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GLOBAL MARKET REPORT

Soybean prices and sustainability

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Market Overview

Soy production has continued to increase in recent years, though at a slower pace, thanks to the versatility, low cost, and nutritional benefits of the "king of beans".

Known as the "king of beans," soybeans account for a large portion of direct and indirect protein consumed around the world. First domesticated in central China 5,000 years ago for food and medicinal purposes, soybeans are a leguminous vegetable that has come to dominate the Americas. Since the 1950s, soy production has increased 15-fold and shifted from Asia to the United States, Brazil, and Argentina, which now account for 80% of global soybean production (Ritchie, 2021). Soy is easy to double crop in the same season and is grown due to its versatility, affordability, and nutritional benefits (20% oil and 40% protein content)—so much so that Henry Ford invested in researching soy-based oils and plastics to create a "soybean car" in the 1930s (Patowary, 2022; The Henry Ford, 2016).

Today, about 76% of soy production is used as low-cost, quality protein for animal feed for meat and dairy production, 20% is consumed as edible oils and human food products (i.e., tofu, soy milk, and tempeh), and 4% is used for industrial purposes, primarily in the form of biodiesel (Ritchie, 2021). Soybean cultivation is largely mechanized, and soybeans are grown on vast fields, requiring grain combines to harvest the plant and separate stems and pods from the bean. The harvested beans are then heated, crushed, rolled, and extruded to separate into edible oil and meal, which is then refined for use in a range of diverse products, such as animal feed, mayonnaise, paint, and fuel (Degnan, 2021). Global demand for soy is rising, propelled largely by consumer interest in animal and plant-based protein options (Fraanje & Garnett, 2020). Expanding soy cultivation to meet growing demand has resulted in the loss of vital ecosystems, notably in the Brazilian Amazon and Cerrado (Chain Reaction Research, 2022; Bicudo Da Silva et al., 2020; Good Growth Partnership,

LIVELIHOODS

Soybean cultivation provides direct employment for over 280,000 farmers in the United States and 240,000 in Brazil.

2020; World Wildlife Fund [WWF], n.d.). Patents for genetically modified (GM) seeds have grown exponentially since the 1980s, with current efforts focusing on developing high-yielding and climate-resilient varieties (Hinch, 2022). GM varieties have been critical for enabling the large-scale expansion of soybean cultivation, as herbicide-resistant varieties allow farmers to more effectively apply pesticides to control weeds and, in doing so, avoid soil tillage.

The global soybean sector is worth USD 155 billion and is projected to reach USD 278 billion by 2031, with a compound annual growth rate (CAGR) of 6% (Persistence Market Research, 2023). The Food and Agriculture Organization of the United Nations (FAO) predicts a sharp rebound in global soybean production for the 2022/2023 harvest season to record levels, driven by demand from China linked to expanding livestock production and replenishing domestic stockpiles (FAO, 2022). The Brazilian soybean sector expanded by 60% in the last decade and is forecast to increase production by another 30% by 2030 compared to 2020 (Fraanje & Garnett, 2020). Soy production in the United States rose by around 16% in 2020 from the previous year. Global soy production has surged by 1,200% over the past few decades (FAO, 2022).

This tremendous growth is primarily due to expanding soybean cultivated area, but also improved yields. For instance, soybean production gains in South America are due to a threefold increase in yields and a 200-fold increase in cultivated area since the 1960s (Fraanje & Garnett, 2020). The global soybean sector provides employment for many people around the world. Soy cultivation provides direct employment for 280,000 farmers in the United States alone, and almost 240,000 Brazilian farms were producing soybeans in 2016 (Bicudo Da Silva et al., 2020; The Soy Hopper, 2020). According to the FAO, soybean production grew to 353 million tonnes (Mt) in 2020 from about 231 Mt in 2008 from cultivating 126 million hectares of soybeans (FAO, 2020). Although soybean production grew consistently at a CAGR of 3.6% from 2008 to 2020, its CAGR dropped to 2.42% from 2014 to 2020 (FAOSTAT, 2022a). Nevertheless, global soybean production increased more than estimated in 2021 to reach 388,098 Mt (FAO, 2023).

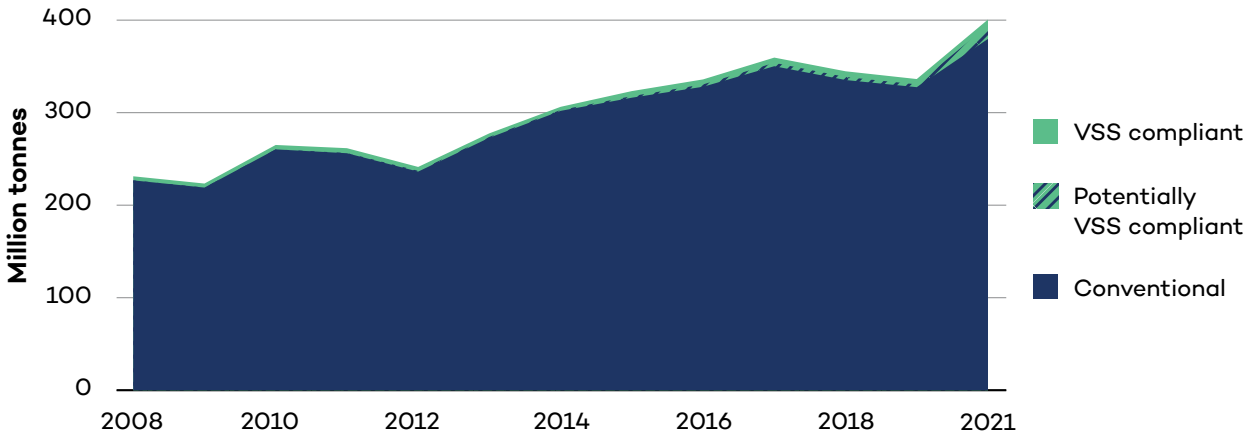
Between 45% and 49% of soybean production was exported in 2020, providing an important source of foreign exchange revenue for exporting countries (Foreign Agricultural Service, 2024). Brazil, the United States, and Argentina have been the largest exporting countries since 2016, exporting 86.1 Mt, 53.1 Mt, and 4.3 Mt, respectively, in 2021, while China, the European Union, and Argentina have consistently been the top importers, importing about 95.5 Mt, 14.6 Mt, and 4.9 Mt in 2021, respectively (United Nations, 2022). Over the last 5 years, global soybean supply and demand have remained fairly even, with some years experiencing excess supply and others excess demand (MacroMicro, 2022). Nevertheless, global supplies recently dropped due to COVID-19 pandemic-related market disruptions and droughts in South America and Canada,

while global demand has increased, led by China and biodiesel mandates in the European Union, the United States, China, and Brazil (Organisation for Economic Co-operation and Development [OECD] & FAO, 2023; Podesta, 2022). Russia's invasion of Ukraine also pressures the soybean sector, as wheat, corn, and sunflower oil production has dropped, which, along with rising energy and fertilizer prices, has sent agricultural commodity prices soaring (Foreign Agricultural Service Global Market Analysis Staff, 2022; Futrell, 2022; Glauber & Laborde, 2022). Soybean prices have climbed 90% since late 2020 (Foreign Agricultural Service Global Market Analysis Staff, 2022).

The COVID-19 pandemic, exacerbated by Russia's invasion of Ukraine, has affected the soybean supply chain in diverse and unforeseen ways. Global vegetable oil prices have increased 140% since late 2020 (Podesta, 2022). In the United States, the pandemic led to losses of more than USD 4.7 billion for soybean farmers and crushers in 2020 due to stay-at-home mandates and transport disruptions (LMC International, 2020).

Global soybean production from 2008 to 2021

Figure 1. Soybean that complies with voluntary sustainability standards (VSSs) reached 1.7% to 2.6% of total production in 2019. In 2021, this share was 1.6% to 2.2%



Sources: FAOSTAT, 2022b; Kemper et al., 2023; Meier et al., 2021; Voora et al., 2020.

Note: VSS-compliant production volumes refer to soybeans produced in compliance with at least one or more VSS. Conventional production volumes do not comply with any existing VSSs. Production volumes that are defined as potentially VSS compliant cannot be definitively listed in either category with the data currently available.

This graph has been produced with data reported to the International Institute for Sustainable Development, the International Trade Centre, and the Research Institute of Organic Agriculture by the ProTerra Foundation, Organic, and the Round Table on Responsible Soy (RTRS). While the analysis was conducted for the period 2008–2019, consistent with other reports in this series, we have also included 2021 figures to reflect recently published data.

Brazilian soybean shipments were delayed in the first half of 2020 because of heavy rains and a reduced workforce restricted by COVID-19 stay-at-home measures, resulting in a drop in China's soybean inventories to record lows, which led to unprecedented Brazilian soy exports to China, rising by 37% from January to June 2020 compared with 2019 (Good Growth Partnership, 2020). The cost of Brazil's emergency payments to compensate informal workers for lost wages due to COVID-19 was about USD 48 billion (Good Growth Partnership, 2020).

The pandemic also revealed the vulnerability of the informal soybean sector, as migrant workers did not receive wages if they did not work due to quarantine measures (Podesta, 2022). Demand for soybean oil and meal for animal feed decreased sharply in the initial stages of the pandemic as various businesses, such as restaurants, closed (Podesta, 2022). Soy-based biodiesel consumption also declined amid stay-at-home mandates, particularly in the United States, the primary consumer of blended soy-based biodiesel, but also in Brazil and Argentina, which produce biodiesel for export (Good Growth Partnership, 2020). Additionally, the Russia–Ukraine conflict has led to a significant drop in sunflower oil exports due to plant and port closures in Ukraine that boosted demand for soybean oil (CBI, 2022b) and led to higher global prices, incentivizing the expansion of soybean production areas in countries like Brazil (Podesta, 2022).

Sanctions and trade restrictions limited fertilizer exports from Russia and Belarus, which are key global producers of nitrogen and potassium, resulting in soaring fertilizer prices and shortages. As a result, many farmers have shifted from wheat production, for example, to less fertilizer-intensive crops, such as soybeans, causing turmoil and uncertainty in global food markets. U.S. farmers, for example, were expected to plant a record-high soybean crop in 2022 (Husain, 2022). The International Fertilizer Association notes that it is rare for fertilizer supply chains to face multiple disruptions in such a short period (Cross, 2022). Soaring production costs are affecting Brazil, the leading global soy producer and exporter, which imports 85% of its fertilizer needs, a quarter of which is from Russia (Ustinova, 2022). Around 44% of the total fertilizer that Brazil imports is applied to soybeans in the country (Ustinova, 2022). Brazil was affected not only by rising fertilizer prices and availability but also by pandemic-related transportation bottlenecks and high energy prices, which led to a major rise in shipping costs (Foreign Agricultural Service, 2022a; Podesta, 2022; Ustinova, 2022).

The imposition of trade restrictions has further complicated this situation, exacerbating the global food crisis to the point of acute food insecurity in many low-income countries, as witnessed in 2008 and 2012 (FAO et al., 2022; G7, 2022; World Trade Organization, 2022). At least 19 producing countries have restricted exports to deal with decreasing supplies and rising prices (Jadhav & Bhardwaj, 2022). For example, India allocated a tariff-rate quota of 2 Mt of crude soybean oil for the 2022/2023 crop year to counter rising domestic edible oil prices (Foreign Agricultural Service, 2022b). Argentina increased export taxes on soybean oil and meal to curb surging domestic prices and inflation (Reuters, 2022).

Climate change continues to threaten the viability of the sector.

In addition to the COVID-19 pandemic and Russia's invasion of Ukraine, the soybean sector faces substantial climate change adaptation and mitigation challenges due to its impact on forest and biodiversity losses, as well as its associated greenhouse gas (GHG) emissions. Rising temperatures, erratic rainfall patterns, and increased incidences of pests and diseases due to climate change already affect soybean production systems (Alcock et al., 2022). Computer models predict that most global soybean croplands will be more vulnerable to hotter and more humid weather between 2050 and 2100, with notable exceptions across Asia (Lesk et al., 2021). This will lead to declining yields as temperatures rise (Lesk et al., 2021). Nevertheless, climate change impacts on soy production will vary depending on location and changing conditions. For example, India, China, Japan, and Eastern Canada may see better growing conditions, while heat will negatively affect production in the Midwestern United States, Eastern Europe, and Italy (Lesk et al., 2021).

With soybean yields projected to drop by the end of the century, the need for climate adaptation in the form of cropping strategies and climate-resilient cultivars able to withstand heat and moisture stresses is imperative (Lesk et al., 2021). Cutting-edge biotechnology research is ongoing to develop soybean cultivars that are more nutritious and use fewer inputs. For example, Argentine researchers found a sunflower gene (Hahb-4) to increase the nutritional value (omega-3) and drought resistance of soybeans (Ribichich et al., 2020). Inari Agriculture is engineering improvements to enhance soy yields by 20% while reducing water inputs (Hinch, 2022). Maintaining soil fertility by minimizing tilling and crop diversification is also an important climate adaptation strategy (Jing et al., 2017).

The soybean sector has great potential to mitigate climate change (Fraanje & Garnett, 2020). As a nitrogen fixer, it can improve soil fertility without having to apply nitrogen-based fertilizers, which are a source of greenhouse gas emissions both in terms of production and application, resulting in nitrous oxide emissions. Soybean production is also an important driver of deforestation and ecosystem conversion. Establishing deforestation-free supply chains will go a long way to halting and reversing the impacts of the soybean sector on climate change (Alcock et al., 2022; Chain Reaction Research, 2020; University of Bonn, 2020). To this end, the European Union is expected to implement its Deforestation Regulation, which is expected to come into effect in December 2024 (European Commission, 2023).

The sector is a vital contributor to global food system GHG emissions, which represent 21% to 37% of total global GHG emissions (Fishfarming Expert, 2022). Measuring these emissions along the soybean supply chain can help target climate mitigation actions. A carbon footprint assessment of the soybean supply chain in various countries found that its cultivation is the biggest GHG emission contributor. Producing countries with low climate impacts tend to be high yielding with low fertilizer use (Blonk Consultants, 2022). The sector's GHG emissions are significantly higher when land-use change is included. One study on the carbon footprint embodied

in Brazil's soybean exports for 90,000 supply chains from 2010 to 2015 concluded that the GHG emissions vary by a factor of up to 200, depending on location, with emissions from transportation in the northeastern region of Matopiba even surpassing the emissions associated with deforestation (University of Bonn, 2020).

Brazil's soybean exports to China rose 30% in 2020 compared to 2019 (Escobar, 2019). This expansion raised concerns about large-scale natural ecosystem conversion, such as deforestation, to give way to soybean cultivation, which has compromised negotiations for a trade deal between the European Union and Mercosur (Good Growth Partnership, 2020; Schatzschneider, 2021). Recent satellite data show a 12-year high in deforestation in the Brazilian Amazon due to several factors, such as illegal logging, mining, livestock raising, and soy cultivation (Al Jazeera, 2022; Moutinho & Escobar, 2022; Rannard, 2022). In fact, the Amazon, with around 33% of global forested area, has shifted from being a GHG sink to a source releasing more carbon than it stores (Gatti et al., 2021). The United Nations Economic Commission for Latin America and the Caribbean calls for adopting a more sustainable soybean production model to recover from the pandemic, which implies lowering the natural ecosystem conversion, such as deforestation risks (United Nations Economic Commission for Latin America and the Caribbean, 2022). For example, Brazilian soy production is forecast to expand by 12 million ha between 2021 and 2050, with more than 11 million ha of newly planted area in the Cerrado to increase production by 27% over the next decade (Alcok et al., 2022; Chain Reaction Research, 2020, 2022). Ensuring that new plantations occur on degraded land instead of natural lands is vital to managing land-use change.

Global consensus at the Glasgow Climate Conference, including both financing commitments (UN Climate Change Conference, 2021b) and public and private zero-deforestation initiatives, hold promise for a more sustainable soybean sector that can mitigate climate change while providing livelihoods (United Nations Climate Change, 2021; UN Climate Change Conference, 2021a). The Collaborative Soy Initiative (CSI), the UK Roundtable on Sustainable Soya, and REDD+[1] offer examples of efforts to do so.

MARKET VALUE

The global soybean sector is worth USD 155 billion and is projected to reach USD 278 billion by 2031, with a CAGR of 6%.

CAGR

Conventional production grew at a CAGR of 3.40% from 2008 to 2019 and at 1.64% from 2014 to 2019. VSS-compliant production grew at a CAGR of 2.52% to 6.46% between 2008 and 2019 and at a CAGR of 11% to 15% from 2014 to 2019.

[1] Reducing emissions from deforestation and forest degradation in developing countries

Producing VSS-compliant soybeans can help build resilience.

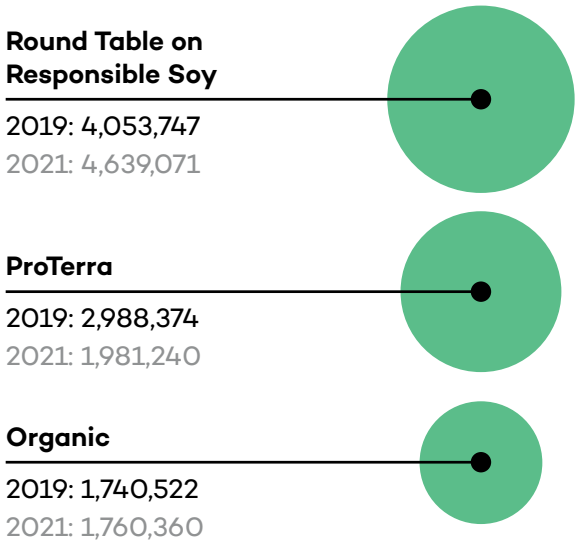
Efforts to move the soybean sector toward sustainability and resilience to mitigate the underlying drivers of global food insecurity, including climate change, are ongoing and vital in the current context of deepening turmoil in food, fuel, and fertilizer markets (FAO et al., 2022). The implementation of VSSs, which began in the soybean sector more than 30 years ago, is one of these efforts. VSSs operating in the sector—such as RTRS, ProTerra, and Organic—support practices that can help build resilience and advance climate action in soybean plantations. These practices include prohibiting or prescribing the responsible use of pesticides while supporting integrated pest management and soil conservation, deforestation prevention, remediation, and forest preservation (Voora et al., 2022). They also include measures to improve labour and human rights, such as prohibiting forced and child labour and equal pay for equal work. Adopting VSSs allows farmers to differentiate their products from conventional soybeans in the marketplace (Voora et al., 2020). In exchange for adopting more sustainable farming practices, farmers can label their goods as VSS compliant or produced in accordance with a VSS.

A total of 5.79 Mt to 8.78 Mt of VSS-compliant soybeans were produced in 2019 with a farm gate value of at least USD 1.71 billion to USD 2.53 billion, dropping by 0.37 Mt to 0.66 Mt from the previous year (Meier et al., 2021). The most prominent VSSs in the sector included in the dataset, ordered by 2019 production volumes, are RTRS (4.05 Mt), the ProTerra Foundation (2.99 Mt), and Organic (1.74 Mt). In addition, the International Sustainability and Carbon Certification, another standard operating in the sector, reported certifying 181,128 ha of soybeans in 2021 (International Sustainability and Carbon Certification, 2022).

Growing at a CAGR of 2.52% to 6.46% between 2008 and 2019, VSS-compliant soybeans represented 2% to 3% of total global production (Meier et al., 2021). There are signs that the supply of VSS-compliant soybeans may be expanding, as its CAGR jumped from 11% to 15% from 2014 to 2019 (Meier et al., 2021). The gains in VSS-compliant production can be partially attributed to greater adoption across the three prominent VSSs operating in the sector. It can also be partly explained by efforts in

How many soybeans comply with a VSS?

Figure 2. VSS-compliant soybean production volumes in 2019 and in 2021 (in tonnes)

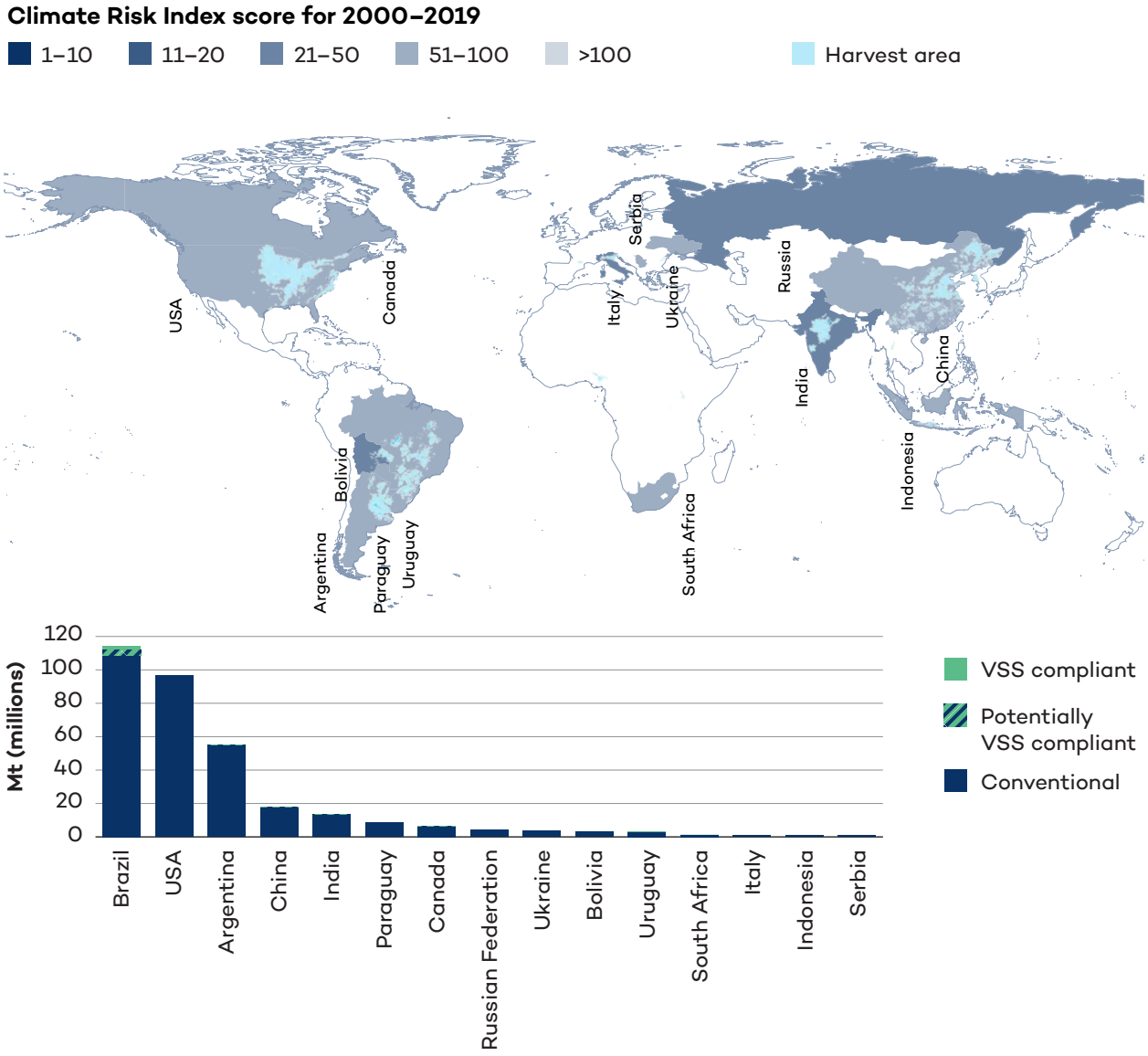


Source: Kemper et al., 2023; Meier et al., 2021.

the public and private sectors to establish deforestation-free supply chains (Asia-Pacific Economic Cooperation Sub-Committee on Standards and Conformance, 2022; Elder et al., 2021). For example, through voluntary sector-wide undertakings, the Scottish and Norwegian salmon industries now source soy feed from Brazilian suppliers certified as 100% deforestation- and ecosystem conversion-free in all their operations, as they implement a cut-off date of 2020 (Fishfarming Expert, 2022). Nevertheless,

Soybean-growing regions of the world

Figure 3. Distribution of soybean production in the top 10 producing countries in 2019



Sources: FAOSTAT, 2022; Meier et al., 2021

recent data indicate that VSS-compliant soybean production ranged between 6.28 Mt and 8.38 Mt (Kemper et al., 2023) in 2021, representing 1.7% to 2.3% of world production (Kemper et al., 2023).

According to our analysis based on data from Meier et al. (2021), for the most part, VSS-compliant soybeans have historically been sold as such. Between 2008 and 2013, about 80% of VSS-compliant soybean production was sold as sustainably certified soybeans. Although there are indications that this percentage may have dropped in recent years, this high VSS-compliant soybean sale-to-production ratio means that farmers are more likely to benefit from the market advantages that VSS compliance offers.

Our analysis finds that among soybean-producing countries, Brazil, the United States, Argentina, China, and India offer VSSs the greatest potential to expand based on the size of their conventional soybean production. Based on their share of global soybean production, the limited presence of VSSs and their Human Development Index ranking, several least developed countries—Malawi, Ethiopia, Mozambique, Burkina Faso, and the Democratic Republic of the Congo—offer VSSs the best opportunity to enable sustainable development via the adoption of more sustainable soybean farming practices. VSS-compliant soybean farming can also affect yields. In 2019, VSS-compliant soybean yields were higher in 13 countries and lower in 21. Although VSS-compliant yields tended to be higher in the larger soybean-producing countries, such as Brazil, China, India, and Russia, they were lower than conventional soybean yields in the United States, Argentina, and Canada in 2019.

Focus on healthy, environmentally friendly goods drives demand for VSS-certified soybeans.

Global VSS-compliant soybean consumption rose from 2019 to the first half of 2020, driven by sustainable sourcing commitments from across the value chain. Most of this increase was in the form of RTRS credits linked to RTRS-certified soybean production (Voora et al., 2020). The global surge in demand for VSS-compliant soybeans stems from consumers, especially in North America, seeking alternative protein sources as well as vegan and dairy-free products and in Europe, which consumes almost a quarter of global protein feed, driven by the importance of animal products in the region (Baski et al., 2019; CBI, 2022a; Nepstad, 2021). Indeed, the European market is the largest consumer of VSS-compliant soybeans, with the Netherlands accounting for 66% of RTRS-certified soybean purchases (CBI, 2022a; RTRS, 2020b).

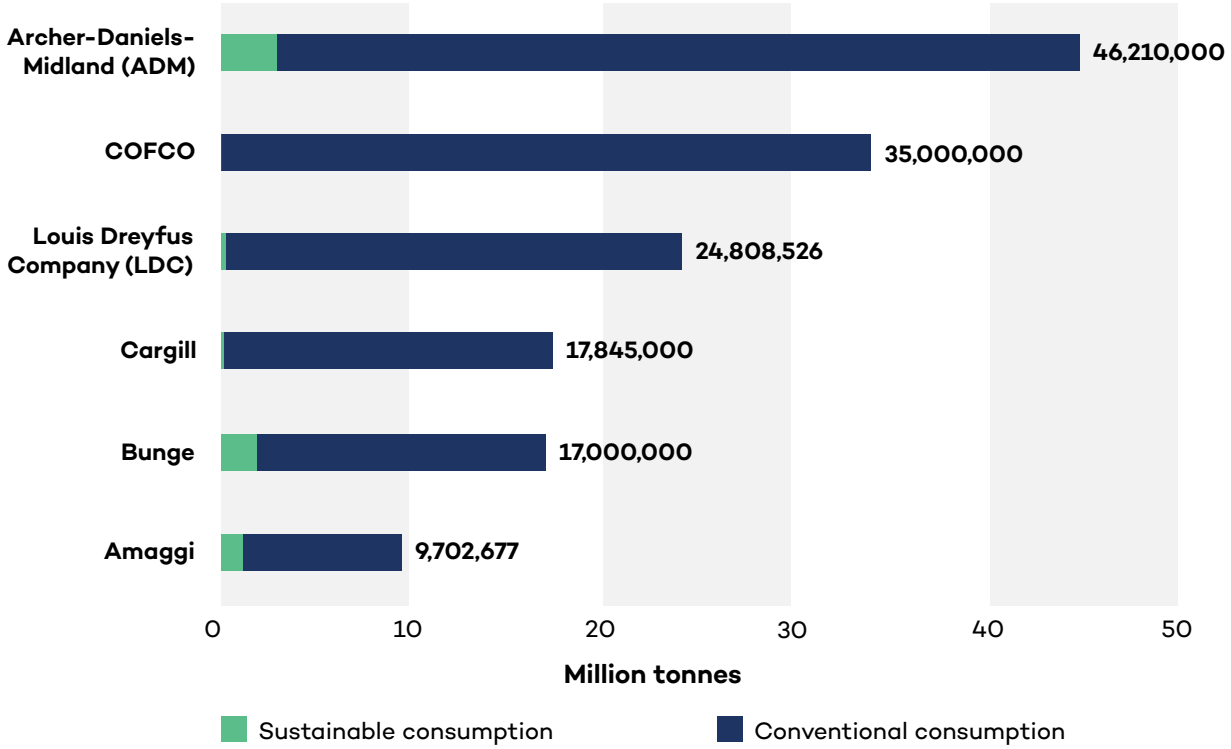
Consumers in these markets are interested in products that are healthy and environmentally friendly (Bashi et al., 2019; Nepstad, 2021). Although the health benefits of soybeans are debated, plant-based protein is often considered healthier than animal-derived protein (Harvard T. H. Chan School of Public Health, 2018). It is important to highlight that only 20% of total soybean production is consumed directly (in the form of tofu, soy milk, oil, and other soy-based products). The rest is consumed as animal feed (76%) or for industrial purposes (4%) (Ritchie, 2021). Tracing and labelling soy-fed meat products (also referred to as embedded or hidden

soy) remains challenging as sustainable soybean feed is harder to trace (Good Growth Partnership et al., n.d.; Institute of Grocery Distribution), resulting in less visibility and awareness among meat consumers.

Growing demand for more sustainable soybeans in China, the biggest soybean consumer in the world, is critical to maintaining the sustainability of the sector. Although domestic production has increased (Reidy, 2022), Chinese demand is mostly met by imports; 75% of soybeans consumed in China are imported from Brazil, the United States, and Argentina (Wishnick, 2020), mostly (85%) for animal feed (Nepstad, 2021). Much of the pressure to increase sustainable soybean imports comes mostly from private sector initiatives, as the Chinese government

Progress on sustainable sourcing commitments

Figure 4. Major soybean trading and processing companies, their sustainable sourcing commitments, and progress in 2020



Sources: Amaggi, 2020; 2023; Bunge, 2020, 2022; Carbon Disclosure Project, 2021a, 2021b, 2021c; Cargill, 2020; COFCO INTL, 2020; FAOSTAT, 2022; LDC, 2022; RTRS, 2019, 2020a, 2020b.

Notes: Bunge—Data showcased is only for Brazil, as volume data for Argentina and Paraguay is not available; Cargill—Total consumption volume was estimated by adding the total volume of soybeans processed and exported in Brazil in 2018 (12,200,000 Mt), Paraguay (900,000 Mt), and Argentina in 2018; LDC—Total consumption volume was estimated by calculating the share of LDC from the 2020 production volumes (FAO data) from the United States, Argentina, Brazil, and Paraguay. Sustainable sourcing commitments were not found for any soybean trading company.

has remained focused on addressing the negative environmental impacts (such as deforestation) of domestic soybean production (Carbon Disclosure Project, 2019).

To boost the import of more sustainable soybeans in China, the Sustainable Soybean Trade Platform (SSTP) and the United Nations Forum on Sustainability Standards Chinese National Platform on Voluntary Sustainability Standards were established. The SSTP supports the Sustainable Soy Project in China, which seeks to source sustainably produced soybeans from Brazil, the top soybean exporter to China. The SSTP also created guidelines for China to source more sustainable and traceable soybeans. Government incentives and awareness raising among importers could boost imports of sustainable soybeans (Cabezas et al., 2019), especially among younger Chinese, who are increasingly interested in healthy and socially and environmentally beneficial products (Nepstad, 2021). Clearly, VSS-compliant soybeans could help address China's growing interest in more sustainable goods (Sommer, 2017).

As illustrated in Figure 4, the six largest soybean trading and processing companies account for 42% of total global soybean sourcing and purchased 150.6 Mt of soybeans in 2020. Of this amount, just 4.3% (6.5 Mt) was sustainably sourced soybeans compliant with a VSS, including in the form of RTRS credits, or a corporate sustainability initiative. Corporate sustainability initiatives, such as the Amaggi Responsible Soy Standard, refer to sustainable soybean production programs established by trading and processing companies rather than by independent third parties. In addition, while all soybean trading companies examined have commitments to source deforestation-free soy, none have commitments to source VSS-certified soy, as they usually source VSS-compliant soybeans based on consumer demand. Therefore, to accelerate the share of VSS-compliant soy they source, the first step is for companies to set commitments along with target years that can close the current sustainability gap.

Demand for soybeans is expected to continue growing steadily until 2030 (OECD & FAO, 2021). Predicting VSS-compliant soybean production is difficult as VSSs have only recently been implemented in the production of GM soybeans, which are almost entirely converted into animal feed. With nearly 80% of all soybeans produced to support livestock rearing and aquaculture, VSS-compliant soybean production has fluctuated up and down in the last decade (Kemper et al., 2023; Meier et al., 2021). This trend could change dramatically as large soybean trading companies aim to consume only deforestation-free soybeans.

Taking a more pessimistic outlook weighs the short-term and fluctuating VSS-compliant production trend more heavily: it would decline steadily to about 4 Mt by 2025 due to a shift toward corporate sustainability initiatives. A more optimistic outlook weighs the increasing long-term VSS-compliant production trend more heavily and projects a significant increase to exceed 8 Mt by 2025. Different potential futures exist between these outlooks, and we predict that VSS-compliant production will reach 7 Mt by 2025 as demand for sustainable soybeans grows, motivating sustainable soybean sourcing commitments as soybean farmers enjoy more success selling their harvest as a VSS-compliant product. Consequently, we expect VSS-compliant soybean production to range from 4.35 Mt to 7.72 Mt by 2025.

A Dive Into Soybean Prices

Weather conditions and geopolitical dynamics are the main drivers of price volatility in the global soybean market.

Pricing is important, as it can determine if soybean producers stand to gain financially from complying with a VSS. Efforts to shift the sector toward sustainability—such as by abiding with VSSs—are partly driven by a need to internalize the external, tangible costs associated with the industry. For example, the natural capital losses associated with conventional soybeans exported from Brazil and Argentina to the European Union between 1961 and 2008 are estimated to be USD 1,007 billion, primarily due to the loss of ecosystem services provided by forests, grasslands, and savannahs cleared to cultivate soybeans (Boerema et al., 2016). Furthermore, soybean imports to Germany from Brazil and Argentina are estimated to be 2.54 kg of carbon dioxide equivalent per kg of soybean meal due to land-use change (Pieper et al., 2020). Internalizing the external costs associated with the production and processing of conventional soybeans in the market price would make VSS-compliant soybeans more competitive. Therefore, examining how global soybean prices intersect with the sector's sustainability is paramount.

Soybeans are one of the most traded agriculture commodities in the world, and as with many other agricultural commodity markets, international prices are largely correlated with macroeconomic and geopolitical dynamics, as well as shifts in supply and demand. Soybeans are traded in the futures markets. Most of the world's soybean trade is through the Chicago Board of Trade Soybeans Futures in the United States (CBOT). Futures contracts for both soybean oil and meal are also traded through the CBOT. Another important global price indicator for soybeans is the Dalian Exchange Contract from China, as the country is the world's largest soybean consumer and importer, with around 60% of the worldwide market share (Orient Futures Singapore, 2022).

Price fluctuations in the last decade have affected the soybean market. The market expanded in 2012 due to a combination of acreage cutbacks and hot, dry conditions in major producing countries. By 2013, though, high feed prices and exceptionally good weather in the United States jolted the market, causing prices to drop substantially. In 2019, an increase in global soybean inventories due to higher production in South America and lower global consumption also put downward pressure on international soybean prices; the average price that year was 20% below the last decade's average (United States Department of Agriculture [USDA], 2021). This pattern of high prices as a response to higher demand, followed by higher production and price drops, has repeated throughout the decade.

Three main factors influence global soybean prices: cost of production and growing conditions in major producing countries that can affect global output; market

responses to economic shocks—such as the COVID-19 outbreak and the Russia–Ukraine war, which has pushed prices higher and increased shipping costs, storage fees, and labour costs for soy crushing (NC Soybean Producers Association, 2020; United Nations Conference on Trade and Development, 2021); and supply and demand changes in response to price volatility (Constable, 2022). Other factors—such as changes in demand for biodiesel and ethanol subsidies, the strength of the U.S. dollar (as most trade transactions are made in this currency), and the market dynamics for alternative oils, including sunflower seed oil—also affect soybean prices.

The international prices of soybeans, soybean oil, and meal are expected to weaken in 2024 and 2025 due to oversupply in the market stemming from elevated production in South America, as "El Niño" is expected to bring above-average rainfall in Argentina, Brazil, and Paraguay. On the other hand, growing demand for biofuel and ethanol in Brazil and the United States will increase demand for soybeans and potentially increase global prices. Supply and demand in the grain and edible oil sectors have adjusted quickly to price changes in recent years and overcome short-term price fluctuations, maintaining the resilience of the sector (World Bank Group, 2023).

As the top soybean consumer and importer, China plays a key role in shaping global trade and pricing in the international soybean market. In recent years, China has increased domestic production to meet domestic demand while reducing the volume of imported soybeans (USDA, 2021). This policy has affected major producers of the crop, including the United States, one of the top soybean exporters to China. In addition, the escalation in trade tariffs between China and the United States in 2019 caused soybean prices to collapse, leading to a shrinkable farm margin. The African Swine Flu outbreak in 2019 also crimped demand for soybeans used in feed in China due to the massive loss (40%) in the country's hog inventory, and this led to Chinese buyers using their market buying power to reduce import prices (Carriquiry et al., 2019; Good, 2019).

Price volatility, trade wars, and rising production costs have threatened soybean growers' incomes.

Price changes in the last decade have affected soybean farmers' incomes in the United States, Brazil, and Argentina. In 2019, U.S. farmers reportedly lost income due to high soy stockpiles caused by weak export volumes during the U.S.-China trade war, aided by record harvests in the United States (Tortajada & Zhang, 2022). However, Brazilian producers benefited from the U.S.-Brazil trade war, as they increased exports and supplied the Chinese market, enjoying record domestic soybean prices in the marketing year 2019/2020. On the other hand, Brazilian farmers had to bear higher costs of imported seeds and fertilizers in 2020 due to bigger exports to China (Anand, 2020; Mano & Weinraub., 2020; USDA, 2020).

Although international prices have climbed in the last couple of years, farmers' margins have been squeezed due to higher production costs (Bicudo Da Silva et al., 2020). For a

typical soybean farmer, less than half of the farm's expenses are generally variable inputs from seed to fertilizer to chemicals, with most of the farm budget going to equipment, land, and family labour—which do not quickly adjust to changing market conditions. Debt repayment can also be problematic among soybean producers. In Brazil, for instance, farmers are struggling to make profits from soybeans, trapping them into endless debt as they take new loans to pay existing debts and placing them at high risk of losing their farms (Bicudo Da Silva et al., 2020). In the United States, many farms in the Midwest are under a cash rental agreement, and if rates are high and prices are poor, this becomes a burden for farmers (Wilson & Durisin, 2016). Growers need to budget carefully and assess the profitability of their crops each year before planting but are then subject to the whims of Mother Nature.

It should be noted that the effects of external shocks on farmers' prices and incomes vary greatly by country, as soybean pricing on the domestic level is subject to regulations or support systems that influence the final prices that farmers receive. For instance, farm gate soybean prices in Argentina are lower than those in the United States and Brazil, as Argentine farmers incur high export costs as well as marketing, handling, and transport costs to the port (Meade et al., 2016). This is due to lower soybean quality, an unstable currency because of high inflation, and the fact that the Argentine government has imposed several taxes on soy producers, including a 30% export tax on soybeans to protect domestic food security (Berg, 2014), which has raised costs for farmers and exporters.

Prices paid to U.S. soybean producers are significantly higher than in Brazil and Argentina. In 2022, for instance, conventional soybean prices paid to producers in the United States, Brazil, and Argentina were USD 488/tonne, USD 270/tonne, and USD 190/tonne, respectively (FAOSTAT, 2023.; La Nacion, 2022). This is because U.S. farmers benefit from the wide application of advanced agricultural technologies, modern transportation systems, handling infrastructure, and supportive agricultural policies.

However, farm-level production costs are much higher for U.S. farmers due to the higher value of land and capital costs. Therefore, even though conventional prices paid to soybean growers in Brazil and Argentina were lower, this does not necessarily mean they had lower incomes. Transport costs for export also play a key role, and an improvement in overland transportation costs could make a country or region in a country far more competitive. For instance, Brazil has taken steps to improve transport, as well as port operations and loading, to avoid lengthy delays during harvest; this can greatly reduce farmers' production costs (Samora & Mano, 2023).

Higher value addition for soybeans comes at the crushing stage.

The soybean value chain can be as simple and direct as it can be complex, with many twists and turns before reaching its final consumer due to the many diverse uses of its final products. The soy structure is hourglass-

shaped, with many producers and consumers at both ends of the value chain and a small number of processors and traders in the middle, who strategically use their position to leverage market power upstream and downstream of the value chain (De Maria et al., 2020).

The first actors in the chain are the producers, either smallholders or the big commercial farms, producing bulk soybeans to sell in the global market. However, the real starting point for value addition for farmers is seed and agrochemical companies. In Brazil, for instance, the business of producing new soybean seed varieties is concentrated among a few private companies that control the market and are a driver of increases in production costs (Bicudo Da Silva et al., 2020). Seed quality also directly influences soybean quality, which plays an important role in the pricing of the beans and their suitability to be globally traded.

Overall, soybean producers receive about 15% of the total soybean export price (free on board [FOB]). Producers' margins are the lowest in the chain (World Wildlife Fund, 2023) but also vary depending on the fixed and variable costs and other imposed taxes. In Argentina, for instance, when selling one tonne of soybeans to the export markets, landowner producers are required to allocate about 43% to 50% of the revenue to taxes, while 40% covers fixed and variable costs, leaving them with a 10% profit margin. However, if a farmer is leasing land for soybean production, profits may dwindle to as low as 1%, rendering soybean production unprofitable (Calzada & Corina, 2016; Origlia, 2022).

Worldwide, most soybean output is stored and shipped in bulk to large-scale industrial units for further processing into oil and meal. Soybean processors add the most value to the chain when they crush the beans to produce soybean meal and oil. They are also able to make decisions and take advantage of favourable market conditions by, for instance, crushing more soybeans or producing more meal or oil. Small-scale marketing of soybeans at a local level has a minor role in the value chain, except for the regions where soybeans are commonly consumed directly as food.

Soybean processing and trading stages are controlled by just a few multinationals that have also started to increase their control in major producing countries by merging with or acquiring national companies, including those involved in pre- and post-production stages, such as seeds and agricultural machinery.

In addition to this, industrialization is often driven by the traders themselves in the destination country, meaning that the incomes generated by adding value to the raw material are concentrated in importing countries like China and not in producing ones such as Brazil or Argentina (WWF, 2023). This shows the great market power of these multinational companies through the value chain (De Maria et al., 2020). Downstream transformation by manufacturing companies and subsequent (export-oriented) marketing of the end

products are separate economic activities that generate considerable value outside the agricultural sector per se, demonstrating the economic importance of soybeans for the global food and feed industry.

Soybean producers are then increasingly dependent on global oligopolies for their economic performance (WWF, 2023); they are also often vulnerable due to high economic indebtedness while also experiencing reduced bargaining power over other actors in the pre-production and post-production stages (i.e., seed, agrochemicals, machinery companies, exporters, and processors). Farmers are more vulnerable to financial and environmental risks and bear a larger economic burden in the chain (Bicudo da Silva et al., 2020). They also lack the sophistication or technology to grow what is demanded, whereas a manufacturer can process foods based on pending orders. Profit and margin distribution discovery are more challenging because most soybeans are not consumed directly by consumers, but rather are processed and used by many industries.

What Have VSSs Done to Pricing in the Soybean Sector?

Unlike for other agricultural commodities such as cocoa, cotton, or tea, VSSs have not yet implemented minimum price and premium mechanisms for certified farmers in the soybean sector. Sustainability standards such as RTRS and the ProTerra Foundation were developed to incentivize more sustainable soybean production and promote a proper approach to soy growth and production in a responsible manner. However, there is no formalized mechanism for arriving at a set price for farmers producing VSS-compliant soybeans—including in RTRS, ProTerra, Organic and other private or public schemes. The rule of thumb for buyers and traders is to take the international commodity price and add a percentage increase, often called a price premium, on which both buyer and seller agree. Indeed, producers adhering to the standards can get their crops certified and potentially command a higher price for their output than the conventional market if buyers are willing to pay.

Among recognized VSSs in the sector, Organic and the ProTerra Foundation certify non-GM soybeans, while RTRS, in practice, mostly certifies GM soybeans, although it has a non-GM option in place (Voora et al., 2020). RTRS is one of the VSSs in the sector that has developed a system to trade credits and physically certified soybeans and negotiate prices and premiums based on supply and demand for RTRS-compliant soybeans. RTRS-certified products can be sold through a physical supply chain following three supply chain models: (i) in-country material balance and (ii) site mass balance systems, where RTRS-certified soybeans are mixed with non-RTRS-certified soybeans across the supply chain, and (iii) segregation, in which RTRS-certified soybeans is kept physically separate from non-RTRS-certified soybeans. In physical transactions, each step of the supply chain is audited and verified, and producers may receive premiums or higher prices than on the conventional market, based on the direct negotiations between producers and buyers.

On the other hand, RTRS producers can also sell credits through an online platform. These

credits are traded separately from the physical product, and the physical soy that each credit represents is sold as conventional in the market. One credit represents 1 tonne of soybeans produced under RTRS's terms. The platform also enables credit transactions for non-GM soybeans; buyers can purchase non-GM credits without obtaining any physical non-GM soybeans (RTRS, n.d.).

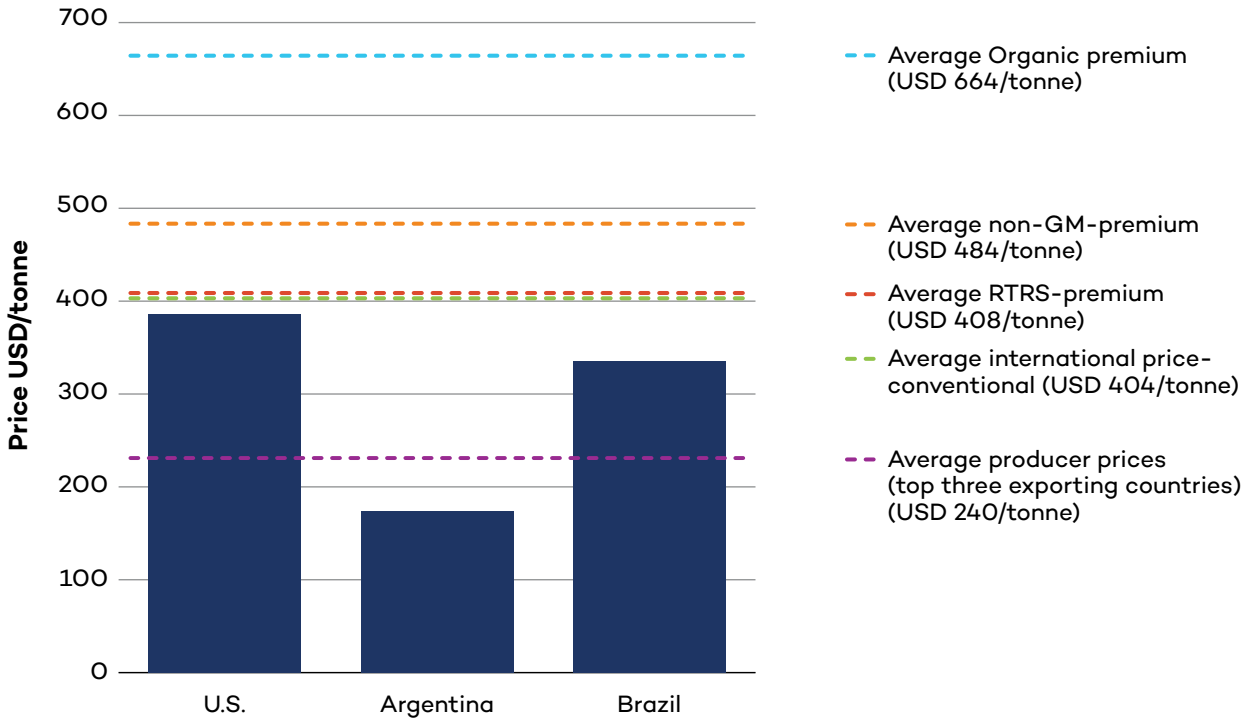
Buyers (organizations, traders, manufacturers, and retailers) initiate transactions by bidding through the trading platform on a producer's credits based on their needs. The system allows for blind trade or anonymous transactions, in which buyers place bids for a required number of credits at a proposed price. All producers registered on the platform receive an alert on the bid, and the first buyer accepting the offer obtains the deal. Producers and buyers can also negotiate credits outside the platform and, if they reach an agreement, confirm the deal on the platform (RTRS, n.d.). The system allows producers to obtain premiums for certified soybeans that was not purchased through a physical supply chain and buyers to make claims about their procurement objectives or publicly support the growth of a more sustainable soybean sector.

RTRS data signal that the market for credit trades of soy compliant with the standard has grown considerably since 2012. Between 2021 and 2022, more than 5 Mt of soybean credits were sold through the platform—though RTRS does not report on the average value of each credit sold. However, physical transactions of RTRS-certified soy have not grown at the same pace. In 2022 alone, 90% of the total purchases of certified material corresponded to RTRS credits and only 10% to mass balance (RTRS, 2022). Also, it is important to note that in terms of global supply, certified soybeans still represent a minimum percentage of total global production, challenging the potential impact of VSSs to increase prices and incomes across the board.

Overall, there is a lack of data on the quantity and value of premiums received by VSS-compliant farmers. However, there are few examples that show how VSSs' premiums are positioned in the soy sector. To better illustrate the differences between conventional and VSS-compliant prices in the soybean export market, Figure 5 showcases the average producer prices (FOB) in the three major soybean-exporting countries (Argentina, Brazil, and the United States) for conventional soybeans in 2017 and the average prices by VSSs such as RTRS and Organic (FOB) in the same countries, based on available data. The figure also shows the average premiums received by non-GM soybeans. It should be noted that the prices represented in the figure are estimates and do not reflect the reality for all soybean growers in these countries.

According to our analysis and the data shown in Figure 5, soybean producers in major exporting countries associated with VSSs, such as RTRS or certified Organic, may have received premiums above the average international FOB price for conventional soybeans in 2017. Also, they were more protected from external market disruptions, which can affect price negotiations and contracts in conventional soy chains. Figure 5 indicates that prices for VSS-compliant soybeans in 2017 may have been between 1% and 64% higher than those of GM-conventional soybeans.

Figure 5. Average farm gate soybean prices in three major soybean export countries, average RTRS, Organic, and non-GM premiums, and average international soybean price in 2017



Source: Author's elaboration based on data from Cameron, 2017; Envirologix, 2019; FAOSTAT, 2023; Kuepper & Riemersma, 2019; World Bank Group, 2023; USDA, 2017.

What stands out is that, in 2017, organic soybean producers in Argentina, Brazil and the United States may have received substantially higher FOB prices than those growing and selling conventional soybeans to the export market. As Figure 5 illustrates, the FOB price for organic soybeans averaged USD 664/tonne, which was about 64% higher than the average international price for conventional soybeans sold at export level in that year (Envirologix, 2019).

In addition, according to Figure 5, prices and premiums obtained by RTRS-certified soybeans in these three countries are at almost the same level as conventional soybean averages at FOB prices, with producers obtaining about 1% of higher prices per tonne of certified soybeans sold. This is a minimal gain that hardly serves as a motivating factor for producers to go through the effort of pursuing certifications. Overall, the trade and pricing system implemented by RTRS gives farmers an opportunity to negotiate premiums for their production of more sustainable soybeans. The trade of RTRS credits is an alternative way for growers to receive a markup for sustainably produced soybeans and to protect them from market volatility. Nevertheless, we

can conclude that compliance with RTRS certification is profitable only if farmers can consistently receive high premium prices either through physical sales or several credit transactions for RTRS-compliant soybeans and if buyers are willing to make sufficient offers either for physical or credit transactions.

Figure 5 also shows that non-GM soybean producers may have received higher prices than conventional ones in the major producing and exporting countries in 2017. This is probably due to greater attention and demand for non-GM soybeans, as the number of countries forbidding cultivation of GM crops increased in the past 10 years amid an extremely heated debate about the safety of modified soy and about genetic contamination (Turnbull et al., 2021). Cooperatives or exporters that sell raw soybeans pay soybean producers a share of this price. As an example, soybean producers in Argentina received about 40% of the export price while those in Brazil and the United States got around 63% and 87% of the final export price, respectively, in the period 2018–2022.

We can also infer that buyers may be more willing to pay premium differentials for VSS-compliant soybeans when international prices are low, while premiums are less common, or lower, when the international market price is high, with buyers also having the incentive to use RTRS credit transactions or the mass balance model as cheaper alternatives to buy and report more sustainable purchases of soybeans.

Evidence of the direct effects of VSSs on farmers' prices and incomes is very limited. Some studies show that the benefits for farmers complying with VSS in the soybean sector are not based on the provision of direct economic incentives, but rather on other factors that can potentially increase their incomes, such as the implementation of good agricultural and management practices that result in productivity increases, more production efficiency, and less use of inputs that help save costs, as well as improved access to finance, such as easier access to agricultural loans (Cameron, 2017).

Even when VSSs can potentially offer higher prices and premiums to some producers, and considering that the market for VSS-compliant soy has grown in the last years, demand for certified soybeans is still very limited, and most farmers continue producing soybeans using conventional practices (De Maria et al., 2020). Demand is also low because many buyers are unwilling to pay or negotiate higher prices than the market for certified soybeans or its byproducts. About 50% to 60% of RTRS-compliant soybeans were sold as conventional, without premiums, from 2017 to 2018 (Kuepper & Riemersma, 2019). This situation affects VSS-compliant growers, who bear the risks and costs of certification but are not necessarily receiving the financial benefits of it. This has resulted in many producers dropping their certifications due to the lack of clear financial benefits (Cameron, 2017).

While some farmers may benefit from premiums and prices above the market price when growing and selling VSS-compliant soy, these premiums are limited and depend on market conditions at the time of the negotiation with buyers, and they are not guaranteed. In addition, farmers engaging with VSSs bear a larger economic burden for accessing and maintaining them, as they must pay for the cost of certification and

conform to the standards. VSSs such as RTRS allow farmers to be certified in groups, reducing costs because audit fees could be shared. However, groups are required to hire independent auditors and managers. They must also set aside land for a period so the soil is free of prior contaminants used, forgoing income on this acreage or growing non-VSS-compliant crops.

Public and private sector actors adopt other supporting measures.

The soybean sector is subject to policies and measures such as subsidies, import quotas and duties, and export subsidies. Given the economic importance of the crop, all major producing and exporting countries attempt to protect the competitiveness of their local industries and insulate their domestic markets from price fluctuations. Governments in major producing and exporting countries are adopting tools such as tax and agricultural policies to support soybean producers.

In Brazil, for instance, the government established an agriculture credit system that provided large amounts of subsidized credit to domestic producers, such as a low-interest rural credit through the National Rural Credit System to finance a substantial part of the farmers' operating costs. In Argentina, the export taxes on soybeans were cut by 3 points to 30% in October 2020, and a tax reduction scheme was launched for small-scale soybean farmers with compensation payments based on the size of production and farm location (FAO, 2020).

In the United States, the 2018 Farm Act created programs supporting farmers' incomes by covering crop losses due to disaster events, covering price loss, and providing farm loans at low interest rates. In August 2020, the government allocated public funds to farmers affected by a derecho windstorm that damaged farmland across the Midwest, including a substantial part of the soybean crops, infrastructure, and storage facilities in the state of Iowa. In addition, the U.S. Department of Agriculture's Risk Management Agency (RMA) offers crop insurance that provides a powerful risk management tool for soybean farmers in hedging price volatility. Farmers who are insured will be protected against losses such as loss of quality due to adverse weather, loss of price, and other events (USDA, n.d.).

On the private sector side, six global agribusiness companies, including COFCO, Cargill, LDC, Bunge, ADM, and VITERRA, are members of the Soft Commodities Forum (SCF) led by the World Business Council for Sustainable Development. The SCF enables collaboration between these companies to identify solutions to eliminate soy-driven deforestation and native vegetation in the Cerrado region. One of their initiatives includes the Farmer First Cluster, which helps soybean producers transition toward more sustainable practices and encourages sustainable land use. Under the program, farmers also receive financial compensation when demonstrating that they protect the legal reserves suitable for soybean production (World Business Council for Sustainable Development, 2023). The forum is also developing strategies to support the long-term financing of the Farmer First Clusters through SCF finance and public–private

partnerships with investors committed to accelerating sustainable investments (World Business Council for Sustainable Development, 2023).

Additional efforts include the program "Soja Plus," which was created in 2011 in Brazil to meet the market demands for sustainable products and improve the environmental, social, and economic aspects of soybeans production through better management of rural properties. The program has provided training and technical assistance to many soybean farmers across the country. Other multistakeholder initiatives, such as the Soy Fast Track Fund, financed by Solidaridad Network, IDH, and the Sustainable Trade Initiative in 2011, provided financial help for 21 projects across Brazil, including Amaggi's project with Aliança da Terra. It also features a partnership between the NGO Friends of the Land Club–Sorriso and WWF France, which worked with farmers surrounding the city of Sorriso in northern Mato Grosso to provide funds to achieve RTRS certification (Cameron, 2017).

The CSI is another example of a multistakeholder collaboration aiming to achieve 100% conversion-free, sustainable soy production and a market update on a global scale. The initiative leverages and promotes several measures and tools, such as mandatory and voluntary measures, legislation, landscape programs and supply chain tools and policies, and building bridges between regional and global soy initiatives by sharing lessons and expertise and aligning strategies among major players in the sector—such as VSSs, buyers, and civil society organizations—on collective concerns to accelerate more sustainable soy supply chains (CSI, 2023).

In sum, governments, non-governmental organizations, VSSs, and other private sector actors have developed various programs and measures to improve the livelihoods of soybean farmers. However, not all farmers have benefited. Soybeans are still a commodity crop that is heavily influenced by a few powerful actors in the value chain that have little concern about the social, environmental, and negative impacts of conventional soybean production or the value of more sustainable growing practices. Market fundamentals, including trading at low prices, still dominate when setting the price of soybeans over the work of farmers and the value of adopting better agricultural practices that contribute to environmental conservation and the well-being of producers.

A Way Forward: What is needed to build a more sustainable soybean sector?

Despite some efforts to provide better price remuneration to soybean producers, more must be done to ensure that production can intensify in a sustainable manner, producers are rewarded for adopting more sustainable practices, and market access for VSS-compliant soybeans is assured. Addressing farmers' needs, especially on good agricultural practices, can help improve the sustainability of the sector.

The complexity of the value chain, the multiple and fragmentated actors, and the fact that soybeans are considered a "hidden commodity" greatly weakens the leverage of stakeholders acting on their own to produce a meaningful change in the industry. Although many soybean-producing countries have developed legislation to move the sector toward more sustainable production, alongside some private sector actors' initiatives, further collaboration is needed from all actors along the value chain to create effective incentives to promote and transition to a more sustainable sector, develop coordinated government policies, and allocate responsibilities and financial costs for the negative externalities of producing soybeans to all links in the value chain, especially those at the downstream stages. Some tools and approaches are being promoted by initiatives like the CSI and Proforest, which have developed the "Soy Magicube" tool to combine the best approaches for conversion-free sustainable soy (CSI & Proforest, 2021).

Supporting the adoption of VSSs in the sector could be a way not only to produce more sustainable soybeans but also to promote stakeholder dialogues grounded at the country level. One example of this is the European National Soya Initiatives, in which nine different national multistakeholder initiatives have come together to advocate for more sustainable soy production in the region (European National Soya Initiatives, 2024). It is also important to understand the costs and benefits of driving the adoption of more sustainable production and consumption in the sector and how they accrue to different players along the value chain. Greater coordination is also required between voluntary and mandatory standards, as well as among private initiatives. In addition, governments in major producing, exporting, and importing countries and the private sector can play key roles in enacting policies and implementing measures to make the business case of VSSs and increase demand for more sustainably grown soybeans. The following are some of the best practices that these actors can undertake to promote a more sustainable soybean value chain while remunerating farmers for committing to more sustainable practices.

VSSs can establish price systems that include minimum prices and premiums to compliant farmers.

One of the main challenges facing producers across soybean-producing countries is the absence of premium prices for their sustainability efforts. VSSs in the sector should work toward a clear pricing system and include price models, such as premiums or minimum prices, that reflect the investments made to join their schemes and adopt sustainable production practices. This approach can also protect compliant farmers from price volatility or market shocks and help offset certification costs.

VSSs' prices for soybeans are still based on conventional prices dictated by the international market, and premiums, when

paid, depend on the willingness of the buyer and the negotiation skills of the farmer. Farmers have few incentives to switch from conventional production systems to more sustainable ones. RTRS, ProTerra, and other sustainability standards operating in the soybean sector have not yet formally incorporated approaches to better remunerate compliant farmers, even if, in practice, some of these farmers receive price differentials or premiums for their credit transactions.

VSSs can also promote the idea of companies downstream on the value chain signing long-term contracts with soybean growers that include floor prices guaranteeing a return for producers. This would motivate more growers to become certified. As the costs to produce certified soybeans are unequally distributed across the production chain—with upstream producers covering higher production costs and certification fees, while those further downstream get the higher profits—these companies can also include other benefits in contracts, such as the provision of inputs, financing to contribute to more fairness in the sector, and making the process of certifying soybeans more feasible for smallholders.

Reward farmers who adopt sustainable production practices and adopt VSSs.

Governments in producing and consuming countries could formulate policies to financially reward soybean farmers who adopt more sustainable agricultural practices and show results. This can take the form of payments for environmental services. International soy certification schemes, such as RTRS, Organic, or ProTerra, could also engage with farmers and countries to adapt and/or develop standards to include extra steps to, for instance, mitigate carbon emissions throughout the value chain, and reward farmers for this.

Indeed, promoting more sustainable practices and reducing deforestation in the soybean sector will require financial incentives for producers: "In a high volume/low margin commodity market, traders and retailers have struggled to agree on who should bear the cost of paying a price premium for zero-deforestation soy" (Kuepper & Riemersma, 2019). Some efforts have been taken on that front. In 2018, when the Brazilian Association of Vegetable Oil Industries (ABIOVE) suggested a joint, pre-competitive fund by signatory companies of the Statement of Support Cerrado Statement of Support to the Cerrado Manifesto,[2] with additional funding efforts from impact investors. Under the proposal, eligible Cerrado farmers would receive an average of USD 150 per ha per year for preserving land that could otherwise be legally deforested. However, no final agreement has been reached, and it remains unclear how such a fund would be administered (Kuepper & Riemersma, 2019).

Other efforts include private sector actors, which include Santander, Bunge, and

[2] In September 2017, over 60 Brazilian non-governmental organizations released the Cerrado Manifesto, a call for "immediate action in defence of the Cerrado by companies that purchase soy and meat from within the biome, as well as by investors active in these sectors." In October 2017, 23 global brands signed the Statement of Support to the Manifesto, recognizing the need to prevent further deforestation in the Cerrado to mitigate future risks associated with climate change and agricultural resilience in the region (FAIRR, 2023).

TNC, establishing a USD 50 million fund to provide long-term loans to Brazilian soybean farmers in Cerrado who are willing to produce soybeans without further deforestation or conversion of native vegetation (Bunge, 2018). In addition to this, the Brazilian government has adopted some public policies to support sustainable soybeans. For example, a green agricultural credit named the National Rural Credit System provides credit to farmers at preferential rates through 13 different programs, each of which has several credit lines with different conditions to access the funds. This system gives farmers who benefit from those initiatives incentives to produce more sustainable soybeans. Furthermore, rewards for early adopters of sustainable soy certification—such as priority in selling certified soy or ensured premiums—would encourage farmers to continue engaging with certifications and increase sustainable soy production. Another example of this is the federal Organic Certification Cost Share Program in the United States, which offsets the costs of Organic certification (Leavitt, 2019).

These efforts could also be supported by buyers and trading companies by publicly and broadly providing financial support to soybean producers and offering long-term contracts and favourable off-take agreements for rotational crops. This support can help reduce farmers' risk during their transition to more sustainable practices and increase engagement with VSSs (Envirologix, 2019).

Access to education, finance, and technology is essential to improving farmers' resilience.

Investing in education and training of soybean producers can make a difference. It can help them defend their rights, address challenges concerning the production and trade of their produce, and improve their resilience (Bicudo Da Silva et al., 2020). VSSs can play an educational role by working alongside local agricultural institutions to enable soybean producers to deal with new technologies, climate change, market, and business management and to empower them to become more active agents within the supply chain.

VSSs can support producers in becoming organized in representative groups in order to act more like bigger players in the global market. This could be a useful strategy for producers to gain influence and bargaining power against transnational companies and input suppliers (Bicudo Da Silva et al., 2020). Additionally, associated soybean producers have a greater capacity to negotiate soybean production inputs with supplier companies and traders than individual farmers, therefore lowering production costs.

One good example of practices already in place is "Dia de Campo," a transfer technology program developed by Embrapa in Brazil wherein producers learn about management techniques to produce soybeans with lower dependency on chemical pesticides and fertilizers. Farmers also receive training in integrated pest management, a strategy with the potential to decrease the use

of pesticides by 50%, benefitting both the environment and producers' profit margins (Conte et al., 2016).

Understanding farm program entitlements and crop insurance is also critical. Crop insurance policies are a powerful tool to eliminate price volatility and increase farmers' incomes. The United States and Brazil have crop insurance policies in place to support farmers: the United States has crop insurance policies as part of the agriculture farm program provided by USDA's Risk Management Agency that are considered an efficient tool to hedge risks, and Brazilian farmers receive federal government support through economic subsidies to buy insurance policies (Ministry of Agriculture, Livestock and Food Supply, 2016). However, farmers in Argentina get limited government support to manage agricultural risks. Therefore, a government-supported insurance policy would be useful to help farmers hedge risks and have more stable incomes.

Technology is another key factor determining soybean yields, so VSSs should step up efforts to promote the use of technology in soybean production among producers and associations. This would also help increase farmers' incomes and reduce their production costs. Many new technologies help reduce costs and enhance returns on investment. For instance, drones, which many U.S. farmers use to scout for weeds and insects, measure crop health, and monitor water drainage, can help improve the return on investment on soybeans (Agremo, 2020).

Farm equipment has also become highly specialized with improved precision and GPS tracking. This improves farmers' efficiency and optimizes planting and harvesting fertilizer applications. As an example, the United Soybean Board and the National Corn Growers Association are collaborating to develop technology that would increase profit margins and help U.S. farmers earn more from cultivating soybeans and corn. Their initiative aims to transform the industrial scenario within 5 years by implementing the latest technologies (Clayton, 2023). In addition, biotechnology has brought many innovations to soybean farming; one result is that high oleic soybean, which is considered healthier and more profitable than conventional soybeans, is gaining traction in the United States and Canada, though it remains a small part of North America's soybean industry (Organic Alberta, 2023; United Soybean, 2021). On-farm storage options or commercial storage facilities can also be provided and supported by VSSs and buyers, as they provide farmers with opportunities to increase profit margins by alleviating the commercialization bottleneck. Proper storage also allows producers to negotiate sales when soybean prices are higher by keeping the grain on their farm after harvest (Bicudo Da Silva et al., 2020).

Increasing global demand for VSS-compliant soybeans is key.

When demand for sustainable soy is low, and the premiums paid for VSS-compliant soy are insufficient to cover production costs, farmers have little motivation to grow sustainable soybeans. Therefore, boosting sustainable soybean production and consumption requires action from many actors along the value chain (Cabezas et al., 2019).

Private sector actors can play an important role in moving the soybean value chain toward more sustainability. Manufacturers, traders, and processors can indirectly influence production practices and supplier standards in their supply chains. For this, it would be necessary for them both to commit to purchasing more VSS-compliant soybeans, not only on VSS credits but also to increase their share of physical certified soy. They can also carry out initiatives to support farmers financially to adopt more sustainable growing practices, promote better trade relations and direct trade relationships, and commit to paying premium prices to growers who adopt more sustainable production practices, including but also beyond domestic or export market legislative requirements.

Indeed, soybean enterprises (such as traders and food manufacturers) are sensitive to external pressure and responsive to market trends and consumer preferences, and they need to perceive social, economic, and environmental issues in soybean production as a source of risk. Thus, procuring more sustainable soybeans—such as VSS-compliant soybeans—presents an opportunity to ensure the longevity of the sector.

China is also a key actor in expanding the sustainable consumption of soybeans globally, given its size and importance as a soybean and soybean meal and oil end market. Efforts by Chinese buyers to consume more sustainable soybean oil would have major implications upstream by incentivizing producers to integrate more sustainable practices and support the enforcement of sustainability standards. Therefore, taking a different approach in their market decisions and purchases by demanding more sustainably produced soybeans would be crucial to increasing the global uptake of VSS-compliant soy. This can be done through measures such as preferential taxes or tariffs encouraging the consumption of more sustainable soybeans and by offering strong economic incentives to producers. Concerted efforts and policies to promote sustainable agriculture could also provide a platform to exchange innovation and technology, know-how, and successful experiences in social and environmental sustainability in the sector.

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The Sustainable Commodities Marketplace Series provides a market performance overview and outlook for key agricultural commodities that comply with a number of voluntary sustainability standards (VSSs), focusing on global sustainable consumption and production. Each year, the series focuses on a different overarching theme, with individual reports for that year devoted to providing a market update for a chosen commodity. These reports are designed to be accessible and relevant for a range of audiences, including supply chain decision makers, procurement officers, policy-makers, and producers. The series builds on *The State of Sustainable Markets 2021*, a joint publication from IISD, the International Trade Center (ITC), and the Research Institute of Organic Agriculture (FiBL), which examines over a dozen sustainability standards for various commodities.

The *Global Market Report* analyzes trends in soybeans production, consumption, trade flows, and other relevant areas. It uses 2019 data for soybeans production that is VSS-compliant, given that this was the most current data available when we conducted the analysis. The report also examines prices and margins in the soybean sector, looking at how VSSs contribute to increasing farm prices. It also provides recommendations to VSSs and other actors to increase the price and income that farmers obtain for their soybeans and build sustainable and resilient soybean systems.

IISD's State of Sustainability Initiatives advances sustainable and inclusive value chains by providing credible and solutions-oriented research, dialogue, and strategic advice for decision-makers about voluntary sustainability standards and other supportive initiatives.

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