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REVIEW ARTICLE

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The voluntary sustainability standards and their contribution towards the achievement of the Sustainable Development Goals: A systematic review on the coffee sector

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Abstract

In 2015, the United Nations adopted the Sustainable Development Goals (SDGs). Voluntary sustainability standards (VSSs) precede the SDGs and are a major governance tool for sustainability. Consequently, it is important to understand the role of VSS towards the achievement of the SDGs. This article contributes to answer this question through a systematic review of literature. Results revealed research gaps for key SDGs, such as SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities). Another relevant finding is that more than half of the studied variables showed no significant difference between intervention or control group, or no significant change over time. This article encourages VSSs and policymakers to work collaboratively towards the use of common indicators and increased data transparency.

KEYWORDS
coffee, data transparency, standard indicators, Sustainable Development Goals, voluntary sustainability standards (VSSs)

1 | INTRODUCTION

The Sustainable Development Goals (SDGs) were adopted by the United Nations Assembly in 2015, and in 2020, the Decade of Action started. The United Nations (2015) in the 2030 agenda for development emphasises that all stakeholders and countries, working in partnership are responsible for the implementation of the SDG agenda in order to

'shift the world on to a sustainable a resilient path' (p. 5). In this context, it is important to improve our understanding of how voluntary sustainability standards (VSSs) contribute to this agenda.

Meemken et al. (2021) emphasised the relevance and influence of the VSS for sustainability policies at national and international levels. Therefore, it is important to analyse the contribution of the VSS towards the achievement of the SDGs. Where do we stand now? How much do the VSS contribute to achieving the SDGs in the coffee sector? How is progress currently being measured? Are some SDGs receiving more attention from researchers than others are? What are the current research gaps remaining in the field? Based on an extensive systematic review of the empirical evidence presented in three types of literature—peer-reviewed journals, meta-analyses and systematic reviews and grey literature—this article offers preliminary answers to these questions in the coffee sector.

Coffee is one of the most studied commodities (Meemken, 2020), which give the opportunity to find enough high-quality articles to do the comparison and to find higher representation of SDGs to measure. Besides, as this is a pioneer exercise matching specific indicators to the different SDGs, this article focuses only in one commodity (coffee) to reduce the variability that emerges when comparing multiple crops or multiple levels along the global value chain (GVC). Future research can easily adapt results from this exercise to other crops or industries or even to other levels into the GVC.

This paper is divided into five sections. The first section includes a brief overview of the VSS; the second presents a theoretical framework suggesting how the VSS may contribute to the achievement of the SDGs; the third section presents the methods used to carry out the systematic review; and the fourth presents the results of the review. The final sections include the discussion, conclusions and recommendations derived from the findings.

2 | VOLUNTARY SUSTAINABILITY STANDARDS AS A GOVERNANCE TOOL TOWARDS SUSTAINABILITY

The VSSs are '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, and others' (UNFSS, 2013, p. 4).

The emergence of VSS can be tracked more than 100 years ago, but their exponential proliferation has taken place since the 1990s (Marx et al., 2021), summing now more than 400 certification schemes (Marx & Wouters, 2014). Dietz et al. (2018) identify a variety of stakeholders establishing VSS; among them are NGOs, single firms, industry and sector associations. In addition, partnership and collaborations have emerged, such as firm-NGO collaborations or multistakeholder initiatives. Political scientists are concerned about the abovementioned proliferation of VSS schemes, as this proliferation has two likely outcomes. On the one hand, it could lead to confusion among consumers and producers who are exposed to different VSS (Fransen, 2011). On the other hand, it could lead to the mainstreamisation of the VSS, which could, in turn, create a race-to-the-bottom dynamic (Dietz et al., 2021; Samper & Quiñones-Ruiz, 2017; Schleifer et al., 2019).

Drivers for VSS adoption by corporations are diverse; Marx et al. (2021) list five major drivers: first, consumer demand, as their consciousness about their consumption foot print increases; second, brand protection, especially to protect themselves from being target of damaging media campaigns and boycotts; third, government regulations especially when the governments lack the capacity to track all products regulations and depend on private certification seals to play the supervision role; fourth, substituting failing multilateral efforts, as it happened at the end of International Coffee Agreement (ICA) in 1989; and fifth, reaction to other VSS, for example, some industry driven created in response to NGO driven ones. For example, Lambin and Thorlakson (2018) explain the emergence of some company or sector-wide standards as a response to the pressure from the NGOs advocating for the adoption of more sustainable practices. Grabs (2021) also points out how these actors are slowly moving to a more collaborative approach. From an alternative perspective, it has also been argued that the adoption of in-house practices may be a

strategy to project a '*sustainable image*' in front of consumers while avoiding actually addressing critical sustainability challenges such as child labour, pollution and deforestation (Bager & Lambin, 2020).

The International Social and Environmental Accreditation and Labelling Alliance (ISEAL) has encouraged their members to develop theories of change or a series of logical steps and actions directed towards specific outcomes and impacts. Oya et al. (2018) and Marx et al. (2021) present general theories of change of the VSS which summarises its interventions as being made up of five main activities: (a) capacity building, (b) market interventions, (c) additional payments (such as premiums), (d) labour standards and (e) regulatory interventions (Figure 1).

In general, the logic of these theories is similar, the implementation of a set of standards criteria, technical support and follow-up to farmers to meet these criteria and the establishment of an assurance system for traceability. Once it is verified that the product complies with the standards, a certificate is awarded to the producer or producers' organisation (Marx & Wouters, 2014). The theory of change suggests that these inputs should translate into better farming practices, improved labour rights, increased knowledge and strengthened producers' networks with better opportunities to access the market.

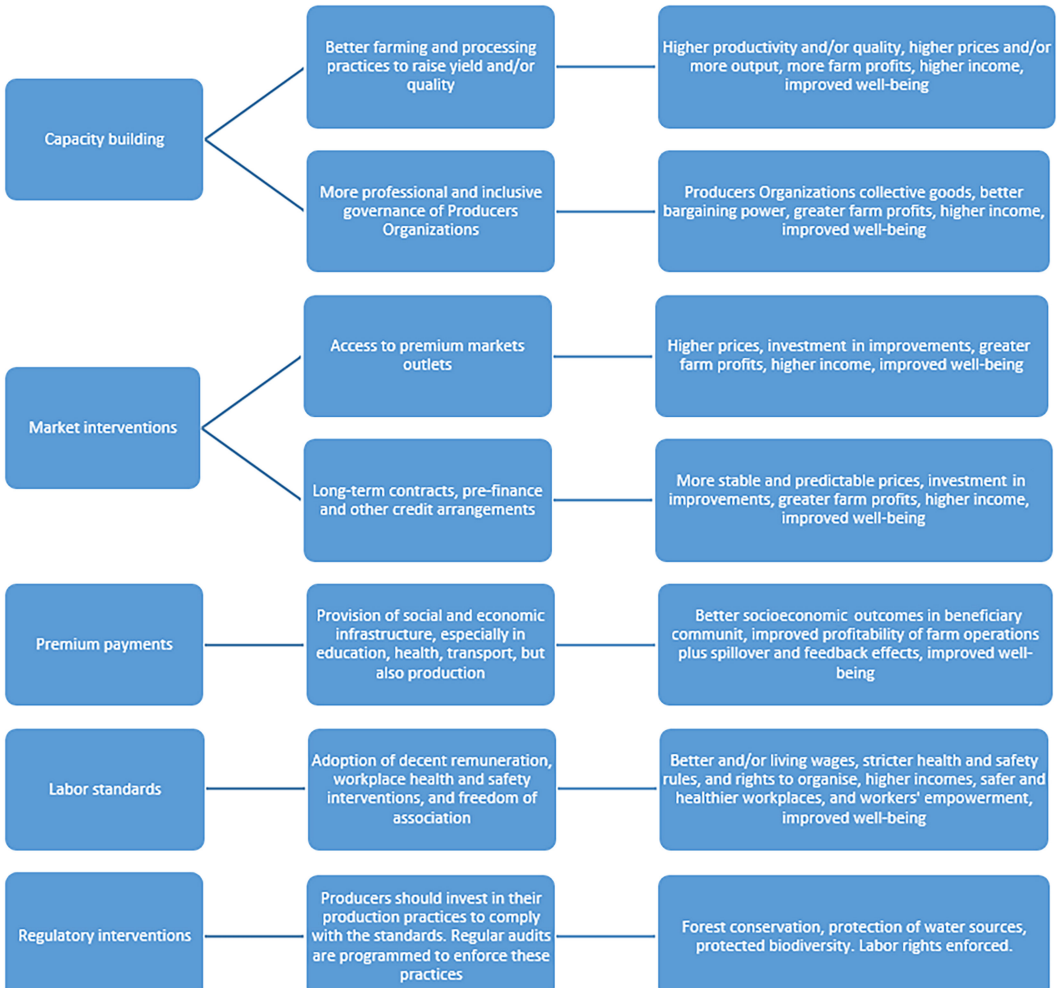
As the objective of this study is to review what the current literature on impact of VSS has covered and to align these results with the SDGs, this article does not discuss each theory of change separately. Although it is important to acknowledge that in practice, every VSS has a different and specific emphasis. For example, Fairtrade focuses on practices of social justice and the improvement of the livelihoods of small and disadvantaged producers. While Organic focuses on organic production in harmony with the ecosystem. UTZ focuses on responsible trade, including improved productivity, social and environmental practices. Other VSSs focus on conservation of ecosystems and biodiversity, such as Rainforest Alliance or Bird Friendly (Cosa, 2013; Reinecke et al., 2012; Ruben & Hoebink, 2015).

As mentioned before, these theories of change are based on the assumption that the adoption and implementation of the abovementioned practices will prompt improvements in the quality of life of the producers, while promoting a more sustainable and fair production and commercialisation. However, despite the fact that one of the main reasons producers participate in certification schemes is to gain access to better prices and markets, farmers do not always receive a premium for their certified coffee (Glasbergen, 2018), or this premium is not economically significant enough to reduce poverty (Akoyi & Maertens, 2018). In other cases, the premium does not directly translate into a higher net income, as certifications also require higher levels of investment to meet their requirements (Piao et al., 2019). Furthermore, the VSSs impose an increased number of responsibilities on producers in return for more opportunities to access markets and premium prices, but evidence from the field shows that these benefits are not always guaranteed (Bager & Lambin, 2020; Estrella et al., 2022; Meemken et al., 2021; Samper & Quiñones-Ruiz, 2017).

In this global context, with a current increase in the amount of demanded and produced certified/verified coffee (Panhuysen & Pierrot, 2020) and with the VSS effectiveness under scrutiny, it is important to examine the current evidence on the contribution of VSS towards sustainability. The SDGs framework stands up as a useful tool for this analysis. In despite of the fact that some VSSs precede by decades the SDG, VSS can be used as implementation tools for the achievement of these goals, as they share similar objectives (Marx & Depoorter, 2020) and VSSs already have an implementation platform on the field. Marx and Depoorter (2020) also highlight the complementarities between VSS requirements and the SDGs. Other factor in common between VSS and SDGs governance systems is the use of not legally binding tools to promote sustainability, instead, compliance and adherence are based on voluntary agreements and dialogue (Biermann et al., 2017; Reinecke et al., 2012).

2.1 | The SDGs and VSS

The SDGs framework consists of 17 goals, 169 associated targets that countries should achieve by 2030 and 231 unique indicators to measure these achievements (UN, 2015). The SDGs, as a global tool for sustainability, provide an opportunity to develop a wider framework for analysing the impact of the VSS.



Adapted after (Marx et al., 2021; Oya et al., 2018)

FIGURE 1 General voluntary sustainability standard (VSS) theory of change

The SDGs are a continuation from the Millennium Development Goals (MDG), which focused their efforts mostly in developing countries. The SDG agenda aims to be broader than the previous MDG agenda, including poverty eradication, health, education, food security and a strong emphasis on protection and recovery of the environment as a key element for sustainable development. Besides, it also includes a specific goal for partnership and collaboration from all stakeholders (SDG 17, Partnership for the Goals), as it makes evident that governments alone will not be able to achieve its ambitious targets (UN, 2015).

Most sustainability criteria of VSS applied to the agricultural sector focus on the producer level. Indeed, as has been argued by Auld et al. (2015), the direct interventions by VSS mainly seek to influence the modes of production at producer level in a given supply chain. In addition, the impact literature on VSS has a strong focus on the producer level. Studies identified during the screening process that focused on other levels of GVCs were mostly theoretical, literature reviews or economic models but were lacking the empirical data needed for this review. Consequently, also, this review focuses on the producer level.

As mentioned by Grabs and Ponte (2019) roasters in industrialised countries dominate GVCs in the coffee sector. Given this, it would be important to also understand how their actions are affecting sustainability. Future research might try to explore deeply this and other sections of the GVC.

Summarising the previous work of Bissinger et al. (2020), Negi et al. (2020), Sachs et al. (2019) and WWF (2017) who previously linked VSS theories of change and the SDGs, the author of this article built a matrix connecting the main VSS actions mentioned in the literature with their respective SDG (Table 1). This analysis found that 14 out of 17 goals are covered by at least one VSS action in the coffee sector at the producer level, with the exception of SDG 11 (Sustainable Cities and Communities), SDG 14 (Life below Water) and SDG 16 (Peace, Justice and Strong Institutions).

As sustainability is multidimensional, the aforementioned actions and their related indicators may relate to more than one SDG; however, to enable the analysis, they are presented as only connected with one SDG. Some examples of variables that might be covered by more than one SDG include gender-related indicators, which are all covered under SDG 5 (Gender Equality), but they could also relate to SDG 10 (Reduced Inequalities). In addition, productivity indicators are under SDG 2 (Zero Hunger), as there is a specific SDG indicator related to productivity and sustainable agriculture, but they could also go under SDG 1 (No Poverty). As net income relates with efficiency, the decision was to leave them under SDG 2, but poverty variables and prices are under SDG 1 (No Poverty), as they relate directly with income and poverty. This table is the basis for the association of the variables extracted from the reviewed literature with a specific SDG. This association frames the analysis presented in the results section.[1]

3 | METHODS

Understanding current research gaps in terms of SDGs coverage, regions, measurements and studied certifications is key to focus future research efforts better. Identifying these gaps and quantifying the impact of VSS on sustainability can help with the implementation of mechanisms that contribute more efficiently and equitably to the achievement of the SDGs. Based on this premise, this article aims to answer one primary question and a series of secondary questions derived from it. The main question is how much do the VSSs contribute to achieving the SDGs in the coffee sector? In approaching this question, this article also addresses the following questions:

- How is progress currently being measured?
- Are some SDGs receiving more attention from researchers than others?
- What are the current research gaps remaining in the field?

[1]A detailed table showing the targets and indicators for each SDG and the related VSS activities covered by each report is available on request in the supporting information.

TABLE 1 The VSS actions and their association to the SDGs

SDG	VSS actions
No poverty (SDG 1)	- Capacity building projects - Improving access to credit (prefinance) and credit trainings - Quality premiums - Improving access to basic services - Providing insurance against shocks - Minimum price (price guarantees) and premiums - Risk assessments and management plans
Zero hunger and sustainable agricultural production (SDG 2)	- Improving harvesting practices, farm, and soil management - Mitigating pests and diseases with safer methods (i.e. biological controls) - Managing the use of chemicals - Increasing farmers' incomes and opportunities - Increasing productivity - Improving food security - Promoting efficient use of agricultural inputs - Improving access to markets
Good health and well-being (SDG 3)	- Promoting the use of first aid and free emergency care for employees' work-related injuries - Implementing occupational health and safety policies and training - Promoting appropriate handling and storage of agrochemicals and fertilisers - Promoting health coverage - Investment in community water and sanitation infrastructure
Quality education (SDG 4)	- Social bonus to promote local education and school improvements
Gender equality (SDG 5)	- Providing childcare services and benefits - Gender equality policies for certified cooperatives - Gender and women's empowerment guidance - Promoting gender equality in agricultural training
Clean water and sanitation (SDG 6)	- Having a wastewater disposal plan - Promoting efficient use of water and reduced consumption - Promoting equitable sanitation and hygiene - Promoting the access to affordable drinking water
Ensure access to affordable, reliable, sustainable and modern energy for all (SDG 7)	- Increasing producers' energy efficiency and reducing dependency on nonrenewable energy sources
Decent work and economic growth (SDG 8)	- Paying the national minimum wage or industry averages to all hired employees

TABLE 1 (Continued)

SDG	VSS actions
	- Having policies and processes in place to ensure proper wage adjustments
	- Implementing occupational health and safety policies and training
	- Promoting the freedom of association
	- Requiring the abolition of forced labour
	- Promoting diversification of income
	- Prohibition of child labour
	- Promoting improved household assets and standard of living
Industry, innovation, and infrastructure (SDG 9)	- Investment of premiums in local infrastructure
	- Promote adoption of new technologies
Reduced inequalities (SDG 10)	- Paying a living wage
	- Requiring participation in social impact assessments
	- Promoting of nondiscriminatory laws, policies, and practices
Responsible consumption and production (SDG 12)	- Environmentally sound management of chemicals and all waste
	- Sustainable management and efficient use of natural resources
	- Reducing waste generation through prevention, reduction, reuse, and recycling
	- Promoting awareness of sustainable lifestyles among citizens
	- Communicating these efforts to their customers and clients, helping them to make more sustainable consumption choices
Climate action (SDG 13)	- Soil management, and restoring tree coverage or other perennial vegetation
	- Climate change adaptation
	- Prevent deforestation
Life on the land (SDG 15)	- No deforestation of primary forest after a specified cut-off-date
	- Agroforestry systems or forest management plans that adhere to best management practices
	- Soil analysis for new production areas
	- Biodiversity and landscape protection
Partnerships for the goals (SDG 17)	- Multistakeholder standard development
	- Linkages to communities to support local development
	- Transparency and knowledge exchange

Note: Adapted from Bissinger et al. (2020), Negi et al. (2020), Sachs et al. (2019), WWF (2017).

Abbreviations: SDG, Sustainable Development Goal; VSS, voluntary sustainability standard.

3.1 | Inclusion criteria

This review covers three types of literature: empirical studies, systematic reviews and meta-analyses and grey literature. Empirical studies include all studies that have collected primary data in the field to measure the impact of the VSS and that have passed through a process of peer-review before publication. Systematic reviews and meta-analyses are also peer-reviewed but include studies that depend on secondary data (previous studies) for their analysis. The last type of literature includes studies published by certification/verification bodies or recognised organisations working in the field. This last group is not peer-reviewed and is included in this article in order to compare the discourse by the different actors involved in the production and diffusion of this data. The author used different inclusion criteria for each of the three types of literature (Table 2).

Dietz et al. (2022) identified three research approaches used to evaluate the impact of VSS: First, quasi-experimental studies: this type of studies assesses the effect of VSS against a counterfactual or control group of nontreated comparable producers; second, quantitative observational studies; these studies use VSS data of certified producers to measure changes over time; however, they lack credible counterfactuals; and third, qualitative approaches, which sometimes include also a control group for comparison. They concluded that nonexperimental approaches also provide useful information regarding the state of sustainability in certified production sites. Similarly, this study also includes the three type of studies, as long as they meet the inclusion criteria.

Cosa (2013) recommends that in order to learn more about impact, it is necessary to compare initiatives against a valid control group over time, as a counterfactual. They identified key factors needed to measure better the impact of VSS on sustainability. Among these, some relevant factors are as follows: the need for more longitudinal data to observe changes over time, the need for more replicable research, the inclusion of control groups to understand counterfactuals, transparent and clear methods to ensure reasonable attribution and inclusion of quantitative methods and statistical significance. Furthermore, they also suggested the need for multidimensional studies where comparison between the environmental, social and economic changes is possible. Nelson and Martin (2015) highlight the importance of including also qualitative evidence. These recommendations were considered when selecting the studies included in this article.

To identify the empirical studies, systematic reviews and meta-analyses, two academic engines were used: Web of Science and Elsevier. The sets of keywords used for the screening were 'Voluntary Sustainability Standards, VSS, Coffee' and 'Certification, coffee'. Then, the empirical studies reviewed by the meta-analyses and any systematic reviews which met the criteria were also included in the study. After the screening, 31 empirical studies were included

TABLE 2 Inclusion criteria

Type of study	Inclusion criteria
Empirical studies	• Year of publication 2015 or later • Coverage of at least one VSS in the coffee sector • Published in English • Inclusion of a control or reference group for comparison • In the case of quantitative studies, the inclusion of at least one method to control for possible bias • In the case of qualitative studies, inclusion a clear method for sample selection
Meta-analyses and systematic reviews	• Year of publication 2015 or later • Includes coffee studies in the analysis (if not exclusively) • Published in English • Clear, well-defined inclusion criteria
Grey literature	• Year of publication 2015 or later • Primary focus on the coffee industry • Published in English • Shows some level of traceable change over time

in the study along with seven meta-analyses and systematic reviews (Figure 2). The grey literature was found on the pages of the certification organisations or coffee companies,and through the Evidensia website, an online library collecting relevant publications from the sustainability field. Fifteen studies were included, representing seven out of the nine VSS included in this paper, with the exception of Bird Friendly and Global G.A.P.

The following step was a content exploration to extract the variables for the analysis. When the studies reported results at different levels (e.g. country, certification and cooperative), each result was counted as a separate value, as each one of them may have had a different effect, for example, positive for some groups but negative or nonsignificant for others. For the studies based on statistical analyses, a significant result was determined based on a statistical significance of $p < 0.05$. For the qualitative studies, a result was considered significant if the authors reported a significant effect accompanied by evidence supporting the claim. In addition, for systematic reviews, a variable was 'significant' if more than 50% of the results showed the same trend. In the case of grey literature, for studies without a counterfactual group, the results were considered 'significant' when the authors reported a trend of at least 10% change over the measured period.

The studies were linked to an SDG if the study contained at least one variable related to the specific SDG. It is important to notice the words 'study' and 'report' that are used interchangeably in this article. As sometimes reports may come from the same study, when the word 'study' is used, it refers to a report.

After the screening process, the selected articles cover the following VSS, 4C (2007), Bird Friendly (1998), Global G.A.P. (1997), Fairtrade (1988), Nespresso AAA (2006), Organic (1990), Rainforest Alliance (1993), Starbucks (2004) and UTZ (2002) (now merged with Rainforest Alliance). Starbucks and Nespresso AAA are company-based, 4C is classified as sector-wide and the rest are Voluntary-Third Party VSS (Ruben & Hoebink, 2015). All these studied certifications, with the exception of Starbucks C.A.F.E. Practices have developed theories of change (4C Association, 2013; Fairtrade International, 2013; Rainforest Alliance, 2021a, 2021b; UTZ, 2017).

It is important to notice that the distribution of SDGs covered by the different studies reflects the specialisation of each VSS, as shown in the results section. This happens because the selected studies probably have taken into account the standards and their respective theories of change to choose the variables to be measured, using a theory-based impact evaluation approach, as suggested by Nelson and Phillips (2018) and Weiss (1997). For example, studies covering the Bird Friendly certification focus only on SDG 13 (Climate Action) and SDG 15 (Life on the Land), reflecting the limited scope of the certification on the environmental aspect of sustainability. Another clear example relates to SDG 5 (Gender Equality), which is covered for studies related to either Fairtrade or UTZ, the two VSS covering explicitly this topic.

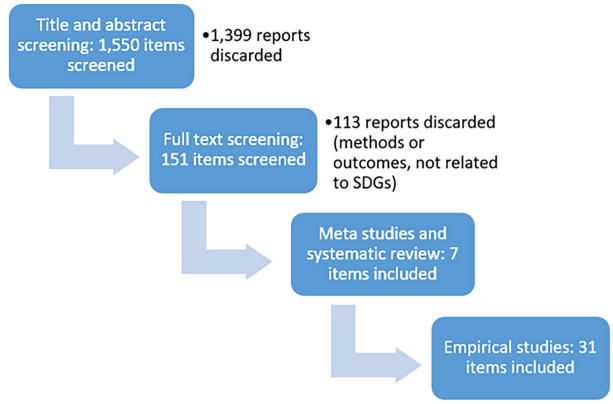


FIGURE 2 Screening process for peer-reviewed selected papers

4 | RESULTS

4.1 | Description of the sample

4.1.1 | Empirical studies

Bissinger et al. (2020) found that the three SDGs most widely covered by the VSS activities are SDG 2 (Zero Hunger), SDG 8 (Economic Growth) and SDG 12 (Responsible Consumption and Production). The 31 empirical studies included mirror this trend for SDG 8 (Economic Growth) and SDG 2 (Zero Hunger), even though none of the selected studies covered SDG 12 (Responsible Consumption), as this SDG is mostly measured at consumer country level. The third most-covered SDG was SDG 1, No Poverty (Table 3).

When broken down by region and country, the reports are distributed as follows: Latin America (10 reports, 7 countries), Africa (17 reports, 3 countries), Asia (3 reports, 1 country) and World (1 report). In the harvest year 2019/2020, 24 African, 20 Latin-American, 10 Asian and 1 Oceanian country reported their coffee production levels (ICO, 2021); consequently, these studies cover 20% (11 countries) of the total coffee-producing countries. These 11 countries account for almost 66% of the total coffee production in the same year. This means that current empirical studies have focused on some of the biggest coffee producer countries by region. Some relevant producer countries not covered by these studies are Vietnam and Indonesia in Asia, Peru in Latin America, Tanzania and Ivory Coast in Africa. As previously stated, the SDGs with the most coverage were SDG 2, Zero Hunger (21 reports), SDG 1, No Poverty (14 reports) and SDG 8, Economic Growth (11 reports). The SDG with the least coverage was SDG 7, Affordable and Clean Energy, with only two reports (Figure 3).[2]

The last descriptive shows the number of SDGs covered for each certification or group of certifications studied (Figure 4). Some studies did not specify the certification they were evaluating; these are presented under two categories. The first one is 'Not specified'; this was used when the author mentioned the studied certifications, but the analysis performed did not allow for the distinction of individual effects by certification. The second one is 'General certification'; this term was used when the author did not specify the covered certifications.

Studies for Fairtrade and UTZ covered the higher number of SDGs (10 SDGs). Bird Friendly, as it is more specific, covered the least number of SDGs, just SDG 13 (Climate Action) and SDG 15 (Life on the Land). SDG 5 (Gender Equality) and SDG 7 (Affordable and Clean Energy) are just covered by studies addressing the impact of Fairtrade or UTZ; similarly, SDG 4 (Quality Education) is just covered by studies related to Fairtrade, Organic and Rainforest Alliance. SDG 17 (Partnership for the Goals) is only covered by studies related to UTZ.

Having enough reliable, diversely sourced and comprehensive information about the contribution of the different certifications on the SDGs is important in order to take action if good practices that could be replicated or ineffectiveness that might be addressed are identified.

4.1.2 | Meta-analyses and systematic reviews

This article identified seven systematic reviews and meta-analyses published since 2015 that met the inclusion criteria (Table 4). Of these studies, only one, Bray and Neilson (2017), focuses exclusively on coffee. Regarding the number of studies by certification, each certification is covered by at least four reports, with the exception of Bird Friendly, Nespresso AAA and Starbucks C.A.F.E. Practices, which are covered by just one study.

[2]A detailed table showing the targets and indicators for each SDG and the related VSS activities covered by each report is available on request in the supporting information.

TABLE 3 Summary of empirical studies included

Author	Title	Country	Year of data collection	Certifications	SDG
Akoyi and Maertens (2018)	Walk the Talk: Private Sustainability Standards in the Ugandan Coffee Sector	Uganda	Feb–May 2014	Fairtrade-Organic, UTZ-Rainforest Alliance-4C	1, 2
Akoyi et al. (2020)	Private Sustainability Standards and Child Schooling in the African Coffee Sector	Ethiopia Uganda	Feb–May 2014	Fairtrade-Organic, UTZ- Rainforest Alliance -4C	2, 4, 8
Bose et al. (2016)	Does Environmental Certification in Coffee Promote "Business as Usual"? A Case Study from the Western Ghats, India	India	2011–2014	Rainforest Alliance	2, 3, 8, 15
Caudill and Rice (2016)	Do Bird Friendly® Coffee Criteria Benefit Mammals? Assessment of Mammal Diversity in Chiapas, Mexico	Mexico	2014	Bird Friendly	13, 15
Chiputwa et al. (2015)	Food Standards, Certification, and Poverty among Coffee Farmers in Uganda	Uganda	2012	Fairtrade, Organic, UTZ	1, 2
Chiputwa and Qaim (2016)	Sustainability Standards, Gender, and Nutrition among Smallholder Farmers in Uganda	Uganda	2012	Fairtrade or Organic or UTZ (Not specified)	2
Cramer et al. (2017)	Fairtrade and Labour Markets in Ethiopia and Uganda	Ethiopia Uganda	2010–2013	Fairtrade	8
Dietz, Estrella Chong, et al. (2020)	How Effective is Multiple Certification in Improving the Economic Conditions of Smallholder Farmers? Evidence from an Impact Evaluation in Colombia's Coffee Belt	Colombia	2016	Nespresso, Starbucks, 4C, Rainforest Alliance (additionally over Fairtrade)	1, 2, 8

(Continues)

TABLE 3 (Continued)

Author	Title	Country	Year of data collection	Certifications	SDG
Dietz et al. (2021)	Mainstreamed Voluntary Sustainability Standards and their Effectiveness: Evidence from the Honduran Coffee Sector	Honduras	2016	Fairtrade-Organic, Fairtrade, Rainforest Alliance, UTZ, 4C	2, 3, 6, 8, 15
Dijkdrenth (2015)	Gender Equity within UTZ Certified Coffee Cooperatives in Eastern Province, Kenya	Kenya	2011	UTZ	5
Elbers et al. (2015)	The Impact of UTZ Certification on Smallholder Farmers in Uganda	Uganda	2009–2012	UTZ	1, 2, 8, 17
Haggar et al. (2015)	Tree Diversity on Sustainably Certified and Conventional coffee Farms in Central America	Guatemala Nicaragua Costa Rica	Not specified	Organic	15
Haggar et al. (2017)	Environmental-economic benefits and trade-offs on sustainably certified coffee farms	Nicaragua	Not specified	Starbucks CAFÉ Practices, UTZ, Fairtrade-Organic, Fairtrade, Rainforest Alliance	1, 2, 13, 15
Hardt et al. (2015)	Does certification improve biodiversity conservation in Brazilian coffee farms?	Brazil	1995–2011	Rainforest Alliance	13, 15
Ibanez and Blackman (2016)	Is Eco-Certification a Win-Win for Developing Country Agriculture? Organic Coffee Certification in Colombia	Colombia	2008	Organic	2, 6, 8, 13, 15
Jena et al. (2017)	Can Coffee Certification Schemes Increase Incomes of Smallholder Farmers? Evidence from Jinotega, Nicaragua	Nicaragua	2010	Fairtrade, Organic	2
Karki et al. (2016)	Fair Trade Certification and Livelihoods: A Panel Data Analysis of Coffee-Growing Households in India	India	2010–2011	Fairtrade	1, 2

TABLE 3 (Continued)

Author	Title	Country	Year of data collection	Certifications	SDG
Meemken and Qaim (2018)	Can Private Food Standards Promote Gender Equality in the Small Farm Sector?	Uganda	2015	UTZ or Fairtrade (Not specified)	5
Meemken, Spielman, and Qaim (2017)	Trading off Nutrition and Education? A Panel Data Analysis of the Dissimilar Welfare Effects of Organic and Fairtrade Standards	Uganda	2012–2015	Fairtrade, Organic	2, 4, 8, 13
Minten et al. (2018)	Tracking the Quality Premium of Certified Coffee: Evidence from Ethiopia	Ethiopia	2014 survey 2006–2014 admin data	Fairtrade or Organic (Not specified)	1
Mitiku et al. (2017)	Do Private Sustainability Standards Contribute to Income Growth and Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia	Ethiopia	2014	Rainforest Alliance, Fairtrade-Organic, Fairtrade, Organic	1, 2
Mitiku et al. (2018)	Certification of Semi-Forest Coffee as a Land-sharing Strategy in Ethiopia	Ethiopia	2014	Rainforest Alliance	2
Ranjan Jena and Grote (2017)	Fairtrade Certification and Livelihood Impacts on Small-Scale Coffee Producers in a Tribal Community of India	India	2017	Fairtrade	2
Rueda et al. (2015)	Eco-Certification and Coffee Cultivation Enhance Tree Cover and Forest Connectivity in the Colombian Coffee Landscapes	Colombia	2003–2009	Rainforest Alliance	13
Schoonhoven-Speijer and Ruben (2015)	Maintaining Sustainable Livelihoods: Effects of UTZ Certification on Market Access, Risk Reduction and Livelihood Strategies of Kenyan Coffee Farmers	Kenya	2011	UTZ	1, 17

(Continues)

TABLE 3 (Continued)

Author	Title	Country	Year of data collection	Certifications	SDG
Takahashi and Todo (2017)	Coffee Certification and Forest Quality: Evidence from a Wild Coffee Forest in Ethiopia	Ethiopia	2005, 2010	Rainforest Alliance	13
Tayleur et al. (2018)	Where are Commodity Crops Certified, and what Does it Mean for Conservation and Poverty Alleviation?	World	2013	General certification	1, 2, 13, 15
van Rijsbergen et al. (2015)	The Effects of Coffee Certification in Kenya	Kenya	2009–2013	Fairtrade, UTZ	1, 2, 3, 5, 7, 8
van Rijsbergen et al. (2016)	The Ambivalent Impact of Coffee Certification on Farmers' Welfare: A Matched Panel Approach for Cooperatives in Central Kenya	Kenya	2009, 2013	Fairtrade, UTZ-Fairtrade	1, 2, 3, 4, 5, 6, 7, 8
Vellema et al. (2015)	The Effect of Specialty Coffee Certification on Household Livelihood Strategies and Specialisation	Colombia	2012	Starbucks or Nespresso (Not specified)	1, 2, 8
Woubie et al. (2015)	Impact of Multiple Certification on Smallholder Coffee Farmers' Livelihoods: Evidence from Southern Ethiopia	Ethiopia	2010–2011	Fairtrade,-Organic, Fairtrade-Organic-UTZ	1,2, 8

Abbreviation: SDG, Sustainable Development Goal.

In reference to the number of countries covered by the studies, 30 countries were explicitly mentioned in the research, 1 study covered the whole world and 2 studies did not specify the countries covered by the reviewed papers. Out of the mentioned countries, 12 are located in Latin America/the Caribbean, 7 in Asia and 11 in Africa.

When analysing the total number of reports by SDG, one observes a reduction in the number of SDGs covered, as SDG 6 (Clean Water) and SDG 7 (Affordable and Clean Energy) are not represented in the studies. This may relate to the inclusion criteria for the different reviews, which could have limited the number of studies meeting these requirements (Figure 5). SDG 13 (Climate Action) is covered by only one study. SDG 2 (Zero Hunger) is again the most covered one, followed by SDG 1 (No Poverty) and SDG 8 (Economic Growth). Similar to empirical studies, this type of literature does not cover SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible Consumption).

Compared with the other two types of literature, these studies included more aggregated results that make it impossible to identify the specific effect of an individual certification. When analysing by certification/verification (Figure 6), SDG 1 (No Poverty) to SDG 5 (Gender Equality) are covered by at least one report of the studied certifications, as are SDG 8 (Economic Growth) and SDG 17 (Partnership for the Goals). SDG 13 (Climate Action) is covered just by literature grouping different certifications under 'not specified'.

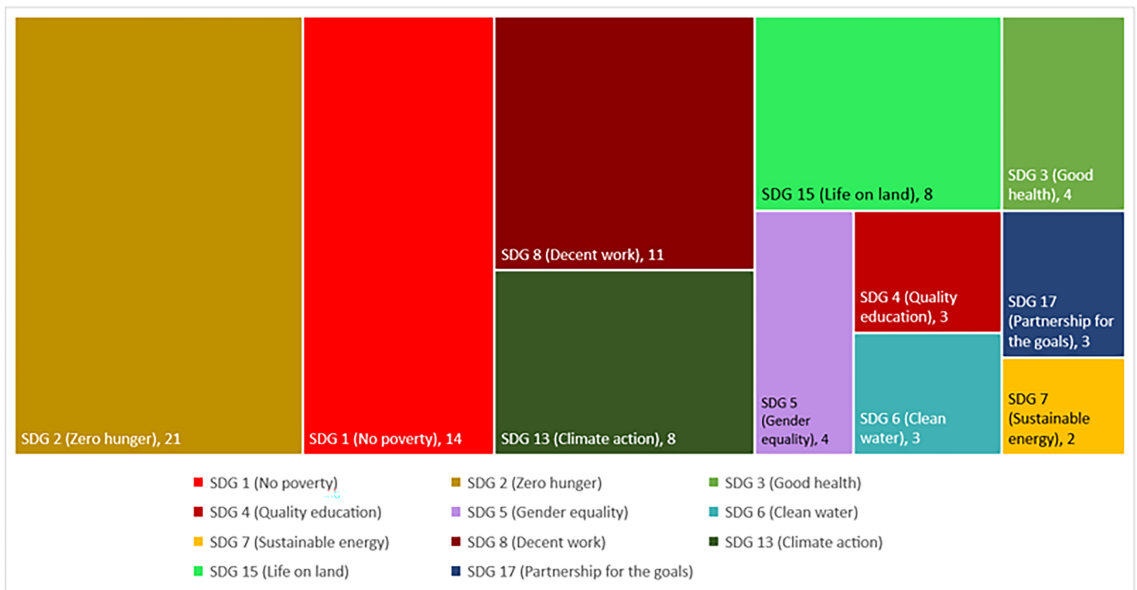


FIGURE 3 Number of empirical studies, by Sustainable Development Goal (SDG)

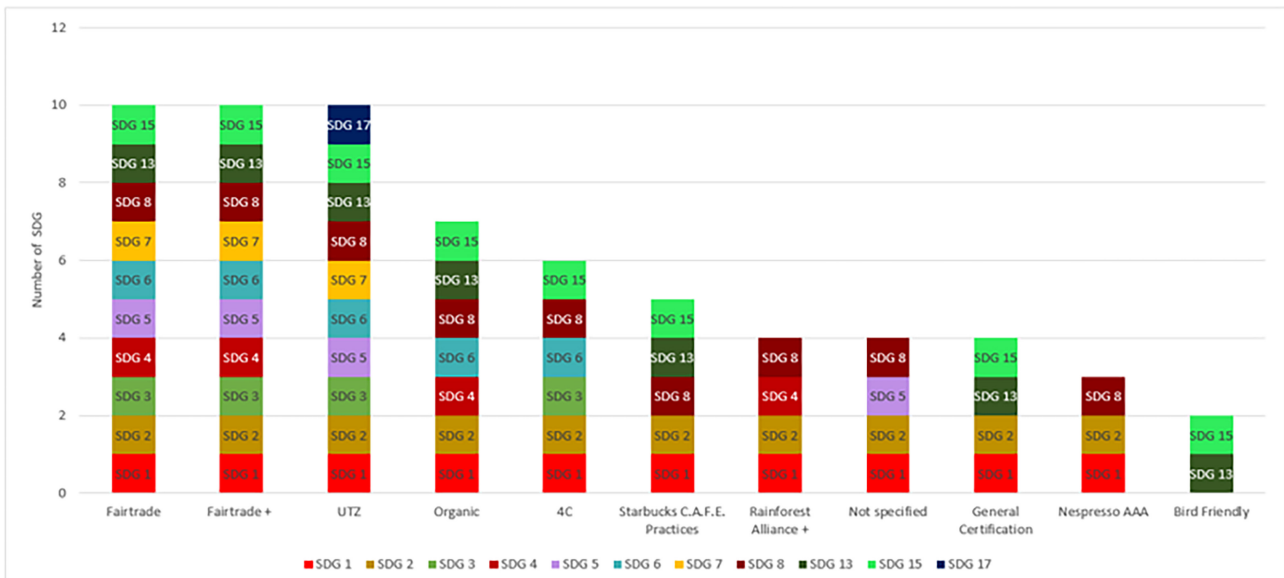


FIGURE 4 Number of Sustainable Development Goal (SDG) covered by empirical studies, by certification

TABLE 4 Summary of the meta-analyses and systematic reviews included

Author	Title of the article	Year of publication	Covered coffee certifications	Covered SDG
Bray and Neilson (2017)	Producer-Level Benefits of Sustainability Certification	2017	Fairtrade, Organic, Rainforest Alliance, 4C, UTZ	1, 2, 3, 4, 5, 8, 15, 17
Crowder and Reganold (2015)	Financial Competitiveness of Organic Agriculture on a Global Scale	2015	Organic	1, 2, 8
DeFries et al. (2017)	Is Voluntary Certification of Tropical Agricultural Commodities Achieving Sustainability Goals for Small-Scale Producers? A Review of the Evidence	2017	Fairtrade, Organic, Rainforest Alliance, UTZ	2, 15
Garrett et al. (2021)	Have Food Supply Chain Policies Improved Forest Conservation and Rural Livelihoods? A Systematic Review	2021	Bird Friendly, Rainforest Alliance, UTZ, 4C, Starbucks C.A.F.E. Practices, Nespresso AAA	2, 13
Meemken (2020)	Do Smallholder Farmers Benefit from Sustainability Standards? A Systematic Review and Meta-Analysis	2020	Fairtrade, UTZ-Fairtrade, Organic-Fairtrade-FSC, Fairtrade-Organic-Rainforest, Fairtrade-Organic, Organic, Organic-Rainforest, Organic-Global GAP, UTZ, UTZ-Rainforest-4C, Rainforest Alliance, Global GAP, General Certification	1, 2, 8
Oya et al. (2018)	The Effectiveness of Agricultural Certification in Developing Countries: A Systematic Review	2018	Fairtrade, Rainforest Alliance, UTZ, Global GAP, 4C, General Certification	1, 2, 3, 4, 8
Traldi (2021)	Progress and Pitfalls: A Systematic Review of the Evidence for Agricultural Sustainability Standards	2021	Fairtrade, Organic, Global GAP, Rainforest Alliance, UTZ, 4C	1, 2, 5, 15, 17

Abbreviation: SDG, Sustainable Development Goal.

4.1.3 | Grey literature

For grey literature, five out of the 15 reports relied on case studies for the analysis. Three reports included quasi-experimental methods with control and intervention groups. Four reports relied on administrative records. Two of the reports used meta-analysis. Regarding authorship, eight of the reports included one of the coffee companies, a certification/verification entity or a related organism (such as ISEAL) as an author. Seven reports were done by independent organisations.

FIGURE 5 Number of meta-analyses and systematic reviews, by Sustainable Development Goal (SDG)

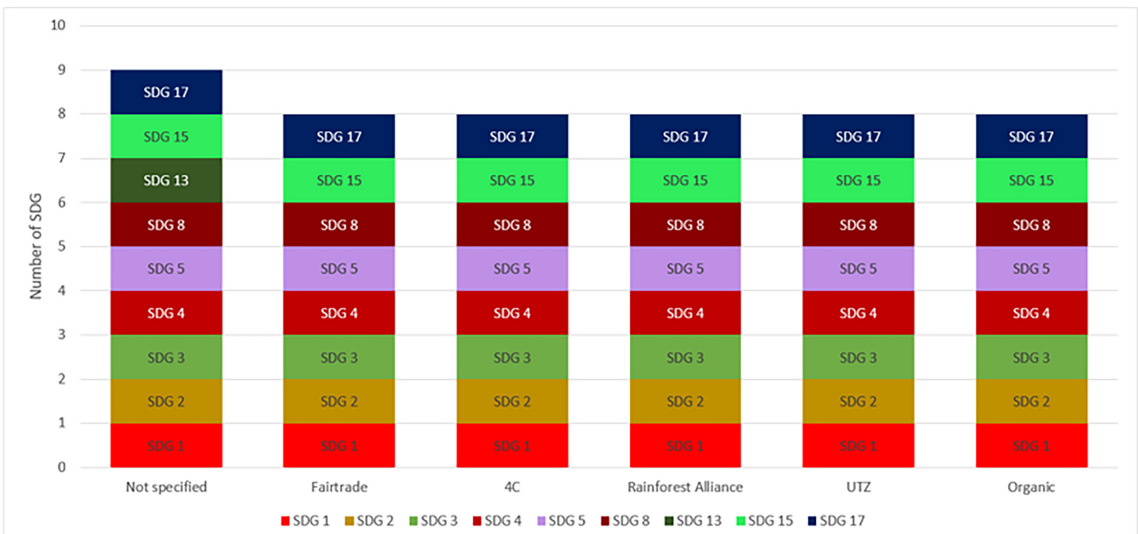


FIGURE 6 Number of Sustainable Development Goals (SDGs) covered by meta-analyses and systematic reviews, by certification

The most studied certification was Fairtrade with nine reports covering it individually, and three reports covering it as multiple certification. UTZ is the second most covered certification, with five reports addressing it individually and one under a multiple certification. The least studied is Starbucks C.A.F.E. Practices with only one report. Bird Friendly and Global G.A.P. certification are not covered by the selected grey literature (Table 5).

Grey literature included 12 SDGs out of the 14 SDGs covered in this study (Figure 7), with the exception of SDG 7 (Sustainable energy) and SDG 10 (Reduced inequalities). One reason for the higher coverage of SDGs may be the access to internal records. An alternative reason could be the need of certification organisations to report results or show increased transparency and data sharing, factors that might have motivated the organisations to create reports that are more detailed. SDG 5 (Gender Equality) and SDG 9 (Industry, Innovation and Infrastructure) are the least covered. The most covered SDG is SDG 1 (No Poverty), followed by SDG 2 (Zero Hunger) and SDG 8 (Economic Growth). Another interesting finding is the higher number of reports and certifications covering SDG 17 (Partnership for the Goals). In the framework used for this analysis, this SDG relates to legitimacy through accountability, participatory certification processes (multistakeholder partnerships) and linkages with the communities and cooperatives (Policy and institutional coherence and multistakeholder partnerships), all elements covered under SDG 17.

When analysing the number of SDGs studied by certifications (Figure 8), one observes that SDG 1 (No Poverty) and SDG 2 (Zero Hunger) are covered by all certifications studied. SDG 4 (Quality Education), SDG 6 (Clean Water), SDG 8 (Economic Growth) and SDG 15 (Life on the Land) are covered by seven certifications (including one multiple certification), with the exception of Organic. SDG 5 (Gender Equality) is just covered by studies of Fairtrade and Fairtrade-Organic, evidencing again the relationship between the used evaluation frameworks and VSS theories of change.

It is important to note that the grey literature covers only two multiple certifications, Fairtrade-UTZ and Fairtrade-Organic (Both under Fairtrade +). One reason for this finding may be that some of the reports included multiple certified producers, but as these reports were generated mainly by a specific organisation, the organisation may have decided to report only their certification of interest, not taking into account possible additionality effects.

After analysing the three types of literature, it is possible to identify a common gap in terms of understanding the impact of VSS on SDG 5 (Gender Equality). Additionally, SDG 9 (Industry, Innovation and Infrastructure) is covered only by one study related to Fairtrade (Nelson et al., 2016).

4.2 | Findings on the impact of voluntary sustainability standards on the SDGs

4.2.1 | SDG covered by the reviewed literature and related variables used to measure impact

The second part of the results section focuses on understanding the impact of VSSs on the SDGs based on the significance and direction of the effect (positive or negative) of the selected variables.[3] As previously mentioned, each variable extracted has been assigned to only one SDG and VSS activity. These variables were also classified as outcome or intermediate. Adopted practices and results that may contribute to an improved quality of life, but do not directly measure well-being or an SDG indicator, were classified as intermediate variables. The intermediate variables included conservation practices, good agricultural practices, productivity, income from coffee and ecosystem recovery among others. Outcome variables are those measuring well-being or a direct contribution towards an SDG target, such as income per person, net and total household income, poverty, health status, nutritional status, women's participation in leadership positions, quality of water, biodiversity levels and carbon capture among others. Dependent variables not related to any SDG were not taken into account in this study.

This process led to the first striking finding of this study: the diversity of measurements used by researchers. For example, poverty is measured sometimes in percentage of population, other times as a poverty index or a poverty gap

[3]A detailed table showing the targets and indicators for each SDG and the related VSS activities covered by each report is available on request in the supporting information.

TABLE 5 Grey literature studies included in the review

Author	Title	Organisation	Certification	SDG
De los Rios (2018)	Impacts of Certification on Small Coffee Farmers Western Kenya, 2014–2017	COSA/ISEAL	UTZ-Fairtrade	1, 2, 6, 8, 13, 17
Dietz, Grabs et al. (2020)	The Impact of Voluntary Sustainability Standards on Sustainable Coffee Production in Latin America	Transsustain	Fairtrade, Fairtrade-Organic, Rainforest Alliance, UTZ, 4C, Nespresso AAA, Starbucks C.A.F.E. Practices	1, 2, 4, 6, 8, 13, 15
Dragusanu et al. (2018)	The Effects of Fair Trade Certification: Evidence From Coffee Producers in Costa Rica	National Bureau of economic research	Fairtrade	1, 2, 8
Elliot (2018)	What Are We Getting from Voluntary Sustainability Standards for Coffee	Centre for Global Development	Fairtrade, UTZ, Rainforest Alliance, 4C	1, 2, 3, 4, 8
Evidensia (2019)	Effects of Voluntary Sustainability Standards and Related Supply Chain Initiatives on Yield, Price, Costs and Income in the Agriculture Sector	Evidensia, ISEAL, WWF, Rainforest Alliance	4C, Rainforest Alliance, Fairtrade, UTZ	1, 2
Linne et al. (2019)	Analysis of the Producer Level Impact of Fairtrade on Environmentally Friendly Production, Biodiversity Conservation and Resilience and Adaptation to Climate Change	Fairtrade	Fairtrade	1, 6, 17
Loconto et al. (2019)	Participatory Analysis of the Use and Impact of The Fairtrade Premium	LISIS	Fairtrade	1, 4, 17
Mauthofer et al. (2018)	Follow Up Study – Assessing the Impact of Fairtrade on Poverty Reduction Through Rural Development	Fairtrade, Swiss confederation	Fairtrade	1, 8, 17
Minten et al. (2015)	Who Benefits from the Rapidly Increasing Voluntary Sustainability Standards? Evidence from Fairtrade and Organic Certified Coffee in Ethiopia	IFPRI	Fairtrade, Organic	1
Neilson et al. (2020)	Evaluation of the Impacts of Sustainability Standards on Smallholder Coffee Farmers in Southern Sumatra, Indonesia	ISEAL	4C, Rainforest Alliance	1, 2, 8, 12, 15, 17

(Continues)

TABLE 5 (Continued)

Author	Title	Organisation	Certification	SDG
Nelson et al. (2016)	Fairtrade Coffee: A Study to Assess the Impact of Fairtrade for Coffee Smallholders and Producer Organisations in Indonesia, Mexico, Peru and Tanzania	Natural Resources Institute, University of Greenwich, Chatham, UK	Fairtrade, Fairtrade-Organic	1, 2, 3, 5, 8, 9, 13, 15, 17
Newsom and Milder (2018)	2018 Rainforest Alliance Impacts Report. Partnership, Learning, and Change	Rainforest Alliance	Rainforest Alliance	2, 3, 4, 6, 8, 13, 15
Rainforest Alliance (2021b)	Nespresso AAA Programme Latin America Impact Assessment Report. 2010–2020 Journey and Outlook	Nespresso	Nespresso AAA	1, 2, 6, 8, 12, 13, 15
UTZ (2016)	UTZ Impact Report. Combining Insights from UTZ Monitoring Data with Findings from Impact Studies	UTZ	UTZ	1, 2, 12, 13
World Agroforestry Centre et al. (2018)	Evaluation of UTZ Certification Focused on Coffee Businesses in Guatemala, Honduras and Nicaragua	World Agroforestry Centre	UTZ	1, 2, 3, 4, 8, 13, 15

Abbreviation: SDG, Sustainable Development Goal.

index. Interpretation and comparability of these variables is sometimes not possible. Biodiversity and conservation variables are sometimes also measured in different noncomparable scales. When counting the total number of the variables analysed, the grey literature presented the higher number, with 1030 variables (150 outcome variables), followed by the empirical studies, with 776 variables (124 outcome variables). Meta-analyses and systematic reviews included 140 variables (24 outcome variables).

Another outstanding observation is the overrepresentation of variables related to SDG 2, Zero Hunger (Figure 9). These variables relate especially to income, productivity and sustainable agricultural practices. There is also a remarkable dominance of intermediate variables over outcome variables. SDG 7 (Affordable and Clean Energy) is covered only by empirical studies; meanwhile, SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible consumption) are covered only by grey literature. SDG 12 (Responsible Consumption) was addressed by reports of UTZ, Nespresso AAA (Elaborated by Rainforest Alliance) and ISEAL. None of the analysed reports covers SDG 10 (Reduced inequalities) directly.

4.2.2 | SDG covered by reviewed literature: Identification of VSS contributions and knowledge gaps

The next level of analysis outlines the number of significant findings by SDG. The objective of this analysis is to identify the VSS contribution by SDG, as well as possible knowledge gaps and differences in the focuses between the different types of literature (Figure 10).

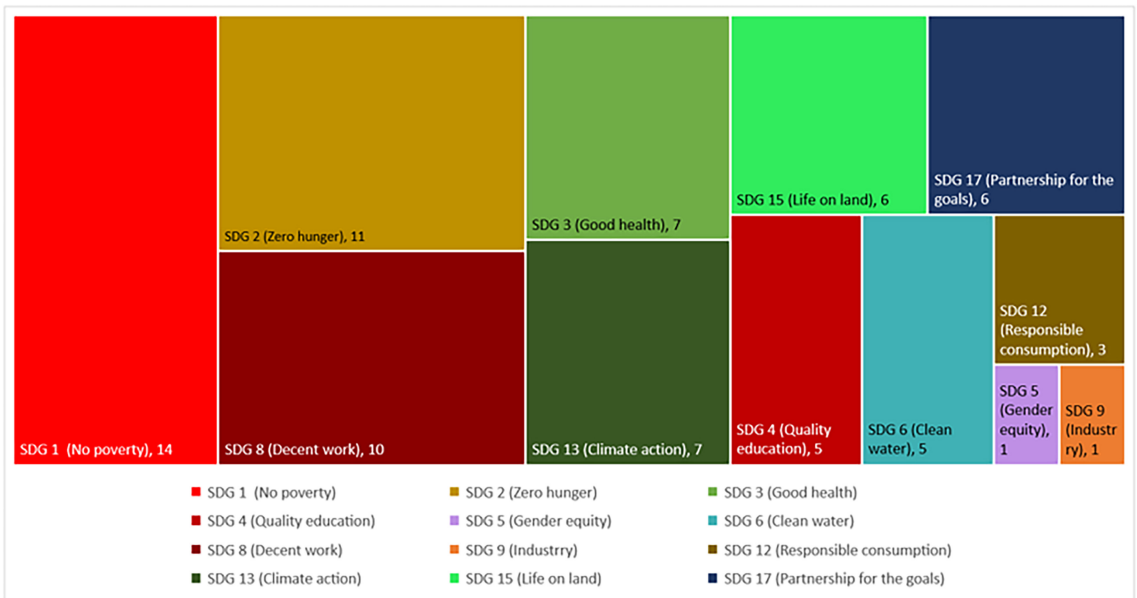


FIGURE 7 Number of grey literature studies, by Sustainable Development Goal (SDG)

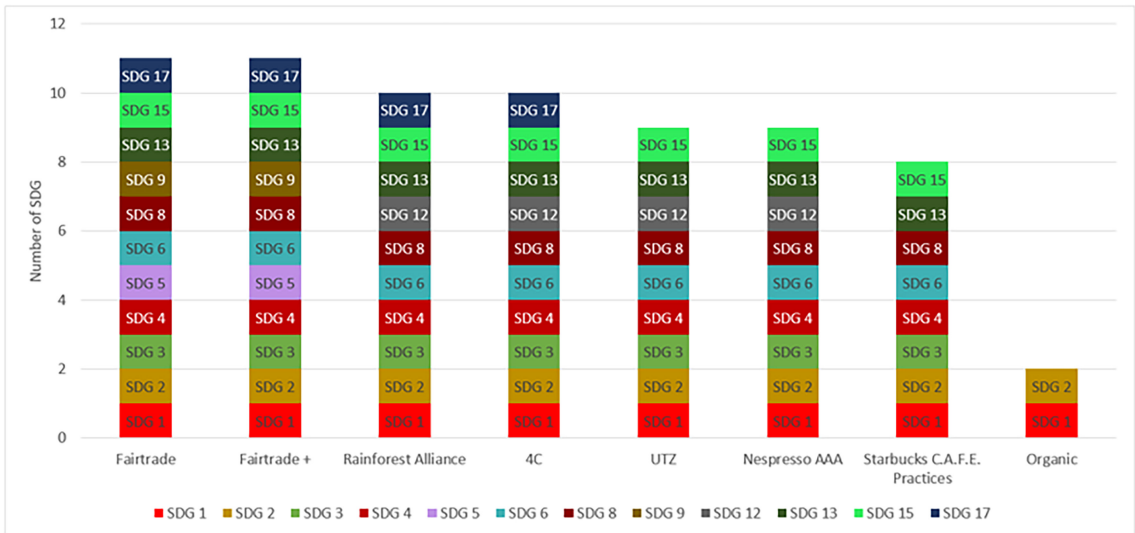


FIGURE 8 Number of Sustainable Development Goal (SDG) covered by grey literature, by certification

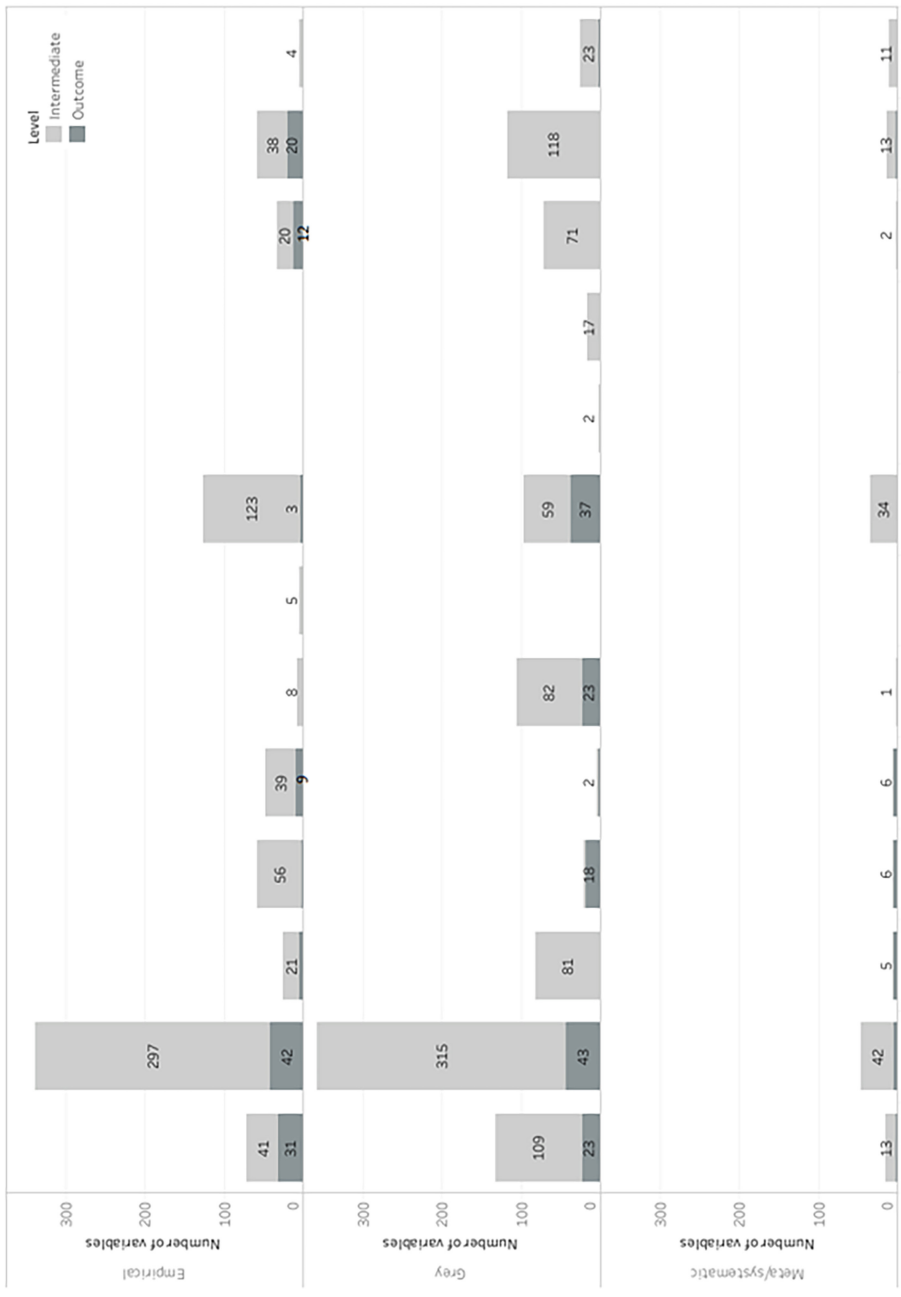


FIGURE 9 Number of variables analysed, by Sustainable Development Goal (SDG) and type of literature

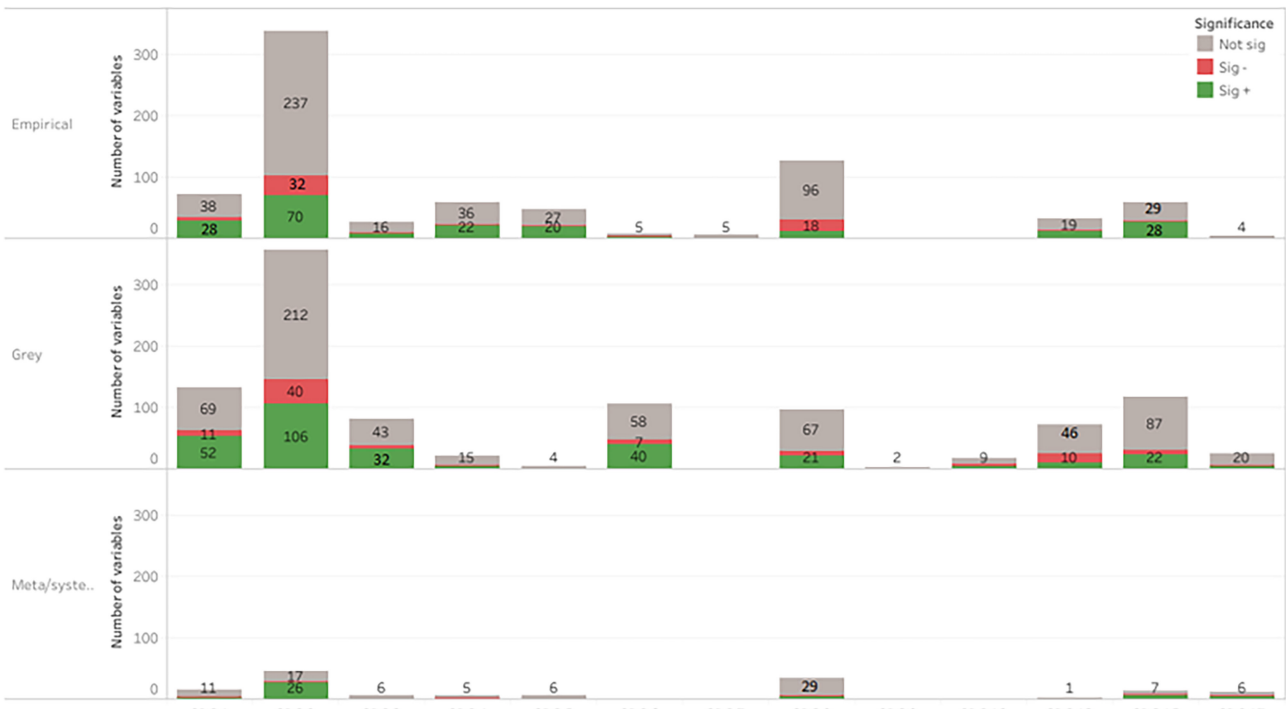


FIGURE 10 Number of significant findings, by Sustainable Development Goal (SDG) and type of literature

One can identify knowledge gaps for SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption) and SDG 17 (Partnership for the Goals). Furthermore, the field would also benefit from more peer-reviewed research covering SDG 3 (Good Health), SDG 5 (Gender Equality), SDG 4 (Quality Education), SDG 13 (Climate Action) and SDG 15 (Life on the Land).

Empirical studies involving SDG 8 (Economic Growth) showed a higher proportion of negative results compared with positive results. The negative results are related to wages, diversification of income, meanwhile the positive ones relate to diversification of income as well and household expenditure. A higher proportion of negative outcomes compared with positive ones was seen in grey literature for SDG 13 (Climate action), another highly relevant SDG as it relates to actions to mitigate the impact of the climate change. The negative findings are related to soil coverage and soil conservation practices.

For most SDGs, the number of not significant findings accounts for more than half of the total number of variables (Table 6). It is interesting to note that meta-analyses and systematic reviews for four out of the nine SDGs reported a higher percentage of positive significant results. Grey literature showed high positive significant results for SDG 3 (Good Health), SDG 6 (Clean Water) and SDG 8 (Economic Growth), key SDGs to measure effects on sustainable development. For SDG 3, the positive findings relate to use of protective equipment, training on use of agrochemical and presence of first aid kit. For SDG 6, they are related to treatment of residual water, presence of buffer zones around water sources and proper pesticide storage. For SDG 8, they related mostly to prevention of child labour and improved conditions for workers.

This analysis was also performed on intermediate and outcome variables separately. At the outcome level (Figure 11), one can identify no variables reported for SDG 7 (Affordable and Clean Energy) and SDG 12 (Responsible Consumption). Beyond, there are no significant[4] results for SDG 3 (Good Health), SDG 9 (Industry, Innovation and Infrastructure) and SDG 17 (Partnership for the Goals). For SDG 5 (Gender Equality), one can only identify one significant positive result found in the empirical literature, which is presented by Dijkdrenth (2015) and relates to the presence of women at influential positions (Qualitative results). Furthermore, SDG 6 (Clean Water), SDG 9 (Industry, Innovation and Infrastructure) and SDG 17 (Partnership for the Goals) are covered only by grey literature. For SDG 2 (Zero Hunger), grey literature showed a higher proportion of negative results compared with positive ones (7 negative vs. 4 positive); these negative results are associated with household income and they come from two independent studies (Dietz, Grabs, et al., 2020; Neilson et al., 2020). Positive results are associated mostly to improved food security, and they also came from one independent study (Dietz, Grabs, et al., 2020).

Compared with the results in Table 6, the proportion of not significant findings is higher for outcome variables (Figure 11); for grey literature, it increased from 61.3% to 72%, for meta-analyses and systematic reviews, it increased from 59.3% to 87.5% and remains about 65% for empirical studies (percentages not shown). SDG 7 (Affordable and Clean Energy) and SDG 12 (Responsible Consumption) are not covered at this level. The analysis of this graph identifies another research gap at outcome level variables, probably related to the difficulty of measuring them in the field.

For intermediate variables (Figure 12) only SDG 9 (Industry, Innovation and Infrastructure) is not covered by any type of literature. SDG 12 (Responsible Consumption) is just covered by grey literature; the results are most commonly not significant (nine out of 17 variables), followed by negative results (five out of 17). All of these negative results came from the evaluation of Nespresso AAA and related to garbage disposal. The remaining three positive ones came from different studies and correspond to 4C, Nespresso AAA and UTZ. SDG 7 (Affordable and Clean Energy) is covered only by two empirical studies, and the variable relates to expenditure in energy; results for this SDG are not significant for all studied variables.

Meta-analyses and systematic reviews cover the least number of SDGs, with only seven SDGs. For significant results, empirical studies showed a higher proportion of negative results for SDG 8 (Economic Growth) compared with positive ones (18 negative vs. 11 positive), negative results related to labour wages and diversification of income and positive ones relate to total expenditure, and diversification of income as well. At the intermediate variable level,

[4]Significant result as defined on p. 8 of this document

TABLE 6 Percentage of significant results, by SDG and type of literature

	Significant positive			Significant negative			Insignificant		
SDG	Empirical studies	Meta-analyses	Grey literature	Empirical studies	Meta-analyses	Grey literature	Empirical studies	Meta-analyses	Grey literature
SDG 1	38.89%	26.67%	39.39%	8.33%	0.00%	8.33%	52.78%	73.33%	52.27%
SDG 2	20.65%	56.52%	29.61%	9.44%	6.52%	11.17%	69.91%	36.96%	59.22%
SDG 3	30.77%	0.00%	39.51%	7.69%	0.00%	7.41%	61.54%	100.00%	53.09%
SDG 4	37.93%	16.67%	23.81%	0.00%	0.00%	4.76%	62.07%	83.33%	71.43%
SDG 5	41.67%	0.00%	0.00%	2.08%	0.00%	0.00%	56.25%	100.00%	100.00%
SDG 6	25.00%		38.10%	12.50%		6.67%	62.50%		55.24%
SDG 7	0.00%			0.00%			100.00%		
SDG 8	9.52%	8.82%	21.88%	14.29%	5.88%	8.33%	76.19%	85.29%	69.79%
SDG 9			0.00%			0.00%			100.00%
SDG 12			17.65%			29.41%			52.94%
SDG 13	37.50%	50.00%	14.08%	3.13%	0.00%	21.13%	59.38%	50.00%	64.79%
SDG 15	48.28%	50.00%	18.64%	1.72%	0.00%	7.63%	50.00%	50.00%	73.73%
SDG 17	0.00%	45.45%	16.00%	0.00%	0.00%	4.00%	100.00%	54.55%	80.00%
Total	26.03%	33.57%	28.64%	7.99%	3.57%	10.00%	65.98%	62.86%	61.36%

Abbreviation: SDG, Sustainable Development Goal.

identified knowledge gaps exist for SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption) and SDG 17 (Partnership for the Goals). In addition, the sector would benefit from more peer-reviewed studies related to SDG 3 (Good Health), SDG 6 (Clean Water), SDG 13 (Climate Action) and SDG 15 (Life on the Land), all of them key for sustainability.

A similar analysis was performed by certification. One evident knowledge gap identified is the absence of representation of multiple certifications, as only 11 out of the 53 studies included any type of multiple certification in their evaluations. In the future, it may be worthwhile giving more attention to multiple certifications, as the number of producers holding more than one certification is increasing (Dietz, Estrella Chong, et al., 2020). When an incremental effect of one certification over a previous one was measured, it was represented here as an independent effect.

When analysing the number of significant findings by certification (Figure 13), the number of variables covered differs depending on the type of literature, especially in the case of grey literature, where Nespresso AAA and Rainforest Alliance have the highest number of variables studied. Fairtrade has slightly fewer variable, and it is as well the one with the highest proportion of negative over positive significant findings for empirical studies and grey literature. Nespresso AAA had the highest proportion of negative over positive significant findings for grey literature, 26 negative to 47 positive, respectively.

4.2.3 | Sensitivity analysis: Measuring the magnitude of the significant positive effects

For empirical studies, a sensitivity analysis was performed measuring the magnitude of the positive impact for statistically significant results. From 202 significant positive results (equivalent to 26.03% of the total number of variables studied), 147 variables were selected for further analysis (Figure 14). Qualitative findings, variables not specifying units or those which establishing a threshold was not possible were excluded from the analysis. Three levels of impact were set: low, mid and high. For example, the low threshold for economic variables was set at 1.90 USD/day (inter-

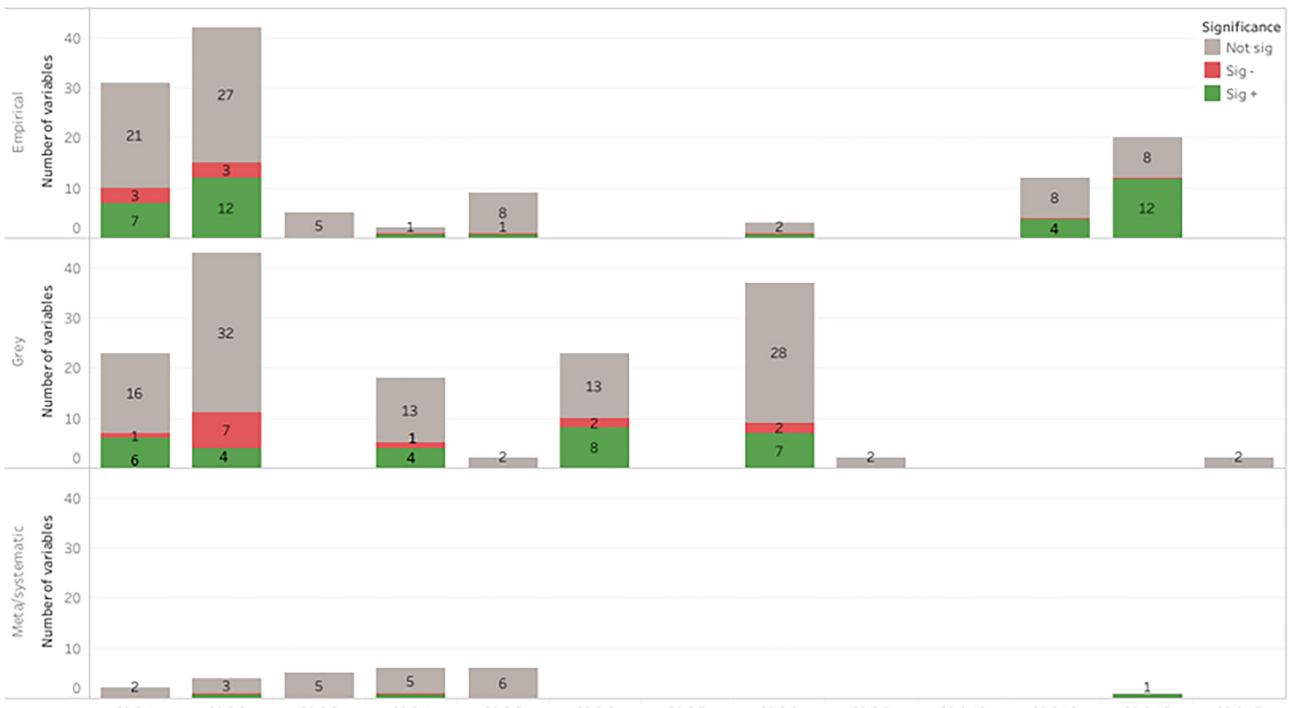


FIGURE 11 Number of significant findings at outcome level, by Sustainable Development Goal (SDG) and type of literature

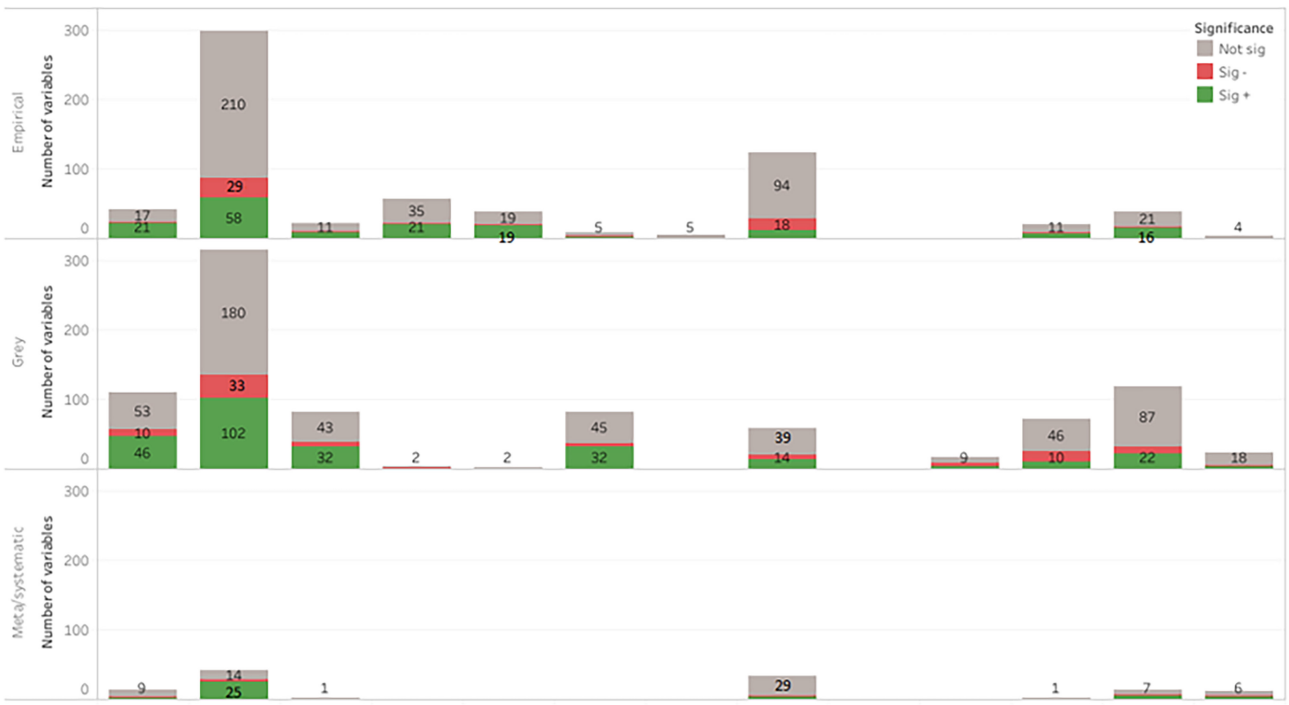


FIGURE 12 Number of significant findings at intermediate level, by Sustainable Development Goal (SDG) and type of literature

national poverty line), for productivity and percentage variables, increases of 10% over the average were set as low impact. Increases of 15% and 20% were used as mid and high impact levels, respectively.

For SDG 2 (Zero Hunger), 41% of all positive and statistically significant findings were not economically/technically significant (change smaller than the minimum set threshold). A similar percentage (38%) was found for SDG 8 (Economic growth). Taking into account that these two SDGs had the highest percentage of nonsignificant findings, this intensifies the finding, as a high percentage of the positive results is minimally contributing to economic growth or dignifying work conditions. For SDG 13 (Climate Action) and SDG 15 (Life on the Land), all findings had a high impact (implying changes of more than 20%). For SDG 6 (Clean Water), all results were mid or highly significant. These results might imply that producers are actually improving their conservation and agricultural practices, but this is not necessarily being translated into better income or labour conditions. In total, 49% of all variables showed high impact, 15% mid impact, 9% low impact and 27% showed no impact (Figure 14).

5 | DISCUSSION

The first part of this section discusses the identified knowledge gaps, and the final part elaborates on the methodologies and type of analyses found in the different kind of literature studied in this article.

In regard to knowledge gaps, SDG 8 (Economic Growth) and SDG 13 (Climate Action) are not sufficiently covered at outcome level for any of the three types of literature studied. Besides this, the number of insignificant findings (this means no difference between intervention and control groups, or difference over time) is also high, more than 50% for all three types of literature. These two SDGs are key for sustainable development and, in the future, should receive more attention from researchers. Out of the 53 studies included, only seven (13.2%) included at least one variable for SDG 5 (Gender Equality). More than half of the variables studied for SDG 5 (Gender Equality) were insignificant for empirical studies and 100% were insignificant for grey literature, meta-studies and systematic reviews. This highlights another gap in terms of knowledge and also in terms of evidence of the effectiveness of VSS collaborating in the reduction of gender disparities.

The absence of studies covering SDG 10 (Reduced inequalities) should receive more attention, as previous studies have suggested the possibility that VSS could lead to increased inequalities among producers and among the GVC. Some identified mechanisms for this are power imbalances inside the GVC, social capital inequalities that favour who gets certified in the first place and certifications being adopted initially by better off households, among other exacerbating mechanisms (Bray & Neilson, 2017; Hartlieb & Jones, 2009). For other crops, evidence regarding the existence of inequalities in certified farms has been identified, especially pointing out differences between wealthier and less wealthy producers or between certified producers and their workers (Phillips, 2014). Replicating this kind of exercises for coffee might be relevant to understand differences of VSS contributions to SDGs in different crops.

The limited number of peer-reviewed studies covering company-based certifications such as Nespresso AAA and Starbucks C.A.F.E. practices should also receive attention. An increased number of studies covering this type of VSS might be useful to identify possible green washing done by companies using their own standards. This concern has already been raised on previous literature (Bager & Lambin, 2020; Levy et al., 2016; Samper & Quiñones-Ruiz, 2017).

Other studies, not included in this review, analyse the contribution of certifications at different levels of GVCs. For example, how the limited effects of VSS are sometimes caused by governance factors beyond the producer level (Millard, 2017). Also, Ponte (2022) exposes how leading firms push their costs of sustainability compliance to producers. Contrastingly, Bissinger (2019) highlights that the Fairtrade scheme, in an ideal world, is designed to achieve producers' economic and social benefit. Other studies, also not in the scope of this article, as the one presented by Meemken, Veettil, and Qaim (2017), explore motivations of producers to join certifications. Contrasting this literature with the findings of this article under the light of the SDGs could provide new insights about how the VSS governance and the relationships among the different actors in the GVC affect the outcomes found in this article.

FIGURE 13 Number of significant findings, by certification

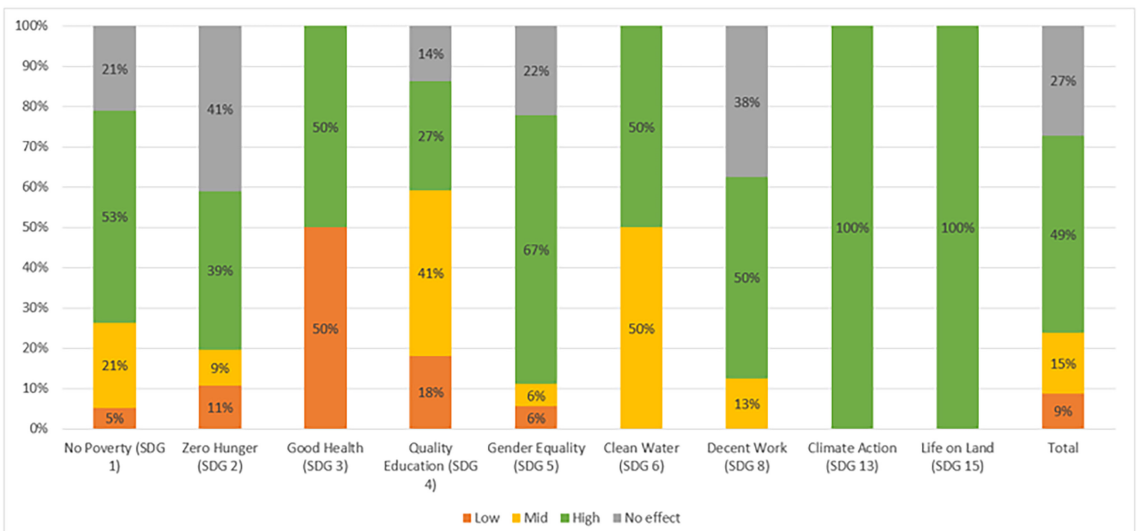


FIGURE 14 Percentage of positive significant findings, by magnitude of the effect

The methodologies employed in the empirical studies were rigorous; however, they only reported on a limited number of countries and used small sample sizes. In addition, the results of the empirical evaluations still fail to demonstrate that the VSS are consistently effective; rather, their effectiveness seems to be dependent on the local context. As mentioned by Nelson and Martin (2015), context is important to understand the impact of VSS; consequently, having a representative sample of countries and producers is relevant.

When analysing the content and results of the different types of literature, internal reports of the organisations showed high levels of compliance. These studies presented two main caveats: The first one was the absence of an equivalent control group to compare, which might have improved the reliability of the results, as recommended by Cosa (2013). The second one is the low percentage of change over time. This second caveat is the main reason for the low percentage of significant results coming from grey literature.

The methodological rigour found in the grey literature is, based on standards suggested by Cosa (2013), lower than that found in the other types of literature, as it relies more on anecdotal evidence, administrative data and interviews; besides, not all of the studies show clarity on the selection of the sample, and counterfactual are not always found. Despite this, the aggregated results for the grey literature do not differ much from those of the empirical peer-reviewed studies (Table 6). As mentioned by Nelson and Martin (2015), this information is valuable, as it provides relevant insights into how VSS are making a difference. Furthermore, this grey literature covers a higher number of countries and variables compared with the other two types of literature included in this article.

These findings are important to strengthen the already existing collaboration between the certification bodies and the independent researchers for information sharing and joint analysis in order to potentiate their strengths and overcome the limits presented by both types of literature. High-quality impact assessments as described by Cosa (2013) include ex ante and ex post information and take into account counterfactual; besides, they preferably depend on an independent agency, have long-term information for the analysis and they require some scientific capacity to be conducted properly. But sometimes these requirements could be more difficult to meet by organisations and researchers working under limited funding (Nelson & Martin, 2015).

Regarding the funding or connection of the independent researchers with any specific agenda or VSS, there was not much information in the reports. Transparency on this is also relevant in order to give visibility to already existing collaborations and connections.

The inclusion of only one crop in this study limits the understanding on how VSS could be contributing in other industries and agricultural sectors to the achievement of the SDGs. Even though, limiting the exercise to only one crop also facilitated the exercise of associating VSS interventions and measured indicators with a specific SDG, opening the door for other researchers to expand the analysis to other industries. Other limit to the study was the high variability of indicators used by researchers to measure the effect of VSS; this fact limited the scope of the analysis.

6 | CONCLUSION

This article summarises the current state of knowledge in relation to the impact of the VSS in the coffee sector as framed by the agenda of the SDGs. The elaborated framework connecting SDGs with VSS activities and specific indicators can be used to compare the VSS effects on SDGs for other crops or industries, facilitating the exercise for future researchers.

Returning to the questions of this study: How much do the VSS contribute to achieving the SDGs in the coffee sector? How is progress currently being measured? Are some SDGs receiving more attention from researchers than others are? What are the current research gaps remaining in the field? This study has summarised the findings regarding the current contribution of the VSS towards the achievement of the SDGs, highlighting the prevalence of insignificant results. This finding should motivate VSS organisations and other stakeholders to look jointly for innovative solutions that promote at the same time sustainable agriculture and better living conditions for producers, their families, and their workers.

It has also found that the current research in the coffee sector uses a scattered range of measurement techniques and concentrates on a small selection of countries; these findings are addressed in the closing paragraph of this section.

In response to question 3, most studies focused on SDG 1 (No Poverty), SDG 2 (Zero Hunger) and SDG 8 (Economic Growth), which are also the SDGs related to the core VSS actions, price/premiums for SDG 1 (No Poverty), sustainable agricultural practices for SDG 2 (Zero Hunger), working environments and diversification of income for SDG 8 (Economic Growth). Furthermore, as the majority of studies analyse only one pillar of sustainability, identification of trade-offs between SDGs is also limited.

The SDG agenda makes the call for improvements in data sharing and transparency. Different stakeholders in the coffee GVC have recently launched unified efforts in an attempt to consolidate indicators aligned with the common work of these organisations and the SDGs (e.g. the Delta project, the Global agenda towards sustainability indicators, COSA) in order to move beyond the isolated corporative reports. Initiatives like these should be adopted more consistently into the industry and the academia in order to generate comparable, reliable research evidence regarding the contribution of the VSS towards the achievement of the SDGs. As mentioned by Cosa (2013), the community of learning benefits from the use of standardised ways of collecting and analysing data; on the contrary, when each study has a distinct form of measurement of sustainability, it is more time consuming to sort out the most relevant takeaways. Furthermore, Giovannucci et al. (2008) already pointed out the importance of standardised, science-based and independent measurement for VSS effects, for VSSs to achieve their full potential as development tools. As mentioned by Meems (2019) in the presentation of the Global Coffee Data Standard Documentation, the main stakeholders involved in the process (producers, governments and the private sector) could benefit from enhanced data sharing and analyses processes in various concrete ways. For producers, this may imply better access to data and services; for countries, the opportunity to have standardised and comparable indicators to assist in the decision-making process; and for the private sector, emerges the opportunity to reduce costs, show impacts and improve investment efficiency.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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