VSS and certified companies should pay more attention to the structural constraints that shape farmers' ability to comply, which may require more reliable premiums, longer-term and adequate support, or diversification opportunities. Third, strengthening farmer participation in decisions about standard-setting and training and premium-distribution modalities would introduce more *power-with* into VSS implementation, which could improve compliance as well as legitimacy (Bennett 2017).

Avenues for future research include investigating the mediating effect of different types of intermediaries (e.g., cooperatives) in implementing VSS or other sustainability interventions and assessing the effect of compliance mechanisms in other study settings (sector, VSS, country, and indicators) and across time. Future endeavors might also investigate how compliance with specific indicators affects intermediate and end sustainability goals (Oya et al. 2018).

Author Contributions

Charline Depoorter: conceptualization, investigation, writing – original draft, methodology, visualization, writing – review and editing, formal analysis, data curation. **Janne Bemelmans:** writing – review and editing, formal analysis, methodology, data curation. **Eva Boonaert:** writing – review and editing, methodology, formal analysis. **Axel Marx:** conceptualization, writing – review and editing, supervision, project administration, funding acquisition. **Miet Maertens:** funding acquisition, writing – review and editing, project administration, supervision, methodology.

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Endnotes

[1] For comparison, in 2022, a 70 USD/ton premium was equivalent to approximately 4.9% of Indonesia's average producer price (1431 USD/ton) (FAO 2026) and 3.8% of the average producer price in South Sulawesi (1831 USD/ton) (BPS 2023a).

[2] RA list of prohibited pesticides and related policy is available at: https://www.rainforest-alliance.org/wp-content/uploads/2022/06/SA-S-SD-22-V1-Annex-Chapter-4-Farming.pdf.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Overview of qualitative data collected. **Table S2:** Probit regression results of compliance mechanisms of RA certification on selected dummy compliance indicators. **Table S3:** Robustness check—probit regression results of compliance mechanisms of RA certification on selected dummy compliance indicators, controlling for company-led certified group. **Table S4:** Results of Oster's coefficient stability analysis.