Chapter

Brazilian Coffee Sustainability, Production, and Certification

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Abstract

Brazil is the largest coffee producer in the world, being responsible for 40% of world total production, 69.9 million bags in 2021. Due its major production and exportation role in the global coffee market, Brazil has been also recognized for its commitment with quality and social-sustainability parameters based on voluntary sustainability standards (VSS) and geographic identification (GI). Despite higher prices at the final market and some changes toward more sustainable production models, certification is not a panacea for sustainability. In that sense, the governance of certification and standards along the value chains plays a central role. Brazil, as the largest coffee producer and exporter, has also a great potential regarding coffee GI, which can lead to differentiation strategies and economic benefits for small farmers, contributing also to sustainable production and cultural and environmental protection. However, the existence of economic and social barriers plays salient challenges for farmers to meet the quality standards as well as GI protocols among other market compliance tools, in addition to the correct value appropriation arising for quality sustainability adopted strategies by coffee farmers in Brazil.

Keywords: coffee, Brazil, sustainability value chain, voluntary sustainability standards (VSS), geographic identification (GI)

1. Introduction

Sustainability has been a crescent worldwide topic in this past decades, especially after the 2000s, as climate change, biodiversity loss, soil erosion, water crisis, among other challenges, are becoming more evident, leading to a crescent concern in the minds of consumers [1, 2]. In food systems (e.g., coffee value chain), sustainability is especially visible: in order to attend the growing population and to avoid economic and social impacts, food production should increase by 70% until 2050 [3, 4]. Hence, the big challenge is how to produce more without destabilizing the ecosystems on which we depend [5].

For coffee, the chain is faced with many challenges, such as water pollution, soil erosion, biodiversity loss, among other climate-related problems, and social impact. Coffee is one of the most traded commodities of the world, but the production is mainly done by millions of small farmers around the world who depend on coffee for their livelihood. Thus, climate change may affect the production areas of coffee

and the livelihoods of the producers [4, 6, 7], increasing the concerns for sustainability in the chain.

According to Baumgärtner & Quaas [1], sustainability, per se, can be understood as a normative notion as to how humans should act toward nature and how they are responsible in relation to the people around them and the future generations. The concern with preserving the natural resources for the future is not just a concept of the modern human, but it was present since the Neolithic Revolution and later in many populations around the world. The topic was also studied by economists for a long time, since the shortage of resources is of central concern to the science [8, 9].

Yet the term "sustainability" became popular in policy-oriented research, with the concept of sustainable development, a common goal for society in the twenty-first century, introduced in 1987 by the report Our Common Future, also known as the Brundtland Report [10]. The ideas presented were also later discussed in the United Nations Conference on Environment and Development in 1992—known as the Rio Summit—where a consensus and commitment of the academia were agreed in engaging in development and environmental problems [11].

Based on these ideas, sustainable development can be defined as "the development that meets the needs of the present without compromising the needs of future generations to meet their own needs," and highlighted that, while environmental concerns are important, welfare and intergenerational equity should also be discussed. Thus, sustainability is not just about the environment, but has two more dimensions—economic and social. It is a multidisciplinary subject, and it is the intersection of these three dimensions that also allows the inclusion of socioeconomic factors, besides the environment aspect [9].

The social sphere is about improving poverty and having social inclusion; the economic sustainability regards perduring of renewable and nonrenewable resources of production system in the long run and the economic growth; lastly, environmental aspects are related to protection and conservation of living being (e.g., humans, animals, and plants) existing on Earth [12–15]. This three-dimensional quality of sustainability is also embodied in the definition of the concept by the United Nations in its Sustainable Development Goals, recognizing that social improvement should walk alongside economic growth, while "tackling climate change and working to preserve our oceans and forests" [16].

According to Hajian & Jangchi Kashani [13], sustainability can also be seen in a weak or strong meaning. The former is based on an economic value, the resources are goods with capital value, while the latter sees resources as natural goods and services it delivers, based on biophysical principles, considering some functions that the environment does for humans.

Despite the definitions above, it is good to note that the term "sustainability" does not have an extremely clear meaning. According to Pretty [17], since the Brundtland Report, there have been over 70 definitions of sustainability, each in a subtle way that enhances different goals, values, and priorities. For example, there can be different types of visions of sustainability depending on from whose eyes we are looking through (e.g., people in underdeveloped country and developed countries) and the time period of the action, such as how many years are we talking about the future in terms of generations [13]. So, even with the three-dimensional diagram (economic, social, and environment) of sustainability already consolidated, we can still have some variations in the actions and challenges faced in different areas.

In the agriculture, for instance, one of the most important challenges regarding sustainability is how to reach food security in the future—that is, how to feed the growing population of the world—while facing climate changes, as appointed in the beginning of this chapter [18, 19]. Besides this goal, sustainability is also generally

associated with economic viability for farmers, environmental conservation, and social responsibility. The goal is how to maintain or increase the production of goods, thinking about the economic viability fir farmers and food security, while working on the conservation of the resources, such as water, soil, and biodiversity [20].

To reach that, the sector already invested in some standards alongside the chain of certain agricultural product, in an attempt to cover the whole value chain from farmer to consumer [20]. According to Bager & Lambin [6], for the coffee sector, companies normally rely on the adoption of combined codes of conduct, voluntary sustainability standards (VSSs), corporate social responsibility (CSR) programs, direct relations with producers, and so on, to address the challenges of sustainability. It is good to note that the sector is also one of the models regarding sustainable actions, with third-party certification standards being widely used as VSSs, although internal standards and various supply chain interventions are gaining attention on the last years [6, 21, 22]. Other forms of addressing sustainability also include direct trade, single origin, and value chain transparency [6].

Brazil is the largest coffee producer in the world, being responsible for 40% of world total production, 69.9 million bags in 2021. The country is also the largest green coffee exporter, with 45.7 million bags, or 32% of total exports [23]. As for differentiated coffees, which includes sustainable certified ones, the country exported 7.7 million bags in 2021 [24], mainly to the United States, Germany, Belgium, Italy, Japan, and United Kingdom. That amount represents a 50% increase in comparison to 2017.

The enrichment of Brazilian coffee in quality and sustainability parameters over the years has positioned the country as an international reference for institutional and private strategies toward agricultural best practices aligned with sustainability goals.

This chapter aims to exploit the quality-sustainability-led strategies largely adopted by multiple stakeholders at the Brazilian coffee chain as a response for local and global demand for guaranteeing high quality for consumers along with fair prices and quality conditions for coffee famers.

Due to the history and importance of sustainability in the coffee sector, this chapter aimed to give an overview on how this theme has been worked on the coffee value chain in recent years and the possible lessons we can get of that. To reach that, the chapter was divided in the methodology, followed by the findings that contemplated broad aspects of coffee production and demand, as well as the specific aspects of sustainability in these topics. It also included the topic of the standards, certification, and governance regarding sustainability in coffee. Lastly, the authors presented the key findings of this study.

2. Methodology

The method used was a qualitative review of the academic literature and private reports on the coffee value chain and sustainability, based on the importance of the publications. It applied a set of key search terms in two scholarly electronic databases (Web of Science and Science Direct) and on Google Scholar in January–February 2022 to identify relevant papers. The string of key search words used were combinations of "coffee" and "sustainability," "production," "demand," "green," "certification," "standards," "voluntary sustainability standards," 'Designation of Origin," and "Geographic Indication." It was searched within the abstract, title, and keyword database categories of original research papers published in peer-reviewed English and Portuguese language academic. These articles were then selected based on the relevance in the platform's journals. It was also included relevant reports

in the coffee sector by instructions and actors such as the International Coffee Organization (ICO), the Global Coffee Platform, and The Economist. Finally, statistics and figures about the sector were obtained from sectoral reports and official databases, such as the Production, Supply & Distribution Online Database, from the United States Department of Agriculture (USDA) and the Brazilian Coffee Exporters Council (CECAFÉ).

3. International coffee demand

Coffee is a multibillionaire business and one of the most traded commodities of the word, involving thousands of companies and millions of coffee growers [6, 25]. According to ICO [26], since the 1990s, coffee production has had an increase of 60%, while the value of exports has more than quadrupled from USD 8.4 billion in 1991 to USD 35.6 billion in 2018, thanks to the rise in consumption and value in the chain. Regarding the production, it is condensed in more than 60 countries in the coffee belt (between the Tropics of Cancer and Capricorn), with Brazil begin the largest producer (33–35%). Yet, most of these countries remain marginal actors, with the international trade of processed coffee dominated by a small number of actors that capture a large value share of the global value chain (GVC), such as members of EU and North America. This is also reflected in the consumption, with the top consumers being mainly developed countries, such as the United States, Germany, Japan, Italy, and France (with the exception of Brazil, the second largest consumer) [26, 27].

This led to some implications in the GVC: today, the coffee value chain is characterized as a buyer-driven chain, where roasters and multinational companies hold the power to coordinate and impose control on the actor in the chain. In this case, while these buyers are subjected to sophisticated institutional regulation within their home countries, they can still exercise power on the producer's end, which can affect their livelihoods and environment. This has led to concerns among consumers and NGOs, who hold large companies accountable for their impact on the environment and laborers. This was especially true in the last years, due to high fluctuation on prices and increase of production costs, caused by climate changes and, since 2020, global chain disruption by the COVID-19 pandemic [26, 28, 29].

This increasing concern for sustainability by consumer (especially in tor consuming countries) is a trend occurring in all of GVCs and has led governments and companies to take action in addressing this matter and meet stakeholders expectations—also increasing income, protecting brand and reputation or differentiation—through the creation standards and regulations [6, 26, 30]. In 2021, the report "An Eco-Awakening" by The Economist Intelligence Unit (EIU) [31] showed an increase of 71% on searches for sustainable goods over the past 5 years (2016–2020) around the world, a trend that continued even during the COVID-19 pandemic. Consumers, waked by the social and environmental concerns, demand each year more actions by companies.

As for the coffee value chain, it is known as a pioneer in the adoption of VSSs, in particular "private" and multistakeholder initiatives, such as the third-party certifications (e.g., 4C, Rainforest Alliance, UTZ, Fairtrade, Organic, etc.) and standards by the private sector (e.g., Starbucks' C.A.F.E. Practices and Nespresso's AAA Guidelines) [6, 29, 32–34].

This trend has been present predominantly since the 2000s. Reinecke et al. [35] showed that the growth rate of coffee sustainable certification was 20% annually. Dietz et al. [36] saw that, while in 2008, the adoption of VSSs was made by 7% of exporters, in 2018, this number increased to 23%, while Panhuysen and Pierrot [37] showed that in the coffee year of 2019/20, 55% of total volume produced was

certified with some VSSs. According to ICO [26], investments on sustainability in the coffee chain are estimated to reach USD 350 million annually, showing the great concern of the sector in attending sustainable goals.

As for the Global Coffee Platform [38], an inclusive and important multistakeholder membership organization that seeks sustainability in the coffee sector, the purchase of sustainable coffee (following third-party and second-party schemes) in 2020 reached 16,3 million bags of 60 kg, or 48% of total purchased, for the members. It is good to note that these players include the biggest coffee companies in the world, such as Nestlé, JDE, Melita and Strauss Coffee, which represented a share of 26.6% of world coffee exports and 20.5% of world coffee consumption in 2019/20. The increase in the sustainable coffee purchase between 2019 and 2020 was of 53.1%, with the major origins reported with sustainable coffee purchases being Vietnam, Brazil, Colombia, Honduras, and Mexico. As for the mainly sustainable schemes, 4c certified coffee was the most common (58%), with a high percentage for two or more sustainability schemes, especially triple certification with 4C-Rainforest Alliance-UTZ (10% of the sustainable purchase in 2020).

Most of the biggest coffee companies around the world also have goals to elevate sustainable coffee purchase in the next years, or for a target of "100% responsible coffee in the next decade," such as JDE, Nestlé, and Melita [38]. Despise these optimistic numbers, it is important to point out that not all the sustainable coffee is sold as so: Panhuysen and Pierrot [37] point out that, in 2019, 75% of coffee with VSS schemes were sold as conventional coffee, which might be a challenge for the sustainable coffee sector, affecting price premiums and the differentiation strategies by producers.

4. Voluntary private standards, sustainable certification schemes, and coffee value chain governance in Brazil

Voluntary private standards (VSS) and sustainability certification schemes have taken a central role in discussions about the future of agricultural production and agri-food chains. VSSs are considered important mechanisms to promote sustainability and upgrading in agri-food value chains [39]. In coffee chain, certification schemes are major issues due its importance and impacts in the sustainability as well for farmer's higher incomes [40].

Sustainability coffee certificates in the global coffee industry are present since the world coffee deregulation aiming to guarantee enhanced quality and sustainability in the production regions. The major certifications in the global coffee scenario are Fairtrade (FT), Organic, Rainforest Alliance / UTZ, and the 4C Common Code/Global Coffee Platform (4C/ GCP) [36, 41, 42]. **Table 1** summarizes the main scope and objectives of those VSSs.

As observed in **Table 1**, most common VSSs in coffee value chain comprise the three-dimensional aspect of sustainability—economic, social, and environmental, although in different ways and considering different indicators and measures. Some of them are more focused on one of the dimensions, such as Fairtrade for social aspects, and organic for the environmental dimension. Another important aspect is the scope of VSS in value chain: some of them are more related to one specific segment of the chain (such as organic in production), while others depend more on actions in/from different parts of the chain, such as Fairtrade.

Discussion on the role of VSS for coffee sustainability abound in literature [26, 36, 42–47]. Based on prior studies, Elliott [44] summarizes different impacts of VSS on prices, quality and productivity, income and livelihoods, working conditions, environment impacts, and other aspects, such as markets, training,

VSS	Scope and objectives
FairTrade (FT)	It comprises economic, social, and environmental sustainability for producers, with focus on social aspects, and the strength of labor rights and working conditions. It sets minimum prices and social premia for producers and producers' organizations.
4C Common Code/ Global Coffee Platform (4C/GCP)	It comprises 27 principles across economic, social, and environmental dimensions, aiming to exclude worst practices and increasing sustainability in coffee production and processing.
Organic	It promotes organic farming practices, intended to avoid harmful practices to the environment, prohibiting the adoption of agrochemicals and promoting environmental practices, such as deforestation restriction and soil erosion control.
Rainforest Alliance (RA)/UTZ	UTZ merged with RainForest Alliance in 2018. It establishes standards for responsible production and delivery, aiming to ensure sustainable practices and the integration of biodiversity conservation, community development, labor issues, and agricultural practices.

Source: Based on Dietz [36]; Piao et al. [42].

Table 1.
Major VSSs for coffee and scope.

and capacity building. The findings presented mixed results, which lead to a controversial discussion on the VSS adoption for coffee farmers' income. The same perspective is pointed out for Piao [42] when analyzing the adoption of the 4C system by coffee farmers in Brazil in the perspective of value chain upgrading. The authors had identified five types of upgrading (product, process, functional, social, and environmental) although most of the improvements can be characterized as environmental. Yet, the main gains are associated with coffee beans differentiation thought high-quality agronomic practices and coffee processing, not necessarily resulting in premium prices for farmers.

Although literature presents a number of positive impacts linked to VSS and certifications in coffee value chains, especially considering coffee farmers "at the bottom of the pyramid" [48], some studies reveal uneven results from region to region. Jena and Grote [47], for instance, observed differences in terms of coffee yield and household income for certified coffee farmers in India, Ethiopia, and Nicaragua, shedding light to role of cooperatives in promoting collective actions and capacity building.

Other issues arise when coffee producers are brought to the center of that discussion: the adoption of certification at the farm level is not always economically viable, once it may bring higher production costs [49]; frequent changes, such as the adoption of new agricultural practices, do not necessarily mean a systemic change toward sustainability [50, 51]; certification is not a synonym of higher prices or better household living and poverty reduction for producers [52, 53].

Despite higher prices at the final market and some changes toward more sustainable production models, certification is not a panacea for sustainability. In that sense, the governance of certification and standards along the value chains plays a central role.

Chain governance agents need to drive more attention to smallholders' inclusion and to support more vulnerable and poorest coffee producers to comply with sustainability standards and develop deep changes toward social and environmental issues [44, 50]. Another governance challenge is related to the producers' awareness of certifications and its meanings, especially for producers in cooperatives or groups [44].

It represents an important alert: collective actions for smallholders' certification may not bring benefits on information sharing, transparency, and administrative competence, compromising its performance in the long run.

The complexity and interactions among the impacts of certifications need to be addressed, to shed light on potential bias or distortions. Impacts on price, for instance, may be related to improvements on quality rather than on the social and environmental aspects of certification itself [44]. Although certification can trigger the development of good agricultural practices and higher levels of assets for producers, the relation may be the other way around: producers already compliant with or close to requirements, or producers already having a minimum level of technical, financial, and structural assets, are generally those who get certified, and not the opposite, which may favor the large-scale producers' adhesion to RA, UTZ, and 4C/GCP certifications [44].

Finally, it is important to consider the interactions and networks for coffee sustainability. Grabs and Carodenutto [54] discuss the role of corporate actors in the governance of sustainable global coffee chain, pointing out benefits but also risks and challenges, such as goal conflict, information asymmetries, and power imbalances. According to Elliott [44], studies also report high levels of dependence on organizations such as NGOs and governmental extension agencies to promote certifications among producers, which sheds light on the need of external assistance and raises questions on the sustainability of certification schemes over time.

The role of the state and public institutions for global value chain upgrading is central. De Marchi and Alford [55] discuss the role of state policies in global value chains, including the coffee one. State regulation is potentially associated with improved social and environmental conditions through the support or requirement of certification schemes. In Brazil, Caldarelli et al. [56] emphasize the importance of public policies to face challenges in Brazilian coffee chain, including efforts to promote quality improvements and social and environmental aspects through voluntary standards and certification schemes.

VSS and sustainable certifications in coffee value chains can emphasize different aspects of sustainability. In general, the adoption of VSS and certifications in coffee value chains brings positive results to the chain and especially to coffee farmers. Promoting product quality, higher revenues, and access to market. Nevertheless, benefits are uneven and not always related to other important indicators, such as household income and coffee yield and producers' empowerment. In that sense, the adoption of VSS and sustainable certifications demands tighter governance. The role of organizations such as cooperatives and governmental agents is crucial to support the adoption of sustainable practices, favor collective actions, and hinder power imbalances between segments, promoting more genuine sustainability in coffee value chains.

5. Coffee production in Brazil

Coffee is produced in more than 60 countries in the coffee belt (between the Tropics of Cancer and Capricorn), but around 70% of the harvest is condensed in four countries: Brazil, Vietnam, Colombia, and Indonesia. Brazil is, by far, the largest producer, with around 33–35% of total production, harvesting both Arabica and Robusta coffee beans [26]. Brazil has been an important (if not the most notable) coffee producer since the eighteenth century, with the commodity having a big role in the history and economy of the country [57].

The first coffee seed came to Brazil in the begin of the eighteenth century in the Northeast, but it was at the end of the century that the plant was introduced in

the states of São Paulo, Minas Gerais, Espírito Santo, Paraná, among others, with different types of coffee being planted and modified by genetic engineering [57, 58]. At this time, coffee was planted by the growing high class (centered especially in São Paulo and Rio de Janeiro) in big properties that used slave labor. Later, with the abolition of slavery, labor was due mainly by European immigrants. With the popularization of the brew around the world, coffee had then become the great economic lever for Brazil in the nineteenth century, contributing to the industrialization of the Southeast region. In this century, Brazil was already the largest producer and exporter of the bean [59, 60].

Nowadays, the most prominent regions of production in Brazil are Paraná, São Paulo, Espírito Santo, and Minas Gerais, although, in each one, the coffee had a different role through history, which led to distinct characteristics in production that will be discussed in the following paragraphs [58, 61, 62]. Minas Gerais is the largest producer in Brazil (from 40–50%), with harvest condensed in Sul de Minas, Zona da Mata, and Cerrado Mineiro regions and mainly for Arabica variety. The second largest producer is Espírito Santo (25–30%), harvesting both Arabica and Robusta coffee beans (the state is the biggest producer of Robusta). São Paulo follows, being the third largest producer (Arabica variety) in Brazil (close to 10%). As for Paraná, the state used to be a big and historical producer of Arabica coffee, but, in the last decades, climate adversity has drastically reduced the harvest [63].

The state of São Paulo is one of the oldest producers and the most affected historically and economically by the culture back in the eighteenth and nineteenth centuries. The most important areas of the state are the traditional regions of Alta Paulista and Alta Mogiana, and the relatively younger region of Garça, which begging production after the 1960s decade. The culture in the state applies mostly traditional techniques of cultivation, producing only Arabica beans in small properties [63, 64].

As for Minas Gerais states, the biggest producer, the regions of Zona da Mata and Sul de Minas coffee are also a century and traditional culture characterized by smaller farmers and traditional techniques of cultivation and lower production technology. While in Sul de Minas, only the Arabica variety is harvested, in Zona da Mata, both Arabica and Robusta are planted. As for the region of Cerrado Mineiro, coffee production is relativity new, when producers from São Paulo and Paraná migrated to this region in 1970, due to climate problems in these states and government incentive for a more modern cultivation in Minas Gerais. Due to this, the production of Arabica coffee in Cerrado Mineiro has a higher technological base and is mechanized, a differential from other Brazilian producer regions [57, 61].

In Espírito Santo, the production was initially concentrated in the Arabica variety. In the nineteenth century, the crop had come as a way to occupy the land, organized as big properties focused on the external market. Later, with economical changes, coffee was harvest majorly by small producers, especially in the South of the state, having similar characteristics as Zona da Mata in Minas Gerais [58]. In the North, however, Arabica coffee beans were not adapted for the high temperatures and low altitudes predominant in the area, and with the Programa Federal de Erradicação dos Cafezais (transl. Nation Program of Eradication of Coffee Plantations) in the 1960s decade, most of these crops were annihilated. Producers then started planting Robusta coffee beans, better adapted for the region. The variety had higher productivity and was benefited by the growth of the soluble coffee industry over the years and the expansion of the use of Robusta in blends with Arabica coffee [62].

The difference characteristic among these regions, on the other hand, is of great importance for coffee sustainable production in the context of origin-linked products. The interest in the origin of the coffee seeds began with the second wave

of coffee consumption, only gaining more importance in the third wave, with the concept "seed to cup." Coffee producers can then gain competitive advantage and economic benefits by differentiating its products by origin, mainly in the schemes of geographical indications (GIs) [45, 62, 65].

Coffee Geographical Indication Certification was a standard that emerged due to the contributions from representatives of companies, exporters, farmers, and coffee sector stakeholders as a way to increase productivity in farms, to improve market access and the livelihood of coffee famers through sustainable improvement, helping with protection of natural resources and biodiversity [66]. GIs is based on the specific features of products on determined locations, due to a combination of natural resources, traditional local skills and knowledge, and historical and cultural aspects of the origin in question. Producers can then use these different characteristics to add value and promote their products, also protecting the local resources and culture, playing an important role in the sustainable development of local communities [45, 67].

In the economical aspect, GIs have positive impacts by different mechanism, such as providing legal protection for the geographical name of the origin of the product; recognizing the role of primary producers and increase farmer acceptance; boosting competitiveness; positive correlation of GI with intention to pay (premium prices), helping improve farm efficiency and coffee quality; creating new strategies beyond the product (e.g., local ecotourism area [45, 65, 66]. In the coffee scene, the IGs are already commonly used by countries such as Colombia, Indonesia, and Thailand as a way to obtain economic, environmental, and social benefits, such as premium prices, brand value, increase in profit, and decrease in production cost, and improve livelihood of farmers, etc. [66–68].

As for Brazil, the use of GIs in coffee has gained significant importance in the last decades. The protection of GI was determined in Law No. 9.279/1996 in articles 176–182, with the National Institute for Industrial Protection (INPI) responsible for defining procedures for creating GIs and the regulation and control made by the Ministry of Agriculture and Supply (MAPA). According to the law, there are two ways to indicate the geographical region of a product: by Indication of Origin (IP) and Designation of Origin (D.O) [60–62]. The difference between the two of them can be checked in **Table 2**.

In **Table 2**, we can see the difference between the Indication of Origin (IO) and Designation of Origin (D.O), the two kinds of geographic indications find in Brazil. The first one, IO, explicated the name of the origin, functioning based on the notoriety or reputation of the region. As for D.O, works as the very designation of an agricultural or extractive product, whose qualities are intrinsically linked in an exclusive or essential way to the geographical environment.

In 2022, eight IOs and five D.Os for coffee production exist in Brazil [69]. The oldest GI used in the country is the IO for the Cerrado Mineiro region, created in

Indication of origin (IO)	**Designation of origin (D.O)**
An indication of origin is the geographical name of a country, city, region or locality in its territory, which has become known as a center for the extraction, production or manufacture of a particular product or the provision of a particular service.	Denomination of origin is the geographical name of a country, city, region or locality in its territory, which designates a product or service whose qualities or characteristics are exclusively or essentially due to the geographical environment, including natural and human factors.

Source: Brazil [69], Vieira [60] and Marré & Fonseca [62].

Table 2.
Difference between geographical indications (GIs) in Brazil.

Type of GI	Region (state)	Variety	Creation date	Graphic representation
Designation of origin	Cerrado Mineiro (Minas Gerais)	Arabica	December 2013	
Designation of origin	Mantiqueiras de Minas (Minas Gerais)	Arabica	June 2020	
Designation of origin	Caparaó (Minas Gerais and Espírito Santo)	Arabica	February 2021	
Designation of origin	Montanhas do Espírito Santo (Espírito Santo)	Arabica	May 2021	
Designation of Origin	Matas de Rondônia (Rondônia)	Robusta	June 2021	
Indication of origin	Cerrado Mineiro (Minas Gerais)	Arabica	April 2005	No representation
Indication of origin	Norte Pioneiro do Paraná (Paraná)	Arabica	September 2012	
Indication of origin	Alta Mogina (São Paulo)	Arabica	September 2013	
Indication of origin	Região de Pinhal (São Paulo)	Arabica	July 2016	
Indication of origin	Oeste do Paraná (Paraná)	Arabica	July 2017	
Indication of origin	Oeste da Bahia (Bahia)	Arabica	May 2019	

Type of GI	Region (state)	Variety	Creation date	Graphic representation
Indication of origin	Campo das Vertentes (Minas Gerais)	Arabica	November 2020	
Indication of origin	Matas de Minas (Minas Gerais)	Arabica	December 2020	No representation
Indication of origin	Espírito Santo (Espírito Santo)	Robusta	May 2021	

Source: Brazil [69].

Table 3.
Types of geographical indications (GIs) for coffee in Brazil.

2005, and according to Almeida and Tabaral [61], it's the first region in the world to issue a D.O. seal for green coffee as well for roasting coffee in 2013. Other GIs in Brazil are issued in the main producing regions of coffee of Minas Gerais, São Paulo, Paraná, Espírito Santo, Rondônia, and Bahia states, accounting for more than 400 cities around the country [69].

A crescent investment for producers in the last years is regarding the Robusta Beans that are achieving recognition in the global market. Thus, the last GI appointed by the government is the IOs for Espírito Santo and Matas de Rondônia.

Figure 1.
GI of coffee in Brazil. Source: Adapted from Brazil [69].

For this last IO, there is a crest adoption of the denomination "Amazonian Robustas," which also reflects the concerns of coffee producers with sustainability [69]. All of the IOs and D.Os can be observed in **Table 3** and **Figure 1**.

In **Table 3** and **Figure 1**, the multiple IOs and D.Os of coffee in Brazil are shown. **Table 3** presents the variety of coffee in question, as well as the state, creation date, and the logo of each geographic indication. In **Figure 1**, the same IO and D.O are shown in the map of Brazil. As we can see, these geographical indications are present in six states, but are concentrated in Minas Gerais state, the largest producer in Brazil.

6. Final remarks

The differentiation strategy aiming value creation for coffee farmers in Brazil has been in place since the deregulation of coffee market in mid-1990s [70]. Industry played an important role to define quality standards through the Brazilian Coffee Quality Program since 1989 with continual enrichment aiming to match the growing interest of the consumers toward the coffee origin and quality. The private and public prizes rewarding famers and roasters for good practices have been another salient institutional tool to achieve and enhance quality and sustainable practices along the coffee chain.

Nevertheless, the VSS adoption and GI's creation have been modern strategies for quality and suitability achievement as demonstrated in this chapter. Brazil, as the largest global coffee producer, has also a great potential regarding GI strategies, which can lead to differentiation strategies and economic benefits for small farmers, also contributing to sustainable production and valorization of the cultural environmental of these regions. However, public and private action should consider economic and social barriers to achieve the VSS and VI's protocols, developing means to foster, maintain, and enhance a quality and sustainability mind set along the coffee chain [60, 65, 71].

The coffee value chain has great importance in the agribusiness, involving a huge number of actors from its production to its consumption, and Brazil has a huge part in this as the largest producer and second largest consumer. Thus, in the context of sustainability in the GVC, it's important to look more thoroughly in the aspects of the Brazilian coffee scenario. Around the world, the sector is already considered a pioneer in the adoption of VSSs, in particular, "private" and multistakeholder initiatives, such as Fair Trade and Organic certifications, which are also applied in Brazil.

Yet, these VSSs are mainly driven by the consumer ends, and there has been contrasting evidence of the real effectiveness of these standards in the incomes and livelihood of producers, thus presenting a possible challenge in the sustainability of the chain. What is known is that these standards may have different effects depending on the country studied.

DOI: http://dx.doi.org/10.5772/intechopen.105135

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