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A systematic review of the impacts of voluntary sustainability standards on the cocoa global value chain

Sara Romano[1*], Federica Demaria[2] and Anna Carbone[3]

*Correspondence:
Sara Romano
sara.romano@unitus.it
[1]University of Tuscia, Via del Paradiso, 47, 01100 Viterbo, VT, Italy
[2]Council for Agricultural Research and Economics (CREA) - Agricultural Policies and Bioeconomy, Rome, Italy
[3]Universitas Mercatorum, Rome, Italy

Abstract

The paper presents a Systematic Literature Review that examines the effects of VSSs on a sector facing increasing social, environmental and economic sustainability challenges: the cocoa sector. To do so, the review addresses the question: What are the economic, social, and environmental effects of VSSs on the cocoa sector, and which factors influence their effectiveness? Despite growing research interest in Voluntary Sustainability Standards (VSSs), literature rarely provides a clear and comprehensive perspective on their impacts on sustainability and adoption dynamics within a specific sector. The paper seeks at addressing this gap. A comprehensive search of Scopus and Web of Science (April–May 2024, updated February 2025) identified 228 studies, of which 45 met inclusion criteria. Each study was assessed for quality and risk of bias using the Mixed Methods Appraisal Tool. Studies were categorised by sustainability dimension and analysed through narrative synthesis. Findings indicate modest income gains, primarily through yield improvements rather than price premiums. Environmentally, certified farmers adopt sustainable practices—particularly agroforestry and regulated agrochemical use—though effects on deforestation and biodiversity are limited. Social outcomes are mixed: child labour and gender inequality persist, with only minor improvements in education and training access. Overall, it emerges that VSSs contribute to incremental sustainability gains, but their effectiveness remains context-dependent and constrained by systemic dynamics in the global cocoa value chain. Strengthening institutional support and cooperative governance is crucial for fairer value distribution; without such reforms, VSSs risk perpetuating existing inequalities.

Keywords Cocoa value chain, Systematic literature review, Voluntary sustainability standards, Sustainability

1 Introduction

1.1 Cocoa sustainability issues

The global chocolate and confectionery industry, valued at roughly USD 46 billion in 2021 [1], is expected to grow significantly in the coming years, driven by rising consumption in emerging economies [2]. To date, countries in the Global North, especially

in Europe, are the largest importers and consumers of cocoa beans and cocoa products, making cocoa one of the most valuable and widely traded tropical agricultural commodities [3]. While the global average chocolate consumption is approximately 0.9 kg per person per year, European countries far exceed this figure: Switzerland leads global consumption with an average of 10.9 kg per person [4].

Cocoa beans, the essential backbone of chocolate and confectionery products, are, on the other hand, produced in tropical regions of the Global South.

West African countries, particularly Ivory Coast and Ghana, dominate cocoa production, contributing approximately 54.3% of the world's supply, followed by Indonesia, Ecuador, Brazil and Cameroon [5, 6].

At the same time, the cocoa economy is geographically segmented by quality and price. If, on the one hand, West Africa dominates global production mainly through the export of bulk cocoa—a lower-quality segment traded in large volumes at prices tied to volatile international markets [7]—on the other hand, Latin America is the world's main source of fine or flavour cocoa, accounting for around 90% of global fine-flavour exports and only 10–12% of total production, but commanding higher prices and premiums [8, 9]. Because West African producers are structurally concentrated in these lower-priced bulk markets, they face more severe income and sustainability constraints, which leads to most empirical studies focusing on this region.

Despite their pivotal role, several factors have led these countries to face significant challenges that threaten both the environmental sustainability of cocoa production and the livelihoods of the farmers involved.

Climate change, coupled with outdated farming techniques and the small-scale nature of cocoa farms, contributes to low productivity. Since the mid-1900s, rising temperatures and shifting rainfall patterns have posed major challenges to the agricultural sector, leading to reduced yields and greater pest and disease pressure. This trend is evident across many West African crops, including rubber, millet, sorghum, maize and cocoa [10–13].

Among the most threatening phytopathogens for cocoa production, the Cacao Swollen Shoot Virus Disease (CSSVD), which can cause up to 80% yield loss, leaving farmers with only one viable way to prevent further contamination: tree eradication [11].

The uneven distribution of value along the cocoa supply chain further exacerbates the challenges cocoa farmers face in achieving sustainable living incomes. The Cocoa Barometer [14] estimates that only 6.6% of the added value generated along the value chain reaches the farmers, while manufacturers and retailers capture more than 70%. This stark imbalance highlights the significant power disparities and uneven profit distribution within the Global Value Chain.

Recent sector analysis illustrate how these structural vulnerabilities have culminated in the last years in an unprecedented supply crisis: the combination of crop disease, ageing trees and farmers, low yields, advancing gold mining, climate-change-induced weather shocks and high input costs led to several years of poor harvests in Ghana and Ivory Coast, driving global stocks to historic lows and pushing futures prices temporarily above USD 12,000 per tonne in April 2024. Despite these record prices, farmer poverty has largely persisted due to the limited transmission of market gains to farm-gate prices, collapsing yields, and rising production costs [13].

As a result, cocoa farmers in Ghana and the Ivory Coast earn, on average, just USD 0.84/day and USD 0.50/day, respectively—far below the poverty line and well under the Living Income threshold, even in the context of recent price spikes.

These economic issues are widely regarded as the primary drivers of the sector's environmental and social challenges, including deforestation. When cocoa yields from existing plots fail to generate sufficient income, farmers often lack the means to invest in sustainable intensification or land rehabilitation. As a result, many resort to clearing adjacent forests to secure their livelihoods. This perpetuates a cycle of forest conversion into cocoa plantations, further accelerating environmental degradation [15].

It is no coincidence that cocoa has been classified as a high-risk commodity under the EU Deforestation Regulation (EUDR), accounting for 7.5% of EU-driven deforestation [16].

Other critical environmental challenges include the overuse and misuse of pesticides and synthetic fertilizers [17]. These practices not only degrade soil quality, pollute water sources and endanger biodiversity [18], but also pose significant health risks to farmers working in cocoa fields, particularly vulnerable groups such as women and children [19]. The problem is further exacerbated by the limited use of protective equipment and insufficient training on safe pesticide use [20].

From the social point of view, child labour is a topic of great concern; roughly 1,56 million children in Ivory Coast and Ghana work on cocoa farms [21]. Of these, 51% are exposed to hazardous work [22] such as carrying heavy loads, using sharp tools and working long hours or at night [23]. Even though socio-cultural factors play a role in the phenomena, as the participation of children in cocoa cultivation is often seen as an important part of their upbringing, it is also connected to economic factors. Cocoa cultivation in Ghana is largely family-based and especially at the peak of the cocoa harvest, the demand for workforce increases. Due to the high cost of hired labour, the whole household may be involved in the farm activities, leading to child labour [24].

Another topic of concern is gender inequality, a complex issue deeply intertwined with cultural and traditional norms, which remains, as stated in the Cocoa Barometer "the rule rather than the exception in many cocoa growing regions" [25]. According to the African Development Bank (2015) women make up about 68% of the labour force in the cocoa sector [26].

Women's empowerment constitutes a pivotal determinant of household well-being, as their capacity to influence daily routines and household decision-making has a direct and measurable impact on the health and nutritional outcomes of their children [27]. Despite this, cocoa farming is often associated with patriarchal structures, where women, despite their significant contributions to production phases which strongly impact the quality of the final product, such as fermentation and drying, still face significant disadvantages, including limited access to land, resources, and decision-making power [28, 29].

1.2 The role of Voluntary Sustainability Standards

Many initiatives at both national and international levels have been implemented to address the sustainability issues of the cocoa sector, reflecting the growing recognition of the need for systemic change.

On the international level, the Cocoa & Forests Initiative (CFI), a multi-stakeholder partnership, was launched in 2017. The initiative is led by the governments of Côte d'Ivoire, Ghana and Colombia, and brings together major cocoa- and chocolate-sector companies, such as Mars, Nestlé, Mondelez International, with civil-society and technical partners, including IDH—The Sustainable Trade Initiative and the World Cocoa Foundation, with the aim of improving the sustainability of the sector. The joint commitments focus on protecting and restoring forests, promoting more sustainable cocoa production and farmer livelihoods, and engaging communities in inclusive development [30].

Recent CFI reports indicate some progress: farm mapping and deforestation-risk assessments have expanded, shade trees to support agroforestry have been distributed, and traceability in direct supply chains has increased [31], with some companies verifying more than 85% of cocoa volumes as deforestation-free [32]. Despite this, the 2025 Cocoa Barometer takes a more critical stance, arguing that CFI has so far fallen short of delivering substantial, measurable reductions in deforestation [33].

Furthermore, at the national level, Ghana and Côte d'Ivoire, the two main cocoa producers, have introduced the Living Income Differential (LID), a pricing mechanism designed to boost farmer incomes by adding a premium of $400 per metric ton to cocoa prices [34].

Despite these efforts, the impact of these initiatives remains too small to drive large-scale change, as neither the CFI nor the LID tackles core structural issues such as the unequal distribution of value along the supply chain, insecure land tenure, persistent price volatility, and broader governance weaknesses that continue to undermine sustainable cocoa production.

In addition, in response to growing consumer awareness and demand for transparency, the private sector has also moved steps towards sustainability, with manufacturing companies developing their own sustainability labels and trademarks—examples include the Nestlé Cocoa Plan, Cocoa Horizons by Mars, and Sustainable in a Generation by Barry Callebaut [35]. Again, despite the mentioned private initiatives representing significant efforts, they often serve to differentiate products in a competitive market rather than fundamentally resolving the sector's sustainability challenges [36]. The 2025 Cocoa Barometer describes this trend as a "race for certified volumes", noting that, despite the multiplication of initiatives and the fact that between one third and one half of global cocoa production is now covered by sustainability labels, farmer poverty, deforestation and child labour remain widespread [33].

Another important tool for addressing the sustainability challenges of the sector, are Voluntary Sustainability Standards (VSSs).

VSSs are defined as *"standards specifying requirements that producers, traders, manufacturers, retailers or service providers may be asked to meet, relating to a wide range of sustainability metrics, including respect for basic human rights, worker health and safety, the environmental impacts of production, community relations, land use planning and others"* [37].

Among the different monitoring systems that VSSs can employ, many of the major schemes operating in the cocoa sector, such as Rainforest Alliance, Fairtrade and Organic, rely on independent third-party verification. In this approach, accredited external auditors conduct on-site inspections, review documentation and evaluate farming

practices to determine whether producers comply with the standard's criteria [38]. This approach stands in contrast to many private corporate initiatives, which often rely on self-assessment methods (first-party verification) [39].

Certification programs have therefore become important mechanisms for promoting environmental, social and economic sustainability while fostering consumers' trust [40].

In this context, cocoa was, in 2022, the second largest commodity after cotton in terms of certified area, with 3.65 million of certified hectares, followed by oil palm and sugarcane [41].

The participation of cocoa farmers in certification programs has seen significant growth over the past decade. Notably, Rainforest Alliance experienced the largest increase, with a 351.36% rise between 2018 and 2022, representing 28.03% of the total area harvested by 2022. Organic cocoa followed with a 53.01% increase, comprising 4.18% of the total area harvested, while Fairtrade saw a 13.20% rise over the same period, making up 13.20% of the total area harvested in 2022 [42]. In terms of global production volumes—bearing in mind that cocoa can carry multiple certifications simultaneously, and categories may therefore overlap—Rainforest Alliance–certified cocoa represented approximately 51% of world cocoa output in 2023 [43], while Fairtrade accounted for around 14.4% [44, 45]. For Organic cocoa, no recent tonnage data are available; however, it represented roughly 0.5% of global production in 2018 [46] and is likely to be higher today given the expansion of certified areas.

In this context, Ivory Coast and Ghana, the world's two largest cocoa bean producers, have the highest share of land cultivated under certification schemes, with 27.4% and 14.7% of land certified, respectively.

As the global significance of Voluntary Sustainability Standards (VSSs) grows, researchers have increasingly asked: Do these standards genuinely promote sustainability?

The effectiveness of certification remains a topic of debate. While some studies suggest that certification can lead to positive outcomes, barriers such as high certification costs, limited accessibility for smallholders, and inconsistencies in implementation, may reduce its overall impact [47, 48]. Additionally, critics have raised concerns about the role of certification in global supply chains, with some arguing that it is often dominated by actors from the Global North, thereby sidelining producer-country governments in the Global South [49, 50].

The 2025 Cocoa Barometer echoes these concerns, arguing that using certification as a proxy for sustainability is misleading in a context where cocoa-farming families frequently cannot meet their essential needs and where certification has done little to close the structural power gap between multinational companies and farmers [100].

In this framework, it is important to note that, despite a growing body of research on Voluntary Sustainability Standards (VSSs) in the cocoa sector, existing evidence remains highly fragmented. Most contributions either focus on specific economic, social or environmental outcomes, or analyse adoption and compliance dynamics—such as drivers, institutional barriers and implementation challenges—in isolation. Cross-commodity reviews, in turn, typically aggregate results from different crops and regions, which makes it difficult to understand how VSSs function within the specific institutional and market context of cocoa. As a result, we still lack an integrated picture of how VSSs

shape sustainability outcomes in the cocoa sector and how these outcomes are conditioned by value-chain governance and adoption mechanisms.

To address this gap, the present systematic literature review offers a comprehensive and integrative analysis that connects these previously separated perspectives. Specifically, it addresses the following research question: What is currently known about the economic, social and environmental impacts of Voluntary Sustainability Standards in the cocoa sector, and what factors influence their effectiveness? In doing so, the review brings together evidence on farm-level impacts (income, yields, food security, environmental and social indicators) and on the dynamics that mediate these impacts, such as value-chain governance, power asymmetries, cooperatives and barriers to participation. A central focus is placed on identifying trade-offs and distributional effects (e.g. income gains alongside persistent food insecurity, or environmental requirements that increase labour burdens), rather than treating VSS outcomes as uniformly win–win.

Crucially, to our knowledge, no prior study has systematically synthesised evidence across all three dimensions of sustainability within the cocoa sector while simultaneously examining the governance and adoption mechanisms that shape VSS performance. This paper aims to fulfil this gap, by providing a cocoa-specific, rigorous and reproducible synthesis of the existing research.

To do so, the remainder of the article is structured as follows:

- Sect. 2: *Materials and methods*, details the PRISMA-based methodology adopted for the review, including the search strategy, screening and eligibility criteria (*Study Selection and Eligibility Criteria—Paragraph 2.1)*, and the framework used to classify studies by indicators and sustainability pillars *(Literature Classification—Paragraph 2.2)*.
- Sect. 3: *Results*, first presents the impacts of VSSs on the selected economic, social and environmental indicators, organised by sustainability pillar (*Paragraphs 3.1.1, 3.1.2, 3.1.3*), and then examines the key dynamics that underlie and influence VSS effectiveness (*Paragraph 3.2*).
- Sect. 4: *Discussion*, synthesises and interprets these findings in light of the broader debate on sustainability standards and cocoa value-chain transformation.
- Sect. 5: *Limits of the study*, outlines the main limitations of the review and highlights opportunities for future research.

2 Materials and methods

To conduct a transparent, comprehensive, and reproducible literature review, this paper uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology. PRISMA is a set of guidelines aimed at enhancing the transparency and quality of reporting in systematic reviews and meta-analyses.

To achieve this, the method requires the explicit inclusion of 27 essential items, known as the PRISMA checklist. These items include, among others, clearly stating the rationale for the review, outlining the used information sources and search strategies, specifying the eligibility criteria for included studies and describing the methods for data extraction and analysis.

Doing so, PRISMA ensures consistency across systematic reviews, making it easier for readers to compare different reviews on similar topics. This consistency leads to greater clarity, as the structure makes it easier to locate specific information about how the

review was performed. Consequently, this standardized approach enhances the reliability of the findings and increases the confidence that the review's conclusions are based on robust and transparent methods [51].

2.1 Study selection and eligibility criteria

This systematic literature review was conducted by searching scientific articles in two academic databases—Scopus and Web of Science—from April 2024 to May 2024. The databases were revisited in February 2025 to include newly published papers.

The search was performed using the following keywords: ((“Voluntary” AND “Sustainability” AND “Standards”) OR (“sustain*” AND “certification*”) OR (“private” AND “standards”)) AND (“cocoa”). These keywords were selected to ensure relevance to the research question and to allow for a comprehensive analysis of the topic.

Studies were identified by searching for these keywords within article abstracts, titles, and author-designated keywords.

To be considered eligible, papers had to be peer reviewed journal articles or other published reviews written in English.

No restrictions were placed on the publication year; however, the earliest study identified through the search was published in 2012, defining the review period as 2021–2025.

The search yielded a total of 228 articles, with 120 retrieved from Web of Science and 104 from Scopus. Additionally, four relevant articles not indexed in these databases were manually added by the authors, bringing the total to 228.

After removing duplicate entries (n = 76), the remaining articles were screened based on their titles and abstracts, as illustrated in Fig. 1.

This process led to the exclusion of 89 papers, while 63 advanced to the next stage, where their full texts were reviewed.

During this stage, the eligibility criteria were applied. To be included in the review, studies needed to focus on the role of certifications in the cocoa industry, either by examining their economic, social, and environmental effects or by discussing their limitations, compliance patterns, drivers of adoption, and underlying dynamics.

To ensure a comprehensive perspective on how certification schemes operate within the cocoa sector, qualitative, quantitative, and mixed-method studies were all considered.

Only papers examining the most widely used third-party verified schemes in the cocoa sector —Rainforest Alliance, Fairtrade, and Organic certification—were included in the review. Studies focusing on other certification initiatives, corporate sustainability programmes, or standards not yet implemented in practice (e.g., the ISO/CEN Standard for Sustainable and Traceable Cocoa) were excluded. Additionally, studies were excluded if they broadly covered multiple crops without a specific focus on cocoa or if they mentioned cocoa in the abstract but ultimately centred their analysis on other crops. Lastly, articles with small sample sizes or lacking rigorous methodological approaches were also removed.

To ensure a rigorous and unbiased selection process, two reviewers independently screened titles and abstracts, and two reviewers independently assessed full texts for eligibility. A third reviewer was consulted to resolve any disagreements, which were settled through discussion and consensus the screening and the eligibility assessments were independently conducted by three reviewers. Any disagreement regarding the inclusion

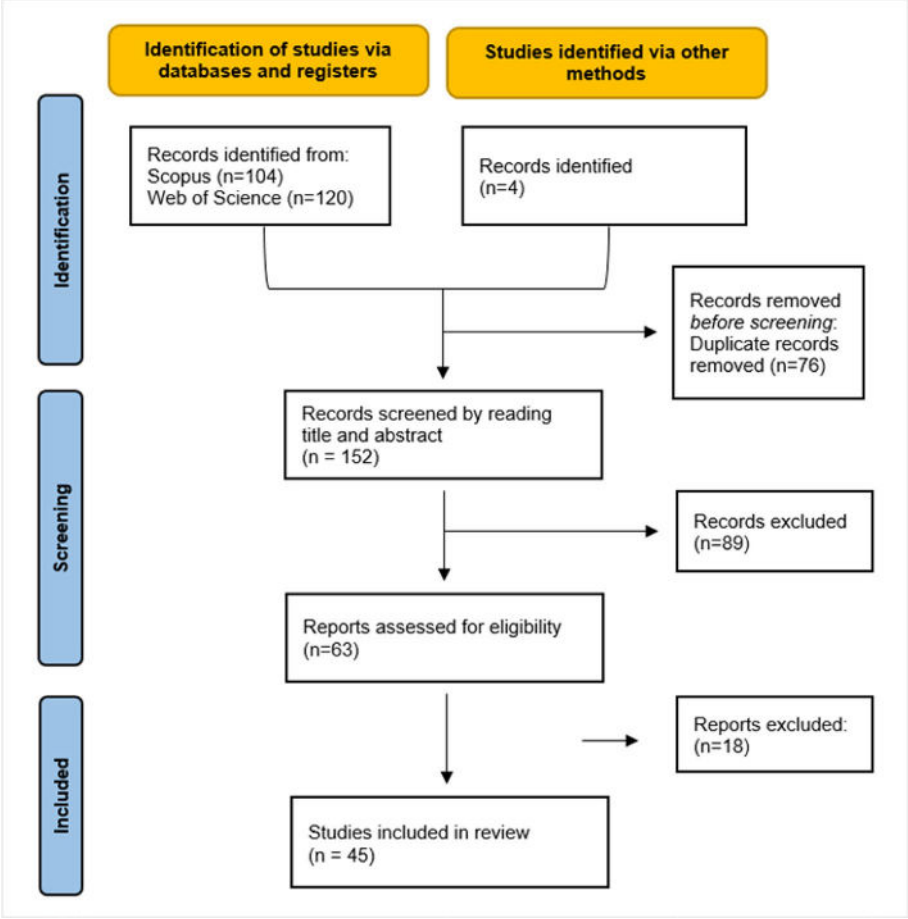

Fig. 1 Prisma flow diagram 1.
Source: own elaboration

or exclusion of studies was resolved through discussion and consensus. This final selection comprised 45 papers, which forms the basis of the following analysis.

As recommended by the PRISMA methodology, the selected papers underwent a quality assessment process.

Evaluating study quality allows researchers to assess the strength of the evidence, identify potential biases, and enhance the credibility of the review's conclusions.

For this systematic review, the Mixed Methods Appraisal Tool (MMAT) was chosen to assess the methodological quality and to assess the risk of bias in the included studies. MMAT is particularly suited for evaluating diverse research designs, including qualitative, quantitative, and mixed-methods studies [52]. This factor was especially relevant given the complexity of Voluntary Sustainability Standards (VSSs) in cocoa, which often integrate qualitative insights—such as stakeholder perceptions—with quantitative data, including impact assessments. MMAT provides a structured and transparent framework for assessing the rigor of different study types, aligning with the PRISMA 2020 guidelines for systematic reviews. By employing this tool, we ensured a consistent and systematic evaluation of methodological quality, strengthening the reliability and validity of our findings [53].

Moreover, MMAT inherently addresses key aspects of study validity, such as the appropriateness of study design, data collection methods, and coherence between

findings and data—critical elements in assessing potential biases. Given its effectiveness in evaluating the risk of bias across diverse study types, no additional assessment tool was deemed necessary, as MMAT provides a rigorous and consistent evaluation framework for this review.

As shown in Annex 1, the papers were categorized by study type. MMAT identifies five categories: qualitative, quantitative randomized controlled trials, quantitative non-randomized, quantitative descriptive, and mixed methods. No quantitative randomized controlled trials were identified in the selection process.

The final sample included 7 qualitative studies, 13 quantitative non-randomized studies, 7 quantitative descriptive studies, and 13 mixed-methods studies. Additionally, five studies that did not fit within MMAT's predefined categories were assessed using five specific quality criteria developed for this review (see Annex 1). These criteria were self-developed, following standard practices in systematic reviews when existing appraisal tools do not adequately capture the characteristics of certain study types. The criteria assessed: (1) whether the research question or objective was clearly stated; (2) whether the methodology was appropriate for the stated objective; (3) whether data collection and analysis were complete and coherent; (4) whether the discussion and conclusions were well developed and supported by the evidence; and (5) whether the study provided relevant insights for the field.

Although it is generally discouraged to calculate an overall score based on MMAT's individual criteria ratings, a total score can offer insights into the robustness of the systematic review's results and conclusions.

To this end, studies were classified as follows:

- High quality: Four or five "Yes" ratings.
- Moderate quality: Three "Yes" ratings, or two "Yes" with two "Partially" ratings.
- Low quality: Two or fewer "Yes" or "Partially" ratings.

If a study received a "Not applicable" rating for any criterion, that criterion was excluded from the total count, and the quality assessment was based on the remaining number of applicable criteria. For example, if only four criteria were applicable, a study was rated as high quality with at least three "Yes" ratings, moderate quality with two "Yes" and one or two "Partially" ratings, and low quality with one or zero "Yes" responses. This proportional adjustment ensured fair assessment across studies while maintaining consistency in the evaluation process. The resulting classification provided a clearer understanding of the reliability of the included studies and their contributions to the systematic review.

Furthermore, a data-charting was developed to capture relevant information from each study. The spreadsheet included the following details: Study characteristics (title, author(s), year of publication, sustainability dimension, thematic area, VSSs of focus, country, see Annex 2), research objectives, used methods (qualitative, quantitative, mixed methods), key findings and limitations or gaps identified in the study.

Finally, in Annex 3, each selected study was summarized using a coding scheme (+, –, +*, and "None") () to indicate the direction of impact that VSSs had on specific thematic areas. A plus symbol (+) was assigned when studies explicitly reported measured and clearly positive effects of certification on the given area. A minus symbol (-) was used when certification was found to have a negative effect, particularly in comparison with conventional farming systems. A plus with an asterisk (+*) is used to indicate positive

effects that are limited or conditional—for example, when impacts are observed only for specific groups or contexts, are small in magnitude, or are accompanied by substantial constraints or trade-offs; further details on these limitations are provided in the "Limits/trade-offs" column. The label "None" is applied when a study reports no effect of VSSs on the thematic area, meaning that expected improvements did not materialise. In cases where the study did not directly address the thematic area but discussed related issues (e.g., access to education rather than child labour), the study was not included in the summary table for that theme but was discussed in the main narrative of the review.

2.2 Literature classification

The selected studies on Voluntary Sustainability Standards (VSSs) can be broadly categorized into two main research streams: those assessing the impact of VSSs on specific sustainability aspects and those exploring the broader dynamics governing their adoption and implementation. Following this classification allowed for a structured synthesis of existing literature, highlighting both empirical findings on certification outcomes and the systemic factors influencing VSSs' effectiveness.

2.2.1 Impact assessment of VSSs

A significant portion of the literature focuses on analysing the impact of certification schemes on specific sustainability dimensions. These studies primarily rely on primary data collected through surveys and analysed through econometric models to evaluate the effects of VSSs on various economic, environmental, and social indicators.

To systematically categorize these findings, impact studies were grouped according to the three pillars of sustainability, covering multiple thematic areas per each dimension:

- *Economic Sustainability:* Effects of VSSs on farmer income, productivity (yield), and climate resilience.
- *Environmental Sustainability:* Influence of certification on the implementation of sustainable agricultural practices, deforestation and biodiversity conservation.

Social Sustainability: ***VSSs' role in addressing child labour, gender inequality, food insecurity, and poor working conditions.2.2.2 Dynamics and governance of VSSs***

This category of studies delves into how power structures, institutional arrangements, and intermediary organizations influence the functioning and fairness of Voluntary Sustainability Standards (VSSs). Rather than focusing solely on outcomes, these works investigate the systemic governance dynamics that shape the lived experiences of farmers within certified value chains. Within this broader focus, four key sub-themes related to VSSs governance emerge:

- *Power Asymmetries and Value Distribution*:

This stream explores how entrenched power imbalances across the cocoa value chain limit the bargaining power of smallholders, even within certified systems.

Research highlights issues such as unfair pricing, opaque contract terms, pre-financing exploitation, and the unequal distribution of compliance costs. It also critiques how standard setting is dominated by actors in the Global North, leaving producers in the Global South to bear the burdens of implementation.

- *Barriers to Participation and Compliance*:

Studies in this sub-theme examine the structural obstacles that prevent marginalized farmers from entering or fully benefiting from certification programs. High compliance costs, limited education, weak institutional support, and digital exclusion disproportionately affect smallholders, leading to partial compliance and reinforcing inequities the certification systems aim to correct.

- *Cooperatives as Double-Edged Institutions*:

This body of literature assesses the ambivalent role of cooperatives in mediating certification access. While cooperatives can facilitate training, resource access, and price premium distribution, they often suffer from internal power imbalances, lack of transparency, and gender disparities. These flaws can undermine their potential to deliver equitable benefits to all members and may even reinforce exclusionary practices within certified value chains.

- *Real behavioural changes*

This sub-theme considers whether certification alters farmers' risk attitudes and willingness to invest. Certification can create incentives to adopt improved practices and to devote more time and effort to compliance, but persistent constraints often limit deeper behavioural change.

By classifying the literature into these two main research streams, this review provides a clearer understanding of both the direct effects of certification on sustainability outcomes and the broader systemic factors shaping their adoption and governance.

It is important to note that, given the heterogeneity of study designs, indicators and reporting formats, we adopted a qualitative, narrative synthesis rather than a quantitative meta-analysis. Findings are therefore compared and interpreted thematically, without pooling effect sizes across studies.

3 Results

Figure 2 illustrates the number of publications per year on Voluntary Sustainability Standards (VSSs) applied to cocoa production from 2012, year of the first retrieved publication on the topic, to 2025. The trend shows a gradual increase in research interest, with fluctuations over the years. Early years (2012–2019) had a relatively low number of publications, ranging from 1 to 3 annually. A significant rise is observed from 2020 onwards, peaking at 8 publications in both 2021 and 2024. The overall trend, represented by the dotted line, indicates a growing focus on the topic, though the 2025 data may increase with further publication in the upcoming months.

Focusing on papers assessing the impact of VSSs, which includes 31 studies, Fig. 3 highlights the diverse distribution of research within the sustainability dimensions of cocoa production. As shown in the Venn diagram, environmental sustainability (green) is the most frequently studied, with eight publications exclusively dedicated to this

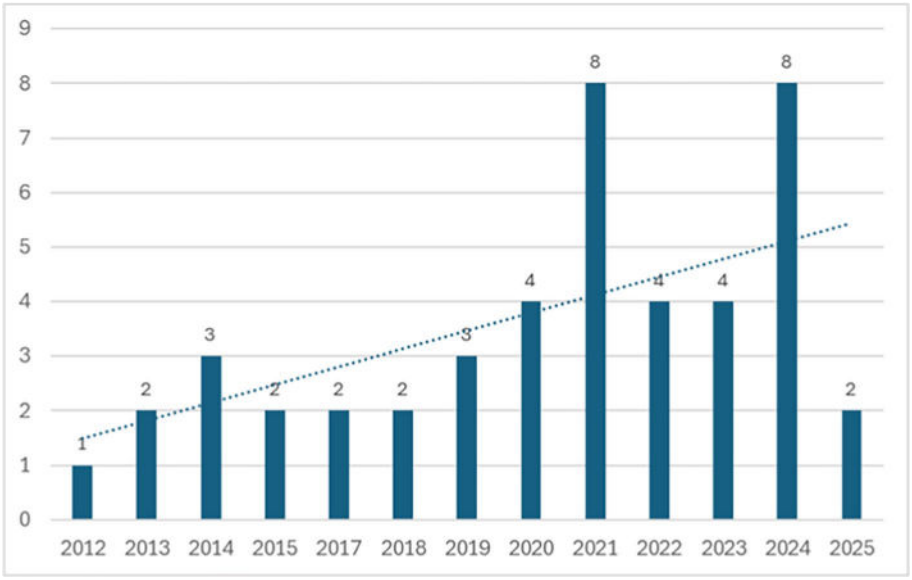

Fig. 2 Number of publications per year.
Source: own elaboration

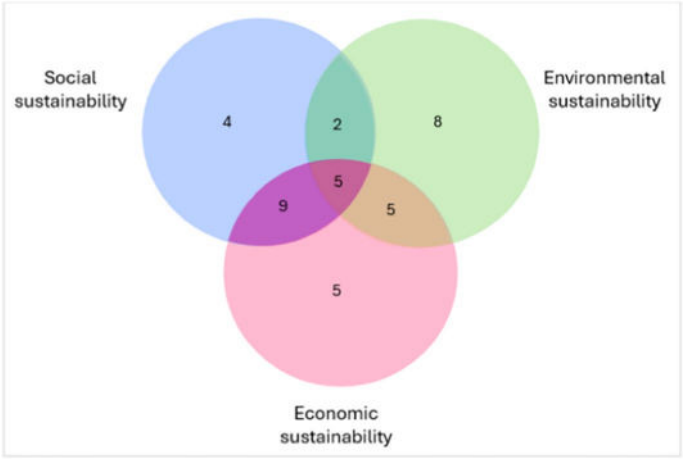

Fig. 3 Number of papers per sustainability dimension.
Source: own elaboration

dimension. Social sustainability (blue) appears in four standalone studies, while economic sustainability (red) is examined in five. However, many studies explore overlapping dimensions, with nine addressing both social and economic sustainability and five each examining economic-environmental and social-environmental intersections. Notably, five studies incorporate all three dimensions simultaneously, underscoring the growing recognition of sustainability's interconnected nature in cocoa production.

Delving deeper into the topics within the three pillars of sustainability, the reviewed literature indicates that the impact of Voluntary Sustainability Standards (VSSs) on sustainable agricultural practices (12 studies) and income generation (12 studies) are the most frequently examined thematic areas (Fig. 4). This reflects a strong research focus on how certification schemes influence farming techniques and economic well-being.

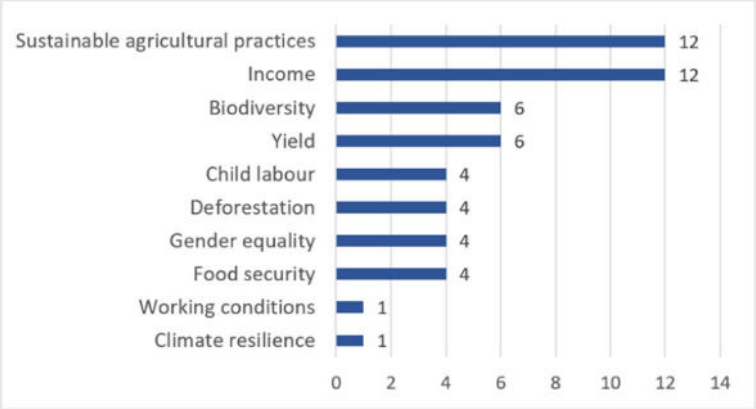

Fig. 4 Number of studies per thematic area.
Source: own elaboration

Other frequently studied topics include biodiversity (6) and yield (6). In contrast, climate resilience (1) and working conditions (1) have received comparatively little attention.

These findings suggest that while economic and agronomic aspects are well explored, social and climate-related dimensions of VSSs remain under-researched, highlighting important areas for future investigation.

Furthermore, the analysis of the chosen papers indicates that Rainforest Alliance/UTZ is the most frequently referenced certification scheme, appearing in 17 of the reviewed papers. This suggests a strong research focus on this certification, possibly due to its wide adoption in the cocoa sector.

Fairtrade follows with 11 mentions, highlighting significant interest in its economic and social sustainability aspects. Organic certification appears in 6 studies, making it the least frequently discussed among the three, likely due to its niche positioning in the cocoa industry. These findings reflect research priorities and may indicate the relative importance of different VSSs in academic discussions on sustainable cocoa production.

Furthermore, most of the studies focus on West Africa: 32 out of 45 articles (72.7%) include at least one West African country in their sample—most frequently Ghana (17 studies, 38.6%) and Ivory Coast (11 studies, 25.0%), followed by Cameroon (5), commonly included in West Africa–focused cocoa literature despite its location in central Africa, and Nigeria (2). Several of these are multi-country designs that analyse two or more West African countries together, and some combine West African cases with non-West-African ones. By contrast, only six studies (13.6%) include non-West-African producers such as Bolivia, Indonesia, Nicaragua, Peru, Rwanda or Ecuador, one adopts a broad global scope ("67 tropical countries"), and in seven cases the geographical context is not specified.

It is important to note that this pronounced geographical skew in the available evidence substantially limits the scope for regional comparison within the present review. In particular, because most empirical analyses concern West African bulk-cocoa systems, the review will not draw systematic contrasts with Latin American contexts, where fine-flavour cocoa predominates. Consequently, the conclusions of this review primarily reflect the dynamics of West African cocoa production, and caution is needed when generalising these findings to other producing regions.

The following subsections will provide an in-depth examination of the identified thematic areas, highlighting key findings and research gaps in the literature.

Note that some studies were excluded after full-text review because, while initially relevant, they did not contribute substantially to the analytical themes or conceptual discourse developed in this review. Furthermore, despite paragraph 2.2 establishing two broad categories in which the paper can be classified, namely 'Impact Assessment of VSSs' and 'Dynamics and Governance of VSSs', in some of the following sections, elements from both categories were integrated to more effectively address the thematic areas, thus providing a more comprehensive analysis.

3.1 Impact assessment of VSSs

This section synthesises the empirical evidence on the impact of Voluntary Sustainability Standards in the cocoa sector on selected indicators across the three pillars of sustainability. It first examines the economic dimension (Paragraph 3.1.1) then the environmental dimension (Paragraph 3.1.2), and finally the social dimension (Paragraph 3.1.3), highlighting both reported benefits and the main limits and challenges of VSSs across these areas.

3.1.1 Economic dimension

This section examines the economic effects of VSSs, focusing on three main aspects discussed in the literature—income, yield, and climate resilience—and highlights the key limits and challenges identified across studies.

3.1.1.1 Income The literature consistently demonstrates that Voluntary Sustainability Standards can improve cocoa farmers' incomes, though the scale and distribution of benefits vary significantly across contexts.

A robust finding across multiple studies is that income gains derive mainly from yield improvements rather than premium payments [54, 55]. Dompreh et al. [56] reinforce this view with their case study in Ghana, revealing that yield gains account for about 92.1% of the income increase among certified cocoa farmers, while only 7.9% can be attributed to premium payments.

The sole exception emerges in Iddrisu et al.'s study [57], which associates UTZ-Rainforest Alliance certification with premium-driven income growth.

It is therefore evident that the positive impact of VSSs on income is, in most cases, primarily driven by higher yields rather than by the intrinsic economic-support mechanisms embedded within the certification schemes. Where does the problem lie? The limited impact of price premiums reflects deeper structural constraints, particularly from the power imbalance between farmers and buyers. Since price premiums are negotiated between traders and farmers who hold limited bargaining power, smallholders often receive little benefit, making the premiums insufficient to significantly improve livelihoods [58]. Even when premiums are defined ex-ante (like Fairtrade's minimum price), they average just 1.3% of farmgate prices in Ghana [54]—too small to offset certification's costs without complementary yield gains.

Moreover, Ansah et al. [59] highlight that in Ghana, Cooperatives and Licensed Buying Companies (LBCs) play a crucial role in distributing price premiums from certified cocoa. However, despite certification principles promoting transparency and farmer

participation, these organizations maintain significant control over premium allocation. Farmers have minimal influence over how funds are distributed, as key decisions are made unilaterally and with little transparency. This imbalance prevents certification schemes from delivering their intended benefits, limiting the financial gains that should rightfully reach smallholder farmers.

Specifically for Organic certification, Mahrizal et al. [60] state that buyers would need to pay at least a 28%–30% premium for organic cocoa to cover for the significant yield losses associated to the certification (around 30%) and lead Organic certified cocoa to be as profitable as conventional production, yet they continue to offer inadequate compensation.

A further nuance on the effect of VSSs on income, is offered by research that emphasizes the uneven distribution of benefits within farming communities. Lescuyer et al. [61], focusing on cocoa farming in Cameroon, observed this phenomenon in their study: while certification schemes generate notable financial benefits for medium- to large-scale cocoa farmers, smallholders often struggle to meet the technical and financial demands required for certification, leaving them at a disadvantage.

Furthermore, Meemken et al. [62], analysing Fairtrade certification in Côte d'Ivoire, demonstrate that while certified cooperative workers experience significant improvements in wages and job security, these benefits do not necessarily extend to all farm-level labourers, particularly those involved in sharecropping arrangements.

Following the same line of research on the unequal distribution of benefits from VSSs, Alho et al. [58] argue that certification can reinforce inequalities. They point out that farmers participating in cooperatives benefit from better access to markets, inputs, and external aid, placing them higher on the living income ladder, whereas non-organized farmers are frequently left out of certification schemes and development programs. Similarly, Jacobi et al. [63] emphasize the key role of cooperatives in supporting farmer training, enhancing market access, and securing higher cocoa prices via Organic certification, reinforcing the concept.

Furthermore, Ingram et al. [64] observe a convergence between certified and non-certified farmers' incomes over time, suggesting that the comparative advantage of certifications may diminish as best practices diffuse through sector-wide reforms and public extension services. This "certification fatigue" phenomenon implies that the value-added of sustainability schemes may be highest in contexts with weak institutional support, becoming less pronounced where robust public programs exist.

When synthetised, findings present certification as highly context-dependent rather than universally effective. While VSSs demonstrably enhance incomes through yield gains and market access [54, 56], their efficacy remains contingent on: (1) farm-scale economic viability [58], (2) value chain governance quality [59], and (3) public support system strength [64]. Furthermore, the ability of VSSs to substantially increase the cocoa price itself is structurally limited. International cocoa prices continue to be set primarily on global markets and through national pricing policies, and certification premiums are generally modest, uncertain and only partially transmitted to farmers [34, 58, 60]. As a result, the effectiveness of VSSs in improving farmers' position in relation to international cocoa prices remains constrained, and certification alone cannot compensate for the entrenched value-chain asymmetries that limit price transmission to farmers.

3.1.1.2 Yield VSSs have shown measurable but limited impacts on cocoa yields across different production regions. Some studies document modest yield increases among certified farmers, typically ranging from 10–14% compared to conventional producers. In Ghana, certified farms achieved 409.57 kg/ha versus 371.56 kg/ha for non-certified operations [57], while research in Côte d'Ivoire found a 70 kg/ha (14%) yield advantage [65].

The mechanisms behind yield improvements include enhanced access to fertilizers and pesticides [56], more frequent training in good agricultural practices [54], and improved extension services [59].

While the aforementioned studies report consistent positive effects, others show minimal differences. In Indonesia, for instance, certified and conventional cocoa farms maintained similar yield levels averaging 448 kg/ha, despite certified farmers adopting improved agricultural techniques [66].

In some cases, certification requirements may inadvertently limit yield potential, particularly when shade tree provisions compete with cocoa plants for resources [67] or in the case of Organic standard, restricting the use of synthetic fertilizers and pesticides [52].

It is therefore clear that the effectiveness of VSSs on yield varies depending on how well they are implemented and tailored to local conditions [54, 66].

Another key finding across studies is that while certification can contribute to modest yield improvements, the absolute productivity gains remain relatively small. Certified farmers' still yields consistently fall below the 1,000 kg/ha benchmark considered optimal by agricultural experts [57, 67].

This persistent gap indicates that certification alone cannot overcome fundamental productivity constraints in cocoa farming, such as aging tree stocks, pest pressures, and soil fertility challenges [66, 67].

The research suggests that, while VSS can contribute to yield improvement, their current impact remains constrained by various systemic factors that require complementary interventions to fully address the issue.

3.1.1.3 Climate resilience As shown in Fig. 3, the effect of VSSs on climate resilience in cocoa farming is addressed by only one paper, namely by Thompson et al. [68].

The study highlights how certifications, especially Rainforest Alliance/UTZ primarily focus on farm-level robustness through productivity and training, while offering limited support for broader adaptability and recovery from climate shocks. Specifically, while certifications enhance resilience components by improving productivity and fostering group-based adaptability, they lack integration with supply chain strategies like insurance or risk transfer.

3.1.2 Environmental dimension

This section examines the environmental effects of VSSs, focusing on sustainable agricultural practices—specifically agrochemical use and agroforestry—as well as deforestation and biodiversity, and discusses the main limits and challenges highlighted in the literature.

3.1.2.1 Sustainable agricultural practices (SAP) As shown in Fig. 3, the impact of VSSs on SAP is one of the most frequently analysed topics in the literature, with 12 papers addressing it.

The selected papers highlight a discernible impact of Voluntary Sustainability Standards (VSSs) on the adoption of Sustainable Agricultural Practices (SAP) in cocoa farming, though their influence varies depending on the certification scheme, region, and individual farmer conditions. Across these studies, SAP are consistently examined through two main dimensions: (i) Agrochemical use and (ii) Agroforestry implementation.

1. *Agrochemicals*

Certifications regulate the use of synthetic pesticides and fertilizers in different ways, with Organic certification enforcing the strictest ban on their use, promoting non-chemical alternatives like crop rotation and organic fertilizers. Thompson et al. [68] provided detailed data showing that organic-certified farmers reduced mineral fertilizer use by 14.9% and inorganic liquid fertilizer by 20.5%, while increasing organic fertilizer use by 33.3%.

Furthermore, Agbotui et al. [69] observe that organic cocoa agroforests exhibit better soil quality, with higher microbial biomass, nitrogen mineralization, and soil organic carbon (SOC) levels compared to conventional farms, which suffer from microbial stress and reduced nutrient cycling due to the overuse of pesticide.

Despite the overall positive effect of Organic farming from an environmental point of view, concerns about its economic viability are raised by Mahrizal et al. [60]. Their paper highlights that, while organic certification effectively promotes farming systems that minimize reliance on harmful chemicals and support healthy ecosystems, it also presents significant economic trade-offs. These trade-offs, specifically the 30% yield loss associated with Organic farming, are not currently offset by the price premiums associated with the certification.

Other papers such as Dompreh et al. 's [56], focus on other certification schemes than Organic, observing that certified cocoa farmers use more agrochemicals, largely due to improved access to recommended pesticides and fertilizers that meet certification standards. These inputs are part of a regulated approach aimed at boosting yields and managing production sustainably, suggesting that certification may enhance farmers' ability to invest in inputs that support both productivity and environmental goals.

On the other hand, Ankuyi et al. [70] demonstrates that while certification schemes, particularly Rainforest Alliance, show a promising commitment to sustainability with a compliance rate of 50% or higher for 10 out of 14 recommended practices, barriers persist. Specifically, limited access to affordable, high-quality pesticides remains a challenge, leading to low adherence to pesticide application guidelines.

Lemeilleur et al. [71] observed broader compliance issues in Rainforest Alliance-certified farms: farmers often struggle with phyto-sanitary management, including the failure to mark buffer zones—designated areas where agrochemicals should not be applied to prevent soil and water contamination. Cooperative technicians, tasked with chemical applications, frequently lack farm-specific knowledge, leading to ineffective or hazardous pesticide use. This non-compliance is largely due to a lack of awareness about chemical risks or limited access to materials such as paint for marking boundaries.

These results imply that, despite certification's potential to promote sustainable pest-management practices, access to resources, inputs and knowledge—particularly in certain contexts—critical factors in achieving full compliance persist.

2. Agroforestry

Several studies examine the role of VSSs in promoting agroforestry and shade-tree integration, generally reporting a positive impact with some limitations. In Bolivia, for example, Organic certification led to a notable increase in shade tree diversity, with certified farmers more inclined to adopt agroforestry. However, its adoption remained limited, as 40 out of 52 farmers cited a lack of knowledge as a major barrier, emphasizing the need for better training and technical support [63].

Similarly, in Ghana, Gockowski et al. [67] found that Rainforest Alliance (RA) certification played a positive role in encouraging shade systems that incorporated indigenous timber species. Ingram et al. [64] and Krumbiegel et al. [72] further reinforced this trend, showing that UTZ-certified farmers were significantly more likely to plant shade trees than their non-certified counterparts. In the first study, 19% of certified farmers planted shade trees compared to just 0.5% of non-certified farmers, while in the second study, certified farmers planted at least 15 shade trees per hectare.

Despite the positive trend, Gockowski et al. [67] also highlighted a widely debated issue, observing a 22% yield reduction in shaded systems compared to unshaded high-tech alternatives due to resource competition between cocoa trees and shade trees.

Overall, while VSSs contribute to the adoption of agroforestry and shade-tree integration, their success depends on balancing ecological benefits with economic viability, as well as addressing knowledge gaps among farmers.

3.1.2.2 Deforestation The literature reveals systemic limitations on the role of VSSs in limiting deforestation.

A dominant finding across studies is that most certifications fail to significantly reduce primary forest loss at scale. Dröge et al. [73] found no large-scale deforestation reduction linked to UTZ, RSPO, or Organic certification, with only Fairtrade showing weak positive effects.

The study highlights different limitations of VSSs in limiting deforestation, among which the "leakage effect", also pointed out by van der Ven et al. [74], where sustainable practices in certified areas simply displace agricultural expansion and forest clearance to non-certified, less-regulated and less-costly crops or regions, allowing them to circumvent land use criteria, resulting in no net reduction in overall deforestation.

Critical loopholes in certification design exacerbate these limitations. Dröge et al. [73] and Cosimo et al. [75] highlight that VSSs often allow deforestation that occurred before arbitrary cut-off dates (e.g., Rainforest Alliance permits certification if deforestation happened before 2015). This system allows recently deforested land to be certified as 'sustainable,' even though the timing of deforestation is based on self-reported data from farmers.

Cosimo et al. [75] further note that exceptions for small-scale conversions (e.g., Rainforest Alliance's 1% farm-size loophole) create compliance gaps with stricter regulations like the EUDR.

Enforcement weaknesses compound these issues, as audits often fail to detect violations—particularly under group certification models where only subsets of farms are inspected [73, 74].

Given the significant impact of cocoa production on deforestation, the debate round its sustainability has become increasingly urgent. The EU Regulation on Deforestation (EUDR) sets high standards for deforestation-free commodities, raising a key question: Do VSSs ensure cocoa meets the regulation's definition of deforestation-free? Cosimo et al. [75] highlight critical issues, such as gaps in traceability (e.g., missing geolocation data), which prevent VSSs from fully aligning with EUDR requirements.

For instance, while certification schemes like RA impose strict traceability protocols—including unique farm codes, recorded production data, and segregated supply chains—empirical evidence reveals logistical shortcomings. Lemeilleur et al. [71] observed that Certified and non-certified cocoa often share warehouse storage due to limited infrastructure, undermining physical separation despite RA's anti-mixing criteria. This inconsistency mirrors broader challenges in VSSs' ability to verify deforestation-free claims, as traceability gaps (e.g., unreliable farm boundaries or unrecorded geolocation) persist.

However, despite these limitations, VSSs can still play a role in EUDR implementation, as their presence in high-risk areas and reliance on independent third-party assessments provide valuable data to help ensure compliance with the regulation.

3.1.2.3 Biodiversity While certifications theoretically promote biodiversity through the implementation of sustainable farming practices, empirical evidence reveals limited or inconsistent effects. For example, Wätzold et al. [54] observed, through quantitative bioacoustics monitoring (a proxy for animal diversity) significantly lower acoustic diversity indices on certified cocoa farms when compared to non-certified ones. This reduction likely results from the more intensive agricultural management practices employed on certified farms, including frequent weeding and stricter pest control that reduce habitat heterogeneity for insects and birds.

Furthermore, Lemeilleur et al. [71] found significant gaps between Rainforest Alliance certification requirements and their implementation on cocoa farms in Ivory Coast. The mandate to plant 18–25 shade trees per hectare, including 12 native species, was largely unmet, with most farmers having only two trees per hectare, showing that certification criteria often fail to lead to meaningful biodiversity improvements.

This is consistent with Milder et al. [76], who argue that sustainability standards often fail to effectively translate conservation goals into on-the-ground results due to weak enforcement and lack of rigorous monitoring. In line with this, Wätzold et al. [54] note that biodiversity-related practices in VSSs are often framed as recommendations rather than strict conditions, and compliance checks rarely affect farmers' certification status or access to premiums. Lemeilleur et al. [71] also reports that audits and support services tend to prioritise productivity-oriented requirements over environmental ones, leaving biodiversity clauses weakly enforced. Together with evidence that routine audit systems rarely include rigorous ecological indicators or long-term biodiversity monitoring [76, 77], these factors help explain why certification often fails to produce measurable biodiversity gains.

Additionally, as Tscharntke et al. [77] point out, other factors beyond certification, such as landscape structure and connectivity, significantly influence biodiversity

outcomes. Larger, more connected habitats are crucial for biodiversity, and these broader landscape-level factors often outweigh the benefits of certification.

When certified farms show modest biodiversity gains, these positive consequences rarely translate to broader ecosystem benefits. For example, Dröge et al. [73] found that certified cocoa farms in Indonesia hosted slightly more bird species within a 25-m range, but this effect diminished at larger spatial scales.

This suggests that while certification may provide small-scale biodiversity benefits, it does not fundamentally alter broader ecosystem dynamics. Instead, external factors like proximity to forests or regional conservation policies play a far more significant role in shaping biodiversity outcomes. Thus, while VSSs provide a framework for biodiversity-friendly farming, their current implementation lacks the enforcement power needed to drive meaningful conservation, often serving as a complementary measure rather than a transformative solution.

3.1.3 Social dimension

This section examines the social effects of VSSs, focusing on the main aspects addressed in the literature—child labour, gender equality, food security and working conditions—and highlights the key limits and challenges of VSSs identified across these thematic areas.

3.1.3.1 Child labour Research demonstrates that child labour remains prevalent despite certification prohibitions, with systemic measurement and enforcement challenges undermining the effectiveness of VSSs interventions.

Ingram et al. [64] provide compelling evidence of continued child labour in certified farms, finding that in their case-study in Côte d'Ivoire, 14% of uncertified and 16% of UTZ-certified farmers still reported children engaging in prohibited activities. Field visits by Lemeilleur et al. [71] similarly confirmed that child labour had not been fully eradicated in Rainforest Alliance certified farms, despite farmers perceiving broader social improvements from certification.

A critical challenge identified by Jouvin [78] is the systemic underreporting of child labour due to social desirability bias. Indirect questioning methods revealed that 24% of farmers employed child labour for harvesting and pod-breaking, while 21.7% did so for farm preparation. However, direct questioning produced significantly lower figures—12.76% and 18%, respectively—suggesting a strong underreporting of the violations. This result is even more critical when considering the study of Lemeilleur et al. [71] who documented that 40% of certified farmers reported receiving only one visit during the production cycle, with no clear sanctions outlined for non-compliance. Ingram et al. [64] further revealed fundamental awareness gaps, with only 35% of certified farmers knowing the legal minimum working age.

While some positive effects of certification were noted, these benefits remain limited and unevenly distributed. Ingram et al. [64] observed that certified farms in Ghana showed reduced hazardous work (0.15 versus 0.6 days per year) but found no difference in overall child labour prevalence between certified and non-certified farms. Sellare [79] demonstrated that while certification increased education spending by 52% for certified farmers, nearly 40% of education projects were restricted to cooperative members, excluding the most vulnerable farm workers. Lemeilleur et al. [71] noted that while

farmers perceived better education opportunities from certification, these improvements did not translate into the elimination of child labour practices.

Lastly, Jouvin [78] identified how poor road access increases reliance on child labour as farmers struggle to hire adult workers, while the seasonal and labour-intensive nature of cocoa farming creates chronic labour shortages, underlying persistent structural barriers that transcend certification status.

3.1.3.2 Gender equality As shown in Fig. 3, four studies address, among others, the topic of gender equality and the role of VSSs in enhancing it.

As Ruben [80] documents, existing power structures frequently marginalize women despite inclusion policies. Benefits are often concentrated among male household heads, maintaining traditional control over income streams. This phenomenon persists in certified farms because VSSs primarily address production practices rather than the deeper social norms governing household decision-making and resource allocation.

Furthermore, Wollni et al. [81] found that, in Peruvian cocoa farming, women absorb most of the additional work required by certified production methods, significantly increasing their workload without corresponding changes in men's labour contributions. While this sometimes leads to greater influence over crop-related decisions, it often comes at the cost of reduced participation in other income-generating activities, potentially limiting overall economic empowerment.

Furthermore, as observed by Ankuyi et al. [70], gender disparities emerge as a significant barrier to Sustainable Agricultural Practices adoption. Male farmers show higher compliance with certification requirements due to their greater access to training opportunities. In contrast, female farmers face compounded challenges including time constraints from domestic responsibilities and limited mobility, which systematically reduce their participation in certification programs and training [72]. This disparity suggests that certification programs, in their current form, may be designed in ways that privilege male farmers' circumstances while failing to accommodate the specific needs and constraints of female farmers.

3.1.3.3 Food security The impact of certification on farmers' food security remains a complex and debated issue.

Knößlsdorfer et al. [82] demonstrate that Fairtrade certification increases total household expenditures by 8.5%, with particularly strong growth in education (33%) and transportation (28%) spending. However, the study finds no significant effect on food expenditures, attributing this to male control over cash crop income and spending priorities. This gender dimension is crucial, as female-headed households show greater propensity to allocate resources to food needs.

Furthermore, contrasting findings emerge from Iddrisu et al. [57], who report that UTZ-RA certification reduced food security for participating farmers. The authors suggest certification income may be insufficient to cover both compliance costs and household food needs, highlighting the importance of contextual factors in determining outcomes. The same result is shown by Alho et al. [58] who analysed how certification influences farmers' ability to afford nutritious food and found that in Côte d'Ivoire, cocoa smallholders still faced a high risk of food insecurity due to low incomes, despite certification efforts.

Finally, Dompreh et al. [83] offer a more detailed analysis of multiple food security indicators. While certified farmers show slightly better dietary diversity scores (55.4 vs 53.6 for uncertified cocoa farmers), these differences are not statistically significant. More notably, certified farmers report significantly lower levels of perceived hunger on the Household Food Insecurity Access Scale (HFIAS), with scores of 2.76 compared to 4.39 for uncertified counterparts. Certified households also employ fewer coping strategies, such as reducing meal portions during food shortages, suggesting some resilience benefits of VSSs. Nonetheless, a large share of certified households still falls in the "vulnerable" category, indicating that certification may alleviate the severity of food insecurity without eliminating it.

Overall, the available evidence suggests that the effects of certification on food security and nutrition are limited, heterogeneous and often non-significant. In several cases, higher cocoa incomes are absorbed by non-food expenditures or compliance costs, while structural factors—such as who controls the income within the household and the seasonality of cash-crop returns—constrain improvements in dietary quality and stability. Moreover, most standards do not explicitly include food security or nutrition in their theory of change [83]. As a result, certification alone does not reliably translate into better food security outcomes and may even be associated with trade-offs when increased specialisation in export crops exacerbates households' vulnerability to price and production shocks [57].

Adding to this, the evidence base itself is surprisingly thin: only four studies were found that directly examine food security outcomes of cocoa certification, which underlines the need for further research on this critical dimension.

3.1.3.4 Working conditions The existing literature reveals limited research on how Voluntary Sustainability Standards (VSS) affect working conditions in agricultural production, with only one study—Ingram et al. [64]—specifically examining the topic by analysing UTZ certification's role in promoting Personal Protective Equipment (PPE) use among West African cocoa farmers.

The findings show divergent outcomes across different national contexts: in Ghana, certified and non-certified farmers demonstrated minimal differences in actual PPE usage, though focus groups revealed that certified farmers perceived health benefits from improved training on chemical handling and safety measures. By contrast, in Côte d'Ivoire, UTZ-certified farmers showed marginally better PPE adoption, along with reported improvements in working conditions such as organized spraying teams and first aid access. However, these positive trends did not achieve statistical significance, suggesting that certification alone may be insufficient to substantially transform occupational safety practices.

3.2 Dynamics and governance of VSSs

This section examines the dynamics and governance of VSSs in the cocoa sector, focusing on how power imbalances and value distribution shape farmers' bargaining position, the barriers to participation and compliance created by certification systems, the ambivalent role of cooperatives as intermediaries, and the extent to which certification leads to real behavioural change among producers.

3.2.1 Bargaining power and value distribution

The cocoa sector is characterised by strong power imbalances that perpetuate inequities across the value chain, as evidenced by multiple studies. At the production level, research by Alho et al. [58] demonstrates how certification schemes fail to address the weak bargaining position of smallholder farmers, who remain price-takers rather than price-makers in negotiations with traders. This dynamic persists even among certified producers, undermining the potential benefits of sustainability programs. Mahrizal et al. [60] calculate that organic cocoa farmers in Ghana would require 28–30% price premiums to offset yield losses but currently receive only 6–9%, reflecting the disproportionate bargaining power of buyers.

Beyond pricing and premiums, power imbalances are also evident in contractual terms, payment schedules, and access to credit. Buyers often impose stringent contract conditions that smallholders cannot negotiate, leading to further dependency and financial insecurity [84]. Many farmers are structurally dependent on intermediaries who control logistics, financing, and market access, weakening their ability to collectively bargain for better prices and forcing them into exploitative arrangements.

Gboko et al. [85] highlight that many farmers lack sufficient capital to invest in essential inputs—such as seeds, fertilizers, and labour—at the start of the planting season. To bridge this gap, exporters or traders often provide pre-financing, later recovering these costs by deducting them from farmers' premiums. However, farmers frequently face a lack of transparency regarding both the deduction amounts and whether these deductions are fair.

Governance structures reinforce these inequities. Krauss et al. [84] reveal how Northern lead firms and civil society organizations dominate standard-setting processes, while Southern producers bear the compliance burden during implementation. This imbalance means that while some actors carry the heavy weight of meeting certification standards, others can "free-ride"—gaining reputational and market benefits of certification without contributing proportionately to the costs or efforts required. Consequently, the system's overall effectiveness is undermined, as the costs of compliance are unequally distributed [86].

3.2.2 Barriers to participation and compliance in certification

The certification system itself creates barriers to equitable participation. Leimona et al. [86] identify how high compliance costs exclude resource-poor smallholders, particularly those outside formal cooperatives.

Compliance in practice is highly uneven: studies show that non-compliance is concentrated among farmers in less developed regions and smaller farms [87]. This disparity stems from these producers often lacking the technical capacity, financial resources, or institutional support needed to meet complex certification requirements—leading to partial or superficial adherence.

Moreover, farmers shoulder hidden costs of certification, including compliance audits, additional labour, and infrastructure investments, which further erode the financial benefits they receive [86].

Similarly, Aidoo et al. [88] observed that farmers who are not part of farmer-based organizations (FBOs) or have lower levels of education are less likely to adopt

certification, indicating that less-informed or, again, isolated farmers, face significant disadvantages in accessing certification programs.

Taken together, these results suggest that marginalized farmers not only show lower propensity towards certification but also struggle more with complying with VSSs.

Additionally, digital and financial exclusion exacerbates these barriers. Farmers without access to digital tools or financial literacy struggle with certification procedures that require documentation, data reporting, and digital transactions [86].

This paradox undermines the credibility of certification as a tool for genuine transformation and reinforces the very inequities it seeks to address, by limiting certification benefits to those with better organizational ties and educational backgrounds.

Lastly, several studies note that farmers happen to produce more certified products than they can sell at a premium price, ultimately being forced to offload excess output as conventional goods. This undercuts the financial incentive for certification and creates disillusionment after the considerable investments of time, labour, and compliance costs involved [84, 89].

Krauss et al. [84] and Siaw et al. [89] also highlight this dilemma, noting that farmers often sell certified cocoa on conventional markets at lower prices due to limited demand.

This disconnect weakens the financial rationale for producers to pursue and maintain certification, particularly when the additional costs of compliance are not met with proportional returns.

3.2.3 Cooperatives: bridges to opportunity or barriers to fairness?

Another important role is played by cooperatives, which, as already anticipated in Paragraph 3.1.1 play an important but complex role in agricultural certification. Certification schemes often channel premiums, training and technical assistance through cooperatives, thereby strengthening them as key intermediaries that can improve farmers' access to markets, agronomic advice and, in some cases, credit and financial services [90, 91]. By concentrating services, information and representation in the hands of cooperatives, certification can also strengthen collective action and farmers' participation [62, 72, 81]. Despite this, because certification is frequently implemented through cooperatives and farmer-based organisations, farmers who are not organised in such structures—often the more marginal and less informed—face additional barriers to entry and may become further isolated from the potential benefits of certification [59, 86, 88].

Furthermore, if, on the one hand, cooperatives help small farmers by providing access to markets, training, and resources [62, 65], on the other hand they often centralize decision-making and financial flows, often leading to lack of transparency and unfairness and reducing the benefits they are meant to provide.

A study by Gboko et al. [85] in Côte d'Ivoire found that farmers only receive a small portion of the price premium exporters pay to cooperatives due to unclear deductions for "administrative costs." Similarly, a 2022 study by Sellare [79] found that 45% of Fairtrade premiums were spent on cooperative investments, while education and health projects—farmers' stated priorities—received less than 5%.

Internal power dynamics within cooperatives can also exacerbate inequalities. Leadership positions are often dominated by a few influential actors who control decision-making and resource allocation, sometimes prioritizing their interests over those of ordinary members [80]. Gender disparities further reinforce inequities, as women

farmers frequently face exclusion from leadership roles or have limited access to training programs [62].

Furthermore, Ruben [80] highlights that while cooperatives are meant to support farmers, they are not always fair or efficient. Farmers who engage in side-selling to access immediate cash—often out of necessity due to delayed payments from cooperatives—are penalized. Certification rules discourage this practice, sometimes leading to sanctions or exclusion, even when farmers have no other financial options.

Overall, while cooperatives are designed to empower farmers, their structural inefficiencies and lack of transparency can sometimes undermine their intended benefits, highlighting the need for greater accountability and farmer-centred reforms [78, 80, 83].

3.2.3.1 Real behavioural changes Only a few studies provide insights into whether certification leads to real behavioural changes, such as different attitudes to risk or greater willingness to invest. When farmers do enter certification schemes, there are signs of willingness to invest more time and effort: Ansah et al. [59] find that farmers who join and comply with certification are prepared to engage in additional record-keeping, training and meetings. However, many struggle to fulfil these extra requirements because of the workload and organisational effort involved, which limits how far behavioural change can go in practice.

Regarding risk, Dompreh et al. [48] and Ruben [80] indicate that farmers often perceive certification as a way to reduce or stabilise market uncertainty. At the same time, they underline that persistent constraints—such as limited access to credit, labour shortages, ongoing price volatility, and premiums and long-term benefits that are neither guaranteed nor transparent—prevent farmers from fully adjusting their behaviour and keep them cautious in their investment decisions.

Consistent with this, Wollni et al. [81] argue that certification can stimulate the adoption of improved practices by enhancing access to training, organisational support and potentially higher prices. Yet they also show that real changes in farmers' behaviour depend on the degree of trust in how premiums and benefits are distributed within organisations: where governance is weak or distribution is perceived as unfair, the incentives created by certification are less likely to translate into sustained behavioural change.

Overall, these studies suggest that certification can create incentives for change and some willingness to invest, but structural constraints and issues of trust significantly limit farmers' capacity to alter their risk behaviour and investment decisions. Moreover, the available evidence suggests that behavioural changes are rarely measured directly: very few studies explicitly examine whether certification truly shifts farmers' attitudes, highlighting an important gap in the literature.

4 Discussion

This systematic literature review provides a comprehensive assessment of the economic, social and environmental impacts of Voluntary Sustainability Standards (VSSs) in the cocoa sector, as well as the broader governance dynamics that shape their adoption and effectiveness. Drawing on the evidence synthesised in Table 1 and the detailed analysis presented throughout the paper, the review highlights the absence of uniform effects linked to certification. The findings do not suggest a consistent pattern of success or

Table 1 Summary table of VSSs' impact, limits and trade-offs by thematic area

Thematic area	Author(s)	VSS analysed	Impact	Limits/trade-offs
Income	Alho et al. [58]	n.s	+*	Slightly higher incomes and better access to input and market information BUT still insufficient to close living-income gaps
	Ansah et al. [59]	n.s	+*	Perceived improvements in cocoa prices and access to training BUT limited and opaque price premiums, additional compliance costs and little farmer voice in decision-making
	Dompreh et al. [56]	n.s	+	Higher yields and income BUT lower income diversification
	Iddrisu et al. [57]	RA/UTZ	+	Higher yields and income BUT lower food security
	Ingram et al. [64]	RA/UTZ	+*	Higher yields, quality and income for farmers receiving full support BUT potential reinforcement of inequalities. Gains might be offset by higher costs
	Lescuyer et al. [61]	FT, RA/UTZ, Org	+*	Higher incomes for farmers receiving full support BUT potential reinforcement of inequalities
	Mahrizal et al. [60]	Org		Lower synthetic input use BUT around 21% lower yields/returns; current premiums are too low to compensate
	Meemken et al. [62]	FT	+*	Higher income for cooperative workers BUT no gains for farm workers, potentially reinforcement of inequalities
	Sadeu et al. [55]	RA/UTZ	+*	Higher yields and incomes BUT potential reinforcement of inequalities and limited price premiums
	Shillie et al. [92]	n.s	+*	Higher incomes BUT potential reinforcement of inequalities and higher production and compliance costs
	Wätzold et al. [54]	FT, RA/UTZ	+	Higher yields and income BUT neutral or even negative effects on environmental indicators
	Dompreh et al. [56]	RA/UTZ	+	Higher income BUT no improvements in food security
Yield	Dröge et al. [66]	RA/UTZ	+	Improved farming techniques, training and yields BUT no detectable effect on environmental indicators
	Gockowski et al. [67]	RA/UTZ	–	Better on-farm shade and environmental services BUT lower yields than intensified full-sun plantations
	Iddrisu et al. [57]	RA/UTZ	+	Higher yields BUT worse food security indicators
	Mahrizal et al. [60]	Org	–	Lower synthetic input use BUT around 21% lower yields/returns; current premiums are too low to compensate
	Sellare et al. [65]	FT	+*	Higher yields BUT potential reinforcement of inequalities
	Wätzold et al. [54]	RA/UTZ, FT	+	Higher yields and income BUT neutral or even negative effects on environmental indicators
Climate resilience	Thompson et al. [68]	RA/UTZ, Org	+*	Improved adoption of climate-resilient and more environmentally sound practices BUT only partial and uncertain gains in yields and incomes

Table 1 (continued)

Thematic area	Author(s)	VSS analysed	Impact	Limits/trade-offs
Agrochemicals	Agbotui et al. [69]	Org	+	Reduced use of agrochemicals and better soil quality BUT lower yields
	Ankuyi et al. [70]	RA/UTZ	+	More regulated and technically sound use of agrochemicals BUT possible reinforcement of inequalities
	Dompreh et al. [56]	RA/UTZ	+*	Better targeted and safer use of agrochemicals BUT overall agrochemicals use increases
	Lemeilleur et al. [71]	RA/UTZ	+*	Better targeted and safer use of agrochemicals BUT overall agrochemicals use increases
	Mahrizal et al. [60]	Org	+	Lower synthetic input use BUT around 21% lower yields/returns; current premiums are too low to compensate
	Thompson et al. [68]	RA/UTZ, Org	+	Quantitatively and qualitatively better use of agrochemicals BUT lower yields
Agroforestry	Gockowski et al. [67]	RA/UTZ	+	Better on-farm shade BUT lower yields than intensified full-sun plantations, implying higher deforestation pressure for a given output
	Jacobi et al. [63]	Org	+	Higher tree diversity BUT higher costs and potential reinforcement of inequalities
	Krumbiegel et al. [72]	FT, RA/UTZ, Org	+	Higher adoption of agroforestry-related practices BUT modest magnitude of change
Deforestation	Cosimo et al. [75]	RA/UTZ, FT	+*	EUDR requirements partially covered by VSSs BUT gaps in transparency and enforcement
	Dröge et al. [73]	FT, RA/UTZ, Org	+*	Fairtrade is associated with lower primary forest loss BUT other VSSs show neutral or even negative effect (e.g. RA and Org)
	van der Ven et al. [74]	n.s	None	Limited measurable impact on deforestation
Biodiversity	Dröge et al. [66]	RA/UTZ	None	No empirically significant biodiversity impacts are detected
	Lemeilleur et al. [71]	RA/UTZ	None	Unrealistic biodiversity-related requirements and weak enforcement; productivity and quality criteria are prioritised over environmental ones
	Milder et al. [77]	n.s	None	No empirically significant biodiversity impacts are detected
	Tscharntke et al. [77]	n.s	None	No empirically significant biodiversity impacts are detected**.** Higher costs for farmers and landscape-scale fragmentation limit effectiveness
	Wätzold et al. [54]	RA/UTZ, FT	None	Higher yields and incomes BUT no detectable effect on biodiversity indicators
Child labour	Ingram et al. [64]	RA/UTZ, FT	None	No clear empirical effect on reducing child labour
	Jouvin [78]	RA/UTZ, FT	None	Child labour remains widespread even in certified chains, and self-reported data severely underestimate its prevalence
	Lemeilleur et al. [71]	RA/UTZ, FT	None	Some improvements in education and health services BUT no clear effect on child labour, as social criteria are overshadowed by a productivist focus

Table 1 (continued)

Thematic area	Author(s)	VSS analysed	Impact	Limits/trade-offs
Gender equality	Ankuyi et al. [70]	RA/UTZ, FT	None	Barriers to women's full engagement persist even in certification, due to limited information, access to land and time constraints
	Krumbiegel et al. [72]	FT, RA/UTZ, Org	None	Barriers to women's full engagement persist even in certification, due to limited information and time constraints
	Ruben [80]	n.s	–	Certification might reinforce existing gender inequalities. Impact studies overlook gender-issues
	Wollni et al. [81]	FT, RA/UTZ, Org	+*	Higher agency for women over cocoa-related decisions BUT less control over credit and savings and increased workload
Food security	Alho et al. [52]	RA/UTZ, FT	None	Slightly higher income and better access to services BUT limited effect on food security
	Dompreh et al. [83]	RA/UTZ	+*	Some positive effects on food security indicators BUT limited in magnitude and often not statistically significant
	Iddrisu et al. [57]	RA/UTZ	–	Positive impact on income and yields BUT neutral or even negative impact on food security indicators
	Knößlsdorfer et al. [82]	FT	None	Higher incomes and higher non-food household consumption BUT no measurable effect on food security indicators
Working conditions	Ingram et al. [64]	RA/UTZ	None	Labour issues remain largely unresolved as social criteria are overshadowed by a productivist focus

[1]FT = Fairtrade; RA/UTZ = Rainforest Alliance/UTZ; Org = Organic

[2]This table summarizes each selected study using a symbolic notation (+, –, +*, "None") to indicate the direction of impact that Voluntary Sustainability Standards (VSSs) had on specific thematic areas. A plus (+) indicates explicitly reported and clearly positive effects of certification on the specific thematic area. A minus (–) denotes negative effects, particularly when outcomes on the specific thematic area under certification were worse than those under conventional farming. A plus sign with an asterisk (+*) indicates a positive effect that is limited or conditional (e.g., only for certain groups or contexts, small in magnitude, or accompanied by substantial constraints/trade-offs); further details on the nature of these limitations are provided in the "Limits/trade-offs" column. The label "None" is used when the reviewed paper reported no effect of VSSs on the specific thematic area (i.e., expected improvements did not materialize)

[3]Studies that did not directly address a thematic area but covered related topics (e.g., access to education instead of child labour) were excluded from the table for that theme but are discussed in the main text of the review

[4]Some studies appear more than once in this annex because they provide evidence on multiple thematic areas/indicators (e.g. income, food security, environmental outcomes, gender). In these cases, the same paper is reported in each relevant section to reflect its contribution to several dimensions of sustainability. The sign attributed to a given study (+, – or +/–) may therefore differ across rows, as each occurrence refers specifically to that study's impact on the particular thematic area considered

failure; rather, they reveal heterogeneous, often partial outcomes, with a large share of studies reporting mixed or non-significant effects across indicators.

From an economic perspective, the evidence points to generally positive or mixed impacts on income and yield, indicating that certification can support higher or more stable incomes and modest productivity improvements. However, these gains are unevenly distributed, highly context-dependent and generally insufficient to close persistent living-income gaps.

From the environmental point of view, VSSs tend to perform better on farm-level practices—such as reducing or better targeting agrochemical use and encouraging agroforestry—than on landscape-level outcomes, where studies on deforestation and biodiversity largely report mixed or limited effects due to design loopholes, weak enforcement and non-rigorous monitoring systems. The social dimension emerges as the most fragile: while certification can lead to localised improvements (e.g., higher education spending or better access to health services), persistent child labour, deep-rooted gender inequalities, constrained food security and only marginal improvements in working conditions,

demonstrate that VSSs have not delivered broad-based social upgrading for cocoa producers and workers.

Some broad patterns emerge when comparing the performance of different types of standards. Rainforest Alliance/UTZ most commonly shows modest improvements in yields, incomes and sustainable agricultural practices—supported by access to training and inputs—but presents weak or ambiguous results for deforestation, biodiversity, child labour and food security. Fairtrade tends to produce stronger outcomes on some socio-economic indicators, such as income, education spending and cooperative strengthening, yet exhibits limited progress on food security, child labour and gender equality. Organic certification stands out for clearer environmental benefits (reduced synthetic inputs, improved soil quality, increased shade-tree diversity), although these gains are offset by substantial yield and profitability losses that are rarely compensated by premiums. Overall, mainstream certifications tend to achieve incremental economic and agronomic improvements, while Organic shows more robust ecological contributions but faces important economic constraints.

Furthermore, across all schemes, positive results are frequently accompanied by trade-offs: higher incomes coexist with persistent food insecurity; agroforestry gains are often associated with yield reductions; and improved services do not necessarily translate into better working conditions or elimination of child labour (Table 1).

At a deeper level, the review highlights that VSS performance is heavily constrained by structural features of cocoa value-chain governance. Persistent asymmetries in bargaining power and value distribution limit premium transmission and help explain why certification rarely closes the living-income gap. Participation and compliance are strongly mediated by cooperatives and farmer-based organisations: better-connected farmers capture a disproportionate share of benefits, while more marginal or less educated producers face higher barriers to certification. Cooperatives themselves play an ambivalent role—serving as vital intermediaries providing training, inputs and market access, but also centralising power and financial decisions in ways that lack transparency and can reinforce inequalities, including by gender. On the environmental side, loopholes in standards' codes of conduct (e.g. permissive cut-off dates and exemptions for small-scale conversion) and weak enforcement and monitoring procedures contribute to the limited effectiveness of VSSs in addressing deforestation and biodiversity loss. Collectively, these findings show that VSSs operate within—and are constrained by—broader patterns of power, exclusion and institutional weakness in cocoa value chains.

These results are consistent with findings from other tropical commodities. DeFries et al. [93] show that certification in crops such as coffee, cocoa, tea, bananas and palm oil yields positive outcomes in only a minority of indicators, with many effects being non-significant or negative. Meemken et al. [94] similarly find that certified farmers often receive higher prices but display highly heterogeneous results on yields, production costs and incomes. Oya et al. [95] document limited and mixed social impacts across certified agricultural commodities, mirroring the constraints observed in cocoa. On the environmental side, meta-reviews indicate that certification tends to improve some farm-level management practices but rarely delivers broad ecosystem-level gains [73, 96]. Overall, the broader cross-commodity literature reinforces the view that VSSs generate selective and context-specific improvements rather than systematic, transformative change.

Finally, this review also reveals several important gaps and contradictions in the existing literature, which point to clear priorities for future research. Empirical work is heavily concentrated on income, yield and a few farm-level environmental practices, whereas other dimensions that are central to farmers' well-being—most notably food security, nutrition and gender relations—remain underexplored, with only a small number of studies directly examining how certification affects intra-household resource allocation, food access or women's agency. Climate resilience and working conditions are also addressed only marginally, and very few contributions analyse whether certification leads to deeper behavioural changes in terms of risk attitudes, investment horizons or long-term adoption of sustainable practices. Geographically, the predominance of studies from West Africa limits the possibility of comparing how VSSs operate in different institutional and market contexts, such as fine/flavour cocoa in Latin America or smaller producing regions in Asia. In addition, while this review shows that the type of standard is a key source of impact heterogeneity, there is still limited analysis of how standard design interacts with corporate sourcing strategies and national policy frameworks. Future research would therefore (i) place greater emphasis on social outcomes (gender, food security, labour conditions) (ii) employ comparative designs across regions and types of standards; and (iii) examining more systematically the interaction between VSSs and regulatory instruments, such as living-income initiatives, price-setting mechanisms and due-diligence and deforestation regulations, in order to understand how these instruments can jointly move the cocoa sector towards more substantive social and environmental transformation.

Within this broader context, a small but noteworthy set of emerging private and civic initiatives illustrates alternative pathways that merit attention. Brands such as Tony's Chocolonely and Beyond Good consistently rank among the top performers in the Chocolate Scorecard [97], an independent assessment of sustainability performance among major chocolate companies. Their differentiation lies in specific governance and sourcing practices: Tony's Chocolonely combines full-chain traceability, long-term sourcing relationships and living-income reference pricing [98], while Beyond Good provides consumers with direct traceability through a QR code that links each chocolate bar to the farms supplying its cocoa [99], thereby enhancing transparency along the supply chain. Another significant example is Fairafric, which produces chocolate entirely in Ghana, retaining a substantially larger share of value addition within the country of origin and demonstrating the potential of local processing for more redistributive value-chain upgrading [100].

These initiatives illustrate how transparent pricing, rigorous traceability and local value creation—rather than symbolic labels alone—can offer more equitable and accountable models of cocoa trade. Yet, as van der Ven et al. [74] argue, such initiatives remain niche, and widespread transformation requires sustainability models to shift from niche to mainstream.

Achieving this shift requires broad structural change. Consumers and policymakers must recognise that food choices carry social and environmental consequences, and VSSs should be reframed as tools that empower consumers with transparent and accessible information—rather than instruments primarily serving corporate interests. At the same time, VSSs must be embedded within stronger public regulation and more redistributive value-chain arrangements. Policy interventions should combine robust public

governance, inclusive value-chain collaboration and tailored support for smallholders. Ultimately, enabling sustainable production and consumption to be economically viable and accessible for all actors is essential. Without such efforts, the benefits of sustainability standards are likely to remain fragmented and insufficient to drive systemic transformation in the cocoa sector and beyond.

5 Limits of the study

This systematic literature review has several limitations that should be acknowledged. First, the review was restricted to studies published in English in peer-reviewed journals, which may introduce publication bias by excluding relevant research published in other languages or in grey literature (e.g., industry reports, government documents). This could limit the comprehensiveness of the findings, particularly in terms of region-specific insights from non-English-speaking cocoa-producing countries.

Second, the heterogeneity of methodologies, metrics, and contexts across the included studies prevented a formal meta-analysis. While the narrative synthesis provided a robust qualitative overview, the absence of quantitative aggregation limits the ability to draw statistically generalizable conclusions about the impacts of Voluntary Sustainability Standards (VSSs). Future research could address this gap by conducting meta-analyses on more focused aspects of VSSs impacts, such as income or yield improvements.

Third, the geographic focus of the reviewed studies was heavily skewed toward West Africa (notably Ivory Coast and Ghana), which together dominate global cocoa production. While this reflects the concentration of certification efforts in these regions, it may not capture unique dynamics in smaller producing countries or regions with different agroecological and socio-economic conditions (e.g., Latin America or Southeast Asia).

Fourth, the review primarily examined widely adopted certifications like Rainforest Alliance/UTZ and Fairtrade, with limited coverage of niche schemes (e.g., Organic) or newer initiatives. This may overlook variations in effectiveness across different types of standards.

These limitations underscore the need for caution when generalizing the results. However, they also highlight opportunities for future research to address gaps in geographic, linguistic, and methodological diversity, as well as to conduct longitudinal analyses of VSSs impacts.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s43621-026-02623-0.

Additional file1 (PDF 200 kb)

Additional file2 (PDF 216 kb)

Author contributions

Sara Romano: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft. Federica Demaria: Conceptualization, Methodology, Project administration, Supervision, Validation, Writing – review & editing. Anna Carbone: Conceptualization, Methodology, Supervision, Validation, Writing – review & editing.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

Not applicable.

Declarations

Ethics approval and consent to participate
This article is based on a systematic review of previously published studies. No new human participants or animals were involved. Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 2 September 2025 / Accepted: 7 January 2026
Published online: 30 January 2026

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