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Assessing the Impact of Voluntary Certification Schemes on Future Sustainable Coffee Production

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Abstract: Coffee production faces major sustainability issues and consumers increasingly look to choose certified coffee as awareness grows. While consumers' understanding of sustainability issues is limited, independent voluntary certification schemes such as Fairtrade, Rainforest Alliance, and certified organic—three high-profile schemes—can play a role in future-proofing coffee production through standard-setting. These schemes can also inform consumers about sustainability issues from economic, environmental, and social perspectives, thus driving up demand for sustainably grown coffee, and supporting an enabling environment for farmers and coffee-producing countries to improve the status quo. Sustainably grown coffee ensures that farmers sustain production while protecting the environment and the income that farmers rely on to maintain their livelihood. Based on a thematic analysis and synthesis of previous studies, this paper examines the social, economic, and environmental effects of voluntary certification schemes for coffee production. It evaluates the current state of coffee production and explores how certification schemes can be effective in encouraging more sustainable practices among producers. Three major voluntary certification schemes are evaluated to identify the impacts on producers, including key barriers and enablers to comply with sustainability standards and to determine how fit-for-purpose certification schemes are in assuring future sustainable coffee production.

Keywords: certification; fairtrade; rainforest alliance; organic; arabica; robusta

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1. Introduction

Coffee, produced from the ground beans of *Coffea arabica* (L) and *Coffea robusta* (L), holds significant economic and societal importance as one of the world's most traded commodities and consumed beverages [1]. Global coffee consumption in 2021/2022 increased by 0.6% to 175. 6 million bags (measured at 60 kg per bag) following a decline during the COVID-19 pandemic (2020/2021). Further decline in economic growth and increases in the cost of living slowed coffee consumption by 2% to 173.1 million bags of coffee in 2022/2023 [2].

Although coffee production increased to 168.2 million bags in 2022/2023, this reflects a marginal growth rate of 0.1% of coffee production in 2021/2022. Coffee production faces major sustainability issues due to challenging global economic and climatic conditions [3]. These include low and volatile prices that mean many farmers fail to make a living income from coffee [4–8], vulnerability to climate change [9,10], the use of high-cost inorganic fertilisers that release greenhouse gases (GHGs) [11,12], unregulated labour with exploitation and inequity [8], and deforestation [13].

The demand for certified coffee is increasing in global consumer markets, especially within industrialised countries, due to rising concerns regarding the sourcing and quality of coffee [14]. Approximately one-third of global production is now associated with at

least one sustainability certification [13,15]. Voluntary sustainability standards (VSSs) are led largely by nongovernmental organisations that employ market-driven governance approaches to set voluntary rules, procedures, and methods for measuring, auditing, and communicating a company's sustainability performance [16,17]. VSSs for coffee, including private initiatives by coffee roasters and retailers, differ greatly but all focus on at least one of the three pillars of sustainable development: economic, environmental, and/or social sustainability [11,18,19]. An increasing number of VSSs has led to high competition between sustainability standards and fragmented markets for certified coffee. Major sustainability initiatives such as Rainforest Alliance (RA)-, Fairtrade-, and organic-certified coffees [14] use a combination of actions related to stipulated standards, different market interventions, and provisions for appropriate labour standards (Table 1). Many producers operating under these standards (e.g., Fairtrade) are also certified organic but would need to address broader sustainability standards with wider socioeconomic outcomes. Often this requires a multisectoral approach involving supply chain actors (e.g., producers, suppliers, retailers, consumers) and other stakeholders (e.g., governments, educational institutions such as universities and NGOs).

Table 1. Sustainability standards for major certification schemes.

	Rainforest Alliance	Fairtrade International	Organic Certification
Certification Body/Representation	Incorporated UTZ in 2020	The Fairtrade Foundation	The Soil Association Certification organic standards cover the UK's organic regulations (EC 834/2002 and EC 889/2008 as retained in Great Britain)
Certification requirements	**Agricultural certification:** • Farms and farmers achieve certification by meeting social and environmental standards • The certification process incurs a cost • Companies pay a license fee to use the seal on their products • At least 90% of coffee must be certified for a product to carry the seal	**Agricultural certification:** • Farms and farmers achieve certification by meeting social and environmental standards • The certification process incurs a cost • Supply chain actors adhere to Fairtrade minimum price and Fairtrade premium standards • Companies pay a license fee to use the FAIRTRADE Mark on products • Full compliance is required prior to certification, and retailed coffee must be 100% Fairtrade to use the Mark	**Agricultural certification:** • Farms and farmers achieve certification by meeting environmental and social standards • Supply chain actors adhere to organic standards • The certification process incurs a cost to farmers • Companies and suppliers pay a license fee to use the Soil Association logo in addition to the mandatory EU logo. Coffee must be 100% organic to use the logos • Full compliance is required prior to certification, with a transition period during which organic production is in place but certification is not yet granted (usually 2+ years)
Strategic areas and objectives	**Climate, forests, human rights, livelihoods:** 1. Certification 2. Landscapes management 3. Advocacy 4. Supply chain services	**Decent livelihoods, social justice for sustainability, collaboration:** 1. Shifting the balance of power 2. Growth and innovation 3. Advocacy and citizen engagement 4. Digitalisation for fairer supply chains	**Four organic principles: health, ecology, fairness, and care:** 1. Campaigning for change 2. Supporting farming innovation 3. Serving healthy food 4. Developing standards 5. Growing the organic market 6. Protecting forests
Sustainability standards/approach	1. **Forests**: protecting standing forests and preventing forest loss through agricultural expansion. 2. **Climate**: land management to increase carbon storage. 3. **Human rights**: addressing child and forced labour, poor workers' rights, and gender inequality. 4. **Livelihoods**: improving sustainable livelihoods for smallholder farmers and communities.	1. **Fairtrade minimum price** ensures farm gate prices for products sold on Fairtrade terms never drop below minimum prices, calculated to cover sustainable cost of production. 2. **Fairtrade premium** paid to farmer groups on top of sales for social, environmental, and community projects. 3. **Social standards**: elimination of child labour, workers' rights, democratic representation, gender policy, and decision-making through co-operatives. 4. **Environmental standards**: elimination of harmful chemicals, requirement to work to reduce GHG emissions, reducing water waste, and preventing soil erosion.	1. **System-oriented approach**: aims to operate production as a closed system requiring minimal input, implying a diverse planting and farming system. 2. **Elimination of artificial inputs**: this includes mineral fertilisers, and chemical synthetic pesticides, and their replacement with biological and/or ecological inputs. 3. **No GMO**: genetically modified organisms are excluded from use.

Table 1. *Cont.*

	Rainforest Alliance	Fairtrade International	Organic Certification
Commercial context	Balance between production and demand; price premium depends on market demand.	Long-term relationship between growers and buyers with pre-financing and guarantee of the Fairtrade minimum price premium.	Market price premium and high assurance of demand for farmers' production.
Top five certified countries for coffee, by area	Brazil, Ethiopia, Colombia, Peru, Guatemala (NB Utz Brazil, Peru, Vietnam, Colombia, Ethiopia)	Colombia, Peru, Brazil, Ethiopia, Mexico	Ethiopia, Peru, Tanzania, Mexico, Indonesia
Area harvested globally (ha) (2019) and share of total area harvested	470,611 4.2% (NB additionally, 720,250 Utz certified, 6.5%)	1,001,002 9.0%	703,762 6.3%
Source(s)	[15,20–24]	[15,19–21,24–28]	[15,19–22,24,29,30]

Aligned with the United Nations Brundtland Commission definition of sustainability *"meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs"* [31], sustainably grown coffee, by implication, must be produced in such a way that farmers can carry on producing it into the future. This implies that it provides farmers with decent livelihoods, does not degrade the land or environment through pollution or habitat loss, protects habitats and biodiversity, protects human rights, and operates within climate limits [32,33].

Certification schemes in coffee have been linked to improved farmer access to markets by securing higher and more stable coffee prices. They also function to improve environmental protection such as conserving forests, preventing biodiversity loss, and reducing plastic and fossil fuel use in production and processing, including reducing agrochemical use. These schemes also contribute to mitigating climate change and supporting supply chain actors to adapt [13,34–36]. Some focus on protecting human rights [37] or facilitating farmers to capture more of the value of the coffee supply chain [13]. While the differences between schemes are significant, all are in line with one or more of the UN Sustainable Development Goals, particularly Goal 12 which locates unsustainable production and consumption as the cause of climate change, biodiversity loss, and pollution [38]. Other commonalities include the costs of certification, which must be borne by farmers, co-operatives, or other supply chain actors such as roasters [18], and the existence of global networks of expertise providing certification services, linking supply chain actors, working to create demand at the consumer level, and providing local support to groups of farmers [27,30,39]. Fairtrade differs in that it offers farmers a guaranteed minimum price, whereas RA and organic focus on improvements to production that have the potential to bring in a market premium [21].

Sales of certified coffees have increased over the last decade [8,36]. The three certification schemes discussed in this paper are the most well-known and widely recognised coffee sustainability labels [13,24]. For example, in the UK, Fairtrade is recognised by 93% of UK consumers [40], RA is recognised by 49% [41], and the Soil Association's organic label certifies over 70% of the UK's organic foods [29]. Although sales of all three have increased over the last decade, global supply outstrips demand (Figure 1).

While consumer interest is growing in coffee sustainability [13,42,43], evidence suggests that they have a limited understanding of sustainability itself. Typically, consumers focus on one aspect, with a bias towards environmental sustainability when selecting food [42] where the main sustainability concerns in coffee are poor working conditions and the use of child labour, deforestation, pesticides, and environmental damage [44]. However, where understanding is low, certification can act as a simple proxy for consumers and as a social contract between them and the farmers who produce their food [18], conveying meaning through the name and logo [44], underneath which lies a set of complex standards, auditing, and protocols that supply chain actors must adhere to in order to use the label. Trust is fundamental in influencing consumers' choices regarding food labels, with choices much more influenced by independent and non-profit certification bodies

(which includes Fairtrade, RA, and organic) than industry- or supermarket-owned schemes (such as Nespresso's AAA Program and Starbucks' C.A.F.E. Practices) [45]. Trust is higher in the UK's organic certification [42] than in others. Overall, however, less than half of UK consumers say they know what to trust when considering food sustainability [46], and independent certification schemes must ensure robust monitoring and evaluation to reassure consumers about the validity of their claims and educate and inform consumers about how their sustainability standards influence the food system, if they are to achieve their aims [42,47].

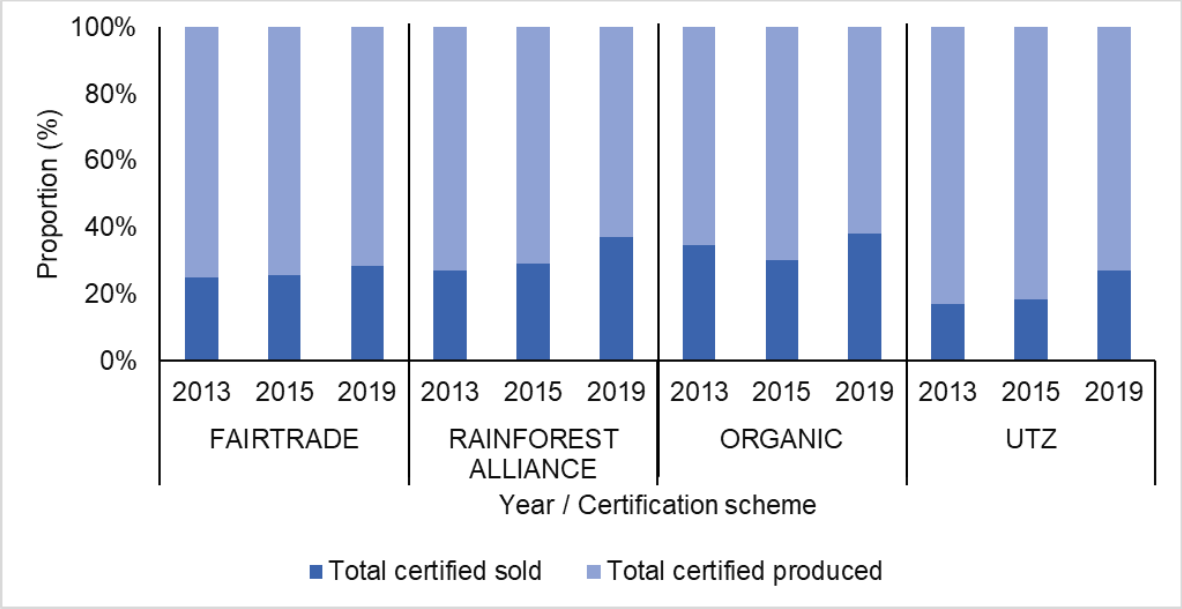

Figure 1. Trends in total global production and demand of certified coffee *: 1a: total coffee grown as certified and sold as certified, and 1b: total coffee sold as certified as a proportion of the total produced under certified standards [8]. * The figure includes Utz certification for reference, which merged with RA in 2020.

Between 21% and 45% of global coffee production is certified [15,48], but given the differences between schemes, there is a question as to which can be the most effective at transforming coffee production to become more sustainable. Certification is not the only approach to achieving agricultural sustainability, but the standards and auditing requirements provide structures that can help farmers, farmer organisations, supply chain actors, and governments to reduce the impacts of supply chains on the natural environment as well as enhanced livelihoods for those involved in them [49]. Given this, there is a growing demand for evidence on the social, economic, and environmental effects of voluntary certification schemes for coffee production and the role that producers and supply chain actors play in supporting more sustainably grown coffee. This paper provides a brief review of the current state of the debate by examining sustainability challenges in coffee production, focusing on the constraints and concerns of producers. It reviews existing strategies and frameworks being developed and implemented in the coffee industry to improve sustainability practice and identifies key criteria, subsequently applied, to evaluate the sustainability outcomes of certification schemes, considering the multi-faceted impacts on producers—i.e., across economic, environmental, and social dimensions—to offer a more holistic and critical view of the role of certification in assuring future sustainable coffee production. The following questions set out the aims of the paper:

(1) What are the current sustainability challenges in coffee production?
(2) What does sustainable coffee production entail and what interventions are effective in promoting more sustainable practices?

(3) What are the impacts of voluntary certification schemes on producers, including key barriers and enablers to comply with their sustainability standards?
(4) Are the schemes fit for purpose in assuring future sustainable coffee production?

2. Methodology

There were two main steps in our approach to the study: (1) a search of the Scopus database to interrogate the existing literature and identify relevant articles for the study, followed by a subsequent selection of articles from search results, and (2) an analysis of articles to extract relevant insights, using thematic synthesis (adapted from Thomas and Harden [50]), to bring together and integrate findings in response to the research questions (Figure 2).

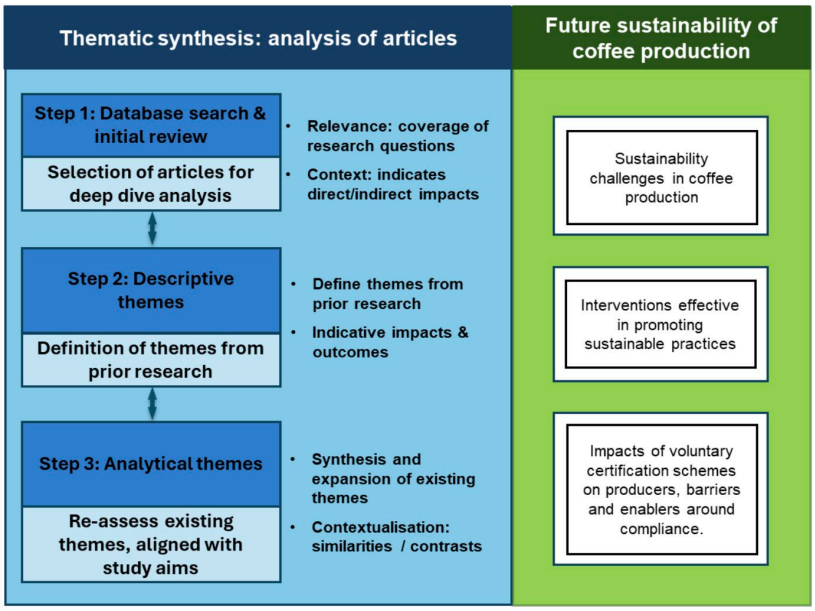

Figure 2. Methodological approach.

2.1. Search Procedure and Results

To find relevant research articles, a search of the SCOPUS and Web of Science databases was carried out limiting the scope to articles published in English, from 2012 to 2023. Key search terms with TIT-KEY-ABST (title/keywords/abstract) containing *coffee AND certif**, then within those results for *fairtrade OR rainforest AND alliance OR organic* were applied. The searches resulted in 183 articles on 15 August 2022. A total of 44 articles containing either "organic", "fair trade", "Fairtrade", or "Rainforest Alliance" were included and then manually filtered to 34 articles based on the title, keywords, and abstract. To be deemed relevant and included in the review, articles needed to address (1) one or more of the three certification schemes and (2) discuss the impacts or outcomes of sustainability certifications for farmers. Abstracts were read and some were removed using these criteria resulting in 18 articles that contributed towards this review. Additional searches on SCOPUS and Web of Science were performed for specific impact categories (e.g., environment, social, and economic) and reference lists and yielded an additional 32 articles. The search results showed more studies focused entirely or partially on Fairtrade than on RA and/or organic; this is supported by Kolk [21]. There was also more focus on economic sustainability than social or environmental sustainability, and limited attention was paid to sustainability impacts for smallholder producers, and also very little attention was paid to the relationship between certification and climate change adaptation and mitigation practice among smallholders.

There were substantial results of the grey literature available on other certification schemes (e.g., RA and organic), including research reports and information by certification bodies, international organisations, coffee industry-supported research companies, NGOs,

and other organisations. While these can be biased, particularly if funded by private companies or NGOs with a vested interest, they provide different perspectives and information to peer-reviewed journals and are often updated more regularly. Moreover, many are reputable organisations that are widely cited elsewhere in academic literature. A search of Google Scholar and the Google search engine, using similar keywords and filter criteria above, yielded a total of 36 articles. The initial body of the grey literature identified was further filtered on the basis of how well each article reflected the topic of the research, reducing the sample to 27 articles included in the review.

Some of the literature dated before RA incorporated Utz in 2020 often includes an evaluation of both RA and Utz certifications or combines the two. Where this occurs, the literature evaluated includes RA where possible, and RA/Utz elsewhere, but does not include Utz where this is considered in the literature as a separate entity compared to RA. This is imperfect, as many farms that achieved Utz certification before 2020 will now have RA certification, but it provides some clarity and boundary to the results and discussion.

2.2. Analysis of Articles

A 'thematic synthesis' of published studies was produced, drawing from Thomas and Harden [50] and Braun and Clarke [51] to identify themes and patterns in primary qualitative research. Thematic synthesis provides a structured and objective method for analysing data produced from qualitative studies, bringing together and integrating the findings from multiple qualitative studies in a systematic way. Thematic synthesis has been applied successfully to conduct systematic reviews of health promotion research (e.g., Tomas and Harden [50]). We adapt and apply the approach to conduct a structured review of qualitative research around the impacts and outcomes of voluntary sustainability standards for coffee production. Our approach comprised three steps: (1) initial review to identify pertinent information for the study, (2) extracting 'descriptive themes' from the primary research, and (3) developing 'analytical themes' by contrasting and comparing findings from the primary research to extract new insights.

Initial review: The selected articles were examined by the lead researcher (KJ) and initially assessed, based on how well each document reflected the topic of the research. Each article was rapidly assessed in terms of its coverage of content (such as the inclusion of one or more certification schemes and sustainability pillars) and context (directly or indirectly referred to impacts on producers or other supply chain actors). Articles with good coverage in both areas were subjected to a more detailed review to capture relevant information, eliminating content that did not directly relate to the study aims. The analysis was carried out manually, where relevant information was tagged and extracted to a Microsoft Excel database to keep a record of outputs.

Descriptive themes: Initial themes were developed through manual coding of the findings extracted from articles. Descriptive codes were inductively developed and captured nuances in the debate around the sustainability of coffee production, noting factors that were attributed to observed impacts/outcomes of certification schemes (e.g., impact on livelihoods or environmental protection). Coding identified themes within the data by teasing out specific/tangible ideas and different perspectives about the impacts of certification schemes on sustainable coffee farming, allowing the translation of concepts from one study to another to initiate the synthesis process. At this stage, the coding elicited broad themes that did not directly address the study aims.

Analytical themes: The broad themes elicited from prior research were combined to respond to the study aims, i.e., assessing how fit-for-purpose certification schemes are in assuring future sustainable coffee production and drawing implications for producers and other supply chain actors. A synthesis of initial themes considered implications for producers, including barriers and enablers around compliance with sustainability standards to assess the fit-for-purpose of certification schemes and upon which to base recommendations. Through this discussion 'analytical themes' emerged paying specific

attention to 'context' to draw out similarities and contrasts for producers, including the support needed for a more equitable transition to sustainable coffee production.

3. Results and Discussion

3.1. What Are the Current Sustainability Challenges in Coffee Production?

While coffee is consumed globally, it remains a commodity crop grown predominantly in the Global South (Figure 3) with 95% grown by smallholders on farms smaller than five hectares [8]. Despite this, 70% of coffee produced is exported outside of its country of origin with 90% of these exports being green coffee. Initial exports of coffee are valued at just USD 20bn [6,52], whereas five of the leading 10 coffee exporting countries by earnings do not grow coffee [53] (Figure 4), and instead capture a large share of the global value chain by processing coffee for re-export [13]. Coffee supply chains are asymmetric with some of the biggest opportunities for value creation far away from the estimated 12.5 million farms that underpin the sector [8,54].

Figure 3. The geographical distribution of coffee production by country (2018) (tonnes) [55,56].

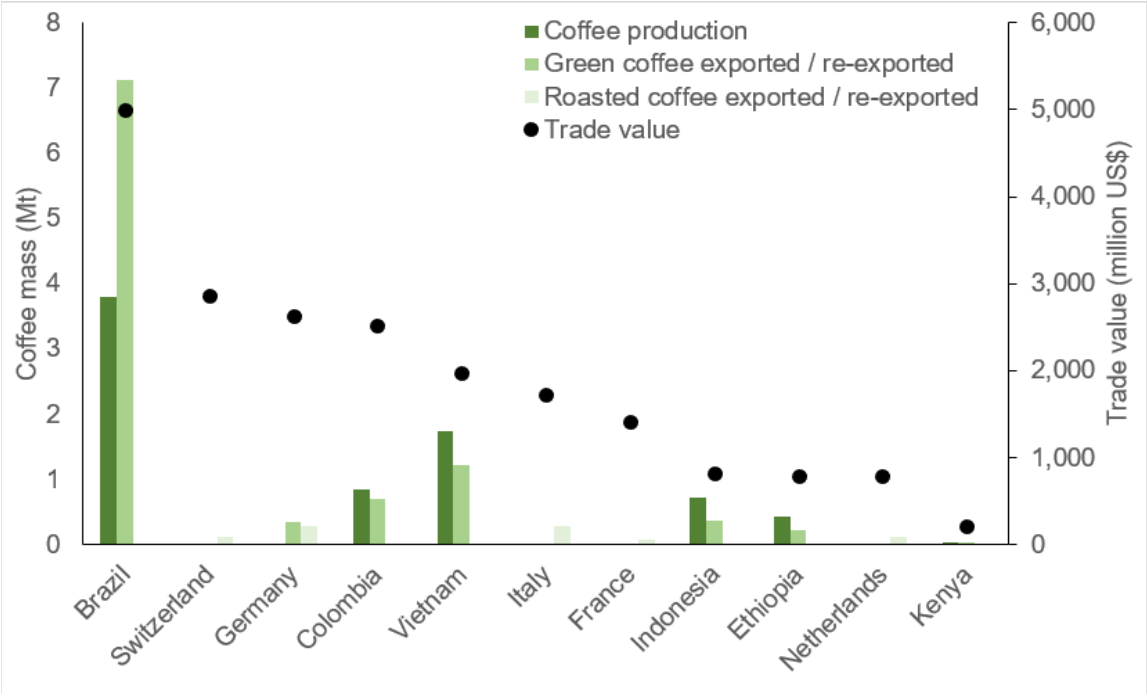

Figure 4. The relationship between coffee exports by weight and income earned from the export of coffee, in the top 10 countries by export earnings. (All data are from 2020. Roasted coffee exported/re-exported is green coffee mass equivalent) [55].

In countries producing the most coffee—Vietnam, Brazil, and Colombia—exports account for just 2%, 3%, and 6% of their merchandise exports, respectively [57]—but many small- and medium-sized producer countries are much more heavily reliant on volatile earnings from coffee (Table 2). Reliance on commodities makes countries, particularly developing countries, more vulnerable to negative shocks affecting the quantity or price of the commodities they export [58]. Similarly, there is a link between reliance on commodities for export earnings and lower economic and human development [58]. Indeed, 20% of coffee-producing countries are ranked as low in the Human Development Index [52] while over 40%—18 of the 44 ICO members—are ranked as Least Developed Countries [57].

Table 2. Commodity-dependent countries (2018) that rely on coffee as one of their top three merchandise exports [59].

Country	Annual Coffee Production (Tonnes)	Where Does Coffee Rank in Merchandise Export Earnings?	Proportion of Merchandise Export Earnings Coming from Coffee (%)
Ethiopia	470,221	1st	31.2
Timor-Leste	8876	2nd	21
Burundi	14,216	2nd	20.9
Uganda	211,200	2nd	14.6
Honduras	481,053	1st	14.4
Nicaragua	141,931	2nd	7.9
Guatemala	245,580	3rd	5.3
Central African Republic	9145	2nd	4.3
Costa Rica	85,340	3rd	2.2
Vietnam	1,616,307	3rd	1.2
Switzerland	0	3rd	0.8

The asymmetry in the global coffee supply chain along with volatile prices means millions of smallholder coffee farmers globally are vulnerable to poverty and food insecurity, and lack the resilience or capital to invest in their farms [4,19,34,60]. Farm size is an important factor, where many smallholder farms are too small to be financially viable when prices remain low, while farmers on larger holdings are more likely to earn a living income [60]. Smallholders report a lack of communication, information, and transparency between them and their buyers [61,62] resulting in low bargaining power, particularly for women farmers [63], which compounds price volatility. The cycle of volatile prices and low access to finance results in yield gaps; this is exacerbated by a lack of farmer knowledge about productivity enhancement and a lack of access to labour [34,64–66].

Production is labour-intensive with health and safety risks arising due to the use of fertilisers and pesticides and sharp tools for harvesting [67,68]. It is estimated that 20% of children in coffee-growing areas are exploited to produce coffee [69], predominantly on family farms [70]. Fundamentally, low and volatile prices are at the heart of many labour issues; they prevent farmers from investing to improve productivity, paying a living wage for hired labour, and using personal protective equipment (PPE) during pesticide application to reduce adverse health impacts [67,71].

Coffee production both causes, and is affected by, climate change (e.g., through GHG emissions from fertilisers, and land use change), with negative impacts on yields from increasing climate volatility, reduced rainfall, and higher temperatures [9]. Robusta coffee tolerates hotter and drier conditions [72] compared to Arabica, which currently dominates global production [10]. Arabica coffee grows best where temperatures average between 18 and 21 °C [72], with bean quality reducing in higher temperatures [10]. Under climate change, optimum coffee-growing areas are set to rise in altitude [10]. Overall, it is predicted that globally there will be a reduction in suitable coffee-growing areas by 50% in 2050 [73], with an accompanying reduction in production by 23.5% for Robusta and 45.2% for Arabica

by 2099 [74]. In the long term, this may mean that farmers will switch from producing coffee to other crops [75].

Conventional coffee production requires large amounts of water and inorganic fertiliser to increase yields, but this exacerbates environmental pollution and climate change [76,77]. Coffee is mainly rain-fed, and producing a ton of green coffee requires over 15,000 m^3 of water [78]. Processing coffee uses a large amount of blue water—15–20 L/kg^{-1} of green coffee produced—that is contaminated during this process [79], causing water pollution if not carefully managed. Fertilisers represent the most significant contribution to GHG emissions during production [64,80] with inorganic nitrogen fertilisers accounting for approximately 40% of the carbon footprint of the coffee supply chain [75,81]. Each ton of coffee cherries harvested removes 33–63 kg of nitrogen from the farm ecosystem [82], necessitating the replacement of nitrogen and other nutrients for sustained production. This implies that some farmers are responding to climate change by increasing the intensification of management practices to maintain yields and sustain their livelihoods [7]. However, over time, inorganic fertiliser may negatively impact productivity, through impacts on nutrient budgets, and soil acidification [3,11,83]. Moreover, periodic soil disturbance from various management practices can result in carbon losses, contributing to net emissions [3,84].

3.2. What Does Sustainable Coffee Production Entail and What Interventions Are Effective in Achieving More Sustainable Practices?

Coffee growers or producers tend to focus on agricultural sustainability standards within certification schemes (Table 1) that address a number of sustainability pillars, e.g., living and working conditions of coffee farmers, biodiversity, and economic stability. However, coffee companies tend to look at sustainability through the lens of their environmental, social, and governance (ESG) commitments. For instance, Nespresso has gained B Corp certification with performance evaluated across the whole company [85]. Interventions like this aim to integrate sustainability into decision-making across operations, widening the focus from production to the whole supply chain and corporate structure. Bager and Lambin [86] surveyed the sustainability practices of 513 companies in the coffee sector as a whole and found that corporate sustainability initiatives tend to focus more on socioeconomic practices than environmental ones, while climate change and deforestation were the least addressed problems. Bager and Lambin [86] point to the need for a set of common coffee sustainability indicators that focus on all actors in the coffee value chain. Given the focus of the study is on coffee production, we draw on sustainability frameworks that discuss challenges at the upper end of the value chain.

The Sustainable Coffee Challenge (SCC) has four goals—strengthening market demand, sustaining supply, conserving nature, and improving livelihoods [87]. It acknowledges that multinational companies play a crucial role in creating demand for sustainable coffee, which is essential for farmers to continue to produce it [87]. The Global Coffee Platform identifies three core areas in its Coffee Sustainability Reference Code—social well-being, economic prosperity, and environmental stewardship [88]. Focused on coffee production, key interventions recommended include increasing farmers' knowledge and access to information to enable them to improve their livelihood, protect human rights, provide safe and appropriate working conditions, and adopt Good Agricultural Practices (GAPs) to improve production. It also includes climate considerations as part of an environmental dimension.

The Sustainable Coffee Challenge and the Global Coffee Platform provide a space for stakeholders across the value chain to find common ground and share insights, which is most useful when government support is lacking. However, the goals of the companies involved may not match what is required for sustainable production [89]. Moreover, neither framework addresses the issue of low and volatile prices for coffee nor emphasises the need for farmers to make a living income [90]. In contrast, both Fairtrade [91] and RA [89] include living income or wage as a primary consideration, recognising that farmers who

struggle to meet costs associated with more sustainable coffee production will equally struggle to achieve other aspects of sustainability.

Increasingly, consumers' choices are influenced by factors related to health, local sourcing, organic products, food waste, and packaging [42]. Disparities in views and opinions on sustainability suggest that the perspective of different supply chain actors is in part influenced by the role and scope that these actors play in influencing more sustainable coffee production. The FAO [92] asserts that the interpretation of sustainability, as a term, is also influenced by political beliefs and the personal values and priorities of an individual, group, or organisation. This is supported by Reynolds et al. [42] who suggested that the food industry and NGO approaches to sustainability tend to focus narrowly on the issues and challenges in supply chains that they can directly influence. This may preclude certification schemes from comprehensively achieving sustainably grown coffee. The FAO's Sustainability Assessment of Food and Agriculture (SAFA) systems framework includes elements of living income, with the inclusion of the need for decent livelihood as a social indicator, plus stability in prices for agricultural products and profitability as economic elements of sustainability (Figure 5) and achieving carbon neutral production. This framework builds on others and is designed to support actors across food supply chains to assess sustainability along four dimensions—social well-being, good governance, economic resilience, and environmental integrity [92]. It covers 21 essential sustainability themes including atmosphere, with the aim of providing a common understanding of what sustainability means [92].

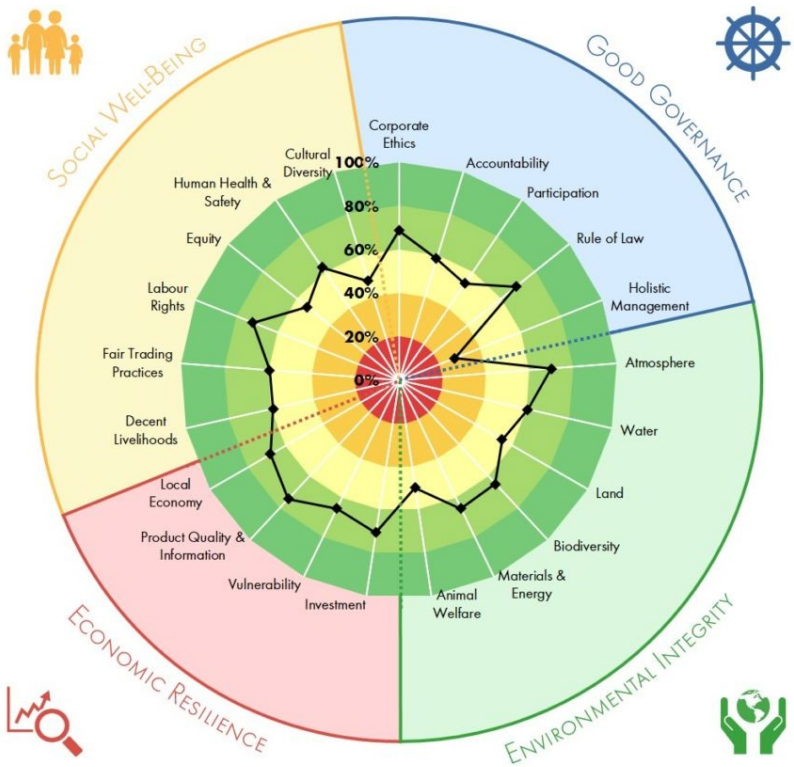

Figure 5. The FAO's Sustainability Assessment of Food and Agriculture (SAFA) systems framework [92].

The sustainability frameworks discussed above capture the need for clear, transparent, and flexible sustainability criteria, utilising elements within the above frameworks, particularly SAFA, which is arguably more comprehensive, covering a wider range of sustainability outcomes. Drawing from these frameworks, five sustainability criteria (Table 3) have been derived and applied to assess how well certification schemes drive sustainable coffee production, evaluating the role that certification schemes can play in promoting decent livelihoods, protecting human rights, minimising environmental harm, protecting the environment, and operating within climate limits.

Table 3. Framework for evaluating coffee certification schemes and their ability to drive sustainability.

Sustainability Criteria	Sustainability Pillar(s) Covered	What Aspects of a Certification's Scheme Standards, Interventions, and Activities Does This Include?
Decent livelihoods	economic and social	• Farmers gain a living income from certified coffee • Farms provide workers with living wages • Positive price differentials are available through certification • Farmers can use technology, finance, certifying bodies, and supply chain partnerships to capture a meaningful share of the value in the coffee supply chain • Demand-generating activities for certified coffee in consumer countries
Human rights	social	• Ensuring that all involved in coffee production can benefit • Human rights are protected during production through adherence to local and international laws • The rights of children are upheld • The rights of women and minority groups are upheld • Action is taken to ensure equality and diversity in decision-making at the farm, farmer society, supply chain, and government level • Farmers can access training for productivity, environment, climate change and best practices, and information and technology for decision-making
Minimising environmental harm	environmental	• Coffee production does not degrade the land or environment through ○ pollution ○ habitat loss ○ deforestation ○ water contamination ○ incorrect or excessive use of chemical inputs
Environmental protection	environmental	• Coffee production protects habitats and biodiversity • Action is taken to improve soil and biodiversity on and around farms • Water sources are conserved and managed for everyone's use
Within climate limits	environmental	• Action is taken to support farmers to mitigate against climate change • Action is taken to support farmers to adapt to climate change • An aim to work towards carbon-neutral coffee production

3.3. What Are the Impacts of VSS on Producers, including Key Barriers and Enablers to Comply with Their Sustainability Standards?

Many studies point to the benefits of certification from an **economic perspective**, particularly regarding Fairtrade [21]. In the study by Pyk and Abu Hatab [93], farmers in Tanzania were economically motivated to obtain Fairtrade certification, while, in Nicaragua, Haggar et al. [20] found that all certifications resulted in better coffee prices than for non-certified coffees (Table 4), with dual Fairtrade–organic certification performing better than others. Fairtrade-certified farms had an average of 43% higher net revenue than their non-certified counterparts [20]. Organic farms had both lower production costs and lower productivity compared to both Fairtrade and RA farms, and a net revenue that closely matched comparable non-certified farms but with lower production costs. This may suit some farmers who lack the funds or desire to buy expensive agrochemicals, and if widely adopted, provide a route away from the pattern of oversupply, thus improving environmental sustainability while stabilising incomes. However, Beuchelt and Zeller [94] found that there was no clear correlation between organic or organic–Fairtrade certification in Nicaraguan farmers' gross margins, and suggest that certification, while it can act as a price stabiliser when coffee prices are particularly low, is not guaranteed to raise farmers' income.

Table 4. Comparative sustainability performance of three voluntary certification schemes.

Framework Indicator	Rainforest Alliance	Fairtrade	Soil Association Organic
Decent livelihoods	+/−	+	−
Human rights	+/−	+	−
Minimising environmental harm	+/−	−	+
Environmental protection	+/−	−	+
Within climate limits	−	+/−	+

− comparatively lower performance; +/− comparatively middling performance; + comparatively higher performance.

The better economic performance of Fairtrade certification is supported by Chiputwa et al. [95] whose study in Uganda found that Fairtrade was associated with a 30% rise in living standards and a reduction in poverty, whereas organic certification had no significant impact. Bermudez et al. [48] found that both Fairtrade and organic certification deliver a price premium to farmers of 20–30%, increasing with dual certification. Conversely, in Brazil, the same study found that profitability is lower with certification, attributed to certification scheme restrictions on fertiliser and pesticides that drive up yields in conventionally managed coffee farms [96].

There is a question as to whether certification is effective in enabling smallholder farmers to achieve key sustainability goals such as profitability and access to finance for investment in production. According to Lyon's [97] study in Mexico, Fairtrade-certified coffee farmers see government support, rather than market forces, as key to increasing profitability. Winter et al. [19] found that although Fairtrade–organic coffee was sold at higher prices than non-certified coffee, this delivered no difference in profitability in Ethiopia—principally due to the small proportion of farmers' coffee harvest that was sold on organic–Fairtrade terms. This is supported by Jena and Grote [96], who found that Fairtrade co-operative members in Ethiopia received a lower income from coffee than their non-certified counterparts. Conversely, RA certification of semi-forest coffee in Ethiopia improved profits by ensuring that farmers received a price premium rather than improving yields and represented a positive outcome for both livelihood and environment compared to either more intensive coffee production or non-certified semi-forest production [98].

Kolk [21] reported on studies that found that while Fairtrade farmers might obtain a higher price and Fairtrade premium, other schemes helped improve quality and productivity, suggesting that RA certification is as capable of improving farmers' livelihoods, but in different ways. This is supported by Akoyi and Maertens [99] whose study in Uganda found that RA certification (along with Utz and 4C, which focuses on GAP adoption) increased income, reduced poverty, and increased land and labour productivity. The difference was attributed to well-organised contract farming with readily available inputs, timely payment, and the requirements to adopt GAPs and environmental sustainability for the RA-certified farmers. Conversely, Fairtrade–organic certification failed to do so because higher prices were offset by lower productivity for Fairtrade–organic farmers due to a shortage of organic fertiliser, reduced yields from intercropped species produced organically alongside the coffee, and reduced labour for other income generation. They suggest that for farmers experiencing low yields and degraded soils, RA–Fairtrade dual certification could be more effective at reducing poverty.

Considering an **environmental perspective**, Tayleur et al. [49] provide a valuable audit of how the three certification programs include environmentally sustainable production, with RA having the most comprehensive standards. However, it is worth noting that reducing GHG emissions is implied in organic production as it eliminates artificial agrochemicals. Winter et al.'s [19] study is an example of the implementation of SAFA's SMART-Farm tool to assess the impact of Fairtrade- and organic-certified farms. It found that organic certification influenced farming practices where coffee was managed intensively with inorganic fertiliser, as in agribusinesses in Brazil, impacting farmers' choices in favour of improvements in water quality, soil quality, species diversity, and waste reduction. However, it had little influence in Ethiopia where coffee is grown typically without artificial inputs. In Costa Rica, farmers see organic certification as a challenge because production is input-intensive and yields can be reduced by approximately 50%, whereas organic certification may be more appealing in countries where production is already based on a low-input model [100].

Pyk and Abu Hatab's [93] study found that Tanzanian farmers overall were less environmentally motivated to adopt Fairtrade certification than they were economically motivated to do so; this was attributed partly to farmers' lack of awareness of the environmental standards in Fairtrade certification, which could point to a barrier to achieving the environmental goals of Fairtrade. A study in Rwanda found that Fairtrade certification had

no effect on farmers' pesticide use, mulching to prevent soil erosion and improve fertility, or fertiliser use. However, it increased agroforestry and manure use, attributed to training for co-operative members [101].

Haggar et al.'s [102] study in Central America found that organic- and RA-certified farms had higher shade and tree species diversity than conventionally managed farms, and hence better potential to protect and enhance biodiversity on coffee farms. A more recent study in Nicaragua [20], examining both economic and environmental impacts of certification, found that Fairtrade- and RA-certified farms had higher productivity than organic ones, but this was also associated with lower carbon stocks and tree diversity, indicating an environmental trade-off alongside economic advantages. This is supported by Vanderhaegen et al. [103], who found that Fairtrade–organic certification improved biodiversity and carbon storage, and RA improved productivity and farm incomes, but neither achieved both. This runs counter to the priorities of both certification schemes and shows that the outcomes of certification depend on context and location.

Pico-Mendoza et al. [22] found that across four ecosystem services (maintaining habitats, water quality, erosion control, and carbon stocks) in coffee agroforestry systems in Costa Rica, organic farms were more effective than RA farms or those with no certification. Surprisingly, Rainforest Alliance farms performed worse on some indicators than conventionally managed farms (Table 4), despite a focus on biodiversity and soil health in the RA standards [41]. Organic farms had a higher percentage of canopy cover, a greater diversity of tree species in coffee farms, and lower soil loss than others. The study also found that farmers in conventionally managed farms were doing more to conserve soil, reduce erosion, and conserve water than on certified farms. However, part of this may be due to the need to carry out such activities because other management practices are less effective at maintaining ecosystem health without intervention, requiring more action by farmers in response. It could also be explained by conditions on individual farms, such as steep slopes requiring more intervention [22].

Considering the **social perspective**, certification in Brazil correlated with an improvement in wages, contracts, and benefits for hired labour on coffee farms, although the introduction of legal minimum wages at a national level is likely to have had a much more significant impact than the certification itself, whose standards require adherence to national policy [37]. All three schemes, as would be expected, ban child labour and seek to protect children's rights—but the impact of this can be different between schemes. Akoyi et al.'s [104] study in Uganda and Ethiopia examined the proportion of children out of school, repeating years, or staying in school beyond school age, and found that Fairtrade certification increased secondary school enrolment and improved schooling efficiency. This was supported by Meemken et al. [105] who found that Fairtrade certification increased household expenditure on education by 146% in Uganda and increased schooling time by eight months, whereas there was no impact on education from organic certified farms. In Akoyi et al. [104], comparing RA and Fairtrade, there was no significant effect on education from RA certification. However, in RA-certified families, children spent less time working than in Fairtrade ones, either doing household chores, or farm or other work. These findings are attributed to awareness-raising by Fairtrade co-operatives on the importance of school; however, the study does not examine the potential impact of the Fairtrade premium; globally, farmers' organisations use 2% of this to pay school fees [106], usually for local children who might otherwise miss out.

In certified contexts, Winter et al. [19] found that organic and Fairtrade certification delivered better on gender equality, non-discrimination, support for vulnerable people, and public health in Brazil, with public health differentials as a factor of organic certification that bans agrochemicals. In Ethiopia, certification delivered similar benefits, and in both contexts, there was a slightly improved market stability, attributed to better access to advisory services [19]. This is supported by Elder et al. [107] who found that Fairtrade certification was associated with a perception of increased participation in decision-making by women, and that co-operatives, in general, increased overall participation, and by Meemken and

Qaim [108] who noted that RA and Fairtrade have very similar standards around gender and that both can contribute to the goal of gender equality through improving women's market access and more equitable control and access to household cash, attributed in part to non-discrimination policies and training from certified farmers' organisations. Pyk and Abu Hatab [93] found that women farmers in Rwanda were more environmentally motivated to become Fairtrade certified than men. This may indicate that Fairtrade has the potential to shift farmers' production methods to enhance environmental protection, and points to the positive impact of Fairtrade's social standards, although Elder et al. [101] found that women farmers in Rwanda were less likely to use regenerative agricultural techniques like agroforestry or organic manure, perhaps because other roles such as looking after children mean they lacked the capacity for labour-intensive practices.

Fairtrade stipulates that farmers belong to a co-operative with a democratic structure and gender equality requirements [28], and Fairtrade certification aims to build long-term relationships between farmers and buyers. Where co-operatives function well, this has benefits for farmers; Jena and Grote [96] find that effective co-operatives have a key function in providing training that helps improve yields, which is supported by Barone et al. [109]. Fairtrade co-operatives must train members in appropriate fertiliser use and measures to reduce soil erosion [101].

There are instances where co-operative structures seem to undermine, or at least do not maximise, the ability of farmers to make decent livelihoods: in Laos, some Fairtrade farmers chose to take an immediate cash payment from middlemen who offered lower prices, rather than trust their co-operative to honour its payment promises, with payment coming later [110]. The issue of mistrust of the co-operative also arose in Rwanda where, although members expressed trust in each other, there was a lack of trust of co-operative board members, particularly in Fairtrade-certified co-operatives. This mistrust decreased amongst farmers who had improved their coffee productivity or received training, again pointing to the importance of farmer engagement [107].

3.4. Are the Schemes Fit for Purpose in Assuring Future Sustainable Coffee Production?

Oversupply is a critical issue in coffee, presenting a potential barrier to certification schemes achieving their aims (Table 4). Ultimately, oversupply means farmers may have to sell at lower prices [48]. Bray and Neilson [18] assert that less than 50% of certified coffee is sold as certified, and others put this figure at 25% [49,111]. This is supported by other studies that found certification had no positive impact on farmer income [94]. Donovan et al. [112] found that while having multiple certifications helped farmers in Central America sell as much coffee as possible at a higher price, they still sold relatively low volumes of certified coffee, at times dependent on agreements to sell larger volumes on a non-certified basis. Snider et al. [100] found that the proportions of compliant production sold under certification in Costa Rica were 30% for Fairtrade and 58% for RA, while only 3% of co-operatives' organic coffee was sold as such. This may discourage farmers from gaining and maintaining certification [48] with standard compliance in coffee reducing from at least 20.7% in 2018 to at least 16.% in 2019 [15].

Bermudez et al. [48] suggested there is a need for better awareness-raising of the advantages of sustainable coffee production. Unless other certification actors from buyers to consumers see the value of certified coffee, there is little benefit to farmers from going through the compliance process, even if their standards align with farmers' priorities and practices. This is critical for certification schemes' success, and all are to some extent taking action to increase demand. Fairtrade has the highest public awareness levels. The Soil Association also engages the public through campaigns and its Food for Life programme [113].

Fairtrade and RA have recently diversified their offer to supply chain actors, for example, through the tailored supply chain services offered by RA [114]. Standards have also changed to include climate change mitigation and adaptation: in 2020, RA introduced a new Sustainable Agriculture Standard and assurance system, and requirements for continuous improvements to maintain certification [41], while in 2020, Fairtrade introduced

a Climate Standard that supports farmers to take steps to reduce their environmental impact and save carbon, making them eligible for carbon credits [115]. The impact of these is not yet apparent and warrants further research.

Fairtrade has started to identify the price farmers need to make a living income by growing sustainable coffee through the Fairtrade Living Income Reference Price calculated using four key parameters (Figure 6) to raise awareness with supply chain actors about the need for sustainable pricing [116]. This approach emphasises the value that coffee should have at the farm gate if grown sustainably on a viable farm. It puts an onus on supply chain actors to ensure that there is enough value in supply chains, adequately distributed, to achieve the goal of a living income for farmers. RA suggests incomes can be enhanced with a holistic set of strategies to improve production, farmers' bargaining power, and price premiums such as the minimum prices offered through Fairtrade, and enabling policy environments [89] (Figure 7) which puts more emphasis on actors in producing countries, including farmers.

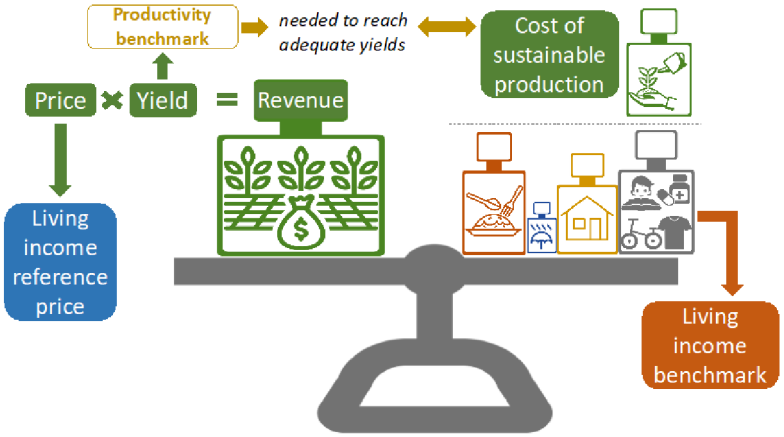

Figure 6. Fairtrade Living Income Reference Price [116].

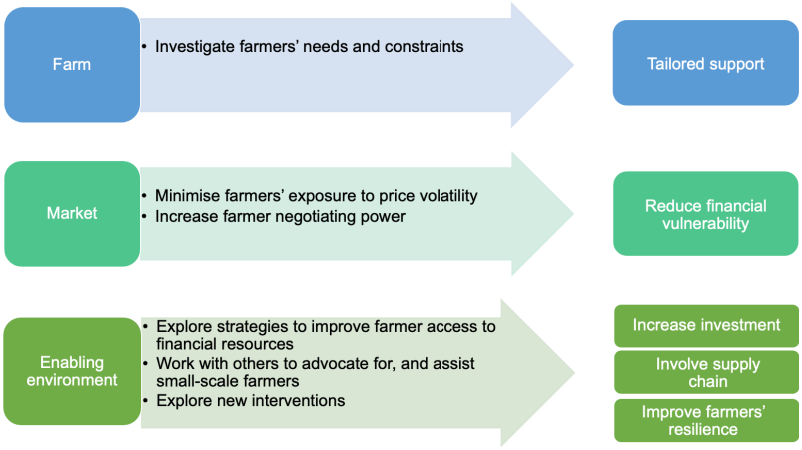

Figure 7. Regenerative agriculture strategies to enhance coffee farmers' income (Adapted from Hochberg and Bare [89]).

4. Conclusions

We examined the social, economic, and environmental effects of three voluntary certification schemes for coffee production. Our findings highlight a complex picture with variations in sustainability standards when evaluating the performance of these schemes, often resulting in trade-offs between economic and environmental sustainability. No single certification scheme drives sustainability more than another on all five criteria of the assessment framework (Table 3). There are inherent complexities in comparing the

performance of each scheme on farmers as the impact is context-dependent and highly influenced by local farming conditions, supply chains, and livelihood options related to (and beyond) certified coffee [18]. This study identified that Fairtrade and organic had comparatively better performance on economic and environmental sustainability, respectively (Table 4). This is associated with a higher market price for certified coffee, although the cost of certification and compliance does potentially lower income among smallholder farmers, resulting in marginal economic improvements [117]. Prior studies confirm larger producers have had more success with certification schemes given the ability to afford associated labour and audit costs, while smallholder farms require external assistance and support with land, labour, skills, and other resources [117,118]. These issues are more prominent among migrant farmers or labourers who do not own the land they are farming on and may not directly benefit from a certification scheme. Hence, from a social perspective, it is essential that the training, capacity building, and standards that are embedded in RA, and particularly Fairtrade certification, add value to smallholder coffee farmers in terms of worker (e.g., migrant labourers) protection and improved income. It is also important that certification does not undermine food security by encouraging the transition to cash crops, dominated by men, and disenfranchising women farmers who contribute to household food security [119]. While the effects of certification on women are not well reported in the literature, the study shows that RA and Fairtrade (Table 1) have standards that could lead to positive gender effects such as improving agricultural practices and women's share of income, through better access to markets, and improving labour rights.

Overall, there is evidence that certification can deliver better outcomes for sustainability than non-certification, but this is highly dependent on context and requires farm-level impact assessments to better understand how certification standards meet the specific and long-term needs of producers. There are benefits of dual certification, although labour and compliance costs generate mixed outcomes for farmers' livelihoods, but with overall better outcomes for environmental sustainability although with some risk in terms of yield trade-offs. Organic production delivers the most effective environmental outcomes as it removes harmful agrochemicals from production, but the picture is less clear with RA and Fairtrade, and trade-offs depend more overall on local contexts than on the certification itself.

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